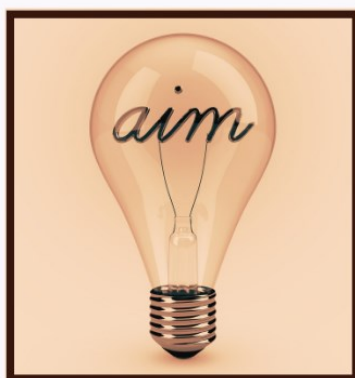
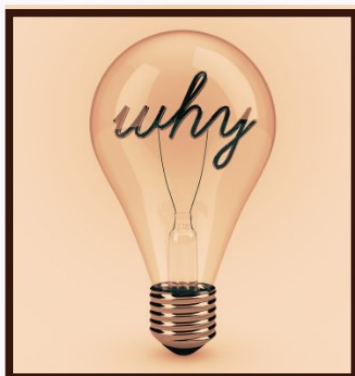


The Undergraduate Journal of the  
Northeast Regional Honors Council



**Building Resilience from Tragedy:  
Understanding Hate, Violence, Loss,  
and Reconciliation**

**Volume 5, Fall 2023**



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# Foreword

This year's edition of *Illuminate* proudly features 24 authors across 23 pieces of work. These students have spent months working through the editorial process, and we are pleased to be able to publish their work in this fifth volume.

As in years past, the 2023 edition of *Illuminate* aligns with the #NRHC2023 conference theme: "Building Resilience from Tragedy: Understanding Hate, Violence, Loss, and Reconciliation." While this theme may not have inspired every piece published in this year's journal, you will certainly feel its presence.

Resilience doesn't come easily. It has to be cultivated. It has to be built. While some may argue that we are more resilient than ever as a result of surviving a global pandemic and continuing to thrive in a world that seems to have so many insurmountable issues, others may argue that our ability to "be gritty" has diminished. As you explore this year's volume, you will see many impressive works of creativity in the form of creative writing and fine art; and you will be educated with 18 academic papers that contain both secondary and primary research by honors students.

Our contributors examine important issues across a variety of disciplines—Business, Economics, and Technology; Education; History, Politics, and Culture; Language, Literature, and Philosophy; Media Studies and the Arts; Science, Mathematics, and Health; and Social Sciences. It is through the research process that our contributors have built their own resilience. Research isn't always easy, but it always leads to a deeper understanding.

It also takes resilience and grit to bring a project like *Illuminate* to publication. The contributors began by proposing their work to the journal earlier this year. Two reviewers are then assigned to each piece, providing comments and scoring the work. Based on the recommendations of the reviewers, pieces are either accepted with minimal edits, conditionally accepted with major revisions, or rejected. Students with either accepted or conditionally accepted pieces were expected to make updates to their works. Those who were conditionally accepted went through a second review process before their piece was either officially rejected or accepted. Final drafts of edited work are then proofread by the editorial board. Whether one is going through this process as a contributor or as a volunteer on the editorial board, it is a rigorous and time-consuming endeavor. It has taken nearly five months to complete this volume.

There are so many people to thank for bringing this project to fruition—you may read every editorial board member's biography on the [Meet Our Team](#) page, along with the biographies of all the authors/contributors to this volume.

Please enjoy this fifth volume. It has been the pleasure of the Editorial Board to review submissions, work with contributors on edits, and bring this volume online. If you have any questions or wish to contact any of the contributors, please email us at [illuminatenrhc@gmail.com](mailto:illuminatenrhc@gmail.com).

Be present, be curious, and always be illuminated. Happy Reading!

Sincerely,

Kathryn M. MacDonald  
Editor-in-Chief, *Illuminate*  
Executive Secretary, Northeast Regional Honors Council  
Honors Program Coordinator, Monroe College

# Mountain Queen

ANGELINA LAMBROS

*Brooklyn College*

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**Artist Statement:** As an artist, singer, writer, and poet, I love being creative and imaginative. I have been writing stories and designing my own characters since my early childhood. I spend much of my time reading, writing, making art, and learning new things. I like to learn about history, art history, and social sciences.

Although I have made many sketches and digitally colored drawings, I have made relatively few paintings in my life. This year, I spent a few consecutive days creating four acrylic paintings, the first in the series being "Mountain Queen."

"Mountain Queen" mixes portrait and landscape, depicting a scene with the profile of an unnamed queen who wears a crown with both ambition and grace. The viewer can feel a sense of power from the figure, who simultaneously dwells on this mysterious mountain and also is the mountain. The sky is separated into three parts which all seem to melt into one another, with the dark blue section being decorated with stars. In the lower half of the painting, luscious rolling green hills remind us that this is also a nature scene.

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# Reframing Recidivism: The Necessary Tools for a Prison System Promoting Growth

JASON BULLER, VANESSA STOLSTAJNER,  
MAGGIE BROOMFIELD, AND GRACE SHARTLE  
*Loyola University Maryland*

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**Abstract:** The United States has the highest recidivism rate in the world. Approximately 68% of prisoners in the U.S. find themselves behind bars again within three years of being released and 79% do so within 6 years (Alper, 2018). These disheartening rates are due to a lack of proper rehabilitation services available for prisoners during and after their incarceration. To decrease recidivism rates, prisons should reallocate their funding towards a variety of programs including secondary and post-secondary education, vocational training, mental health services, self-actualization opportunities aimed at cultivating the mind, post-release planning, financial literacy courses, and other hobby-developing activities. When prisons, both private and public, invest in these types of programs, prisoners are adequately prepared to reenter society as reconciled citizens, humbled by the transformative experience, aware of the consequences of their crimes, and incentivized not to recommit. Such rehabilitation programs would support an effective prison system that ameliorates certain sociological, economic, and lifestyle factors that fostered the original crime. Not only do such programs have profound benefits for the individual, but they are proven to contribute to economic growth, “for every dollar spent on prison education, the government saves \$4 to \$5 on the cost of reincarceration” (Benecchi, 2021). Investing in the rehabilitative capacity of the United States prison system while taking a holistic approach will set the formerly incarcerated population up for success while contributing to future economic growth.

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## Introduction

Prior to the 1970s, the prison system in the United States operated on a philosophy that rehabilitation programs aimed at helping an offender learn and reenter society were effective. Between 1925 to 1974 the record high prison population occurred in 1961, when 220,149 persons were in prison (Langan et al., 1988). Then, in 1974, Robert Martinson published the “What Works” doctrine, which undermined the fact that rehabilitation programs reduce an individual’s chances to recommit a crime after completing their initial incarceration. The doctrine states, “...education... or psychotherapy at its best, cannot overcome, or even appreciably reduce, the powerful tendency for offenders to continue in criminal behaviour” (“Historical Background”). Martinson’s claims were based on methodologically weak studies yet prompted correctional authorities to halt investments in rehabilitation programs. In 1975, the prison population was 240,593; every year since a new record high has been set.

Today, the United States is the world leader in incarcerations with 1,900,000 individuals behind bars (Sawyer & Wagner, 2023). Per capita, the United States has 629 per 100,000 in prison followed by Brazil with 381 per 100,000. The United Kingdom, Italy, and Germany follow with 132, 92, and 71 per 100,000 people, respectively. In the past 30 years, America’s prison population has quintupled. This growth is directly correlated to the halt on investments in

rehabilitation programs, the war on drugs, and mass incarceration. In addition, according to Michelle Alexander’s study, *The New Jim Crow*, “the target populations of our prison system are highly skewed toward three groups of citizens: Black males, low-income people in urban environments, and immigrants” (Harper, 2013).

Every year, about 600,000 former inmates are released from federal and state prisons, with another 9 million released from local jails. Two-thirds of these individuals are rearrested within three years and 50% are reincarcerated. Many times, this is not due to a new crime being committed, but for parole violations. Some of these violations include failure to secure employment, inability to pay court fines and fees, and missing appointments or curfews. It has been shown that inmates who participate in vocational training or academic remediation while in prison are 43% less likely to re-offend and return to prison. Only one third of American prisons offer education or job training programs, however (Eberhardt, 2022). The scant resources currently provided for these initiatives contribute to the inability of many newly released individuals to meet the expectations that come with parole, making it more likely that they will end up behind bars once again. With these prisoners back behind bars we are hurting not only the people themselves but the U.S. economy. Therefore, there is a need to invest in resources for prisoners to be able to meet expectations upon release to create a more sustainable economy and U.S. prison system.



Rehabilitation resources such as opportunities for education, basic and advanced, vocational training, mental and medical health services along with a holistic approach to uplifting the whole person, have the potential to provide a foundation for inmates' successful reintroduction to society, benefitting individuals and setting the stage for sustainable economic growth for their communities.

### Problems

There are a wide range of issues regarding recidivism rates and the rehabilitative environments in prisons. The underlying problem is that private and public prisons are not incentivized to implement effective rehabilitation programs. Around 127,000 prisoners in the U.S. are housed in facilities operated by private companies such as the Corrections Corporation of America or the GEO Group. High recidivism benefits them and generates profit, so they are not eager to implement programs that will decrease recidivism; thus, decreasing profit. In fact, the Bureau of Justice Assistance demonstrates that the existence of private prisons is not financially justified (Austin, 2001). American prisons operate to generate profit; therefore, this motive incentivizes them to provide the least amount of services to as many inhabitants as possible.

Implementing rehabilitation programs is also very expensive. The population of the U.S. prison system is larger than the entire U.S. university system, and it costs \$10,000 more to send someone to prison than it does to send them to an Ivy League college (Harper, 2013). Stefan LuBuglio, a nationally recognized reentry specialist and former chief of prerelease in Montgomery County, Maryland states that "Over the past 20 years, interest and innovation in reentry services for incarcerated individuals has risen dramatically in this country, yet ironically, correctional education – the mainstay of correctional rehabilitation since the founding of jails in this country in the late 1700s – has not ridden this increased wave of support" (Steurer, 2020). Education in the prison system is perceived to be more expensive than other programs due to the space, materials, and technology required; thus, short-term budget difficulties also influence administrative decisions about programs, rather than long-term program savings due to the impact of lower recidivism. These decisions have severe negative consequences for society.

The ETS Center for Research on Human Capital and Education found that two-thirds of the formerly incarcerated population in the U.S. could not perform basic tasks, such as writing a letter to explain a billing error or calculating miles per gallon, and only 30% of them had attended education classes in prison (Steurer, 2020). Also, increasing rates of incarceration mean large numbers of the formerly incarcerated population reenter society with 3 major disadvantages: difficulty finding a job with a living wage, lack of valuable work experience required by employers, and employer reluctance to hire formerly incarcerated individuals. In this study, researchers looked at the literacy scores of incarcerated individuals using the PIAAC literacy test

and found that the mean score (249) was 21 points lower than that for the general population (270). These scores indicate that these individuals lack "the most basic information-processing skills considered necessary to succeed in today's world" (Steurer, 2020). With these scores, prisoners will be unable to enter society from an educational standpoint, not including the mental and emotional trauma of being imprisoned. It is unreasonable to expect for people, let alone formerly incarcerated individuals, with inadequate literacy scores to be able to maintain a job able to meet their financial needs and the requirements of parole.

A survey distributed to 2,000 federal inmates at the El Reno Federal Correctional Institution in Oklahoma found that 1) job training classes are limited to prisoners nearing their release dates, 2) programs are inconsistent among prisons regarding topics and skill sets, 3) fellow inmates taught classes 93% of the time, and most classes lacked rigor and substance, 4) the high cost of classes making earning a college degree nearly impossible, and 5) 3% of inmates had computer access, a necessity for many online colleges (George, 2017). Thus, there are many barriers preventing inmates from pursuing education, even if they wish to. These examples highlight only some of what contributes to high recidivism in the U.S. prison system: lack of proper education in the U.S. prison system, the lack of enforcement and incentivization of such programs, and the negative preconceptions that individuals in our society have towards the formerly incarcerated population.

In addition to the limits outlined above, incarcerated individuals must also contend with poorer mental and physical health outcomes. Time served has a direct correlation to years of life lost. Incarcerated individuals have also been found to have a lower life expectancy than the general population; for each year lived in prison, a person can expect to lose two years off their life expectancy. More specifically, five years in prison increased the odds of death by 78% and reduced the expected life span at age 30 by 10 years (Widra, 2017). The effects of time in prison are tremendous on individuals; they are repaying their debt to society without a doubt. However, a sentence to months or years in prison should not be equivalent to a life sentence chipping at years off their lives. These statistics are concerning from a population health standpoint, as well as the impact on individuals, families, and communities on a personal level. The system should aim to reform citizens without concurrently negatively impacting their mental and physical health.

On top of poor mental and physical health, inmates face racism and logistical issues that perpetuate the cycle of mass incarceration and act as a deterrence to trying to alter the trajectory of their lives. In a study conducted by the Crime and Research Alliance in 2018, they found that "the most potent predictor of recidivism was being a Black male, even though Black men had less contact with the criminal justice system and few of the risk factors traditionally associated with recidivism" (Crime and Justice Research Alliance, 2018). Black men scored lower on all but

two risk factors thought to drive recidivism – age at intake and marital status. Furthermore, more than 58% of Black men in the study were reincarcerated in a North Carolina state prison within the 8-year follow up period, compared to fewer than half of the White men and White women, and just over 41% of the Black women released during the same time frame (Crime and Justice Research Alliance, 2018).

Given all of these deficiencies, it is clear that incarcerated individuals are not given a fair chance at proper rehabilitation. The issues surrounding recidivism demand a holistic approach that starts with caring for the entire person. With this approach there can be positive economic and social impacts for American society at large.

### Making a Difference

Many prisons only focus on one aspect of education and rehabilitation while the demonstrated needs run much deeper. *Cura personalis* is "care for the entire person" and suggests individualized attention to the needs of the other. A holistic approach to rehabilitation including mental and physical healthcare, vocational training, education, spirituality, and interconnection with a broader society will lead to broad economic benefits and lower levels of recidivism. Utilizing *cura personalis* as a framework, we have developed three guiding pillars in our approach to prisoner rehabilitation: mind, body, and spirit.

The first pillar of rehabilitation focuses on education and providing prisoners with the technological tools for success upon reentry to society. According to Vivian Nixon, "In a country where second chances and opportunity are professed values, democratic access to high-quality higher education must include access for people in prison. We cannot bar the most vulnerable people from the very thing that has the greatest potential to change their lives" (Esperian, 2010). Many prisoners are unable to read and write, let alone able to obtain their GED. It is recommended that legislation be advanced to mandate that prisons require inmates to take educational classes no matter their age. There are already acts supporting our "mind" pillar of rehabilitation. For example, the Promoting Reentry through Education in Prisons (PREP) Act establishes an office of prison education within the Bureau of Prisons that is mandated to create and implement educational programs across all federal prisons. This established a new program focused on the partnerships between federal prisons and local education providers. The Maryland Resources and Education for All Prisoners (REAP) Act has many ambitions including setting goals for the number of inmates in rehabilitation programs, tracking the progress of inmates in rehabilitation programs, and helping inmates receive Pell grants.

Often overlooked is the technological setback that prisoners experience while in prison. With such a fast-paced society and constant innovation, prisoners are released not understanding the basic technology needed to both find a job and navigate the work environment. Their understanding of

technology is put on hold while in prison and by the time they are released, their knowledge is outdated, and they are forced to learn a whole new system. Employers frequently do not have time to account for this learning curve or fill in the gaps. The introduction of technical-skill development programs in prisons is underway, but red-tape barriers such as not allowing chargers in prison cells for donated hardware hinders the effectiveness of these innovative approaches to prison education (Steurer, 2020). Keeping prisoners up to date is vital to ensure their smooth reintroduction into society. By creating accessible learning programs, recidivism rates could decline and create a population capable of successful reintegration into society and the working population.

The second pillar pertains to rehabilitation of the body, specifically healing from potential substance abuse and mental health struggles. According to the American Psychological Association, inmate drug abuse treatment slows prisons' revolving door. The American Psychological Association cites a Federal Bureau of Prisons Report that stated, "in fiscal year 2002, more than 16,000 inmates participated in in-prison residential drug abuse treatment programs, and more than 82% of them participated in community transition drug abuse treatment. Rigorous analysis of these programs by the Bureau of Prisons and the National Institute on Drug Abuse shows these programs make a significant positive difference in the lives of inmates following their release from prison, as they are substantially less likely to use drugs or to be rearrested, compared to other inmates who did not participate in the treatment programs" (American Psychological Association, 2004). Research shows that potentially creating and mandating inmate substance abuse treatment programs can deter former inmates from falling back into bad habits after release. With these tools, prisoners will be able to heal their body from the damage done and increase their motivation to strive for right-minded goals.

It is also important to consider mental health while healing. "Studies indicate that approximately 18-22% of the general youth population suffers from a mental disorder while 40-90% of youth involved with the juvenile justice system have one or more mental disorders" (Harper, 2013). It is an injustice to not provide treatment to juvenile offenders suffering from mental illness, which is even more pressing under the stressful conditions of present-day prison. Therapy and healthy outlet programs can increase emotional intelligence which is a vital tool to operate successfully in the workforce and in life interactions, let alone survive the prison environment intact.

In creating these programs, prisoners can learn to forgive themselves and see that prison doesn't have to be the end of their story. The impact of the disconnect from society and families is a major contributor to the mental setbacks that prisoners face. The national GAINS (Gather, Access, Integrate, Network, and Stimulate) Center and Project Avary both work to help prisoners and families connect and heal. The magazine *State v. US* provides a platform to connect inmates with the outside world, keeping them up to date

and able seamlessly blend back into society upon return. It is recommended that therapy and healthy outlet programs be mandated to help manage mental health and increase emotional intelligence among all prison populations.

The soul or spiritual pillar focuses on forgiveness of oneself and healing through a creative outlet such as art and religion. To combat the risk of mental health, spirituality shows promise to aid rehabilitative efforts (Roman, 2019). While some religious support is already offered in prisons, it is important to spread awareness and help inmates to see the larger picture and the meaning of life outside prison walls.

Holistic rehabilitation programs that incorporate a spiritual component have been shown to empower individuals, promote their dignity, foster humanity, and cultivate faith (Stewart, 2019). Participants in these spirituality-oriented programs often experience stronger relationships and exhibit increased prosocial behavior. Engaging in spiritual practices prompts individuals to become aware of their personal issues and encourages deep reflection on their past offenses, leading them to seek self-improvement and forgiveness. Rehabilitative programs that embrace spirituality instill hope within prisoners, enabling them to set ambitious goals despite the challenges posed by a painful and broken system. The shift in mindset that occurs through spiritual growth catalyzes a transformation of behaviors, decreasing the likelihood of reoffending. By addressing the spiritual needs of individuals in the rehabilitative process, these programs contribute to the holistic development of prisoners, fostering positive change and enhancing their chances of successful reintegration into society.

Chris Wilson is an example of someone who has been able to heal through the creation of art.

At age 17, Wilson was sentenced to natural life in prison. While he was imprisoned, he was able to earn a high school diploma, graduate from all of the vocational shops, earn an Associate of Arts Degree, and teach himself to speak and write in several foreign languages. Wilson's endless motivation for self-betterment and shifting his perspective to view prison as an opportunity rather than the end, allowed him to take advantage of these opportunities. Chris Wilson spreads awareness for the issues in prison systems through the creation of art and other creative outlets. Wilson, as an artist himself, said in a *Gothamist* article, "Art is a way of forcing people to confront that both elevates the spirit but also challenges the soul" (Wilson, 2022).

"Art has the capacity to absorb the interests and mold the values of those who practice it" (Welch, 1991). Art can create a way for prisoners to reconnect with themselves, heal, and find a greater purpose. Allowing prisoners to embrace their emotions and express them in a beautiful and meaningful way can create more Chris Wilson. Wilson went on to become a mentor, start a career center, and a book club. Wilson served 16 years in prison then was able to reenter society a changed man and a valued community

member.

It is important to provide programs pertaining to the mind, body, and soul pillars to change the mindset of prisoners and give them the tools available to self-reform. Positive economic effects can arise from changing the prison system's mission from focusing on punishment to advocating for individual change and betterment.

### **Benefits of a Holistic Approach to Rehabilitation**

The basis of the solutions presented comes from the idea that prisoners can reflect on their actions, feel humility, understand what led them to commit their offenses, and reenter their communities with a better understanding of themselves to not recommit and become functioning, reconciled, and productive members of society. In reimagining the corrections system with a pre- "What Works" philosophy, we recognize that investing in the rehabilitative capacity of the prison system has compounding benefits across society as both communities and former prisoners turn economic losses into gains. The benefits of investing in a holistic rehabilitation prison system which accounts for the mind, body, and soul have the potential to yield strong economic results while improving prison conditions and reducing recidivism rates.

The costs of incarceration vary widely across the country. In Kentucky, the average cost per inmate is \$14,603, whereas in New York, the average cost is \$60,076. Despite the high costs of imprisoning individuals, recidivism rates remain high and create an economic drain. While costs differ across state lines, it is estimated that the U.S. loses between \$57 and \$65 billion of output per year due to recidivism (Hernandez, 2020). Contrasting the level of investment in the prison system against the outcomes of high recidivism rates and immense economic losses, policy makers must look to the benefits of levying investments towards holistic rehabilitation programs to reduce the propensity to reoffend while simultaneously creating economic savings.

Vocational training and educational programs can reduce recidivism rates thus reducing economic losses. When prisoners participate in secondary education courses in prison, their chances of recidivism drop by 43% (Benecchi, 2021). If a prisoner can participate in post-secondary education courses, their chances of recidivating drop to 6%. Further, participation in vocational training programs significantly reduces one's odds of recidivism by up to 36% and increase odds of finding jobs post-release by 28% (National Institute of Justice). Lower recidivism rates produce positive outcomes for the economy overall. A report by the RAND Corporation, a non-partisan American nonprofit global policy research institute, has found that for every \$1 invested in prison education programs, the government saves \$4-\$5 on the costs of reincarceration (RAND, 2014). Educational and vocational training programs decrease recidivism rates as they prepare ex-convicts to assimilate into a rapidly changing society, allowing for economic savings.



A significant barrier prisoners must contend with upon release is the prejudice they face in obtaining gainful employment. This creates significant challenges for the over 1.9 million people with criminal records who are unable to find employment, resulting in substantial economic losses. In 2014 alone, these barriers cost the economy an estimated \$78 to \$87 billion (Taylor, 2018). Over 40,000 laws and regulations across the country that restrict ex-offenders from certain jobs, residences, and activities exacerbate the problem. Surprisingly, despite approximately one in three Americans having a criminal record, 60% of employers say they are unlikely to consider hiring an ex-offender (Taylor, 2018). However, research indicates that businesses can benefit from hiring individuals who are exiting the prison system. The study found that this not only leads to a reduction in turnover rates, from 25% to 11%, but also provides these individuals with opportunities to find stability and rebuild their lives (Taylor, 2018). By giving ex-offenders a chance to secure gainful employment, businesses can tap into a pool of potentially well-rounded employees who have undergone rehabilitation programs and acquired valuable skills while in correctional facilities. This approach not only aids the individuals themselves but also contributes to the overall well-being of society by promoting successful reintegration and reducing recidivism rates. Thus, by overcoming negative attitudes and misconceptions surrounding hiring ex-offenders, businesses can play a crucial role in facilitating their reentry into the workforce, ultimately leading to positive economic and social outcomes.

Equipping prisoners with the skills and tools to adapt to the changing world after serving their sentence offers significant benefits not only to the individuals themselves but also to the families who have endured emotional and economic hardships throughout their incarceration. A survey conducted on families of inmates revealed that the average debt attributed to court-related fines and fees amounted to a staggering \$13,607 (Martin, 2017). The burden of such financial obligations is compounded by high recidivism rates, which perpetuate the cycle of economic strain for these families. By effectively reducing recidivism through comprehensive rehabilitation programs, the cumulative costs borne by families can be alleviated, thereby reducing financial stress, and fostering increased economic mobility. Empowering prisoners with the necessary skills and support to successfully reintegrate into society not only positively impacts their own lives but also brings much-needed relief to their families, offering them the opportunity to rebuild and thrive in the aftermath of their loved one's incarceration.

Decreased recidivism is good for the economy and society at large and therefore a heightened systemic effort to invest in the transformation of the prison system to be holistic and care for the individual's rehabilitation must be made. Not only are the investments cost-effective, but they are humane; attitudes of forgiveness may ripple across society to create a more harmonious culture.

There have been notable successes in various rehabilitation programs across the country, demonstrating their potential to decrease recidivism rates and expand education opportunities for individuals involved. One such program is Defy Ventures, founded by Catherine Rohr, an ex-venture capitalist. Defy Ventures focuses on creating internship programs that empower ex-convicts to succeed as entrepreneurs, income earners, responsible fathers, and positive role models within their communities (Harper, 2013). By providing these individuals with the necessary skills, resources, and support, Defy Ventures has achieved remarkable outcomes in terms of reducing recidivism and facilitating successful reintegration into society.

Another example of a successful program is the Safer Foundation of Illinois, which offers job-finding services to individuals with criminal records. Through their dedicated efforts, the Safer Foundation has managed to lower recidivism rates to just 13 percent among their participants, a significant decrease when compared to the state's overall recidivism rate of 52 percent (Harper, 2013). This success demonstrates the effectiveness of targeted job-finding services in providing opportunities for individuals to rebuild their lives and break the cycle of repeated offenses.

The Hudson Link for Higher Education is yet another noteworthy program that focuses on providing college education, life skills training, and comprehensive reentry support to both currently and formerly incarcerated individuals. By equipping them with education and essential life skills, the program aims to empower participants to make positive impacts not only on their own lives but also on their families and communities. This approach has resulted in lower rates of recidivism, increased employment opportunities, community regeneration, cohesiveness, and reciprocity. Hudson Link values transformation, lived experience, a holistic approach, access and agency, collaboration, dedication, and family as guiding principles for their program's success (Hudson Link for Higher Education in Prison, 2023).

These examples highlight the transformative power of rehabilitation programs in creating positive outcomes for individuals involved in the justice system. Through education, skills training, employment services, and comprehensive support, these programs have successfully decreased recidivism rates and provided individuals with opportunities to reintegrate into society as productive and law-abiding citizens. By investing in and expanding such successful initiatives, communities have the potential to break the cycle of incarceration, foster social and economic mobility, and create safer and more inclusive environments for all.

Danish philosopher Søren Kierkegaard stated that there is "a higher mentality than socially sanctioned morality that goes beyond logical thinking. It's called faith" (Kierkegaard, 2005). We must work to change the current narrative and encourage society, as well as former

inmates, to express more forgiveness for themselves and others. We must instill the radical idea in prisoners that they can have a second chance to achieve their big goals despite a painful and broken system. A change in mindset will cause a transformation of behaviors, reducing recidivism, thus incentivizing further investment in rehabilitative capacity. Overall, a systematic overhaul within the prison system is necessary. Prisons must shift from operating solely to generate profit, to operating for the betterment of society. The financial resources are available. By pairing these resources with a moral compass of uplifting other humans, society will achieve these goals.

## Conclusion

Currently the U.S. is supporting a system that does not give prisoners the resources to succeed in society, and sadly, there does not seem to be a lessening of the social and financial crises that cause individuals to commit crimes and become incarcerated. Without attention to the needs of this sizable population, the economy of the United States is at risk of losing the productive capacity of a significant portion of its citizenry.

The forces at work that bring many Americans into the prison system include failures at many levels such as basic education, available and affordable health care, negative attitudes towards mental health care, poverty, and domestic strife, among others. Then, while incarcerated, inmates are exposed to yet more failures to adequately address their ability to one day become productive, law-abiding citizens. This failure upon failure leads to hopelessness and despair that can become endemic and systemic.

Providing inmates with perhaps their first opportunity to be treated fairly and as persons worthy of having a better life should be the foundational mantra of the American prison system. Making a difference by attending to the three pillars of rehabilitation, 1) education and technological competency, 2) drug abuse treatment and in-depth mental health evaluation and therapy, and 3) creative and spiritual methods to achieve self-healing, have the potential to change the trajectory of incarcerated individuals. An introduction to resources integral to the concept of *cura personalis* allows for prisoners to heal and reform their mind, body, and spirit. The path towards humility and self-worth can turn a ward of the State into a functioning, creative and productive member of society, with a significantly lowered risk of recidivism; this may even have the unintended, but desirable, effect of lowering the future number of incarcerated Americans.

It is critical to note that the economic impact of a person who is gainfully employed, living in a stable community, and spending on goods and services, has an unintended multiplier effect on the broader community and U.S. GDP overall. In implementing the holistic approach described here, it is possible that even the poorest of communities can find a way to thrive and grow as their men and women are welcomed back into the life of their communities ready to

fully commit to their responsibilities as citizens and live productive and happy lives.

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# Quantum Computer Solving Crime: Is Quantum Computing the Future of Cybersecurity?

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**Abstract:** Rapid progress in quantum computing has the potential to alter the nature of cyber security radically and the technological landscape as a whole. This study sheds light on where quantum computing is headed as a possible indicator of where cybersecurity is headed in the future. While traditional computing approaches have succeeded in many areas, they must improve when applied to cybersecurity. Traditional methods must catch up to cybercriminals' sophisticated strategies and constant innovation. By utilizing quantum mechanics to perform information processing in fundamentally new ways, quantum computers emerge as a potentially fruitful solution. The purpose of this paper is to highlight the revolutionary potential of quantum computing in the field of cybersecurity by delving into the unique features of quantum technology.

Part of this discussion involves looking at where we are now with quantum computers and determining what that means for cyber security. When solving difficult problems, quantum computers' remarkable ability to process massive amounts of data simultaneously gives them a distinct advantage. Due to quantum computers' superior computational power, traditional cryptographic algorithms, which have been cornerstones of cybersecurity, may become quickly obsolete. The paper examines the current state of affairs and critically evaluates the dynamics of quantum technology's interaction with current cybersecurity measures. This research highlights how quantum computing can improve online safety, raising hope for a more secure digital future.

Alongside the potential of quantum computing is the understanding that cyberattacks are becoming more common and sophisticated as the digital age progresses. The threat landscape is growing more complex and dangerous as more and more sectors and societies adopt digitalization. It is not just smart but essential to prepare for future cybersecurity threats. This paper highlights the importance of simultaneously addressing the growing risks of cyberattacks and recognizing the ongoing research in quantum computing. The foundation for a successful symbiosis between quantum technology and robust cybersecurity measures can be laid by encouraging a comprehensive understanding of the evolving cyber threat landscape. In light of the rapid development of quantum computers, this research highlights the importance of taking preventative measures by encouraging individuals, businesses, and governments to innovate, adapt, and work together to guarantee the safety of future digital exchanges.

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## Introduction

Over the past few decades, the digital world has transformed remarkably, ushering in unprecedented changes that have remodeled our approaches to interpersonal communication, business, and commerce. As much as this quick growth has opened up incredible prospects, it has also given rise to a new breed of challenges in the form of adaptable and persistent cyber threats. Cybersecurity experts are always on the front lines of the battle to keep sensitive information and vital systems online in the face of new and emerging dangers. Emerging at the same time as these shifts is quantum computing, a relatively new development with the potential to revolutionize the cybersecurity industry. A quantum computer's superior computational power gives it a leg up on traditional computers, allowing them to quickly and accurately solve complex problems. In this paper, we look into the intersection of quantum computing and cybersecurity, exploring how the former has the poten-

tial to alter the latter radically.

For this paper, we will concentrate on the far-reaching effects that quantum computing will have on cybersecurity. Based on the intricate principles of quantum mechanics, quantum computers outperform their classical counterparts thanks to several unique properties. Quantum computers' properties mean they have the potential to radically alter the methods currently used to detect, prevent, and investigate cyber threats. By exploiting the phenomenon of superposition and tapping into the power of entanglement, quantum computers can solve challenging algorithms and equations at speeds that surpass traditional computational limits. This research sheds light on how quantum computing is altering the landscape of cybersecurity by examining its fundamental ideas, outlining its advantages and disadvantages, and speculating on how it might be implemented to bolster online defenses against increasingly sophisticated cyberattacks.

## Quantum Supremacy

Quantum computing is at the vanguard of an evolution brought about by the unstoppable march of technology, which has ushered in revolutionary changes across many fields. Many people are intrigued by quantum computing, but also must realize it represents a significant departure from classical computing rather than merely an extension. IBM (International Business Machines, Corp.) claims that quantum computing, which uses the mysterious laws of quantum mechanics to solve problems beyond the capabilities of classical computers, is a rapidly emerging technology (IBM, 2019). Quantum computers can be considered a "supercomputer" that is called into action to solve problems that are too difficult for traditional computers to solve.

In cybersecurity, where criminals are constantly improving their methods for penetrating online defenses, the shortcomings of classical computers have become painfully obvious. Traditional cybersecurity measures, such as cryptographic algorithms, rely on the difficulty of certain mathematical problems to encrypt data. Traditional cybersecurity protocols are useless against the immense computational power of a quantum supercomputer, which can quickly break these cryptographic algorithms. Quantum computing offers a promising avenue to this end, and there is an immediate need for novel methods of digital defense.

Quantum parallelism and entanglement are the foundations of quantum computing's potential to revolutionize cybersecurity. As a result of quantum parallelism, it is now possible to perform multiple computations simultaneously, which is something classical computers can only aspire to do in the future. This property arises because the principle of superposition permits quantum bits, or qubits, to exist in a superposition of states at the same time. Quantum entanglement, on the other hand, makes it possible for quantum states of physically separated particles to be instantly correlated with one another. Using this remarkable phenomenon, quantum key distribution (QKD) protocols can generate unbreakable encryption keys. According to the NSA (National Security Administration), QKD makes it easy to detect any attempt to tamper with or eavesdrop on cryptographic keys because it uses the unique properties of quantum systems to generate and disseminate them (Allende et al., 2023). We can see the deep connection between quantum entanglement and cryptography by applying it to this context.

There will be some difficulties in implementing quantum computing into the current state of cybersecurity. Although it has enormous potential, the application of quantum computing to cybersecurity is still in its early stages. Many obstacles must be overcome before this technology can fulfill its transformative potential, such as software bugs, hardware maintenance, and scalability issues. The creation of quantum-resistant encryption methods that can withstand the computational might of quantum computers is a major area of focus. The ever-evolving nature of cryptography is exemplified by the persistence of researchers and developers hard at work on new algorithms (Allende et al., 2023).

In addition, a mixed approach is required on the road to understanding the effect of quantum computing on cyber security. The gap between quantum computing's theoretical promise and its implementation in cybersecurity may be bridged by hybrid techniques combining classical computing with quantum systems. This combined method considers where quantum computing is and at the same time, still preparing the ground for its smooth incorporation into today's digital infrastructures.

In sum, the future of quantum computing holds tremendous potential for radically altering the state of cyberspace. It has the potential to solve difficult problems that classical computers cannot, thanks to the phenomenon of quantum parallelism and quantum entanglement, which give it unprecedented computational power. Combining quantum mechanics and cryptography may lead to novel approaches to protecting private data and ensuring the confidentiality of electronic communications. However, there are obstacles that remain and a concerted effort is needed to overcome them so that the full potential of quantum computing can be utilized in cybersecurity. The advent of a new era in digital defense is on the horizon as ongoing research and development bring us closer to a world where quantum supremacy is a practical reality, increasing the safety of digital-age individuals, communities, and economies.

## Cybersecurity Era

The software has many layers of code, and the internet has three layers of code, sometimes called "dark energy." Dark energy, in astrophysics, is a mysterious form of energy that makes up a substantial portion of the universe but is not directly observable; in this context, the term "dark energy" is used metaphorically to refer to layers of the internet that are not readily visible or commonly interacted. The analogy to invisible forms of energy highlights that the public may need to be more familiar with or aware of these aspects of the internet. The infrastructure, protocols, and systems that keep the internet running might fall into this category; they do their work behind the scenes and are rarely noticed by end users. Comparable to how we can infer the influence of dark energy from its effects on cosmological expansion, these hidden internet layers can be inferred from their effect on the internet's overall structure and functionality.

Data scientist Denis Shestakov uses an iceberg analogy to describe the three main layers of the World Wide Web: the surface web, the deep web, and the dark web. Only about 4% of all online content is publicly accessible via search engines; the remaining 96% is not indexed and can only be accessed by those with the proper credentials. Bypassing this authorization allows threat actors access to sensitive data such as financial records, medical records, and legal documents stored on the dark web (National Institute of Justice, 2020). In addition to breaking into databases, some criminals use the dark web for other heinous activities like drug trafficking, buying and selling unregistered weapons, illegal trades, and more.

On the other hand, ANONYMITY is the primary motivation for participating in the Dark Web. The Dark Web is used by people who want to remain anonymous online while hiding sensitive information or engaging in illegal activities. Due to the changes in the digital landscape, security risks and the number of cyberattacks have increased. However, there may be severe repercussions for such carelessness. Academics, businesses, institutions, and quantum computing entities are increasingly at risk as the pursuit of quantum computing gains traction as a prime target for advanced persistent threats, cybercriminals, and hacktivists. According to researchers, there is a key role for threat actors, motivated by their own unique goals and objectives, in every cyberattack. As digitalization and connectivity grow globally, so does the cybercrime ecosystem, with many criminal organizations providing resources to threat actors and adding to the sophistication of cyber threats (National Institute of Justice, 2020). Data exfiltration, ransomware, and malware-as-a-service work in tandem with one another.

As time progresses, the cybercrime ecosystem has grown to include numerous illicit services. Cybercriminals offer services like wire fraud and cryptocurrency exchanges, as well as the recruitment of victims, the development of web injection kits or exploitation networks, the delivery of spam emails, and other similar activities. It has been determined that the development of quantum computing is a matter of national security significance because of its importance to the advancement of science. Because of this, progress in this area is critically important and urgent. There will likely be a rise in the dependability, quality, and accountability of quantum computing providers as their availability and economic viability grow. The downside is that this progress makes these systems more susceptible to attack from cybercriminals (National Institute of Justice, 2020). The goal of these bad actors, whether theft, extortion, or damage, is to make money - so that they may target these systems.

### **Trust in Quantum Computers**

As a negative side effect of the quantum computing revolution, a nuanced dynamic develops between the shifting nature of technology, the allocation of scarce resources, and the varied goals of hacktivists. Competing interests often make it difficult to decide how to divide available resources. It is possible that hacktivists, who are motivated by a wide variety of ideologies and agendas, would protest the selection of certain projects as top priorities. Scientists are working hard to develop public-key methods that can withstand the decryption attempts of quantum computers. However, progress in quantum computing offers a promising avenue for bolstering digital trust.

These techniques were developed as a coordinated response to an impending threat posed by the unprecedented computational power of quantum computers, which could render today's cryptographic mechanisms useless. These initiatives to strengthen cryptographic defenses aim to

keep the current level of trust intact and restore any lost faith in vital aspects of our digital lives. Certification authorities, digital signatures, and encrypted messages are all part of these building blocks. According to Shamshad et al., (2022), The United States National Institute of Standards and Technology is a shining example of proactive participation; they carefully assess sixty-nine potential new approaches in "post-quantum cryptography." The institution's proactive stance suggests it plans to establish new norms immune to quantum computers' computational power. A proposed standard from this effort is expected by 2024, and it promises to infuse future digital infrastructures with strong protections against growing threats. While cryptography is undoubtedly important, it is important to remember that it is only one piece of the cybersecurity puzzle. Even though encryption is incredibly powerful, it cannot provide full immunity to human vulnerabilities and mistakes. The harsh reality is that even with top-notch encryption, attackers can still find ways to break in, such as when users click on malicious links or open malicious email attachments. The invincible shield of encryption can also be breached by flaws in the underlying software or malicious actions from within the organization.

This contrast illustrates the complex interplay between technological advancements and human nature in cybersecurity. The threat of powerful quantum computing entering the scene casts a looming security shadow, compelling us to look ahead with foresight. Given the lengthy processes involved in implementing new standards, preparations must be made for quantum-resistant cryptography as soon as possible. We must develop new cryptographic methods and strengthen our cybersecurity in all areas to prepare for the quantum computing era (Lewis & Wood, 2023). This strategy relies on strong encryption, user education to reduce the likelihood of mistakes, secure software development procedures to prevent flaws, and vigilant monitoring to detect intrusion attempts as soon as they occur.

To summarize, the ever-changing ecosystem of quantum computing calls for a concert of efforts to bolster trust in our digital interactions. The road to secure digital landscapes is complicated, from the determined efforts to develop post-quantum cryptographic solutions to the intricate interplay between encryption and human vulnerabilities. The revolutionary possibilities of quantum computing are intertwined with the requirement of an all-encompassing cybersecurity strategy that can adjust to a constantly shifting threat landscape. When properly combined, technological innovation, foresight, and collaborative preparation are keys to preserving confidence in the digital realm and launching a safe, quantum-powered future.

### **Preparing for the Quantum Future**

The promise of a quantum future brings exciting possibilities and formidable obstacles. At the forefront of this discussion is a wide range of scientific complexities and engineering achievements necessary to realize the enormous potential of quantum computing. However, as appealing as



they may seem, building a quantum computer is a challenging feat. The principle of coherence time (central to physics) presents a significant obstacle. On the other hand, significant technical obstacles exist to overcome, most notably the daunting requirement for scalability or the ability to orchestrate many qubits to perform useful quantum operations. Improvements in system fidelity and correction of errors are ongoing priorities for the efficient operation of quantum computers.

According to Brandhofer et al. (2021), NISQ (noisy intermediate-scale quantum) refers to the current era of quantum computing, characterized by quantum computers with moderate computational power but struggling with system instability. There is still a long way to go before quantum computing reaches maturity, as evidenced by the unstable nature of current quantum computers and the ongoing pursuit of error correction. Despite these complexities, the development of quantum computers will soon intersect with cybersecurity, ushering in a new era of threat detection and analysis.

Quantum computers, as we know them today, are still in development, but they show promise as hybrid system co-processors. We foresee a cooperative partnership between quantum and classical computers, with the former taking on specialized mathematical workloads while the latter supports the overall process. The importance of cybersecurity has skyrocketed in a world where cyber threats are constantly expanding. Quantum computers' unparalleled computational prowess could lead to significant changes when detecting and analyzing threats. Despite widespread skepticism, the widespread belief persists that quantum computers will present a formidable obstacle to the status quo of cybersecurity paradigms and encryption techniques.

Scientists may have different opinions but cannot change the underlying fact, "quantum computers are nothing more than advanced conventional computers." Quantum machines' unrivaled ability to quickly analyze intricate patterns directly results from their capacity to process vast data streams simultaneously. The fact that the advancement of quantum computing is motivated by a desire to improve machine learning and AI only serves to increase these technologies' potential influence. Cybersecurity professionals can be better prepared for potential vulnerabilities with the help of algorithms running on quantum computers, which can sift through massive datasets and identify new threats.

Furthermore Price et al. (2020) states, Quantum Key Distribution (QKD) is crucial to how quantum computing and cyber security interact. This method's role in maintaining privacy and security in the quantum world is crucial. Man-in-the-middle attacks would fail to gain access to the secret key because any attempt to steal it would be immediately uncovered. As a result of this fundamental property of QKD, digital communications are more reliable, secure connections are strengthened, and the groundwork for quantum-resistant encryption is laid.

As the quantum future develops, the opportunities and threats it poses are intertwined. There is a delicate tango between scientific advancement and engineering challenges that will eventually lead to the emergence of quantum computers as formidable tools in many fields, including cybersecurity. Improvements in error correction and the removal of existing roadblocks are crucial for the development of quantum computing. Combining quantum abilities with cybersecurity opens new doors for spotting and stopping cyberattacks. The dynamic interplay between quantum and classical systems hints at a future where the best of both worlds will be harnessed to make the digital world safer for everyone. While there are still many obstacles to overcome and a long way to go, the marriage of quantum computing and cybersecurity highlights the vitality of technological progress and the necessity of staying ahead to protect our digital future.

## Conclusion

In conclusion, quantum computers have the potential to alter the future of cyber defense dramatically. The unprecedented computational power and capabilities made possible by quantum mechanics' quantum parallelism and quantum entanglement have the potential to impact the future of cybersecurity significantly. Despite the drawbacks of classical computing methods, quantum computers can break traditional cryptographic algorithms; this opens the door to developing quantum-resistant encryption protocols. Quantum computing is still in its infancy, but it shows great promise. As a result, hybrid systems that take advantage of the benefits of both approaches are being developed, with quantum computing serving as a co-processor. When discussing cybercrime and trust, it is essential to consider quantum computing. As the threat landscape in the cyber world evolves, sophisticated security tools, such as a supercomputer, will become increasingly important. Experts have spent the last few years perfecting "quantum-safe" encryption in case commercial quantum computers become available at any point.

Many experts believe that quantum computers will revolutionize cybersecurity in three key ways: by making it easier to spot threats, improving cryptography, and opening up new encrypted communication channels. While there are certainly obstacles and concerns that must be addressed, the progress in quantum computing offers promising solutions for a safer digital future. By working together across fields, we can make the internet a safer and more secure place to work and better prepared to deal with cyberattacks and other forms of cybercrime.

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# The Impact of Biases in Facial Recognition Artificial Neural Networks

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**Abstract:** This study probes how biases are formed, and then mitigated within artificial neural networks for facial recognition. In current research on facial recognition neural networks, it has been shown that there are many ways that biases/prejudices can negatively affect the accuracy of the network on characteristics such as gender status and identity. In order to test this, two pre-trained neural networks were fed novel datasets - one on cisgender faces and one on transgender faces. The two pre-trained models were then analyzed with regards to gender identity and status variables on accuracy rates calculated from the direct prediction outputs provided by the neural networks. Notable biases were found within both datasets and models on gender characteristics.

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## Introduction

### Neural Networks

Artificial neural networks (ANNs) are a subset of artificial intelligence and machine learning that can provide us with predictions of important information. Simply put, they consist of inputs and outputs. Inputs can be different types of information and are fed into the Neural Network (NN) in order to make it “learn” and can be used to “test” how well the algorithm performs after it has “learned” sufficient information. This “learning” is achieved through the shifting of weights in the artificial neurons within the neural network and facilitates the “conversations” that happen between neurons (1). These conversations form connections between neurons, sometimes in more than one layer (called a hidden layer) (2), that then converse with each other to form predictions which serve as the output. For example, for the scope of this paper, the inputs will be images of cisgender and transgender people of different races and ages, and the output is a prediction of their gender. The working definition of cisgender at the time of publication is someone who identifies with their assigned gender at birth, and the definition of transgender is someone who does not identify with their assigned gender at birth. The neural network used in this study is a classification algorithm that takes an input and classifies the facial images into demographics that are of interest to be measured.

The specific type of neural network used for this project is a Convolutional Neural Network (CNN). This network is different from a traditional Artificial Neural Network (ANN), because it relies on layers of convolution to compute the output predictions rather than weights and nodes. In short, the difference is that the CNN is a two-part NN: it does feature extraction and feature mapping, while ANNs

typically only extract features.

### Why Is This Important?

Historically, transgender and non-white people are left out of important discussions, even when it predominantly affects them. Research on artificial neural networks has been progressing rapidly and providing a lot of development with such technology. However, the ethics of using AI lags behind the pace of technological development.

There have been conversations involving research and development on AI for a long time, however according to The AI Index 2022 Annual Report (Zhang et al., 2022), ethics within machine learning started to be discussed more prevalently circa 2014. Additionally, Zhang et al. (2022) reported that publications involving AI ethics have increased by 400% since 2014, with 71% of the publications produced by the industry sector. This report noted that the number of papers is expected to continually grow each year. Such notable literature that are discussed below show how pertinent the issue of ethics is whenever new technology such as NNs are being formed. Scheuerman et al.’s (2019) work on How Computers See Gender has found that transgender people are also often misgendered by computer vision algorithms, while Buolamwini and Gebru (2018) focused on race and gender - specifically bias against Black Women. According to the United States Census bureau, around 0.6% of the US population that responded to the House Pulse Survey identified as transgender (2021). Although transgender individuals are not the majority according to the census, it is still extremely important to include diverse data into training sets to avoid potential bias and discrimination.

Others have noted that there are some governmental pro-

grams that have been found to use AI in ethically questionable ways, such as the police in Detroit, Michigan (Johnson, 2022) as well as England and Wales (Radiya-Dixit, 2022). According to several authors, there have been ethical ramifications noted with AI that could misgender transgender people and does not allow for their algorithmically-assigned gender to be changed (Keyes, 2018; Scheuerman et al., 2019, 2020). With the case of AI being discriminatory against transgender people, there may be adverse effects on mental health due to misgendering (McLemore, 2018). The consequences of not fixing such discriminatory AI may lead to more disproportionate targeting of minority groups.

In addition to the research findings mentioned above, it has been documented that these marginalized groups of people are typically underrepresented in the datasets used to train and test the algorithms (Wu et al., 2020; Karkkainen and Joo, 2021). Importantly, during the training phase, if a neural network is not exposed to diverse demographics, it will not perform well on even basic recognition tasks of such individuals. The training phase is critical for the outputs to be accurate and representative of the population it is being tested on. Even though there is an immense need for such diversity, many larger projects use datasets that have been cited more often in AI literature. Although these pre-created datasets may be convenient, they may be detrimental to the equity and accuracy of the most impacted groups that this software will be used on.

There have been other attempts in the past to specifically create datasets to help NNs train on transgender faces, such as the HRT Trans Database (AIAAIC, 2023). This dataset was bashed by several authors such as Keyes and Scheuerman for questionable ethics involving the lack of information on consent from the subjects, lack of publication of the dataset despite public funding, and feuds over the dataset being created for “national security purposes” (AIAAIC, 2023). Other papers including transgender people in their testing and training datasets have opted to not publish their datasets online because of other potential ethical concerns. Gay individuals have also been included within research on computer vision, however such research has also been deemed problematic. In 2017, two authors sought to determine the accuracy rates of Deep Neural Networks on sexuality based on facial image data (Wang and Kosinski, 2017). Many individuals and organizations were quick to point out potential problems with the study, regarding stereotypes of the LGB community and the lack of inclusion of any non-white people (AIAAIC, 2017). Because of transphobic, homophobic, and racist targeting, there may be concerns about datasets that specifically include these populations.

It is important to note that not all of the biases that come from ML algorithms are formed during the training process. There is a lot of research that has been conducted on how biases form and how we can mitigate them before they cause harm (Buolamwini and Gebru, 2018; Scheuerman et al., 2020; Wu et al., 2020; Google, 2022). Balancing da-

tasets is one of many ways that have been proposed to lessen the biases that can be formed within AI applications. Many researchers have noted specific ways that we can reduce biases within these algorithms as a way of harm reduction through dataset balancing (Wu et al., 2020; Joo and Kärkkäinen, 2021). Others have argued that balancing datasets will not be enough for bias mitigation within NN models (Zhang et al., 2018; Wang et al., 2019A; Wang et al., 2019B; Alberio et al., 2020; Gong et al., 2020).

This honors thesis was important to try to see what methods can potentially reduce biases/prejudice against transgender people. By creating novel datasets using scraped images of transgender people and cisgender people on two identity categories, there could be testing for (and mitigation of) potential biases that may arise, even from a model that prides itself on being balanced on race, gender, and age. It was questioned if FairFace’s dataset balancing on cisgender people would show different accuracy rates within non-cisgender populations, and whether or not using a different model trained on a non-balanced dataset would make a difference for gender classification outputs.

## Methods

### Models

To find and mitigate biases, I used a pre-trained neural network model from the Github repository for FairFace (Karkkainen and Joo, 2021) that was said to be trained on a balanced dataset (3). This is in direct contrast to more well-known and used datasets (which do not have the same claims of being “balanced”) - these “unbalanced” datasets typically contain high amounts of cisgender white men, and do not seem to account for diversity of race, age, and gender during the training phase. It was hypothesized that because of the FairFace model being trained on a more diverse dataset, that it may be less prejudiced against transgender people, especially those of different age and race groups.

The specifications for race, gender, and age outputs used were those that were already specified with the pre-trained model - 4 races (White, Black, Asian, Indian), 7 races (4 races + Latino/Hispanic, Southeast Asian, East Asian, and Middle Eastern), gender, and age. Some gender identity terminology was changed (“Male” to “Man”, etc.). The switch to gender-based rather than biologically sex-based language was designed to include transgender people within this study, as transgender people may not identify with their assigned sex at birth. Several snippets of code from the original FairFace model were modified to fit the purposes of this project.

To empirically test potential differences from the model based on fairness of gender categories, a second pre-trained model was used with the same novel training datasets. The model in question is InceptionResNet v1, which has made no claims to debias or balance the datasets that the neural network was trained on. Similar parameters were from the FairFace model for outputs (7-race, man and woman) for consistency purposes. However, certain characteristics

were not able to be parsed into outputs within this model, such as a 4-race contrast, and age outputs. The only outputs that were measured within data analysis, however, were gender groups across both models.

The required code for implementing the InceptionResNet v1 model was taken from the author's GitHub repository (Sandberg, 2023). Original code was written for this model's classification outputs and predictions. The IRNv1 model was pre-trained on the VGGFace2 dataset, which consists of over 3 million images (Cao et al., 2017). The number of men reported within the dataset is approximately 59.7%, with no reports on racial demographics within the original paper (Cao et al., 2017).

## Datasets

Because there are no known ethical datasets that are available on the internet consisting of transgender people for facial recognition purposes, I used the Instaloader Python API (Instaloader, 2023) to scrape images of transgender and cisgender people from Instagram. An API, or Application Programming Interface, can be used for a wide variety of tasks involving communications between applications and platforms. In this case, Instaloader's API was used to access data from Instagram by way of an original Python script. This script was then used to download necessary images from target demographics for dataset formation. Through this script, a hashtag was inputted as a string for the scraper, so that all images within the inputted hashtag would be downloaded. Examples of hashtags used for transgender populations include #GirlsLikeUs, #FTMtransgender, etc. The scraped images were then cleaned accordingly (images consisting of subject matter other than faces were omitted), and then the testing datasets were thus created. The images from the datasets were found and used based off public information available on Instagram, in accordance with Instagram and Instaloader's privacy regulations and guidelines.

The individuals within the cisgender dataset were gathered based on self-identification of race through hashtags. Categorization of images into folders were done by racial self-identification via hashtags (4) (7 race categories) rather than gender (as done with transgender men/women) to denote that they were in the cisgender dataset. At the time when the images were scraped for the datasets, all individuals self-identified as their respective gender status within this dataset.

While running the pre-trained models, images from the constructed datasets were cleaned and cropped around faces found within the files and automatically sorted into a folder of detected faces. This process happened automatically, without supervision or action required on the part of the author. Final dataset information is found in Table 1.

## Analyses

For individuals whose images were included in the test set

of this study, their self-identified gender identity was used to mark correct/incorrectness. Because of the nature of the binary categories within the study, the accuracy formula that was adapted for the use of this study is as follows:

$$\frac{\text{True Positives} + \text{False Positives}}{N}$$

In the above adapted formula, the True Positives represent the correctly classified individuals, the False Positives represent the misclassified individuals, and N represents the total number of images within each dataset.

Further analysis on the test datasets (both the transgender and cisgender test sets) on both models were conducted using R Studio and the R programming language. Logistic Regressions were performed to determine analysis of each predictor variable on the outcome variable. Predictor variables within the analyses were model (FairFace vs. InceptionResNetv1 or IRNv1), gender identity (man vs. woman), and gender status (transgender vs. cisgender self-identification). The sole outcome variable measured is the accuracy rates calculated.

## Results

### Both Models

It is important to note that unless otherwise specified, gender classification rates only include gender identity. Outside of specific instances, analyses to be described below consider general gender identity without respect to gender status. In Table 2, FF and IRNv1 on the vertical axis of the table represent the models (FairFace and InceptionResNetv1) used within the study. The highest accuracy percentage is for cisgender women within the FairFace model (97.5%), and the lowest accuracy is for transgender men within the IRNv1 model (47.4%).

A logistic regression was calculated to determine the odds ratios and effects between both models with respect to the gender identity and gender status on accuracy rates. There was a significant main effect of the model employed, gender status, and gender identity. Regarding the models, it was found that FairFace was 6.27 times more likely to be accurate on general gender classifications than the IRNv1 model,  $p < 0.001$ , 95% CI [-0.30, -0.18]. Based on the gender status, the odds of a cisgender person being gendered correctly was 12.34 times more likely than a transgender person,  $p < 0.001$ , 95% CI [-0.47, -0.33]. Lastly, with gender identity, it was found that the odds of a woman being gendered correctly was 2.73 times more likely than a man,  $p < 0.001$ , 95% CI [-0.02, 0.11].

In the same logistic regression, two out of four interactions were found to be significant. The two significant interactions were between model and gender identity, as well as model and gender status. FairFace was found to have a higher accuracy on men, with the odds of a man being gendered correctly as 2.99 times higher than within the IRNv1 model,  $p = 0.05$ , CI [-0.15, 0.03]. Additionally, FairFace was more likely to gender a cisgender person correctly around 4.89 times more than the IRNv1 model,  $p < 0.001$ ,

CI [0.07, 0.28]. The interactions between gender status and gender identity (1.12,  $p = 0.82$ , 95% CI [0.10, 0.30]), as well as model, gender identity, and gender status were not significant (2.83,  $p = 0.1$ , 95% CI [-0.08, 0.21]).

Within a logistic regression the Odds Ratios provided can be used as the effect size. We can see that the largest effect on the accuracy outputs that was measured was from gender status (an Odds Ratio of 12.34 for the gender status alone on accuracy rates). The smallest effect size noted was from a statistically insignificant interaction between gender status and gender identity (an Odds Ratio of 1.12 for the interaction between gender status and gender identity). Figure 1 is separated between Model - FairFace (FF) and InceptionResNetv1 (IRNv1), Gender Status - cisgender (cis), transgender (trans) and Gender Identity - man (blue / left bars), woman (pink / right bars). The dotted line denotes the chance-level accuracy for classification (50%).

### FairFace Model

Preliminary analyses were conducted on accuracy rates for the FairFace model. The binary transgender testing dataset showed an initial accuracy rate of 66.7% overall on binary transgender status. For trans women specifically, the accuracy rate was 77.93%, in contrast to trans men accuracy rates of 53.65%. This is in stark contrast to the binary cisgender testing dataset, where classification rates for cisgender women had a 97.5% accuracy rate, with cisgender men lagging behind with an accuracy rate of 93.5%. The total accuracy rate when tested on cisgender status was 95.3%.

A logistic regression was conducted to determine the FairFace model's correct rate of gender classification on the identity of woman given the correct rate of gender classification on the identity of man. It was found that, when holding gender status constant, the odds of a woman being gendered correctly within the FairFace model was 2.73 times higher than a man being gendered correctly,  $p = .05$ , 95% CI [0.18, 19.95]. With respect to gender status, while holding gender identity constant, the odds of a cisgender person being gendered correctly was found to be 1.08 times higher than transgender people within this model,  $p < .001$ , 95% CI [-3.06, -2.01]. The interaction between gender status and gender identity within the FairFace model was not found to be significant (1.12),  $p = .82$ , 95% CI [-.92, 1.04].

### InceptionResNetv1 Model

Preliminary calculations were done on the IRNv1 Model's accuracy rates. The overall accuracy rates on the binary transgender testing dataset were 60.7%. For trans women specifically, the accuracy rates within the IRNv1 model predictions were 72.2%, while on trans men it was 47.4% (5). The overall

accuracy rates on the cisgender test dataset were 68.6%. Cisgender men had an accuracy of 69.5% while cisgender women had an accuracy of 67.5%.

An additional logistic regression was conducted to determine the IRNv1 model's correct rate of gender classification on the identity of woman given the correct rate of gender classification on the identity of man. There was a significant main effect of gender status and interaction between gender status and gender identity. When holding gender identity constant, the odds of a cisgender person being gendered correctly within the IRNv1 model was 1.47 times higher than a trans person,  $p < 0.001$ , 95% CI [-1.32, -0.58]. Additionally, it was found that the odds of a transgender woman being gendered accurately within this model was 3.22 times higher than a cisgender man,  $p < 0.001$ , 95% CI [0.64, 1.71]. However, the effect of gender identity within the IRNv1 model on accuracy rates was not found to be significant (2.47),  $p = 0.56$ , 95% CI [-0.45, 0.24]. With respect to the interaction between gender identity and gender status, it was found that a transgender gender status created an effect in gender identity that was not present outside of the interaction, because the main effect of gender identity was found to be statistically insignificant.

## Discussion

### NN Model Outcomes

The results of this study provide important insights into the accuracy of gender identity and status classification between two different Deep Learning models, FairFace and IRNv1. The two models within this study were chosen because of the datasets used within pre-training.

Overall, both models were typically better at gendering women (regardless of gender status) (6), however, with regard to gender status alone, cisgender people were more likely to be gendered correctly than transgender people. The study found that FairFace was significantly more accurate in general gender classification (both gender status and gender identity) than the InceptionResNetv1 model.

Further analysis revealed significant interactions between all predictor variables - model used, gender identity, and

*Total Number Of Images Per Dataset*

Datasets	N of Women	N of Men
Transgender (n = 414)	222 (53.62%)	192 (46.38%)
Cisgender (n = 550)	280 (50.91%)	270 (49.09%)

*Table 1*



gender status. FairFace was more accurate in gendering men and cisgender individuals than InceptionResNetv1. The study also found that the FairFace model was more accurate in correctly gendering women compared to men. The InceptionResNetv1 model, on the other hand, had no significant difference in accuracy between gender identities. This suggests that the FairFace model may be biased towards gendering women correctly.

*Accuracy Rates per Demographic*

		Datasets		Demographics	
		Gender Status	Total Accuracy	Accuracy Men	Accuracy Women
IRNV1	Cis		68.7%	69.5%	67.5%
	Trans		60.6%	47.4%	72.2%
FF	Cis		95.3%	93.5%	97.5%
	Trans		66.7%	53.6%	77.9%

Table 2

The findings of this study have important implications for the development and use of gender classification algorithms. It is crucial to consider the potential biases that may exist in these models and to ensure that they are trained on diverse and representative datasets. Additionally, the study highlights the importance of considering the datasets used to pre-train NN models. Although FairFace was technically better on all gender classification tasks than the InceptionResNetv1 model, there were still discrepancies pertaining to gender status classification. Despite claims of FairFace being “fair” and “balanced” with respect to gender, because those operations were done solely on cisgender individuals (7) that may have contributed to a major lapse in accuracy on the transgender dataset. Within both models, the transgender accuracy rates were dismal in comparison to the cisgender accuracy rates, especially in regard to transgender men (8), who were misgendered the most frequently across both models. It remains to be seen if adding transgender individuals into the datasets similar to those used to train FairFace and/or IRNV1 would result in better accuracy rates for such populations.

Interestingly, the findings from this study echoed similar research previously done by authors on the subject of facial recognition software classifying transgender individuals - with transgender women often being misgendered less than transgender men (Scheurman et al., 2019). Within and between the models, there were noticeable differences in transgender vs. cisgender accuracy rates. Specifically, significant main effects from the logistic regressions with respect to gender status were found in both the IRNV1 and FairFace models, as well as the between model comparison. When both models were considered, in general, cis people were 12.34 times more likely to be gendered correctly on both models than trans people.

When interpreting the Odds Ratio results from the logistic regressions, we can take them into account for effect size as well. Interpretation of the “size” of the Odds Ratio in a similar fashion to Cohen’s *d* was done following calculations from Chen et al. (2010). So, when discussing the effect that gender status had on each model and across models, we can see that for the IRNV1 and FairFace models,

there was a small effect of gender status on accuracy rates. When taking into account both models, there was an extremely large effect of gender status on accuracy rates. The interaction between model and gender status also had a large effect on accuracy rate outcomes.

Within the FairFace model alone, the findings suggest that the FairFace model may have some limitations in accurately classifying gender for transgender individuals, particularly for trans men. Generally, the FairFace model’s accuracy rates for gender classification were influenced more by the gender status of the individual (cisgender vs. transgender) rather than their gender identity (male vs. female). Because there was an insignificant interaction between gender status and gender identity within this model, we can see that the model’s accuracy in classifying gender status was not massively affected depending on whether the person was a man or woman.

Within the IRNV1 model alone, the results suggest that there is a large discrepancy between gender identity and gender status accuracy rates. It was found that there was a significant interaction between gender identity and gender status but not a significant main effect on gender identity. This suggests that gender identity may be a more critical factor in accurately classifying gender identity for transgender individuals within this model. However, it was found that the model performs significantly better on cisgender people as a whole than transgender people, without respect to gender identity.

As stated above, across both models there seemed to be critical differences within the accuracy rates of transgender individuals and cisgender individuals. Depending on the within-models analyses and between-models analysis, there were differences in gender classification accuracy rates. However, the large takeaway is that there are tangible biases that are seen in the models used within this study, regardless of the debiasing precautions used (i.e., balancing a dataset). This may be because of a lack of inclusion of transgender individuals, or potentially other confounding variables such as race and age. If we solely look at Figure 1, the graph shows that there are extreme differences be-

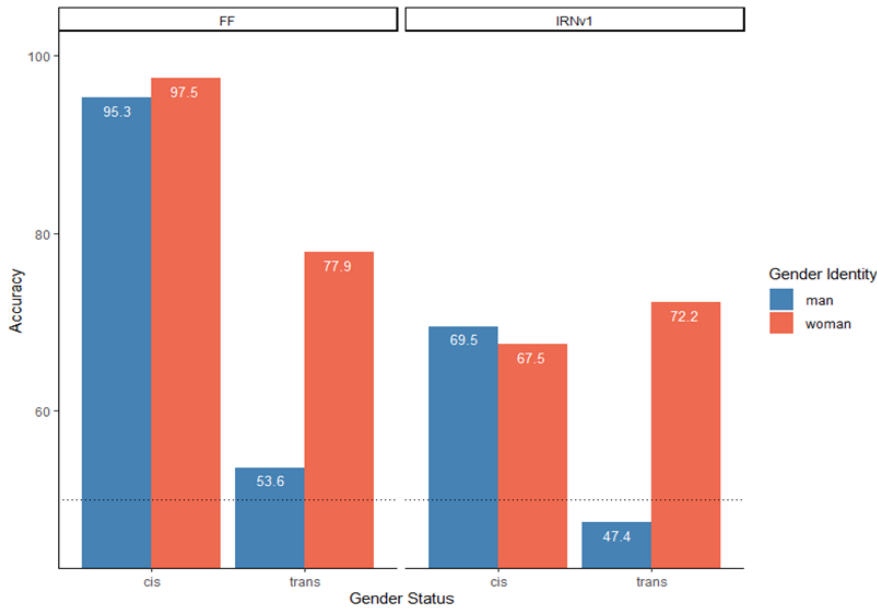


Figure 1. Examples Of Dataset Inputs To The Fairface And Irnv1 Models.

tween models and within models on transgender accuracy rates (9). Further research is needed to understand the reasoning behind the differences discussed here.

### Future Work

As suggested by Hamidi et al. (2018), the incorporation of gender identity and presentation as a spectrum would be beneficial in the event of inclusion of gender-diverse individuals such as non-binary individuals. Moving away from a dichotomous view of gender would allow for the incorporation of non-binary individuals and create more ethical algorithms towards cisgender and other individuals who do not abide by strict gender norms. Lastly, by classifying gender on a spectrum, we could better identify biases within humans as well as AI with respect to masculinity and femininity.

The inclusion of transgender individuals in datasets to train ML algorithms is a must. The misgendering of transgender people in real life is already an epidemic, and it would be irresponsible to allow NN algorithms to misgender transgender people as well. More studies should be done on the opinions of marginalized groups (such as transgender and gender-diverse individuals) on the ethics and potential uses of such technology, such as the one conducted by Scheuerman et al. (2019).

### Study Limitations

There were several limitations within this study, including but not limited to the testing datasets, racial and age group exclusion, and tangible bias mitigation measures. Specifically, the testing datasets contained uneven amounts of images based on gender identity and gender status. Although

the cisgender dataset was more “balanced” with respect to age and gender categories than the transgender dataset (10), the number of images between datasets was also uneven (11). Within the accuracy and logistic regression analyses, race and age were also not considered as factors, which could serve as confounds that could have affected analysis outcomes and thus interpretations of the results. Within the IRNv1 model, age and race were not able to be programmed correctly at the time of gender analyses, and thus were omitted from all calculations and predictions used within this study.

This study also did not include specific bias mitigation measures that were recommended by several researchers within the field of ML. Specific bias mitigation measures that were noted were the inclusion of the gender variables as continuous rather than discrete and the use of bias detection programs such as InsideBias (Hamidi et al., 2018; Serna et al., 2021). Within the context of this study, it was unknown how to implement gender variables as a spectrum, and thus the scope of the study had to change to only include binary transgender individuals.

### Conclusion

Although dataset balancing can provide some benefits in regard to gender classification amongst gender identities, NN classification based on gender status is still lagging behind. The findings from this study highlight the urgent need for further research of AI models that are sensitive to the nuances of gender. Additionally, we must critically examine the underlying biases and prejudices that may be ingrained in these models, and work to address and mitigate them. This research also underscores the importance of diverse and inclusive datasets for training AI models, as biased data can lead to biased outcomes.

As AI continues to play an increasingly prominent role in our lives, it is crucial that we strive to ensure that these systems are equitable. If biases within NN algorithms are left unchecked, marginalized groups may be severely affected within real-world applications. By recognizing and addressing biases in NN models, we can move towards a more inclusive future for all individuals, regardless of characteristics like gender.

### Footnotes

1. Conversations in the context of neurons within ANNs means that one neuron or node within the algorithm will pass along its information to similar nodes to form connections.
2. A hidden layer in NN terminology denotes that there is one or more layers in between the input and output layers that can create more connections and provide more

detailed and potentially accurate outputs.

3. “Balanced” within NN datasets means that the number of images within the dataset that were used to train the neural network were sorted in a way to ensure that the amount of photos pertaining to race, age, and gender were equal. This “balancing” is thought to potentially decrease the negative effects of a NN model experiencing overfitting on one specific population, such as older cisgender white men.
4. In the transgender dataset, a trans woman would be named something like TW1\_1 which denotes an individual face and the first image of said person. For the cisgender dataset, Latino men would be LM#\_#, and Black women would be BM#\_#.
5. This accuracy rate of 47.7% was the lowest of ALL average accuracy rates across demographics measured in both models. For contrast, the highest average accuracy rate for a demographic was 98.2% accuracy on cisgender women within the FairFace model.
6. There is one exception to this generalization across models. Within the cisgender dataset on the IRNv1 model, cisgender men were 2% more likely to be gendered correctly than cisgender women.
7. Within the FairFace paper, there was no notable mention of the inclusion of transgender people within their attempts to create a balanced dataset. Thus, it is assumed that because there was no identification of transgender individuals there are only cisgender people within the FairFace dataset used for pre-training.
8. Although transgender men had the worst accuracy rates, both models generally performed worse on men within both gender status groups.
9. Although the percentages displayed in that figure demonstrate major differences, it is important to note that the data points shown were averages between each demographic. Within the logistic regressions calculated, all data outputs from the model were included.
10. The cisgender dataset had around a 1% difference in men vs. women, and images were gathered based on racial groups. The transgender dataset had around 7.24%, and images were not balanced on race.
11. The number of images within the cisgender dataset was 550, and the number of images within the transgender dataset was 414 - a difference of 136 images or 28.22%.

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# Post Pandemic Innovations: Closing the Gap in Children's Social-Emotional Learning Through Creative Arts

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**Abstract:** Research shows that 3-6-year-old children post-pandemic are more likely to struggle with developmental challenges such as communication, expression, as well as emotional recognition and understanding (Kamei & Harriott, 2021; Maynard et al., 2022; Moazami-Goodarzi et al., 2021; Singh et al., 2020). Without social skills appropriate to their age group, children can face long-term effects like falling behind in school and difficulties functioning in society. New programs pertaining to post-pandemic challenges and geared toward child engagement need to be developed in order to combat these developmental setbacks in child social skills. Instead of traditional language- and math-centered programs, this paper argues that with the implementation of creative arts as social-emotional learning (SEL) programs, teachers and children will see social skill improvements and increased levels of engagement. Creative arts programs including instrumental instruction, group music, creative story writing, collaborative creative projects, and art therapies, can all be used as effective innovations in classrooms faced with post-pandemic SEL challenges. The use of creative arts as a pedagogical methodology will improve 3-6-year-old children's ability to effectively communicate, understand both others and their own emotions, and improve interactions among students. This program has the potential to close the gap between where 3-6-year-old children's social skills currently are and where they need to be in order to guarantee both social and academic success for students, and resiliency in our education systems post-pandemic.

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## Introduction

In the U.S. alone, about 53.1 million students were enrolled in a Pre-k to 12th grade classroom for the 2019-2020 school year, meaning 53.1 million students were sent home in March of 2020 and consequently removed from the structured social interaction of the typical classroom (United States Census Bureau, 2019). According to Kamei and Harriott (2021), the challenges of the COVID-19 pandemic "coincide with limited opportunities for social engagement and an increased potential for isolation," which prevents the development of healthy social skills (p. 365). This is particularly true of children ages 3-6, who at the height of the pandemic were at a pivotal point in their social-emotional learning (SEL) development. Durlak et al. (2011) list social skills such as identifying emotions, understanding other perspectives, interpersonal problem solving, and communication as skills that were neglected and underdeveloped because of quarantine (p. 411). Kids isolated at home were unable to practice and develop these skills leading to an increase of struggles for students when they returned to a classroom setting. Such struggles take the form of aggressive behavior, bullying, repeat suspensions, and delinquent behavior; as early as kindergarten, such SEL setbacks can be used as indicators of whether a child will graduate high school on time, obtain a college degree, find steady employment, or be more prone to crime and substance abuse (Jones et al., 2015, p. 2283). A kindergarten-er's SEL will provide the framework for the rest of their

education, either setting them up or setting them back for the rest of their life. Consequently, SEL programs are a critical innovation to close the developmental gap left behind by the COVID-19 pandemic (Singh et al., 2020, p. 9). A program centered around the use of creative arts such as music therapy, creative storytelling, and arts therapy can be used to encourage creativity and student engagement while improving communication skills, emotional recognition and understanding, and interactions with peers. This program will outline how the implementation of instrumental instruction, attentive listening and comprehension of others performance, inclusive group song circles, creative story writing, collaborative story writing, performance, and art therapies can be used in school systems post-pandemic to remedy social-emotional learning setbacks.

## Music Therapy

Music therapy has proven to be an incredibly effective, fun, and engaging way to teach kids to solve interpersonal problems, communicate and express themselves, and evaluate their own emotions and the emotions of others. Goodman (1989) explains that their effectiveness can be accredited to their creation of a therapeutic environment that provides safe communication opportunities (p. 179). Music therapy can take the form of one-on-one instrumental lessons, observing other students' musical performance, "me too" group song activities, and separate part assignments in group songs. By creating a safe environment that kids feel they can be heard in, these types of social-emotional learn-

ing programs foster creativity and freedom of expression which increases young children's interest in learning communication and interpersonal skills. According to Moazami-Goodarzi et al. (2021) learning should be seen as “playful, insightful, and participatory,” to maximize the effectiveness of SEL programs; Music therapy’s holistic approach to teaching social skills engages such principles by adding an aspect of fun to the classroom (p. 4).

One way of utilizing music therapy as a social-emotional learning tool is with one-on-one instrumental instruction. Music education in terms of instrumental instruction engages multiple parts of the brain: visual, audio, and kinesthetic learning take place all at once, and for this reason it is thought that musicians can solve social and academic problems more effectively and creatively, (Collins, 2014). By giving children instrumental instruction, it engages multiple parts of the brain which increase cognitive function both academically and in terms of interpersonal problems with peers, all the while encouraging expression of self. Music is incredibly expressive and can convey a variety of emotions; through playing music, kids have a nonverbal method of communicating their thoughts and feelings. Where young children in classrooms post-pandemic often experience difficulties expressing themselves, music therapy has potential to be an effective pedagogical tool with SEL teaching potential. Yeaw (2001) states, “music therapy seems to be an appropriate intervention for the younger child who does not have the cognitive and language skill to express affect,” (p. 57). This could be applied to classrooms today –particularly young children ages 3-6– as we use music as an expressive outlet for speech-challenged students. By teaching children instruments, they can improve problem solving skills crucial to social interaction, encourage understanding and expression of their own emotions, and provide a nonverbal way to communicate thoughts and feelings.

Communication of need and expression of emotion are two challenges frequently faced by 3–6-year-old children in post pandemic classrooms. These affective problems inhibit student’s ability to make their needs known, leading to those needs not being met, and inhibiting students’ ability to learn at their full capacity. Yeaw (2001) states that these communication problems can be addressed through music listening with discussion, leading to the conclusion that a lesson designed around analyzing the emotional effects of music would be beneficial for young children’s social skills (p. 58). Active discussion about the emotional impact of music being played or performed in the classroom can increase student’s understanding of tone and emotion, as well as teach them to communicate this understanding to their teachers and peers.

Teaching kids to perform for an audience of peers it will work to build up the confidence of the individual performer as well as give them an outlet for their musical expression, this is backed by research that shows learning to play a musical instrument greatly increases self-esteem in young children versus those who have not received instrumental in-

struction (Murray, 2007, pp. 15-19). Self-esteem is an internal issue faced by many young children and is often a reason they demonstrate withdrawn or quiet behavior even when they have something to say. The audience members should provide positive feedback for both their classmates' self-esteem but also as an exercise in giving respectful feedback and treating each other with sensitivity (Camilleri, 2000, p. 186). Following the performance and feedback, the instructor should prompt discussion questions about both the lyrics and musicality of the song, to see how the kids interpreted it, and how it made them feel. This encourages self-reflection upon one's own emotions, providing kids with an understanding of how to assess what they are feeling, acknowledge what these feelings mean, and why they are feeling that way.

According to Durlak et al. (2011), poor SEL development is linked with aggressive behaviors and bullying as a result of children having pent up anger and no healthy way to release it. Such behaviors are incredibly harmful to the individual child’s learning, their peers’ learning, and the classroom environment (p. 411). Fortunately, the act of listening to music has proven to be incredibly therapeutic and to have positive effects on behavioral issues in the classroom (Hogenes, 2014, p. 1509). Playing music in a classroom introduces kids to a new method of calming themselves down, introduces self-regulation techniques, and prevents the desire to express emotions through violence. The application of music therapy can be as simple as turning on a soothing radio station while classwork is being done and “can improve the behavior and academic achievement of children with emotional and behavioral difficulties” (Hallam & Price, 1998, p. 90). Having children listen to calming music throughout the day can serve as an easy method of teaching kids to work through their emotions, express them in healthier manners, and feel more at ease in their environment.

The COVID-19 pandemic necessitated prolonged periods of isolation at an early age, because of that and a resulting lack of social interaction, one of the most common SEL problems addressed in classrooms today is withdrawn behavior. Yeaw (2001) claims that withdrawn behaviors can be combated through contingent music, known in elementary education as group music time (p. 50). Group music consists of students sitting in a circle and working together to create a piece of music, creating an inclusive environment and bolstering social interaction between peers while encouraging child expression (Camilleri, 2000, p. 185-186). One way of doing so is a musical variation of Kamei and Harriott’s (2021) “Me too” game in which a song prompts students to stand if... and a physical attribute, characteristic, or opinion follows, if the students relate to the statement they are encouraged to stand up and exclaim, “Me too!”. This exercise gives students time for self-reflection as they must stop and think about how they look and how they feel about themselves (p. 369). For example, they may reflect on whether they are artistic, or fast, or have brown eyes. The object of the activity is to let them come to terms with the conclusion they draw about them-

selves and allow them to express who they are and what they feel while being comforted in the knowledge that they will be celebrated for it no matter what. In addition to giving kids a safe space, it has potential to improve self-efficacy, and teach them to create an inclusive environment for their peers both in and out of the classroom.

Collaborative learning activities have numerous benefits and should be implemented in classrooms as much as possible (Kamei & Harriott, 2021, p. 369). Group music sessions have students work together to create one cohesive product, a song, and in doing so promote positive interactions to solve interpersonal problems. This can be accomplished by assigning students various parts, where certain groups of students play at different parts in the song than others. Through this exercise kids are forced to listen to and have respect for their peers, step back and understand what they are playing in order to form their response and make space in the song for those around them (Camilleri, 2000, p. 187). This activity simulates a conversation between multiple people and teaches students how to listen to others, respect their classmates, and know when it is their turn to talk. Knowing their place in the song promotes space-sharing awareness and acts as a parallel for learning societal roles.

### **Creative Storytelling**

Creative story-writing provides students with direction but not explicit guidelines, allowing them to develop an original story of their choosing. This exercise gives students the freedom to express themselves, state their beliefs, and work through suppressed feelings as they write their story. This is backed by Di Blas and Ferrari (2014) whose research shows that storytelling education programs have benefits such as improving communication and expression (p. 82). Story-writing is like music in the sense that it is incredibly expressive and allows for communication of thoughts or feelings without directly saying the situation it applies to. Such story writing programs have had success in the past, namely the Digital Storytelling program through the Berkeley center which used technology as a tool for children to create stories and as a result, saw improvements in communication skills in an educational setting (Kim & Li, 2021, p. 20). In a post-pandemic world, an in-person approach to creative story writing could be implemented in the classroom, allowing kids to write what they feel using their imaginations as a pedagogical tool for learning expression. In children ages 3-6, physically writing down their story is above their skill set so to implement this program instead provide “‘objects’ that help making up the story, rather than writing a full script” which allows kids to go through the same process of storytelling but is a more practical application for this age group (Di Blas et al., 2012, p. 82). Such programs could allow students to create stories fitting of their academic skill set in order to improve their social and emotional skills.

Creative writing by itself is beneficial in teaching kids to express themselves more effectively while also engaging

their imagination, encouraging individuality, and aiding them in self-discovery. Multiple other social skills can be taught simultaneously by adding another element to this lesson: collaboration. Di Blas (2022) identifies collaboration as a key component of creative story writing programs because it allows students to work through interpersonal problems, it forces them to communicate with one another, and it teaches them to share ideas and find inspiration in one another (p. 82). For young children who were developing social skills during isolation, conversation and compromise can be a foreign idea because as Maynard et al. (2022) point out, they have had little exposure to social settings (p. 3). For this reason, collaborative learning which submerges students in an environment that requires interaction in order to reach their end goal is potentially an essential tool for closing the developmental gap in children’s social skills. Collaborative creative storytelling is a fun and engaging way for young children to both learn to express themselves but also learn to communicate and compromise with others.

Branching out from creative writing, another method of teaching social skills is a form of drama therapy that has students act out their original stories. Drama therapy has been proven to improve the development of social skills, regulation of emotions, and enactment of self-expression (Moore et al., 2017, p. 133). By physically and verbally moving through their story, kids must think about the emotions they wish to convey and how to accomplish the desired effect. They also must watch their peers do the same and interpret both what the provided social cues mean and how to respond accordingly. Additionally, acting out their original work promotes creativity in terms of the work itself and works towards a higher self-esteem. Upon implementation of such a program, Gresham (2014) states that the students “began to see collaboration as something beyond working together and sought inspiration from each other,” indicating new skills being obtained from the exercise and them learning to create real connections with their peers (p. 52).

### **Art Therapy**

The creation of physical works of art is an activity commonly found in pre-k and kindergarten classrooms as a way of keeping students excited about and engaged in their learning. Art is also incredibly expressive, regarded as a safe way of expressing oneself, and therefore used as an outlet of nonverbal communication by young students (Klorer, 2000, p. 242). Young children attending classes in a post-pandemic world can face an abnormal number of challenges when verbalizing their thoughts and feelings. By introducing children to art creation, instructors can open another route their students may take to express themselves. Even in cases where students have the physical ability to speak but are unsure of what to say, Deboys et al. (2017) states that, “Art therapy with children can be an empowering and exhilarating experience leading to self-discovery,” promoting reflection of self and further understanding of one’s own emotions, which is the first step towards better self-regulation (p. 118). When children be-

come aware of their feelings and are taught healthy mechanisms of working through such feelings, it can decrease behavioral struggles in the classroom and children can develop the ability to monitor themselves. Art therapy encourages young children to reflect and learn about themselves, provides them with an expressive outlet, and gives them a safe and healthy way to voice strong emotions.

Art is a multifunctional tool to teach various social and emotional skills to young children, however, by adding another component it can also teach interpersonal problem-solving skills, conversational skills, and improve interactions with peers. This of course refers to collaboration between multiple students in order to form one coherent piece of artwork, because as Di Blas (2022) says, collaboration is a key component to social-emotional learning (p. 82). Collaborative artworks can take many shapes, such as the “Hand mural” project demonstrated by Sutherland et al., (2010) which prompts students to decorate an image of their hand in a way they feel expresses themselves. Each hand is then arranged into a collage that demonstrated unity and acceptance of oneself and others (p. 72). Using this basic idea, many other art projects have potential to emerge based around the principle of each student creating their own mini piece that represents themselves and that then becoming a part of one large class artwork. Sutherland et al., (2010) says that in doing so children build relationships with peers, learn to non-verbally express themselves through art, and create a sense of confidence and belonging in the classroom (p. 71). Such lessons then work to improve classroom interactions, conversational skills, and respect for oneself and their peers.

The creation of artworks has potential not only for individual expression but also for increased engagement with peers, community, and family members. This principle is demonstrated through the research of Biag et al. (2015), whose “Art in Action” program provides an example of an art program that allows students to “be more visible to one another and the larger community” through their artwork (p. 3). Immersion within society is how young children develop the appropriate social skills needed to navigate through their world, therefore becoming more active in and seen by their community through their artwork can assist in the development of their social skills (Kamei & Harriott, 2021, p. 367). Displaying artwork acquaints young students with public self-expression, allowing them to nonverbally show a piece of themselves to their peers, teachers, and parents. Art is a safe way for students facing communication challenges to announce themselves to the world and help develop a sense of self. Kids should have a route of nonverbal expression when they lack the words to convey their thoughts and feelings, art can act as such a tool because “everyone can look at art and express what they see in a picture” (Biag et al., 2015, p. 28).

### Potential Setbacks

There are numerous higher education opportunities for those who wish to educate themselves specifically in crea-

tive arts therapies, which are extremely beneficial for an SEL program. Organization of in-depth approaches to creative arts therapies geared towards populations of students with more specific needs is better suited to educators with higher knowledge and experience. However, in a typical classroom setting, “SEL programs could be integrated into daily educational practices by a classroom teacher and do not require an outside professional in order to deliver it effectively,” making widespread SEL programs a more feasible goal even for low-income school systems (Kamei & Harriott, 2021, p. 367). With this said, the most effective programs are those accompanied by professional development training to raise comfort levels with this pedagogical approach because as Moazami-Goodarzi et al. (2021) says, teachers are the cornerstone to any SEL program (p. 2). Professional development sessions entail short after-hours workshop(s) to educate teachers on instruction techniques new to them so that they may be effectively implemented in classrooms throughout the school. These short seminars have the potential to both greatly improve execution of teaching strategies in the classroom and allow for widespread use of creative arts to teach SEL.

In school systems across the United States, educating students on language and math takes precedence over the arts, so why should an SEL program be centered around the use of creative arts? Robinson (2006) defines creativity as, “the process of having original ideas that have value” and claims this as an essential part of formulating original ideas. Originality is how society makes advances, by encouraging kids’ individuality and teaching them how to express it, educators prepare the next generation for progress. Mishra et al. (2013) claims the world is characterized by volatility, uncertainty, complexity, and ambiguity, and as such, it requires people with the capacity to think and solve problems in an effective and original way (p. 10). Di Blas (2022) goes so far as to claim that “to argue in favor of why creativity should be ‘taught’ at school is not necessary,” leading to the conclusion that creativity is a vital aspect of learning in preparation of a student’s future (p. 80). Furthermore, intelligence is incredibly diverse and teaching every student in a single way will not be as effective for some as it is for others (Robinson, 2006). Creative arts therapies provide a degree of freedom for the student to shape their own learning experience, as necessary to maximize their academic potential.

### Conclusion

The COVID-19 pandemic caused numerous developmental setbacks in 3-6-year-old students’ social skills, accompanied by various struggles in the classroom such as poor behavior, aggression, and withdrawn behavior (Kamei & Harriott, 2021, p. 366; Durlak et al., 2011, p. 411). Classroom techniques that incorporate music therapy, creative storytelling, and arts therapy have potential to close developmental gaps in children’s social skills and will therefore both prevent and correct such classroom struggles. In a post-pandemic world, creative arts programs centered around social skills development can be greatly beneficial for stu-



dents struggling with communication, emotional understanding, and interactions with peers. Additionally, creative arts provide a holistic approach to learning as they increase student engagement and promote individuality. The potential for creative arts program development and their benefits is “seemingly endless,” and there is a clear need for more research on the subject to better unlock its capabilities in the classroom (Yeaw, 2001, p. 60). With further research on the various practical applications of creative arts in a pedagogical setting, such programs can become a widespread method of teaching social skills in school systems, reviving post-pandemic classrooms.

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# Federal Funding as a Solution to Public Education in the United States: Resolving Disparities and Inequality in the Current System

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**Abstract:** Public education in the United States regularly ranks well below the education systems of other industrialized nations, with the U.S. ranking thirty-seventh in mathematics among OECD countries (Schleicher 7). An increasingly serious problem with widespread implications, the issue of public schooling in the United States has become over-politicized and lost to the crushing gears of bipartisan bureaucracy. At the root of this substandard education is the issue of local funding, which results in deep-rooted inequities causing low-income students to suffer. In the following essay, I determine the shortcomings of our current system, focusing on problematic methods of school finance and the effects of inadequate funding on student educational outcomes. I then explore the role of federal funding as a solution to the United States' inferior education finance system and review evidence both supporting and opposing its adoption. I conclude with the necessity of moving to a system of federal public school funding and address possible avenues of doing so.

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## Introduction

The founding fathers of the United States understood the importance of an educated populace, and the early American government encouraged the creation of publicly funded schools, which became significantly more widespread in the 1830s. Throughout the nineteenth and twentieth centuries, the United States focused on growing and improving access to education, passing legislation aiding in the establishment of schools across the country. As universal public education became increasingly common, the question of minority rights became central to American education. Well into the twentieth century, when minorities were guaranteed the right to education, the issue of access shifted from the previous concern that not enough Americans had access to education to the concern that not enough Americans had access to a quality education, an issue that remains at the forefront of educational policy today (Chen). Quality education is an indispensable aspect of contemporary society, but public education standards in the United States are seriously failing, as evidenced by the low ranking of the U.S. in the Programme for International Student Assessment (PISA), an OECD initiative that seeks to ascertain how student outcomes in OECD countries compare. In its most recent report, the United States ranked thirty-seventh in mathematics among seventy-nine OECD countries, below Hungary and barely above Belarus (Schleicher 7). Unfortunately, this ranking is by no means an anomaly; there have been no significant changes in math scores since 2000 when the PISA was first administered (“Highlights of U.S. PISA” 30). This dismal series of results suggests the

need for a serious reevaluation of the American education system in order to assess exactly what is driving this lackluster performance in student achievement.

## The Elitist American Education System

The United States Constitution does not specifically guarantee a right to education, nor does it mention upon whom the burden of educating the people falls. Thus, each state and territory is tasked with educating its children and funding its schools as each sees fit. In a 2022 report on the necessity of a larger federal role in public education, researcher Sylvia Allegretto, along with her colleagues, writes that the U.S. education system “relies too heavily on state and local resources (particularly property tax revenues)” (2). Obviously, poorer families live in poorer areas, therefore paying less in property taxes. The poorer an area, the less funding the school district receives, and as evidenced by Allegretto and her coauthors; “high-poverty districts get less funding per student than low-poverty districts” (2), a difference amounting to \$2,710 per pupil. Wealthier people buy better properties, pay more in property tax, and gain exclusive access to higher-quality education. This system locks families into economic classes; poverty-stricken children receive a substandard education, and face increased difficulty in pursuing secondary education, which lowers their chances of gaining better, higher-paying employment. In a report by the National Center for Education Statistics (NCES), schools reporting the highest levels of poverty (75% or more of students eligible for the free or reduced-price lunch program) had average math scores 118 points lower than schools reporting the lowest

levels of poverty (10% or less of students eligible for the free or reduced-price lunch program) on the PISA (“Highlights of U.S. PISA” 36). The effects of even a “10 percent increase in per-pupil spending each year for all twelve years of public school leads to 0.27 more completed years of education, 7.25 percent higher wages, and a 3.67 percentage-point reduction in the annual incidence of adult poverty” (Jackson et al. 2). These effects were especially pronounced among children from low-income families.

Funding increases are linked to immediate benefits in student outcomes as well, with higher funding correlating directly with higher student achievement. A 2021 study showed that funding increases, even those as little as \$1,000 per student, significantly improved test scores, high-school graduation rates, and college-going rates (Jackson and Mackevicius 4). Clearly, funding directly impacts student outcomes, but because of the problems inherent to local funding, school districts and low-income students suffer. The American education “system contribute[s] to institutionalizing inequities, especially in the absence of a strong federal effort to counter them” (Allegretto et al. 13). Over 40% of school funding is local, and Allegretto and her colleagues conclude that “spending is not nearly enough, on average, to provide students with an adequate education” (8). In 2020, federal funding for education was 60 billion dollars, accounting for only 7.6% of public school funding (Conman et al. 2). In contrast, state and local funding amounted to 734 billion, accounting for the remaining 92%. In this system, schools rely heavily on the funding that their state and local taxes can muster, leading to a massive funding deficit, not only between local areas, but between states as well, with New York spending the most per pupil, at \$24,881, \$16,930 more than Utah, which spends the least per pupil at \$7,951 (Hanson). With such a vast range of spending occurring across the United States, many public schools do not have the funding nor the resources to provide a quality education, and because of the nature of their funding, enormous disparities exist between schools in the richest and poorest areas. In fact, schools reporting the highest levels of poverty faced a deficit of \$5,135 per student between required spending to achieve national average test scores and actual spending, with schools reporting the lowest levels of poverty, possessing on average, a surplus of \$1,926 on the same metric (Allegretto et al. 8). In practice, local funding leaves “highest-poverty districts still \$2,710 short per student relative to the lowest-poverty districts” (Allegretto et al. 15), a truly massive amount, especially in districts where every penny counts.

### **Attracting Quality Educators**

A quality education depends primarily on the quality of the teacher, which is a direct result of the pay they receive. The link between funding and salary is simple: “any rise in teacher salaries will require greater funding” (Lafortune 20). A 2010 study by Duke University public policy professor Charles Clotfelter and colleagues showed a negative correlation between the ratio of disadvantaged students at a certain school and the number of highly qualified teachers (determined by their test scores) at that school (410).

Schools with more disadvantaged students, or those in poorer districts, had fewer highly qualified teachers, with richer school districts, conversely, employing more. “[T]eachers are attracted to positions with higher salaries and ... they are more inclined to leave their current post or to leave teaching altogether when alternative salaries are higher” (Clotfelter 403). In essence, schools with more funding offer higher salaries, attracting more highly qualified teachers, leaving underfunded districts with lower quality teachers, which heavily impacts student achievement. The evidence clearly shows that “paying teachers more improves student achievement” (Hendricks 50), suggesting that the solution to better student achievement is hiring and retaining more highly qualified teachers, which is reliant on the salary a district offers, stemming from, once again, the available funding of a certain district. With such massive disparities between schools in high and low-income areas, current federal expenditures are not nearly enough to resolve the inequalities that result from local funding. Despite government intervention providing high-poverty school districts with necessary funds, these districts are still left massively short-changed, with high-poverty school districts earning 14.1% less in revenue than low-poverty school districts (Allegretto et al. 9).

### **Federal Funding: The Ultimate Solution?**

Income and education expenditures clearly have a positive correlation (Bensi et al. 285), and a relatively simple solution to these financial disparities seems to present itself in the form of full federal funding for education in the United States. Federal funding would reduce inequalities between school districts across local and state lines by distributing funds not with equality, but with equity, granting more to the high-poverty school districts that need these funds. This would alleviate student achievement and per-pupil funding disparities between high and low-poverty schools, boosting literacy in the core subjects, and closing the gap between the United States and high-achieving OECD countries in terms of education rankings. According to a report by the Center for American Progress, a federal system of weighted student funding, which provides additional funds for high-poverty school districts “will have the greatest impact on the student population” by “attract[ing] highly qualified teachers, improv[ing] curriculum, and fund[ing] additional programs such as early childhood education” all of which are vital and necessary to student success (Martin).

### **Opposing Arguments**

For all its strengths, there is serious opposition to increased federal funding, with the most prevalent arguments being the potential misuse of funds and the consolidation of power in local school boards. In a system where school boards hold absolute power over annual budgets, a surplus of money could lead to incompetent and harmful decisions. *The Washington Post* reports that in March of 2021, the federal government granted \$122 billion in vital pandemic aid to schools. Despite their need, “school systems throughout the country reported spending less than 15 percent of

the federal funding” with the hardest hit districts, facing shortened school years and technology struggles, spending “5 percent or less of their . . . money last school year” (Lumpkin and Jayaraman). Local boards, in an attempt to make the funds last, are actively hurting the progress of their students, withholding funds during a crucial period of rebuilding and relearning after a global pandemic. Chicago City Public Schools, where students lost an estimated 20 weeks of learning in math and 21 in reading, “spent just over 6% of almost \$1.8 billion” (Jacobson). Researchers at Georgetown University estimated that the district would have to spend just over 50% of its aid to remediate the steep learning loss that students faced (“Calculating Investments”). With more federal funding, local school boards are given more power, making the impacts of their decisions, both positive and negative, further felt.

While compelling, this argument fails to comprehend that radical changes to the current funding system will take time. When managing billions of dollars and the futures of the 50 million children enrolled in public schools across the country (“Fast Facts”), state and local governments must go through bureaucratic processes to ensure the proper allocation of funding for every student, especially in high-poverty districts. The massive influx of pandemic funding was a solitary grant meant to keep schools floating, but these federal funds did not fundamentally change the still biased system of local funding for schools, and school boards, in desperate need of these funds, sought to “make the money last, according to interviews with school officials and education experts in six states” (Lumpkin and Jayaraman). Foreseeing the inevitability of federal funds sinking back to previous levels, schools looked to maximize the grants, expanding their potential use beyond just the current school year. With regular and sufficient funding, school boards would not be forced to choose between current and future students, but would be guaranteed the necessary funds every school year.

Putting aside for a moment the necessity of any proposed system of federal funding, another significant obstacle is the legal difficulty of implementing such a system. The first of these conflicts is Constitutional. In the Supreme Court case *San Antonio Independent School District v. Rodriguez*, the court found that education is not a Constitutional right and that Texas’ educational funding system was legally sound and did not infringe upon any rights guaranteed to American citizens (United States Supreme Court). Texas’ public schools rely on local funding, and through this decision, the Supreme Court, while acknowledging the inequity inherent to the current system, maintained the legality of local funding, providing no incentive for the adoption of federal funding. In view of the fact that education is not a Constitutional right, the federal government has no responsibility to fund schools nor to provide education to its citizens. Furthermore, federal funding could create overdependence on the government, which in turn, could result in “increased federal control of education” (Mongeau). If the government is given the power to grant funding, then it

also holds the power to withhold funding, once again bringing into question a variety of potential Constitutional breaches. Establishing a Constitutional amendment to guarantee a federal right to education for all Americans seems the ultimate solution; simultaneously solidifying what the United Nations calls a “fundamental human right” (“What You Need to Know About the Right to Education”), and compelling the federal government to provide for the public education of American students, lessening or even eliminating the impacts of local funding.

## Conclusion

The dismal state of the American education system is, in part, due to the issue of local funding. In this essay, I have examined a varied selection of reputable literature regarding the issue of local school funding and the viability of federal funding as a possible solution. The public education system is fraught with institutionalized inequalities, exacerbated by a lack of resources and necessary funds. The current system of local funding actively hinders students and locks them into economic classes. To improve the quality of the U.S. education system, we must enact an institutional change from local to federal funding. This change would have extensive impacts: from teacher salaries to the changes that increased educational expenditures would have on student achievement, through initiatives such as improved curriculums, early education programs, and after school programs. Arguments against federal funding of education chiefly point to concerns about the mismanagement of increased federal funds, but these arguments present weak and biased evidence against a structural change in funding. To improve our education system, improve student performance, and achieve equity in educational opportunity we need to move to a fully federally funded system. Only then will we be able to improve our standing in international education rankings to levels on par with the highest achieving OECD countries.

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# Finding a Home in Hawaii: Picture Brides and Their American Dream

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**Abstract:** Between 1907 and 1924, approximately 15,000 newly married women emigrated from Japan to the Territory of Hawaii. Known as “picture brides,” these women travelled across the Pacific to meet husbands that they had only ever seen in photographs. This paper first examines this “picture bride” phenomenon by looking at the factors leading to their emigration, the circumstances they faced upon arrival, as well as how they were treated by those in power. Seeing them as a threat to the stereotypical American way of life, efforts were made to force these Japanese immigrants to assimilate into the wider American culture, a process known as “Americanization.” While the lives of these picture brides have been studied in detail, there has been much less research into how their personal experiences relate to the concept of the American Dream, a drawing force for many immigrants to the United States, both past and present. Societal expectations from this period of what it means to be “American” are examined to determine if they align with the definition of the “American Dream” given by James Truslow Adams in his book *The Epic of America*. This analysis clearly shows that efforts to Americanize these women opposed the core values of the American Dream by attempting to repress their freedom and individuality, thus interfering with their capacity to succeed. Despite the odds against them, these picture brides managed to persevere and build a better life for themselves and their families, thus fulfilling their own versions of the “American Dream.”

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After the Gentleman’s Agreement of 1907 heavily restricted Japanese immigration to the United States, the Japanese population in Hawaii was faced with a dilemma: a surplus of unmarried men and a comparably scarce number of women. To solve this problem, the “picture bride” system was created, which allowed these men to legally marry Japanese residents, who would emigrate to Hawaii to live with their new husbands. This practice, which was in place from 1907 until the passage of the Immigration Act of 1924, facilitated the arrival of over 15,000 Japanese picture brides to Hawaii. These women, like the many immigrants who went to America in that period, were enthralled by the “American Dream” and its promise of freedom and opportunity for all. However, many Americans felt that immigrants should not be given such freedoms and saw them as a threat to American culture. This viewpoint led to a push for Americanization, a movement whose goal was to strip immigrants of their native culture and transform them into “real Americans” through the adoption of traditional American cultural values and practices. This movement was advertised as being beneficial for immigrants, but this was quite far from reality. The Americanization movement had many harmful effects on immigrant communities and attempted to deny them of their chance at fulfilling their American dreams.

It is important to recognize that, during this period, the picture bride practice was more widespread, both in terms of the nationality of its participants and the places that they immigrated to. A number of picture brides also originated from Korea and Okinawa. Additionally, picture brides did not just immigrate to Hawaii, but also went to the mainland

United States and Canada. This study focuses on Japanese picture brides in Hawaii for two key reasons. First, the majority of picture brides immigrated to Hawaii. According to the New York Historical Society, over 15,000 Japanese picture brides immigrated to Hawaii, while approximately 10,000 immigrated to the mainland United States (New York Historical Society 2022). While 5,000 may not seem like a major difference, one must consider the fact that Hawaii has a much smaller population than the continental United States, and thus the ratio of picture brides to the total population was much larger in Hawaii. This ties into the second reason, which is the considerable impact that Japanese immigrants have had on Hawaiian culture, and the fact that this impact would not have been as profound without the immigration of picture brides. Despite the odds against them, these picture brides managed to persevere and build a better life for themselves and their families, thus fulfilling their own versions of the “American Dream.”

The earliest Hawaiian settlers are thought to have arrived in the islands around 500 to 700 AD, bringing with them a number of non-native animal and plant species (Hawaii.gov 2013). Among these was sugarcane. It was not until over a millennium later, after the arrival of Captain James Cook in 1778, that the islands would be opened to the influence of the Western world. American colonizers recognized the potential profitability of sugarcane, and the first sugarcane plantation was opened in 1835 in Kōloa, Kauai (National Parks Service, n.d.). Plantations were originally staffed by native Hawaiians, because they provided cheap and convenient labor for the white plantation owners, who were known to pay wages as low as two dollars per month (Takaki 1984, 5). However, as the industry grew and the



native population shrank, labor shortages became a problem for plantation owners (Takaki 1984, 23). Instead of improving conditions and paying more reasonable wages to entice the local workforce, plantation owners instead decided to outsource their labor. The first international workers came from China, and they were quickly favored by plantation owners for being “far more certain, systemic, and economical, than that of the native,” (Takaki, 1983) meaning that they were considered more efficient and were willing to be paid less than the native Hawaiian workers. Portuguese immigrants followed soon after the Chinese, and these two groups made up most of the labor force of the island in the 1880s, but this would soon change.

A large influx of Japanese workers and their families in the next two decades resulted in a sizeable Japanese population on the islands. By 1900, people of Japanese descent made up 40% of the total Hawaiian population (Thernstrom, Orlov, Handlin 1980, 562). The majority of these immigrants were unmarried men, who often intended to work on plantations for a while to make money before returning home to Japan. While some of these men did follow through with this plan, many others found a permanent home in Hawaii, either because they could not afford to go back to Japan or because they were able to start their own farms and businesses (Ickioka 1980).

Plantation owners, initially pleased by the abundance of cheap labor, quickly grew paranoid that “the Japanese were getting too much of an upper hand in the labor market” (National Parks Service, n.d.). Similar anti-Japanese sentiments from government leaders and labor unions were a major factor in the establishment of the Gentleman’s Agreement in 1907 (Lee 2003, 26). As a result of this agreement, Japan completely stopped issuing passports to Japanese laborers going to Hawaii or the mainland United States (“Gentleman’s Agreement”, n.d.). The only exception to this was that immediate family of U.S. residents were allowed to emigrate to live with them. This meant that many unmarried Japanese laborers were both unable to afford to return to Japan and unable to find a single woman to marry, as Japanese men in Hawaii outnumbered Japanese women seven to one (Nakamura, n.d.). This proved to be a major dilemma for the island’s Japanese population. These unmarried laborers were often extremely lonely, and this loneliness coupled with long hours of demanding labor led many of them into alcoholism (Chai 1979). A solution to this problem would need to be found, or thousands of men would be stuck living alone with no way to start a family and continue their bloodlines. The Japanese population in Hawaii was in danger of practically disappearing within a matter of generations.

The outlook for these men was not so bleak for long, as they quickly found a loophole in the conditions set by the Gentleman’s Agreement. For a marriage to be considered legal in Japan, the wife’s name only needed to be added to her husband’s family registry (Ickioka 1980). After a couple was legally married, the Japanese government could issue the woman a passport to the United States to be with

her new husband. Essentially, arranged marriages were the only way for many of these laborers to find wives and start families. They would first send photos of themselves and descriptions of their lives to an intermediary known as a matchmaker, who would do the majority of the work of finding them a bride (Ickioka 1980). These matchmakers would present this information to the parents of potential brides, who were often the primary decisionmakers, with the bride herself having little say in the matter. Once matches were made, the groom was tasked with adding his bride to the family registry to make the marriage official in Japan. Wedding ceremonies were often held without the groom present. With the matchmaking and marriage steps out of the way, there was only one thing left: the bride’s immigration to Hawaii.

Picture brides, usually several at a time, arrived together at the immigration station in Hawaii, the cold and judgmental environment being their first taste of America (Ickioka 1980). They were met with an exhausting immigration process, where they were inspected to determine if they were fit to enter the country. It was also at the immigration station where they would meet their husbands for the first time. Many women were met with husbands who were nothing like the photos they had sent. It was alarmingly common for men to send photos of themselves that were heavily edited or from when they were decades younger, and in extreme cases, some men would resort to sending photos of a completely different person. Many of them would also lie about their jobs and living conditions to make themselves seem like more suitable marriage partners. This type of deceit was done out of fear that they would have been unable to find a bride if they had been honest about their appearances and living conditions, and many brides were left feeling distrustful of their husbands and fearful of the future in store for them.

Life in Hawaii brought forth a whole new set of challenges for picture brides. Out of necessity, many of these women had to take on additional roles outside of what was traditionally expected of Japanese wives. In traditional Japanese culture, “a good wife is a woman who, by bringing forth sons, helps to safeguard and perpetuate the family name, and by being obedient, properly humble and diligent, helps to maintain peace and order in the family” (Masuoka 1938). Essentially, wives were expected to spend the majority of their time at home supporting the family, particularly the patriarch. This family dynamic was what picture brides were expecting to experience when they immigrated to Hawaii, but that was often not the reality of the situation. During the matchmaking process, it was common for men to lie about their occupation and exaggerate how much money they made. Therefore, in addition to taking care of the home and raising the children, many Japanese women in Hawaii had to work because their husband’s salary alone was not enough to support the family. The labor that these women provided to plantations and businesses was considered indispensable, but they were paid considerably less than the men they worked alongside (Ickioka 1980). The seemingly never-ending responsibilities placed on these

Japanese immigrant women, both domestically and in the workplace, reinforces the critical role that these women played in the Japanese immigrant community in Hawaii.

Another major challenge they faced was the anti-Japanese sentiment that was growing more and more prevalent in both Hawaii and the United States as a whole. Japanese women, in particular, were seen as “easy targets” for anti-Japanese nationalists to direct their aggression towards (Ickioka 1980). A major reason for this anti-Japanese sentiment was a lack of understanding and respect for cultural differences. Many Americans did not understand Japanese culture and saw it as “inferior” to American culture. For example, in American culture love is considered an important factor in marriage. However, the opposite is true in traditional Japanese culture, where marriages are relationships characterized by duty and respect, and wives are meant to be “obedient, humble, and diligent” to their husbands and families (Masuoka 1938). The love and affection that was considered important by many Americans was treated as “a secondary matter” in Japanese culture (Masuoka 1938). Because of these differences, people deemed the picture-bride practice as “immoral and uncivilized,” and some even accused picture brides of being “laborers disguised as brides” (Ickioka 1980), when, in reality, they never intended to become laborers in the first place, but many had no choice but to do so in order to survive.

This growing sense of nationalism and anti-immigrant sentiment spawned the Americanization movement. The Americanization movement was large-scale, including the government, churches, and many other organizations. Samuel Rea, former president of the Pennsylvania Railroad, defined Americanization as “the task of producing good United States citizens from the millions of men and women of alien birth who are in this country, and who in normal times come here by the hundreds of thousands yearly... they must be induced to give up the languages, customs, and methods of life which they have brought with them across the ocean, and adopt instead the language, habits, and customs of this country, and the general standards and ways of American living.” (Central Connecticut State University, n.d.). By looking at this definition of the movement, one may think that the intentions behind the movement were altruistic. While pro-Americanization organizations and leaders at this time may have marketed the movement as being beneficial for immigrants, the reality of the situation was more complicated.

Un-Americanized immigrants were not portrayed in a positive light by the Americanization movement. Pro-Americanization literature from this time reflects the negative sentiment held towards these immigrants. A commonly cited quote about the goals of the movement uses the phrase “the unskilled inefficient immigrant” to describe un-Americanized immigrants (Central Connecticut State University, n.d.). This quote reflects that those who were pro-Americanization assumed that immigrants were inherently unintelligent and incapable of success and must be educat-

ed before they can be functional members of society. This viewpoint is especially ironic when considering the Japanese laborers in Hawaii, whose labor was highly desired by plantation owners because of their skill and efficiency. Immigrants were also often referred to as “aliens,” which exemplifies how the Americanization movement ended up isolating first-generation immigrants, ultimately harming their original goal of assimilating them into American society.

Second-generation Japanese immigrants, known as *nisei*, were seen in a more positive light than their parents. This was primarily because these children, having lived in Hawaii for their entire lives, were seen as more malleable and easier to influence as opposed to their parents, who grew up in Japan and moved to Hawaii as adults. The *nisei* also made up most of the school-aged population in Hawaii. In 1925, 51 percent of school-aged children in Hawaii were of Japanese descent (Talbot 1926). For this reason, most Americanization efforts took place in schools. The *nisei* were encouraged to renounce their Japanese citizenship. Having dual citizenship was seen in a negative light, because of the assumption that dual citizenship equated to double allegiance and therefore meant that they were not completely loyal to the United States (Talbot 1926). In reality, most of these immigrants were very loyal to the United States, but they were not seen as such because they did not fit in amongst their white compatriots. They were expected to prove their loyalty by completely abandoning their native culture and becoming American in every way possible.

Japanese language schools in Hawaii were seen as a major hindrance to the Americanization movement. These schools, which children would attend after the regular school day was over, taught topics including Japanese language, history, and religion (Talbot 1926). Governor Farrington called these schools “a handicap to the American progress of the children of alien parents” and claimed that “they represent a desire to hold our children, who are our future citizens, under a control that is not American” (Talbot 1926). Attempts were even made to ban the schools, illustrating how any effort to retain Japanese culture within the Japanese immigrant community was frowned upon. This intense effort to keep *nisei* children as far away from Japanese culture as possible was driven by fear. The white residents were already uncomfortable with the large Japanese population on the islands and thought that, if they did not subdue and Americanize them, their Japanese population would take away control of the Hawaiian economy and government from the “true Americans” (Talbot 1926). This also illustrates the ethnocentric viewpoint held by many Americans at this time, since they saw their own culture as superior to any other (Dictionary.com, n.d.).

The Americanization movement represents societal standards that existed during the early 20<sup>th</sup> century. The question is, did the ideals of the movement align with the ideals that exist at the very core of the country’s culture? There are

few concepts more fundamental to American culture than the American dream. The term “the American dream” was created by James Truslow Adams in his 1931 book *The Epic of America* (Wills 2015). Adams defined the American dream as “that dream of a land in which life should be better and richer and fuller for every man, with opportunity for each according to his ability or achievement...it is not a dream of motor cars and high wages merely, but a dream of a social order in which each man and each woman shall be able to attain to the fullest stature of which they are innately capable, and be recognized by others for what they are, regardless of the fortuitous circumstances of birth or position” (*The Epic of America* 1931, 404). Although Adams coined the term in 1931--seven years after the end of the picture bride practice--he was simply giving a name to an ideal that had been present in the United States since its foundation. This can be seen in how the Declaration of Independence declares that “all men are created equal” and that everyone has the right to “life, liberty, and the pursuit of happiness” (Declaration of Independence). By comparing the Americanization movement to the key parts of the American dream, we can determine if this movement was truly as “American” as it claimed to be.

First, the definition of the American dream states that the United States should be a “land in which life should be better and richer and fuller for every man, with opportunity for each according to his ability or achievement.” By “richer and fuller,” Adams did not mean that everyone in America should focus on wealth and materialistic things; he means that everyone should be able to lead lives where they can find personal fulfillment. The Americanization movement, however, put a pressure on immigrants to conform to an “American” lifestyle. By doing this, they took away immigrants’ freedom to find what brings them fulfillment. How can life be “richer and fuller” if everyone holds the same values, wears the same type of clothes, practices the same religion, and holds the same political views? A richer and fuller America is one where the separate cultures of its people are allowed to flourish and coexist. Additionally, Adams says that all Americans should have access to opportunities based on ability and achievement alone. However, during the Americanization period, immigrants were not provided opportunities they deserved. In Hawaii especially, white Americans had a tight grip on the property and government of the islands, with little room for Asian immigrants to stake their claim (Talbot 1926).

Adams continues his definition with language that includes women’s freedom to pursue happiness to their fullest capabilities. In America as a whole, women were not granted the same opportunities as men. This treatment was even worse for immigrant women. Picture brides often took jobs alongside their husbands but received lower wages. Considering the fact that these women worked such long hours on top of raising their children, they had very little opportunity to pursue their own interests. Finally, Adams says all Americans should be valued based on character, not circumstances such as of birth. At the core of the Americanization movement was the belief that American culture is

superior to any other country’s culture. People had these preconceived notions that Japanese culture was inferior to American culture, and thus did not see them as equals. When you have preconceived notions about a group of people, you make unfair judgements about them and cannot see them in an objective manner. In other words, they were not “recognized for what they were” (*The Epic of America* 1931).

One might argue that the Americanization movement did improve immigrants’ lives since becoming more Americanized often led to more opportunities and helped them to fit in with their fellow citizens. This was true, but only to an extent. A number of the movement’s educational programs were beneficial, such as those that taught English. However, the true harm of the Americanization movement lies in the underlying pressure that it placed on immigrants to adhere to social norms. When talking about the entire population of a country, there are circumstances where it is beneficial for everyone to share the same viewpoint. For example, a certain degree of loyalty to the country and respect for others is important to maintain social cohesion (Volokh 2015). However, everyone should not be expected to hold the same values and personal beliefs. We can have an overarching American culture while still respecting the various subcultures and what they contribute. This is why the United States is commonly referred to a “melting pot,” because of the “diverse cultures and ethnicities that come together to form the rich fabric of our Nation” (Drexel University 2021).

Essentially, while presenting itself as a movement whose goal was to preserve and promote American culture, the Americanization movement went against the ideals of the American dream. This movement acted to take away immigrants’ freedom of expression, denied them opportunities to succeed, and made negative generalizations that harmed immigrant communities.

Despite facing many obstacles, from dishonesty of their husbands to the damaging effects of Americanization, Japanese picture brides were able to persevere and find success in their own ways. One of the ways that they found success was through forming a community with each other. They encouraged each other to persevere through the hardships they shared. Japanese women who had been long-term residents of Hawaii acted as mentors to the newly arrived picture brides (Honolulu Star-Bulletin 1917, 9). One picture bride recounted in an interview that, after working 16-hour days for years at a laundry facility, she was able to finally open her own boarding house with the help of her friend who lent her money (Chai 1979). While not every picture bride was able to open her own business, many were able to find success on a familial level. Ushii Nakasone was a picture bride who lived a relatively humble life. When interviewed after having lived in Hawaii for several decades, she said that she was so happy because she had children, grandchildren, and great-grandchildren. Her personal success came through raising a family and being able to give her children a better life than she had.



These women also have made a long-lasting impact on the Japanese community in Hawaii. People of Japanese descent make up about 14% of the current population in Hawaii (National Geographic Society, n.d.). Without the arrival of picture brides and the families that they started, this number would be considerably smaller. This also resulted in the preservation of Japanese culture in Hawaii. Organizations like the Museum of Japanese Emigration to Hawaii and the Japanese Cultural Center of Hawaii are dedicated to sharing the rich history of Japanese Americans living in Hawaii, a history that would not be possible without those brave women who took a chance, worked hard, and persevered.

Despite the odds against them, these picture brides managed to persevere and build a better life for themselves and their families, thus fulfilling their own versions of the “American Dream.” Although sentiment towards immigrants has begun to shift in a more positive direction in recent years, immigrants to America continue to face many of the same obstacles that these women faced, such as discrimination and unequal opportunities. The stories of these picture brides can undoubtedly serve as a source of inspiration for immigrants today, because no matter how bleak things seemed, these women kept fighting for their futures and never lost hope for a better tomorrow.

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# How Christian Persecution Influenced the Symbolism in Revelation

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**Abstract:** In the book of Revelation, Readers are bombarded with bizarre and disturbing imagery. At first glance, it is difficult to make any sense of the book due to all the strange events and grotesque monsters. However, when looking at the contents of Revelation through a historical lens, it is revealed that the outlandish imagery in Revelation is symbolic, and that it represents the persecution suffered by Christians under the Roman empire in the late 1st century while the book was being written. Babylon in Revelation 14 represents the Roman economy and the empire's hostility towards Christians. The beasts in Revelation 13 represent the imperialistic nature of Rome. The mark of the beast represents Roman money. The number 666 is a code representing emperor Nero Caesar. Finally, Jesus' victory over evil at the end of Revelation represents Christianity overcoming its persecutors and sends a message of hope that told the book's persecuted audience that relief from Roman persecution is coming soon.

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Revelation is a religious text written by John; It is unknown whether John is the apostle, John. However, what is known is that John was well-known by the Christian community in the late 1st century. Revelation is structured using fantastical, supernatural, and often terrifying images and events to represent real-world events of the late 1st century. Revelation's genre is known as an "Apocalypse." Contrary to popular belief, the word Apocalypse does not mean the end of the world as we know it (1). Apocalypse is derived from the Greek word *apokalypsis*, which means "to reveal." Logically, one of the main themes of Revelation is the incrimination that the Roman empire opposed God and Christianity. Another critical aspect of Revelation is the overarching theme of the struggle between good and evil. Throughout Revelation, readers encounter a variety of evil entities, such as Babylon, the beasts, and others who attempt to prevent God's plan from coming to fruition while God and his angels fight back against them.

I will analyze five major symbolic entities in Revelation, including Babylon, the beasts, the mark of the Beast, the number 666, and Jesus' ultimate victory. Each of these aspects connects with the structure of Revelation; each subject represents events during John's time, specifically the persecution of Christians by the Roman government. Likewise, the aspects of Revelation covered in this thesis connect to the apocalypse genre by highlighting the struggle between good and evil.

The city of Babylon first appears in Revelation 14:8 when an angel prophesizes death over the city. In Revelation,

Babylon is portrayed as a powerful, wealthy city that is hostile to Christianity; Babylon is personified as a woman who rides atop a demonic beast, seduces everyone with her wealth, and is drunk on the blood of the Christians she has murdered. Babylon fits with the structure of Revelation because Babylon is used to represent Rome, its wealth, and the empire's hostility towards Christians. Babylon fits into the genre of Revelation because it symbolizes how Rome is hostile to Christianity and values material wealth more than righteousness.

The unnatural beasts that baffled many readers make their debut in Revelation 13. The beasts inhabit the entirety of chapter 13 and continue throughout the rest of Revelation. The two beasts are described as freakish abominations that rise out of the land and sea. The beasts fit the structure of Revelation because they symbolize Rome's imperialist nature. The beasts also fit into the apocalyptic genre because their presence represents Rome's hostility towards Christianity.

The mark of the Beast, one of Revelation's infamous defining features, emerges in Revelation 13:16-17; the mark is placed upon people and is required if people want to buy or sell anything. The mark of the Beast fits the structure of Revelation because it represents money imprinted with Roman emperors and gods, forcing Christians to use and accept the presence of other gods. The mark of the Beast fits into the apocalyptic genre because it symbolizes money as being evil.

Unlike the mark of the Beast, the infamous number 666

only makes a single appearance in Revelation. The number 666 appears in 13:8, stating that it is the "number of the beast." Despite its short appearance, it has become infamous and synonymous with evil. The number 666 fits into the structure of Revelation because it symbolizes Roman emperor Nero Caesar, one of the most infamous persecutors of the Christian church. The number 666 fits into the apocalyptic genre because it represents emperor Nero's mythological return and re-conquest of Rome.

At the end of Revelation, we see that Jesus claims victory while the antagonists of Revelation meet their demise. Following the events of Revelation and Jesus proclaiming that he is "coming soon," the righteous live in paradise in the new Jerusalem. Jesus' final victory fits into the structure of Revelation because it symbolizes Christianity's ultimate victory over its persecutors and provides a beacon of hope to persecuted Christians in the Roman empire. Jesus' final victory fits into the apocalyptic genre because it announces that Roman persecution of Christians will end, and Christianity will prevail.

### Babylon

The first aspect of Revelation to be placed under the historical lens will be Babylon. In Revelation 17, Babylon is represented by a woman dressed in fine fabrics and expensive jewelry who rides a demonic beast and is drunk on Christian blood. At first, Babylon seems to have little to do with Christian persecution; upon further examination, Babylon represents many aspects of the Roman empire. First, Babylon's use of excessive wealth and opulence represents the Roman economy and how Rome flaunts its wealth. Second, Babylon's alluring form and temptress nature represent how the Roman economy lures Christians into compromising their faith for financial gain. Finally, the depictions of Babylon harming Christians represent Rome's hostility towards Christianity.

In Revelation, Babylon displays boundless wealth and is depicted wearing fine fabrics and expensive jewelry while carrying a golden goblet and engaging in trade with many nations (2). Babylon's use of excessive wealth is symbolic. Looking at the historical context behind Babylon's opulent appearance represents the wealth and power of the Roman economy. Rome's massive road networks and unrestricted access to the Mediterranean and Black Seas gave Rome an immense trading network incorporating conquered territories and foreign trading partners (3). Furthermore, Rome gained revenue from their constant expansion and numerous conquests. Between Rome's trading network and wartime revenue, it is no surprise that the Roman empire was incredibly wealthy, and Romans flaunted their wealth. Roman rulers regularly built arenas, villas, statues, and other costly projects to leave an impression that would live on after their deaths (4). Rome's tendency to flaunt its wealth is directly reflected by Babylon as she shows off her extravagant jewelry and extravagant garments. Naturally, many found Rome's wealth and prosperity attractive.

Another aspect of Babylon's excessive wealth is her temptress nature, where she attempts to lure kings, traders, and Christians into sexual relations (5). Since Babylon symbolizes Rome, these relations symbolize entering a financial relationship with Rome. Due to Rome's massive trading network, Rome had access to goods from around the ancient world, which allowed Rome to engage in trade within the Mediterranean, the distant East Indies, and China (6).

In Revelation, it seems that John depicted the common act of shopping as being evil. However, John emphasizes the action of engaging in economic relations with Rome as being evil. During the first century, Christians were outsiders in Rome since they did not adhere to Roman religious traditions; this led to Romans persecuting Christians (7). This persecution then led zealous Christians, such as John, to outright reject the Roman society, which hated Christians. One aspect of such rejection was not engaging in financial dealings with the Romans. However, this was not easy because Rome offered opportunities for financial prosperity, and they sold virtually everything needed to survive. Revelation portrays the temptation of Roman wealth with Babylon as an alluring female prostitute who entices people into relationships (8). According to zealous Christians, financial dealings with Rome would compromise the Christian faith, just as engaging in a sexual relationship with a prostitute tarnishes one's standing with God (9).

Some passionate Christians refused to participate in the Roman society that despised them. Revelation 17:6 portrays Rome's hostility towards Christians in the form of Babylon (the woman) being "drunk with the blood of the saints and the blood of the witnesses to Jesus." Although the Roman Empire was polytheistic and worshipped recycled Greek gods (10), Rome was also a theocracy, a state ruled by one human who is considered a deity. The Romans worshipped their emperors through a state religion called "the imperial cult" (11). Since Christians believed that there was only one God, they refused to worship Roman gods, the emperor, or to participate in Roman religious traditions; this ostracized Christians. Furthermore, Christianity's refusal to join the imperial cult was seen as a rebellion against the emperor and incited the wrath of the Roman government (12). Because Christians refused to compromise their faith, the Romans began persecuting Christians (13). This persecution prompted John to depict Babylon as being drunk on the blood of saints. With Babylon analyzed, our focus shifts to Revelation 13, where readers are introduced to the tyrannical beasts from the Sea and the Earth.

### The Beasts

The Beast from the Earth and the Beast from the Sea debut in Revelation 13:1 and Revelation 13:11, respectively. The historical context behind the symbolism of the Beast from the Earth and the Beast from the Sea reveals



that both creatures represent Rome's imperial nature, which was Roman Empire's desire to conquer and rule over everything. Multiple aspects of these beasts represent Roman imperialism.

First, the beasts' descriptions and events that involve them contain multiple elements that symbolize Rome and the empire's conquests. Then, the beasts rising from the land and the sea represent the Roman Empire's desire to have complete authority over the world. Finally, the beasts' interactions with humanity represent how Rome wants complete control over people through the imperial cult.

In Revelation, John provides a detailed description of the beasts and their roles. Revelation 13:1-10 describes the Beast from the Sea as having seven heads, holding blasphemous titles (14), sitting upon a throne, having authority over people of many nationalities, and killing anyone who is associated with Christianity (15). Meanwhile, in Revelation 13:11-18, the Beast from the Earth ensures humanity remains loyal to the Beast from the Sea, by enforcing decrees and punishing dissenters (16).

These aspects of the beasts, support how the Beast from the Sea and the Beast from the Earth symbolize Rome. The seven heads on the Beast from the Sea represent Rome's famous claim of being the city that was built on seven hills (17). The Beast from the Sea's blasphemous titles and the throne it sits upon symbolize Roman Emperors who sat upon a throne and believed themselves to be divine (18). The Beast from the Sea's authority over people of multiple nationalities represents how the Roman Empire ruled over many people from different nations and ethnicities (19). Finally, the Beast from the Sea slaughtering dissenters represents Rome's persecution of Christians (20).

The Beast from the Earth's tasks of ensuring loyalty to the Beast from the Sea, enforcing the decrees made by the Beast from the Sea, and directly punishing dissenters all represent Rome's military might and how the military maintains order in the Roman empire (21). By establishing how both the Beast from the Sea and the Beast from the Earth symbolize Rome, it is revealed how these creatures represent the imperial nature of the Roman Empire.

As their names imply, one Beast rises from the Sea while the other rises from the Earth. The symbolic event of the beasts rising from the Earth and the sea represents the Roman Empire's conquests and the Roman government's authority in the lands they controlled. During the late 1st century, the Roman Empire controlled almost half of modern-day Europe, a tiny sliver of territory in Northern Africa, all of Asia Minor, and even encroached into the fertile crescent (22). Among the Roman Empire's impressive domain, included the entire Mediterranean Sea, a feat that the Romans took great pride in, often referring to the Mediterranean as "Our Sea" (23).

The Beast from the Earth is meant to represent the territory that the Roman Empire controlled and the authority of the

Roman government in the lands Rome conquered. As seen with the Beast from the Earth enforcing the will of the Beast from the Sea, the Romans kept a tight leash on their territory, using politicians and soldiers to keep Rome's territories under the emperor's control (24). In Revelation, the beasts were not content with having authority over just the land and sea. Likewise, the Roman Empire's imperialistic desires were unsatiable. Comparable to the beasts in Revelation 13, the Roman Empire equally sought complete conquest over their human subjects.

The beasts' interactions with humanity in Revelation demonstrate their objective to command absolute control over humanity. In Revelation 13: 13-15, the Beast from the Earth displays the power to astonish humanity and make people worship the Beast from the Sea. The Beast from the Earth also created animate statues of the Beast from the Sea that people are ordered to worship. Finally, both the Beast from the Sea and the Beast from the Earth punish dissenters with death (25).

Viewing this through the historical lens of Christian persecution in Rome reveals that the actions the beasts take to appear divine and command complete authority over humanity reflect practices used by the imperial cult to make the Roman emperor appear divine and command absolute loyalty of the Roman populace. The imperial cult used many tactics to make the emperor appear divine. The Beast from the Earth's ability to perform displays of power, such as "making fire come down from heaven to earth," (26) represents how the Romans believed fire and other natural displays were signs of divine power. Some examples of this include Roman emperors depicted holding lightning bolts, insinuating they could wield lightning bolts like Zeus (27), and how the Romans considered leaping flames a sign of divine approval, as observed when a flame leaped from an altar to show divine approval of emperor Tiberius' aspirations for power (28). The Beast from the Earth's ability to create animate statues also represents a ploy the Romans used to make the emperor appear divine. Engineers created statues of the emperor that could be manipulated like stone puppets, making it appear as though the emperor possessed a statue and was using it to commune with his subjects (29). Finally, the beasts slaughtered those who refused to worship the Beast from the Sea represents the Roman government's persecution of Christians who refused to participate in the imperial cult and worship the Roman emperor (30). Along with the Beasts from the Earth and Sea, Revelation 13 also contains the mark of the Beast.

### The Mark of the Beast

Revelation 13:17 reveals the mark of the Beast. In Revelation, the mark of the Beast is described as a mark placed on one's right hand or forehead that is required to buy or sell anything. Most people believe that any mark on their right hand matching the description of the mark of the Beast is evil. However, the historical symbolism behind the mark of the Beast indicates that the mark of the Beast is a metaphor

for Roman money. In Revelation's original Greek manuscripts, the mark of the Beast is directly correlated to stamps Rome used to press images into their coins. John denounces Roman money in Revelation because of the Christian zealots, who desired isolation from a sinful Roman society and the evils of Roman money, which was connected to the imperial cult.

In Revelation 13:17, the mark of the Beast is described as a mark placed on one's right hand or forehead that is required to buy or sell anything. Most people take this description at face value (31). However, when looking at the historical context behind the mark of the Beast, we see that the mark of the Beast is meant to represent Roman money (32). Considering that original Greek manuscripts referred to the mark of the Beast as Charagma, the ancient Greek word for the stamps Rome used to press images into their coins, it is easy to see that Roman money directly correlates to the Mark of the Beast (33). Although it is often thought that money is the root of all evil (34), it still may seem an exaggeration for John to imply that Roman money is evil. However, several members of John's audience during the late 1st century believed John's opinions on the evils of Roman money.

During the late 1st century, while Revelation was being written and Rome was persecuting the early church, the persecution of Christians gave rise to an extremist sect of Christians known as the Zealots (35). Between suffering under government-sanctioned persecution and being forced to worship the imperial cult, the Zealots saw the Roman empire as a nation that hated Christianity and openly defied God. The Zealots decided that if Roman society rejected them, they would reject anything related to Roman society. The Zealots formed Christian communities that rejected Roman cultural practices, their religion, and Roman money (36). Because Christian Zealots opposed Roman society and their evil money, it is understood why money earned a distinct symbolism in Revelation.

The Christian Zealots thought Roman money encompassed evil because of its connection with the imperial cult. The Romans followed the imperial cult, the state-sponsored worship of the emperor, and the Roman government. Another facet of the imperial cult was the Roman coins stamped with depictions of the emperor being a deity, or the goddess Roma among other imperial religious icons (37). The Zealots, upheld the first commandment, "You shall have no other gods before me," (38) and did not condone being forced to accept the existence of foreign gods, let alone a man proclaiming himself as a god. Between the necessity of Roman currency in daily life and the Roman government coercing Christians to accept foreign gods, John symbolized Roman money in Revelation as the mark of the Beast. Now that the mark of the Beast has been analyzed, our focus shifts to one of Revelation's most infamous symbols of evil.

Revelation 13:18 presents the number 666, also known as "the number of the beast," and arguably one of the most infamous aspects of Revelation. Regardless of your religious affiliation, you have probably heard of the number 666 either from someone or in pop culture; the number 666 is almost universally portrayed as a symbol of evil (39). However, the truth is that the number 666 was never evil (40). When looking at the historical symbolism behind the number 666 in Revelation, we recognize that what the number 666 represents is what John is portraying as evil. In Revelation, the number 666 represents emperor Nero Caesar, one of the most infamous persecutors of the early Christian church. John used the number 666 because it is the sum of all the letters in the name Nero Caesar ran through an A-1, B-2 style cipher. John made the number 666 a symbol of evil because of Nero's reputation for persecuting the early Christian church. Nero was denoted in Revelation because of a myth in ancient Rome that emperor Nero never died and would eventually return to Rome.

John did not randomly choose the number 666 to represent Emperor Nero; he cunningly chose an equation representing Nero's name (41). Nero Caesar's name ran through an A-1, B-2 style cipher (42) and added together using the ancient Hebrew alphabet equals the number 666. Nero Caesar's name in ancient Hebrew, נְרוֹ קֶסֶר (pronounced "Nrwn Qsr"), deciphered (N = 50, r = 200, w = 6, n = 50, Q = 100, s = 60, r = 200), and added together totals 666 (43). So now that it has been explained why John chose 666 to represent Nero, why did he use 666 to portray Nero as malicious?

John portrayed Nero as malevolent because of Nero's infamous reputation as a persecutor of the early church. Any Historian of the Roman Empire acknowledges that emperor Nero Caesar despised Christianity. Nero often blamed Christians for anything that went wrong in the Roman Empire. One of the most infamous examples of this was the Great Fire of Rome in 64 AD, a massive inferno that destroyed nearly 75% of the city. After the fire, Roman citizens began to blame Nero for intentionally starting the fire. Nero, not wanting to be removed from power, blamed the Christians for starting the fire, which launched a campaign of Christian persecution (44). With the number 666 used to represent emperor Nero and Nero's hatred of Christianity, it makes sense why John chose to make the number 666 a symbol of evil.

It would not be Revelation if the number 666 were merely a representation of Nero. In true apocalyptic fashion, John also used the number 666 to represent the Nero Redivivus Legend, a widespread belief in the late 1st century stating that former emperor Nero Caesar would return after he died to re-conquer Rome. Today, it is irrefutable that emperor Nero Caesar was overthrown and committed suicide in 68 AD when the Roman senate denounced Nero as an enemy of the state for his disinterested response toward the grow-

ing uprisings within the empire. Having lost the favor of the senate and his praetorian guard, whom both chose to support the Roman governor, Galba, Nero Caesar committed suicide to avoid capture and trial by his political enemies (45).

The people of ancient Rome did not have quick and easy access to information. So, when the news of Nero's suicide spread, many did not believe it. This denial gave birth to the Nero Redivivus Legend. The myth states that Nero faked his death and hid in Parthia to amass an army. One day, Nero would come out of hiding and return to Rome with his army to wreak vengeance upon Rome, destroy the city, and reclaim his throne (46). Given Nero's reputation with Christians and the Christian church, no Christian wanted this myth to become a reality (47). John added this reference to the Nero Redivivus legend because it portrays the destructive potential of the Roman Empire, which not only threatened the followers of Jesus but ultimately threatened late 1st-century society itself (48). With several of the antagonistic components in Revelation analyzed (49), now would be a good time to move out of Revelation 13 finally, and on to the more optimistic conclusion, Jesus' ultimate victory at the end of Revelation.

### The Final Victory

What better way to conclude a thesis on Revelation than with the ending of Revelation (50)? Considering that the events of Revelation symbolize Christian persecution in ancient Rome during the late 1st century, it seems fitting that God's final victory over evil represents a message of hope to persecuted Christians during the late 1st century. The end of Revelation brings hope to Christians in Ancient Rome by detailing the ultimate destruction of all the antagonists, representing the eradication of the forces persecuting Christianity. The vision of the new Heaven and the new Earth represents the rewards that await Christians who persevere and remain faithful through persecution. Finally, Jesus' message that he "is coming soon" represents the end of Roman persecution.

By the end of Revelation, John uses the annihilation of all the antagonists to represent Christianity overcoming its persecutors. All the book's antagonists have met a violent end. Babylon is drowned in Revelation 18:21 when an angel casts a millstone into the sea, creating a tsunami that destroys the city. In Revelation 17:16, it is implied that Babylon, the woman will be betrayed by the Beast she rides, which bucks her off its back and roasts her (51). The cities and the people who rejected God and persecuted faithful Christians are violently destroyed by various supernatural disasters and plagues (52). The kings and armies who made the grave mistake of opposing Jesus in Revelation 19:17-21 were all slaughtered in battle and birds feasted on their corpses. Lastly, Satan, the false prophet, the Beasts from the Land and Sea, and anyone's name not in the Book of Life at the final judgment are tossed into a lake of fire in Revelation 20:10, where they will be roasted for all eternity (53).

Each antagonistic figure is symbolic and exemplifies good versus evil. Although it is not explicitly stated, the mark of the Beast and what the number 666 denotes, which represents Roman money and emperor Nero Caesar respectively, are implied to have been destroyed along with all the other evils (54). This leaves behind the people, kings, and armies who rejected God, persecuted Christians, and attempted to fight God. In ancient Rome, Christian persecution was usually a communal affair. Therefore, these groups represented Romans who persecuted Christians (55). The false prophet is another allegory for the myth of Nero Caesar's return (56). Finally, Satan is the ultimate personification of sin and evil (57). By knowing what each of these antagonistic figures represented, it can be concluded that their destruction epitomizes Christianity ultimately overcoming persecution.

With the defeat of persecution, John wanted to assure his audience that their continued faithfulness to God would be rewarded. Just as the evil entities seen earlier in Revelation represented Roman persecution, many aspects of God's paradise are also symbolic. In Revelation 21:11, the new Jerusalem, also known as the Holy City, is described as a massive walled city that gleams like a jewel (58). The new Jerusalem symbolizes a future in which Christianity is free from persecution. Now that Christianity's persecutors are destroyed, the city represents a future where worship will occur freely in God's presence. Revelation 21:22 also states that the new Jerusalem has no temple. In Judaism, temples facilitated access to God, with the holiest sections being off-limits to everyone except priests. By removing temples from the new Jerusalem, John is saying that Christians will have no obstacles between them and worshipping God (59). Revelation 21:3 states that the population of the new Jerusalem encompasses people from various nations. The varied population of the new Jerusalem is meant to reflect a prevailing Christianity. When Revelation was written, many believers thought Christianity's future was uncertain since Christianity was a young religion and believers were persecuted. With the new Jerusalem depicted as a holy city filled with people from many nations, John reassured his audience that Christianity would prosper (60).

John did not just symbolically destroy evil and reward the faithful; he wanted to sow hope into his persecuted audience and assure them that Roman persecution would end soon. In Revelation 22:7-12, John writes that Jesus said, "I am coming soon." This message of Jesus coming soon represents a sign of hope for faithful Christians and an omen of reckoning for Christianity's persecutors; John's message communicates that persecuted Christians should remain faithful to Jesus because their oppression will soon come to an end (61).

### Conclusion

The events in Revelation symbolize historical events that occurred while Revelation was written. At first glance, Babylon the woman seems to have nothing to do with Christian persecution. However, further examination of the historical context of Babylon reveals that she represents the



Roman Empire. The use of excessive wealth and opulence by Babylon represents the Roman economy. The alluring temptress form of Babylon represents how Christians refuse to participate in a society that persecutes them and how the Roman economy tries to tempt Christians into compromising their faith for financial gain. Finally, the depictions of Babylon harming Christians represent Rome's hostility towards Christianity.

By looking at the historical context behind the symbolism of the Beast from the Earth and the Beast from the Sea, it is transparent that both creatures represent Rome's imperial nature.

First, the beasts' descriptions and events that involve them contain multiple elements that symbolize Rome and the empire's conquests. Then, the beasts rising from the land and the sea represent the Roman Empire's desire to have complete authority over the world. Finally, how the beasts interact with humanity exemplifies Rome's desire to gain complete control over people through the imperial cult.

By looking at the historical symbolism behind the mark of the Beast in Revelation 13:17, it can be concluded that the mark of the Beast is a metaphor for Roman money. In the original Greek manuscripts of Revelation, the mark of the Beast is described using Charagma, the ancient Greek word for the printing presses Rome used to stamp their coins. John denounces Roman money in Revelation because of the Christian Zealots, who wanted nothing to do with the Romans who persecuted them and considered any participation in Roman society sinful. The main reason why Christian Zealots thought Roman money was evil was due to Roman money's connection to the imperial cult.

When looking at the historical symbolism behind the number 666 in Revelation, it is revealed that rather than the number itself, it is what the number 666 represents that John is saying is evil. In Revelation, the number 666 represents one of the most infamous persecutors of the early Christian church, emperor Nero Caesar. The number 666 is used because it is the sum of all the letters in the name Nero Caesar ran through an A-1, B-2 style cipher. John made the number 666 a symbol of malice because of Nero's reputation as a persecutor of the early Christian church. Nero was mentioned in Revelation because of a prevailing myth in ancient Rome that emperor Nero never committed suicide and would return to conquer Rome.

God's final victory over evil at the end of Revelation represents a message of hope to Christians facing persecution during the late 1st century. The most prominent symbol of how the end of Revelation is a message of encouragement to Christians in Ancient Rome is the annihilation of all the antagonists by the end of Revelation, representing the destruction of the forces persecuting Christianity. The vision of the new Heaven and the new Earth represents the rewards that await those who persevere and remain faithful through persecution. Finally, Jesus' message that he "is coming soon" reflects a hopeful message that relief from Roman persecution is coming soon.

By understanding the historical symbolism in Revelation, readers are given a new angle from which to view Revelation and all its eccentricities. The events that took place during the late 1st-century may also explain why John wrote Revelation the way he did. In the end, Revelation will unfold just as the Bible portrays, but this new view of Revelation will lead to a better understanding of the mysterious religious text that is Revelation and give readers insight into what life was like for Christians in the late 1st century.

## Footnotes

1. Feelin' fine about it is optional.
2. Revelation 17:2-4, NRSV.
3. Payne, Robert. *Ancient Rome*. New York: American Heritage Press, 1970, pgs. 217-221.
4. Payne, 180-192.
5. Rev 17:2.
6. Payne, 217-221.
7. Croix. "Why Were the Early Christians Persecuted?" *Past & Present*, no. 26 (November 1963). <https://www.jstor.org/stable/649902>, pg. 10.
8. Koester, Craig. *Revelation*. Yale University Press, 2014, pg. 391.
9. Collins, Adela. "The Political Perspective of the Revelation to John." *JOURNAL OF BIBLICAL LITERATURE* 96, no. 2 (1977). <https://www.jstor.org/stable/3265880>, pg. 253.
10. In a similar fashion to how China manufactures of-brand copies of other people's products.
11. Croix, 10.
12. Croix, 10.
13. As bad as all of this may sound, this persecution was not as universally severe across the entirety of the Roman empire. Some areas were worse than others. For example, Christian communities in Sardis and Laodicea had very little Christian persecution to the point where Christians became lax with their faith as seen in Rev. 3:1-6 and 14-22, while Christian persecution in other places such as Pergamum was so severe that John literally described the Christian community there as "living, where Satan's throne is." In Revelation 2:13.
14. Basically calling itself a god.
15. Rev 13:1-10, NRSV.
16. Rev 13:11-18, NRSV.
17. Koester, 597.
18. Tripvarakoon, Wiriya. "The Sea-Beast in Revelation 13:1-10." In *The Theme of Deception in the Book of Revelation: Bringing Early Christian and Contemporary Thai Culture into Dialogue*, 89-149. Claremont, Ca.: Claremont Press, 2017. <https://www.jstor.org/stable/j.ctvbcdd1fj.8>, pg. 113.
19. Tripvarakoon, *The Sea-Beast in Revelation 13:1-10*, pgs. 98-105.
20. Tripvarakoon, Wiriya. "The Earth-Beast in Revelation 13:11-18." In *The Theme of Deception in the Book of Revelation: Bringing Early Christian and Contemporary Thai Culture into Dialogue*, 151-92.

- Claremont, Ca.: Claremont Press, 2017. <https://www.jstor.org/stable/j.ctvbc1fj.9>, pgs.37-38.
21. Payne 215-217.
  22. Encyclopædia Britannica. "Map of Ancient Rome: 1st Century AD." Encyclopædia Britannica, n.d. Encyclopædia Britannica. <https://www.britannica.com/place/Roman-Empire/images-videos#/media/1/507739/1821>.
  23. Koester, 580; Payne, 217.
  24. Payne, 215-217; MacMullen, Ramsay. *Enemies of the Roman Order*. Cambridge Massachusetts: Harvard University Press, 1966, Pg. 194.
  25. Rev 13:7 and 15.
  26. Revelation 13:13, NRSV.
  27. ...or more accurately, the Roman knockoff Jupiter.
  28. Koester, 603.
  29. Koester 469, and 593; Tripvarakankoon, Wiriya. "The Earth-Beast in Revelation 13:11–18."pg. 21.
  30. Croix, 10.
  31. Yes, this is addressed to all the doomsday preppers who think cybernetic implants are evil.
  32. In retrospect, this does make sense. It would definitely be impossible to buy or sell without money. No, trading items of equal value instead of money does not count, as that would be bartering.
  33. Collins, 252.
  34. 1 Timothy 6:10, NRSV.
  35. Christian Zealots. Not the Elite Zealots from the Halo games.
  36. Collins, 252.
  37. Schussler-Fiorenza, Elizabeth. *Revelation: Vision of a Just World*. Minneapolis: Fortress Press, 1991.
  38. Shelton, Jo-Ann. *As The Romans Did*. 2nd ed. New York: Oxford University Press, 1988, pg. 86.
  39. Exodus 20:3, NRSV.
  40. To be honest, I once believed this as well, hence why I always dreaded the math problem 2000/3, which rounds to 666.6 repeating. Not one of my finer moments.
  41. To any of you who are not math majors or just do not like math in general, I apologize to you now. Since I enjoy math as much as you do, I feel your pain.
  42. A cipher in which letters are represented as numbers. A=1, B=2, C=3, etc.
  43. Koester, 597.
  44. Payne, 203-204.
  45. Payne, 203-205.
  46. Koester, 602 and 665; Another reference to the Nero Redivivus legend can be seen earlier in Revelation 13:3, where the beast from the sea is dealt a mortal wound and heals itself.
  47. Zombie Nero, two words that should never go together. Not as bad as a zombie Caligula, but still...
  48. Koester, 126.
  49. That and due to time constraints (I have deadline to meet if I want this thing to be published).
  50. It is certainly a far better ending than focusing on one of the other various monsters or other symbolically evil elements of Revelation.
  51. Literally, not figuratively. It is a demonic beast that breathes fire like a dragon, not one that uses bad jokes to insult people.
  52. Specifically, the seven seals in Revelation 6:1-17, the six trumpets in Revelation 8:6-9:21, and the seven bowls of God's wrath in Revelation 16:1-20.
  53. Again, literally roasted, not figuratively roasted. I don't think a lake of fire can insult people.
  54. If you already read this far into the paper, you should know where these facts came from.
  55. Koester, 805.
  56. Koester, 606.
  57. Koester, 682.
  58. When viewing the New Jerusalem, Sunglasses are recommended. The city will not be held liable for any blindness or melted eyeballs caused by not heeding this warning.
  59. Koester 831.
  60. Koester, 805.
  61. Koester, 848 and 853.

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# Hartford & the West: Ocean Vuong and His Re-Generation of Samuel Colt's Western Environment

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**Abstract:** If we were to identify the most renowned Hartford writer – one whose stories span both eastern and Western American settings – most would likely name Mark Twain. As many of Twain's novels such as *Roughing It* are situated in the West, he appears as the most conceivable “rhizomatic” connection between Hartford's literature and the Western genre. But what if we considered Hartford as its own “weird Western” city where the stories about cowboys were created and told by the cowboys themselves? The nineteenth-century Yankee arms maker Samuel Colt and the contemporary poet Ocean Vuong are equally shapers of Western myths as Cowboy Poets: “Westerners” as the crafters of their own tales who dwell somewhere between reality and fiction in our cultural consciousness. As his own storyteller, Colt invents the iconic revolver just as much as the revolver invents him as this mythic rugged individual. Vuong as a contemporary Cowboy Poet reframes the image of the cowboy and his revolver while challenging its associated masculinity and violence. In evaluating how these Hartford figures as Cowboy Poets generate and regenerate these iconographies of the West, I challenge where the “Western” takes place and unveil how violence – never an isolated incident – has become so deeply ingrained into our nation geographically, ideologically, and linguistically.

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Because everyone knows yellow pain, pressed into American letters, turns to gold. / Our sorrow Midas-touched. Naphalm with a rainbow afterglow.

—Ocean Vuong, “Not Even,” from the poetry collection *Time is a Mother*

Not now of the renown we speak / That gathers round his name, / For other climes beside our own / Bear witness to his fame; / ... Nor the Midas-touch that turn'd / All enterprise to gold...

—Lydia H. Sigourney, from her death poem written for Samuel Colt

In *Revolver* (2020), Jim Rasenberger suggests that Hartford's inventor of the revolver, Samuel Colt, had an uncharacteristically close relationship with today's often forgotten poet, “The Sweet Singer of Hartford,” Lydia Sigourney (15). Sigourney was a teacher to several of Colt's siblings, and the two remained in contact through written letters, so? in doing what she had been known best for, Sigourney wrote “sentimental death poetry” or eulogy poems for Colt and his children's funerals. After introducing this relationship, Rasenberger speculatively asserts, “The truth is, Sam Colt never had much use for poetry” (20). With Sigourney as this sentimental female writer, Rasenberger seems to suggest that the individualistic, impulsive, and often violent Colt could never have had the inclination

to take the time to write or appreciate a poem: something pathetic and feminine, not virile and masculine. Colt, as a gimmick, however, sometimes sold his revolvers in false books. On the spine of these “books” were titles such as *Law for Self Defense*, *The Tourist Companion*, or *The Common Law of Texas* (Rasenberger 155). Although not a literal poet himself, these books open to what might as well be Colt's poetry: revolvers that encapsulate the stories of what it meant to be a self-made man like Colt and those venturing off to the Western frontier with his guns.

Mark Twain, who moved to Hartford in 1871 several years after Colt's death, often praised the Colt factory. In reference to Colt, he had even once stated, “an inventor is a poet – a true poet – and nothing in any degree less than a high order of poet” (*The Colt* 16). As a connection himself between the Western region of the developing Frontier and Hartford, Twain was originally born in Missouri but only began to write his most popular novels, which often featured Western settings, after he moved to Hartford. In his novel *A Connecticut Yankee in King Arthur's Court* (1889), which actually begins in Hartford rather than the West, the protagonist Hank becomes a superintendent of Colt's factory, only to start a fight with a worker who knocks him out so severely that he ends up in King Arthur's Camelot. Hank's miraculous journey to this historical yet fictional England demonstrates how the Colt Factory functions as an instrument of time travel and mythmaking as much as an actual arms factory.

The poetics of Western mythology have led to memorable and meaningful stories which have allowed Americans to construct an identity for themselves. At the same time, however, they have led to violent self-identifications and the erasure of minoritized groups. Even so, these poetics continue to lead the push and pull struggle revolving around who puts these myths in place. In a 2022 interview with Alok Vaid-Menon focused on the harms of western perspectives, the contemporary Vietnamese American novelist and poet who grew up in Hartford, Ocean Vuong, explained,

A truth in nineteenth-century America was that white settlers were predestined, ordained by God through Manifest Destiny, to settle the land where people had been thriving for thousands of years. That was considered truth. I have a lot of trouble surrendering the ground. When we surrender the ground, we have to assume that an objective truth is there to be seen. If we actually give up that ground, someone else is taking it over. (“Interview”)

In this statement, Vuong ponders the tensions that exist between destructive American Western myths and the persistent need for mythmaking. Ocean Vuong, a poet himself, has become a significant voice in the middle in this contentious battle for who is included in the process of mythmaking. “Poetry” as well as “poem” and “poet” are etymologically derived from the Greek word “*poiesis*,” meaning to make or create, and the American nation has been built upon the creation of myths which intentionally include the stories of a select few white men while systematically excluding the others (Rigby). The “Western” – whether genre, region, or likely somewhere in between as myth – of the collective American cultural consciousness pulls upon such “poets” and poetic contributions as Frederick Jackson Turner and his Frontier Thesis; Buffalo Bill and his Wild West Shows; John Wayne and his many reincarnations of the filmic cowboy. While Turner makes the claim that American men need that Western environment to shape their identities by putting them “in the hunting shirt and the moccasin,” Buffalo Bill and John Wayne as revolver-wielding actors also perform that expectation of violent masculinity (Turner 33).

Western myths surrounding masculinity and violence, however, spread far beyond the American West and the nineteenth century in the poststructuralist and rhizomatic way in which Neil Campbell posits the West “as always already transnational,” or for this essay’s purposes, national (*The Rhizomatic* 4). As the city that manufactured the iconic Western image of the Colt revolver, Hartford is a significant battleground where Western mythology becomes told, retold, and reshaped. In this two-pronged essay, I first analyze how Samuel Colt’s actions and the stories told by him and about him relay how he upheld and further generated Western myths concerning masculinity and violence, not only through his guns but through the industrial violence he

inflicted upon Hartford’s environment. In the second part, I contend that Vuong, as a part of another generation of mythmakers, engages in a *re-generation* of Colt’s Western images as well as other Western landscape images in Hartford in his novel *On Earth We’re Briefly Gorgeous* (2019) to call attention to the persisting impact of such dangerous myths on the environment as well as on others often excluded from Western mythology. In the process, he inserts himself as a queer Asian American along with other queer individuals who respect and appreciate the landscape in order to *re-build* the nation-building narrative.

Richard Slotkin puts forth that the central myth that not only lies at the root of Western myth but all American myth is “regeneration through violence”: the concept which “represented the redemption of American spirit or fortune as something to be achieved by playing a scenario of separation, temporary regression to a primitive or ‘natural state’” (*Gunfighter* 12). Heavily tied to the concepts of violent masculinity and stereotyped Native American savagery, “regeneration through violence” strongly resembles how Michael K. Johnson, Sara L Spurgeon, and Rebecca M. Lush explain in *Weird Westerns* (2020) that the Western genre has specifically remained “obsessed with the violence necessary to police the borders of white American masculinity and those borders grind against gender and racial identities, cultural and social identities, Native American frontiers and national borderlands, and imaginary lines between civilization and savagery, freedom and conquest” (4). Many may imagine the white-rugged-cowboy West as fossilized at the turn of the 19<sup>th</sup> century with Turner’s proclamation that that the Frontier was no more. Clearly, however, these Western mythologies have never been contained to the West, let alone the nineteenth-century West. In Samuel Colt’s Hartford, there are, of course, revolvers but also an environment which had begun to vanish as a result of industrialization just like Turner’s image of the Frontier.

In Vuong’s semi-autobiographical novel *On Earth We’re Briefly Gorgeous* (2019), Little Dog’s Hartford mirrors a mythological Western landscape; a landscape whose images have been generated both by Western and Eastern figures like Samuel Colt. In subverting the expectations around where the West(ern) takes place, where many of its concepts originate from, and where its environment can be encountered, I place Colt and Vuong in conversation together as mythmakers in order to engage in what Neil Campbell – extending upon Edward Said’s idea of worldliness – calls “Worlding the Western”: where “tropes and assumptions [about the Western genre] are indeed ‘overlapped and interfered with,’ opened up to different entangled visions of the region as a space of multiple relations with its outside and, in turn, its formations made, remade, and dismantled from diverse perspectives” (*Worlding* 4). The invocation of both Colt and Vuong interferes with where readers expect to find imagery of the Western environment; at the same time, it exposes how Western myths not only have reverberating effects outside

of the West but often originate outside of the region altogether. Vuong specifically calls attention to these nation-building myths, which have continued to harm the land and non-white individuals as the United States continues to develop upon stolen ground today. To never *surrender the ground*, he inserts himself into the poetics of American mythmaking. In exploring the interconnectedness of violent masculinity, violence toward nature, and violence toward non-white individuals, this essay unveils how Colt's generation, which perpetuated concepts similar to "regeneration through violence," may be in the process of being overthrown by a generation which perpetuates Vuong's declaration that "the language of creativity [*can*] be the language of regeneration" (*On Earth* 179). Vuong's linguistic regeneration becomes a process of including, healing, and restoring systematically neglected narratives.

### Samuel Colt and the Generation of Hartford's Western Environment

So, if we were to open one of Samuel Colt's false books, what kind of stories would the revolver tell? One of the most synonymous stories with Samuel Colt and the revolver would be the story of how Colt first invented it. Colt as a young man once boarded a ship called the *Corvo*. Legend has it that either the ship's wheel or its windlass inspired him to gather "a few pieces of scrap wood," pull out a jackknife, and whittle away until he created his first model of the revolver (Rasenberger 48). Just as Slotkin explains how "the conception of America as a wide-open land of unlimited opportunity for the strong, ambitious, self-reliant individual to thrust his way to the top," the origin story of the revolver relays how Colt becomes this masculine self-made man with the help of weapons as his tools (*Regeneration* 5).

Another famed Hartford native named Frederick Law Olmsted reported in *A Journey Through Texas: Or a Saddle-Trip on the Southwestern Frontier* (1857), "There are probably in Texas about as many [Colt] revolvers as male adults, and I doubt if there are one hundred in the state of any other make" (Olmsted 75). With revolvers following in the path of Westward Expansion, the popularity of Colt's six-shooters among men allowed for an increase in effectiveness and violence against the threat of Native Americans. Although Olmsted was only a young journalist at the time and not yet one of America's most renowned landscape architects, his survey lays out the design of a newly evolving Western landscape saturated with men who hold the violent yet industrial novel of the Colt revolver.

While the open seas and the expansive West may have been the perfect environments for Colt to dream up his iconic invention and later disseminate it, Slotkin's *The Fatal Environment* (1985) asserts that significant American figures at the turn of the nineteenth-century revealed a newly evolving Western myth. In pulling upon Walt Whitman's poem about Custer's Last Stand titled "Fatal Environment," Slotkin contends Whitman means something more by "fatal

environment" than the Native Americans that circled around Custer and killed him:

The idea that Custer's death completes a meaningful mytho-historical design, a grand fable of national redemption and Christian self-sacrifice... Custer's Last Stand became part of a renewed and revised Myth of the Frontier... It is this industrial and imperial version of the Frontier Myth whose categories still inform our political and rhetoric of pioneering progress, world mission, and eternal strife with the forces of darkness and barbarism. It is this myth whose fictive fatalities lurk in the cultural environment we inhabit, whose significance can still be seen behind the silhouettes of skyscrapers, casinos, pipelines, gantries, and freeways. (11-12)

Slotkin, on one hand, determines that the nineteenth-century Western myth became the idea that to interact with and conquer the Western environment meant to ultimately annihilate it. Many virile American men like Colonel Custer would also have to die with it. On the other hand, Slotkin recognizes that instead of submitting to this end, the myth of "regeneration through violence" has continued on but with the desire to survive while continuously dominating and putting an end to that vast American environment. In short, America, particularly white American men, turned to industrialization. While revolvers may be the most blatantly violent part of Colt's legacy, he, like many others in his generation, also took part in this Western myth in other ways. He capitalized upon industrializing, conquering, and suppressing Hartford's environment, degenerated Hartford residents' ability to access the city's nature, and allowed for the paving over of histories that were not white.

While Colt's false books might open up to revolvers, Colt's first biography, Henry Barnard's *Armsmear* (1866), opens up to an image of the enormous Charter Oak. Barnard begins by telling the legend of the Charter Oak, which was used to hide Connecticut's charter when King James wanted to join all the colonies together to form New England (17-19). Strategically, Barnard places Samuel Colt into Hartford legend by directly connecting where Samuel Colt held his property, on the grounds where the Charter Oak used to stand before a storm struck it down, with this legendary tree. This biographer, however, makes sure to point out that the Hartford legend full of figures like Thomas Hooker and Samuel Colt has no room for Native Americans. In fact, Colt's legend appears to supplant and erase Native American stories associated with the tree altogether. In inserting Lydia Sigourney's poem "Intercession of the Indians for the Charter Oak," which tells of an incident with the Charter Oak where Native Americans pled for the tree not to be cut down, Barnard explains how "Although we are prepared to believe in the rude Indians' veneration for our old oak, and even in their making an agricultural oracle of its young leaves, we doubt if their intercession was necessary to the salvation of a tree so old and majestic

as this, with either Mr. Wyllys, or Mr. Gibbons, his manager, who had been brought up under the ancestral oaks of Fenny Compton...and who probably selected his 'house-lot' because of this and other noble forest-trees" (24). With these words, the poetics of Western myth are at play. While Barnard may find it easy to belittle Sigourney's feminine and sympathetic perspective toward Native Americans as a "poetess," he engages in these poetics by using language to dangerously exclude other perspectives that are not white and masculine. He further implies that Colt's decision to settle himself and his enterprise in the same area of the Charter Oak was an act to elevate himself and other similar white masculine figures, not the histories of Native Americans.

Barnard continues to explain that the most significant part of where Colt decided to have his property was not only the history of the Charter Oak but rather how,

the genius and enterprise of Samuel Colt rescued [his land but also the rest of Hartford] from the capricious and devastating dominion of the floods of Connecticut River, and made part and parcel of the residences, warehouses, and workshops of the city of Hartford...By constructing a dyke, seventy feet broad at the base, and with a top surface as broad as the average of the streets of the city, along the southern bank of Little River to its junction with Connecticut River. (19)

While Barnard later praises Colt's decision to own land that lies in front of "the beautiful valley of the Connecticut," he ironically also praises Colt's decision to construct a massive dike in front of the river in order to combat spring floods (57). Colt's condemnation of the Little River to this prison likely arose from spring flooding but also from the inundation of neglect and exploitation that the Connecticut River already faced in the nineteenth-century. The Connecticut River and its tributary Park River, formerly the Little River, were often not revered for their beauty. Rather, Steve Grant explains in his *Hartford Courant* article "Hartford: A City on the River" (2014), how "In 1843, with the city population growing, the first sewer channeled untreated human waste into the Park River and on the short distance into the Connecticut River. By midcentury, wastes from new factories, like the Colt Firearms complex, poured into rivers like the Connecticut, polluting them". As a result, people were often disgusted by the stench and appearance of the polluted Park River. As the owner of a massive industrial factory, Colt contributed to the abuse of the Connecticut River and the Park River by using them as dumping grounds rather than preserving their cleanliness as the integral parts of local agricultural practices that they once were. Since the beginning of the twentieth-century, Colt's legacy of polluting and covering the Park River only continued to transpire. Frederick L. Ford's *East Side Flood Protection Report* from 1909 outlines plans to install more dikes along the Park River, a plan which eventually evolved into more drastic ways to hide the river, such as placing a highway over the it. While the environmental

movement of the 1960s did a lot to clean up the polluted the river, Colt represents an undeniably lasting connection between the destructive industrialization which closes the river off from the public and the persisting mentality that such an important environmental resource should be utilized as a sewer ("Hartford"). If these industrial fixtures were somehow dismantled as the mental and physical barriers they persist to be, Hartford residents would perhaps be able to better take care of the river, which has the potential to provide its scenery, fertile grounds, and fresh water in return. As part of the American generation from the nineteenth-century, Colt participated as a main arbiter in a push toward the end of nature in Hartford in the same way that industrialization led to the end of the Frontier in the West, thus creating the generation of Hartford's "Western" landscape.

### **Ocean Vuong: *Re-generation* of Hartford's Western Environment**

In the epistolary novel *On Earth We're Briefly Gorgeous*, Vuong's semi-autobiographical protagonist Little Dog asks his mother, "Do you remember that one night, after we had gathered around Lan to hear a story after dinner, and the gunshots started firing off across the street? Although gunshots were not uncommon in Hartford, I was never prepared for the sound" (21). Through his narrator, Vuong makes clear that rapid gunfire has become no longer reserved for the image of the Colt revolver gone West in the nineteenth century. In twenty-first-century Hartford, Little Dog, as a representation of Vuong, is especially threatened by national gun violence as a queer Vietnamese American. In a conversation with Trevor, with whom Little Dog had his first gay relationship, Little Dog recalls that they talked about "how the Colt factory in Windsor might be hiring again now that the latest shooting spree was three months done and already old news" (*On Earth* 98). With Vuong's illustration of not only modern-day Hartford, but the United States, Slotkin's term "Fatal Environment" begins to take on a new meaning. The Colt factory that can still be found in Little Dog's Hartford remains as a symbol of Colt's legacy and as a reminder of the persistence of gun violence and the nation's desensitization toward it. When recalling how he first came out to his mother, Little Dog remembers how during the previous summer, Florida native Omar Mateen murdered forty-nine people with an automatic rifle at an Orlando gay club (*On Earth* 137). With the image of an automatic rifle, a gun which fires even more rapidly than the Colt revolver, this Western myth of industrialization persists to violently harm the environment. At the same time, however, it also specifically harms those who do not fit the white, masculine, and heterosexual mold.

In an entry in *Keywords for Environmental Studies* (2016) titled "Queer Ecology," Catriona Sandilands relays how,

In *The History of Sexuality*, Michel Foucault lays the groundwork for much contemporary queer ecological scholarship... [Foucault's] establishment of



sex as a matter of biopolitical *truth* could not help but be connected to ideas of nature, and especially to racialized, sexualized, and other anxieties over hygiene and degeneracy. In this context, the figure of the homosexual came to haunt the margins of emerging discourses in urban development, environmental health, and even wilderness preservation: the effeminate homosexual and the lesbian gender invert were...seen increasingly as *against nature*. (169)

Sandilands describes how writers and other mythmaking contributors have manufactured an association between the industrial and corrupt urban landscape with those that are queer persons of color. In *Re-Dressing America's Frontier Past* (2011), Peter Boag illustrates how this manufactured association was especially relevant in the West, where "the public imagination by the end of the nineteenth century came to associate male-to-female cross-dressing and male effeminacy more generally with nonwhite/non-Anglo races. Accomplishing this stripped the male-to-female cross-dresser from America's history along with its Asians, Mexicans, Indians, and other nonwhite/non-Anglo peoples. This rendered America's frontier past not only a white place and time, but a heterosexual one as well" (Boag 7). When white settlers decided that those who were homosexual, or possibly gender queer from today's perspective, were the antithesis of what the virile West represented, they created an association between individuals of color and homosexuality in order to further dominate the region. In this part of the essay, I argue that Vuong subverts these Western expectations surrounding the naturalness of a heterosexual white America and the urban abnormality of queer persons. He specifically exposes how Hartford's industrialized "Western" environment, where violent masculinity prevails and there is barely any living nature to be found, is truly what is *against nature*.

In order to confront this dangerous yet prevalent mythology, Vuong frequently *re-generates* an image that was also very familiar to Samuel Colt: the Connecticut River. In one scene, Little Dog describes how he would ride alongside the river on a bike while on his way to work at the tobacco farm (*On Earth* 87). In another, he relates how when he took a train back to Hartford after Trevor passed away from an overdose, the river appeared as "the brightest thing in the afternoon's overcast" (*On Earth* 166). The Connecticut River in modern-day Hartford appears to always be an ominous travel companion alongside Little Dog. Although a river with its own currents, the way Little Dog never actually uses the river for travel translates to how the entire city of Hartford has continued resort to other industrial ways of travel, such as trains or highways. Rarely can people visit or even see the Connecticut River unless they are on industrialized railways or roads. If these structures which support travel are not covering up the river, they at least outcompete the river's usefulness in the eyes of the public.

In another instance, Little Dog describes how he and Trevor "rode along the Connecticut River as night broke into

itself, the moon freshly high above the oaks, its edges hazed by an unseasonably warm autumn. The current churned with white froth to our right. Once in a while, after two or three weeks without rain, a body would float up from its depths" (144). With the Colt factory's pollution of the Connecticut River and Colt's decision to install dikes on the Park River in mind, a disconnect between the public and the river has continued to fester in modern-day Hartford. Although a more extreme example of how the Connecticut River continues to function as a sewer or dumping ground, live humans are often not what interact with the river. Instead, the body of water intermingles with dead human corpses. The Connecticut River continues to exemplify how Colt's decision to suppress and hide the river away still has a major influence on Hartford residents and their relationship with the river today. These persisting attitudes of neglect toward the river normalize environmental violence as if it were a dead body hidden below the river's surface.

Little Dog's partner Trevor also often finds himself combatting the suppression of his environment, having to deal with expectations of masculinity thrust upon him by his alcoholic father. Trevor's struggle to perform masculinity leaves him with a deep sense of internalized homophobia. The poetic voice of Little Dog encapsulates this internal struggle with several verses:

Trevor Burger King over McDonald's 'cause the smell of smoke on the beef *makes it real*. /...Trevor I like sunflowers best. They go so high. / Trevor with the scar like a comma on his neck, syntax of what next what next what next. / *Imagine going so high and still opening that big*. Trevor loading the shotgun two red shells at a time. (*On Earth* 154)

This poem juxtaposes Trevor's inner and more vulnerable feelings about a sunflower with his tougher exterior which likes meat and knows how to load a shotgun. Just like Colt and his concealment of the Park River, the placement of these verses expresses how Trevor suppresses and conceals his compassionate yet more effeminate feelings about nature with more violent activities. While Vuong and his protagonist Little Dog might be literal poets, Trevor engages in Western poetics and challenges the idea of tough and invulnerable masculinity as well. Trevor's poetic declarations of appreciation and amazement for nature *re-generate* the work of cowboy poets whose "poems often express a spiritual connection to the land, a respect for nature, a love of animals, a reverence for the weather, a love of freedom and an admiration for people of integrity" (Blasingame 5). While filmic cowboys often appear stoic with little need for words, cowboy poets engage in ranch work at the same time they entertain themselves with these poetic verses full of the nature imagery that surrounds them in their everyday lives. The character of Trevor not only brings queer voices into the nation building narrative but brings to the surface a history of cowboys who appreciate nature rather than harm it. Trevor further expresses how Western myth need not only be a story about the struggle to perform masculinity. It



can also be a story about the desire to respect the nature that Western myth so greatly relies upon.

Beyond sunflowers, Trevor also finds a fascination with one of the most iconic landscape images to come from Western novels and films: sunsets. In a conversation with Little Dog, Trevor romantically ponders how “Cleopatra saw the same sunset. Ain’t that crazy? Like every-body who was ever alive only seen one sun...No wonder people used to think it was god himself...Sometimes I wanna just go that way forever” (*On Earth* 99). Just as the cowboys of Westerns go off toward sunsets in order to leave town and move onto their next adventure, Trevor finds himself encapsulated by the beauty of sunsets as a form of escapism. In contrast, Little Dog who also finds himself suppressed by his environment – whether he be working to support his family at the nail salon or facing hateful slurs about his sexuality – writes how he “can’t tell the difference between a sunset and a sunrise. The world, reddening, appears the same to me – and I lose track of east and west” (*On Earth* 238). Since Little Dog cannot tell the difference between a sunrise and a sunset and feels the pull of neither, he also lacks the desire to escape into the American myth of escaping away into a place like the Frontier. He continues to recall a sunset he had once seen with Trevor and how, “Because the sunset, like survival exists only on the verge of its own disappearing. To be gorgeous, you must first be seen, but to be seen allows you to be hunted” (*On Earth* 238). While Trevor has continued to hunt after that gorgeous sunset of escape, Little Dog instead turns inwardly to where his identity lies in that liminal space between sunset and sunrise to accept himself as gorgeous. Trevor, as a young queer white man, tells the story of one Western myth where performing masculinity and appreciating the environment collide. Little Dog, as a young queer Vietnamese American man excluded from the myth of white heteronormative masculinity, provides hope for another Western myth where the environment can be appreciated without the need to bear the weight of masculine expectations.

While poetry and the use of language might be written off by some as feminine and reserved for certain sentimental women writers of the nineteenth century, the poetics of Western mythology exemplify how violent the use of language can really be. In the poem “Old Glory,” Vuong exemplifies how deeply violence is infused within the English language: “Knock’em dead, big guy. Go in there / guns blazing, buddy. You crushed / at the show. No, it was a blowout. No, / a massacre” (*Time* 18). This language has the potential to destroy lives, land, and even legends held long before European settlement in the Americas. Yet, Vuong maps out in Hartford how this language of violence can be taken, dismantled, and reinfused with the stories of those who have had their identities excluded. In his *regeneration* of the language which has illustrated such “Western” and violent imagery as the Colt revolver or the polluted Connecticut River, he undergoes a regeneration, a healing of himself as a queer Vietnamese American; at the same time, he provides hope for a new Western myth

which calls for the regeneration of America’s relationship with nature.

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# Art of Fashion as Sociopolitical Weaponry

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**Abstract:** For the majority of history, society has considered fashion as a lesser form of art, seen as being more focused on the material and commercial aspects of clothing, rather than its aesthetic or cultural value. It also, in contrast to other visual art forms such as sculpture, painting, and architecture, is considered more ephemeral as styles tend to change more rapidly, especially in modern times. Most critically, however, is that the art world and the general public often deems fashion as superficial, shallow, ego-driven, and less deep and profound than other art forms. This perception is unsurprising considering that, despite being monetized and weaponized against marginalized peoples by those in power, fashion and textile creation has long been an overwhelmingly female art form in both design and creation.

By analyzing various artworks, ranging from the Egyptian Book of the Dead, to Rogier van der Weyden's St. John's Altarpiece, to John Singer Sargent's controversial painting of Madame X, history shows that not only is fashion an emotive art form like any other, but it is also a political tool used to survive, succeed in, and even challenge unjustly hierarchical societies.

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*"One should either be a work of art, or wear a work of art." (Wilde 143)*

For the majority of history, society has considered fashion as a lesser form of art, seen as being more focused on the material and commercial aspects of clothing, rather than its aesthetic or cultural value. It also, in contrast to other visual art forms such as sculpture, painting, and architecture, is considered more ephemeral as styles tend to change more rapidly, especially in modern times. Most critically, however, is that the art world and the general public often deem fashion as superficial, shallow, ego-driven, and less deep and profound than other art forms. This perception is unsurprising when considering that, despite being monetized and weaponized against marginalized peoples by those in power, fashion and textile creation has long been an overwhelmingly female art form, not only in design and creation, but in its use to survive, succeed in, and even challenge unjustly hierarchical societies.

Why was the creation of clothing, the root of fashion, relegated to women? In her article *A Note on the Division of Labor by Sex*, anthropologist Judith K. Brown suggests that, as most societies throughout history have relegated women to a role of constant child care and various domestic labors, the gendering of textile creation was almost certainly because sewing, weaving, etc. can be performed without leaving home, can be interrupted, and are well suited to "simultaneous child care" (Brown 1073-78). As such, the progression of practical clothing into fashion as an art form not only follows the aesthetic, political, and cultural

evolution of other art forms but that of women's rights, place, and power in society throughout time. Like other forms of art, the roots of fashion (as an art form, and beyond simple protection from the elements) go hand in hand with religious belief and humankind's desire to be in proximity to the Divine, and, accordingly, status. While the most obvious example of this desire is the modesty laws common in both Christendom and Islam, the power of religion to dictate fashion is also seen in the cultural losses that occur when the dominant cultural and religious power replaces existing spiritual practices.

Ancient Egypt stands out as a glaring example of the overlapping of religion, culture, and status in its use of fashion. While the textiles themselves are prone to degradation, much can be determined from the visual artwork that remains, especially as ancient Egyptian women's fashion shows less frequent change across the centuries than many other cultures (Boucher 92). While the image presented in Fig. 1, as was standard in the art of the era, depicts an idealized representation rather than a realistic portrayal of actual Egyptian life, it does offer insights into the fashion trends of the time.

On the right side of this image, the gods Osiris and Isis (The British Museum) are presented in contrast to the mortal figures on the left. This depiction offers a very detailed example of the differences in clothing based on status, which is even more insightful when taking into account the relationship between pharaohs and gods in ancient Egypt. The mortal woman is shown wearing a flowing, white tunic, or calarisis (Boucher 92). This calarisis was likely

meant to portray linen, which was well suited to the hot climate, but more importantly, was naturally white, which was considered a sacred color (Boucher 92). The ornate jewels she wears, contrary to later representations of status and to romanticized versions of Egyptian women in film, speaks to a lower social status (Matić 174-83). This low status image is apparent when looking at the comparatively un-bejeweled figure of Isis. Even more of a contrast is shown by the style of dress. While the calarisis is a New Kingdom style that steadily grew in popularity under Roman influence, Isis' colorful, woven, and markedly less modest sheath dress is in the style of the Old Kingdom, and incredibly common in depictions of both pharaohs and gods in the New Kingdom (Tortora and Eubank 26-29). This clear conflict between what was actually worn in the time period and what is shown in relation to the gods shows how fashion, their own fashion, was an intrinsic part of the Egyptian's cultural identity, and how it defied, even passively in artistic depictions, the cultural dominance of Rome, particularly in regard to female modesty.

In Rome, particularly after the fall of the Roman Republic (Sebesta 529-541), we see a contradiction that has persisted through the ages. Depictions of women became increasingly idealized, but in a realistic manner of depiction, setting the stage for the concept of an ideal female form that extends from even before the Han Dynasty to Botticelli all the way into modernity, splashed across the pages of the *Sports Illustrated* swimsuit edition. However, Roman women simultaneously existed under a heavily patriarchal system with limited rights and strict edicts on both behavior and modesty. In essence, this is an early example of the oft discussed "male gaze", the sexualized and objectifying portrayal of women as determined by heterosexual male desire in the visual arts. As another component of this complex dynamic surrounding fashion, while many women had foregone the traditional role of weaver and seamstress, it was still considered a sign of ideal wifehood to do so, as exemplified by the tale of Lucretia, which:

[...] relates how Lucretia's husband and his friends amused themselves during a tedious siege of a nearby city by boasting about the virtues of their wives. To settle the contention, they made an unexpected journey home and discovered that all the wives, save Lucretia, were attending dinner parties. Only Lucretia was found at home, weaving cloth for her husband. (Sebesta 529-541)

Lucretia, in this instance, represents the foremost virtues of a good Roman wife, such as modesty, fidelity, and compliance. As a seamstress, specifically a seamstress laboring for the benefit of her husband and not herself, she further fulfilled her responsibility to enhance the status of her husband.

In the above fresco (Fig. 2), the subject is Flora, the Roman goddess of flowers. She is shown wearing accurate Roman dress, with some key exceptions. While Roman fashion is usually defined by the toga, women wore a longer version

called a stola, meant to cover a woman's legs and feet, along with a shawl, or palla, often used to cover her shoulders and hair (Tortora and Eubank 64). These were both intended for modesty, but, as in *Flora*, were frequently removed and re-draped in art. The off-the-shoulder draping of fabric, slightly shortened and thus feet-baring stola, and lack of palla entirely gives the work a sensuality, or even an overt fertility that conflicts with the reality of the period. The alteration of intended fashion design that bares Flora's shoulder is repeated later in history, with the soon-to-be discussed painting, *Madame X*, only, in accordance with the ever-changing rights for women, that painting subverts a patriarchal system, rather than upholds it. However, that is only after the monumental changes in fashion brought about by the invention of the spinning wheel, as well as the economic boost and influence of and interest in Eastern fashion, via the Crusades (Boucher 173), during the rise and zenith of Christendom.

The Crusades were a pivotal moment for fashion, specifically through the contact with and appropriation of the fashion styles and fabrics of the East. The appropriation of fashion and the associated materials by colonizers boosted, and continues to boost, the economy of the dominant power while simultaneously subjugating the producers of said fashions and materials. In addition to the exposure to, and then adoption of, vibrant colors and patterns previously not seen in the west, the huge monetary boost incited a love for luxury, particularly among the emerging middle-class society that developed from this boost. This new middle class offered a challenge to the previously unquestioned nobility, which, in turn, also motivated an increase in luxury in fashion, to reaffirm the status of that nobility. It also brought about various rules and regulations forbidding various fabrics, colors, and jewels to those outside nobility, though these rules were not particularly effective (Boucher 178-180). These changes are the key to understanding the transformation and exuberance of fashion beginning in the 12<sup>th</sup> century and extending well into the beginning of the Renaissance.

The painting shown in Fig. 3, though clearly of a religious nature, portrays the luxurious status-driven fashions of the time in which it was painted, rather than the time period of the figures represented. On the left, the figure of the Virgin Mary is clad in blue, as expected in Christian art. However, the shine of the fabric is indicative of silk. Likewise, the patterned red, reminiscent of Islamic and earlier Byzantine patterns, is a much more ornate and rich fabric that would have been accurate to Mary. These types of gold embroidered patterns were very popular and have even been known to include Arabic lettering (Houston 64). These fashions are a clear tie to the court of Burgundy, which was particularly opulent in fashion (Boucher 202). Also indicative of the court of Burgundy is the woman on the right of the altarpiece, Salome (Der Johannesaltar), who wears typical fashions of the time. Like Mary, she is dressed in layers. The underskirt, or chemise, is similarly ornate and patterned. However, while modernized and westernized, Mary's dress still shows the flowing modesty expected in



depictions of the Virgin Mary, and its shape maintains a loosely Middle Eastern undertone. By contrast, the tight sleeves and slightly cinched waist worn by Salome are not only thoroughly in vogue, but also a sign of an increasingly secular world of art that is more focused on earthly beauty than on heavenly beauty. This movement toward earthly beauty leading into the Renaissance is no more apparent than in the emphasized abdomen trend of this era, as seen in Jan Van Eyck's painting, *The Arnolfini Portrait*, which shows a drastic change in silhouette from earlier periods and acts as a precursor to how fashion evolved to create the illusion of the ideal female form.

Using fashion to create an illusion, particularly an illusion of an ideal figure as in the case of the aforementioned pregnancy dresses, evolved with the passage of time, eventually bringing with it the corsets, bustles, and exaggerated hourglass shapes associated with the Victorian Age. While this evolution hardly seems a step forward for women by today's standards, functionally, the clothing of this period was significantly less immobilizing than in the years preceding. Flammable and cumbersome crinolines, popular in the 17<sup>th</sup> and 18<sup>th</sup> centuries, went by the wayside, and simplicity of fabric reduced the overall weight of garments (Everett). The women's rights movement was on the rise, and with it came more overt challenges to the patriarchy via fashion. Purity culture and feminism, for a moment in time, went hand in hand. Suffragettes, while vying for their rights, began to adopt more typically male clothes like trousers, but also began to cast judgment on those with more sexualized fashion taste, asserting that "current feminine clothes incited immorality" (Riegel 390-401). There is no better example of this complicated era of fashion than in John Singer Sargent's scandalous portrait, *Madame X* (Fig. 5-6).

The subject of Sargent's portrait, American born Madame Pierre Gautreau, later known as Madame X, was an aspiring socialite and fashion icon of late-1800s Paris, known for her daring style (Farago). While the gown she wears is, to an extent, typical of the time, with a subdued bustle and emphasized waist, how it was worn, and then depicted, resulted in scandal. The confident posture and plunging neckline, especially on a married woman, resulted in widespread claims of immorality. The slight gap at the bust between the dress and skin implied a lack of strict Victorian undergarments (Pollard). Perhaps most shocking, the original portrait showed Madame X with a shoulder baring loose strap (Mahon). These salacious alterations of dress not only show great daring amid the divisive politics surrounding women's rights, but they also show the truly collaborative nature of fashion as an art form, and how the canvas, or wearer, can be just as influential in the meaning of the art as the original designer.

Both Sargent and Madame X faced the consequences for this dress. While she remained in Paris but was effectively removed from high society, Sargent fled to London to resume painting much more modest subjects. However, years later, after repainting the notorious bare shoulder and after

the death of Madame X, Sargent sold his work to the Met (Farago), stating "I suppose it is the best thing I have done" (The Met). Madame X, before dying in relative obscurity, did model again, most notably in Gustave Courtois's painting, *Madame Gautreau* (Fig. 7), which unapologetically showcases that infamous shoulder. By choosing to be depicted in this manner after being shunned by society and with no hope of regaining her former reputation or status, Madame X clearly flaunted, with deliberate provocation, the public's opinion and judgement by weaponizing the very fashion choice that had been used against her. Madame X chose to wear an off-shoulder strap, not inherent to the original design, and entirely changed the image of the gown, and thus exemplifies the inherent collaboration between designers and wearers.

*That fashion is a collaborative art becomes no clearer than in the rapidly changing fashions of the 20<sup>th</sup> century. In the 1920s, fashion truly began to meld with other art movements, particularly music, as well as with political and social justice movements, the most obvious examples of which are the avant-garde fashions of Dadaism and Surrealism. These movements, in visual art and in fashion, were meant to disrupt the capitalist nature of art. As Gavin Grindon states in his article, Surrealism, Dada, and the Refusal of Work: Autonomy, Activism, and Social Participation in the Radical Avant-Garde, "[t]he sovereignty of art, expressed in autonomy-as-a-value's ideal of free play, could be imagined as allied with attacks on other forms of sovereignty, such as that of capital or the state" (Grindon 79-96). While the advent of fast fashion in modern times shows that this attack was rather a failed attempt, at least on a large scale, this idea of artistic free play and autonomy is the essence of the varying fashions of today.*

Fashion is simultaneously an individual and communal form of art, allowing the canvas equal play in its creation. It establishes identity, dismisses and affirms gender, and challenges societal and political norms. It gives power in unity, even under the weight of oppression, as seen with the beret of the Black Panthers, the polarizing low-rise bellbottoms and halter tops of the anti-Vietnam movement, and the intentional abrasiveness of punk style (Fig. 8). In the words



Fig. 8. Rich Mulvey, *Callie, CBGB*, 1989 C.E.

of Virginia Woolf, “[v]ain trifles as they seem, clothes have, they say, more important offices than to merely keep us warm. They change our view of the world and the world’s view of us” (Woolf 187), and isn’t that, after all, what art is meant to do? Art is meant to express ideas, personality, and views. Fashion, as an art form, is inherently political and by using fashion, as a uniquely collaborative art form, perhaps we can create a more collaborative union against unjustly hierarchal societies.

## Figures

Figure 1: Unknown Artist, Book of the Dead, 1292 B.C.E.-1189 B.C.E. [Click here to see image.](#)

Figure 2: Unknown Artist, *Flora*, 1-100 C.E. [Click here to see image.](#)

Figure 3: Rogier van der Weyden, The St. John Altarpiece, 1450 - 1464 C.E. [Click here to see image.](#)

Figure 4: Jan van Eyck, The Arnolfini Portrait, 1434 C.E. [Click here to see image.](#)

Figure 5: John Singer Sargent, *Madame X*, 1883–84 C.E. [Click here to see image.](#)

Figure 6: “[Madame X] as it appeared at the Salon of 1884 [...]” (Mahon) [Click here to see image.](#)

Figure 7: Gustave Courtois, *Madame Gautreau*, 1891 C.E. [Click here to see image.](#)

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# A Feminist Analysis of “Barbie as Rapunzel”: Examining the Powerlessness of Girl Power

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**Abstract:** Hot pink, Barbie dolls and unfulfilling promises of girl power dominated the early 2000s. This essay examines the true powerlessness of girl power through a critical feminist analysis of the movie, “Barbie as Rapunzel.” The unfortunate reality of the girl power movement is that it limited true empowerment by catering to the patriarchal male gaze. Rapunzel was subsequently robbed of her freedom, identity, and the right to diverge from dominant social norms. This harmful portrayal of girl power sends a false message to little girls that empowerment is only reserved for the “ideal” woman; a woman who conforms. The lack of diversity and female comradery in this film also limits the promoted message of uniqueness. Young girls need to see representations of female friendships to understand that comradery provides a space for validation and realization. It is crucial for the future of girlhood that we critically examine media such as “Barbie as Rapunzel” through a critical lens to make positive progressive media that creates a space for true empowerment.

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The animated Barbie movie series captivated Gen Z youth with hot pink color palettes and promising portrayals of girl power. I remember watching “Barbie as Rapunzel” when I was around six years old, and being terrified of the talking dragon, but loving Barbie’s pretty pink dress. I learned from rewatching the film that my fears may have resulted from the choppy, blocky, computer-generated animations. Regardless, no matter what animated Barbie film I watched, I remember thinking, “I want to be Barbie.” I admired Barbie’s kindness and her prioritization of moral values. She showed me that pink was a color to be proud of and that women deserve to be the heroes of their own stories. However, I also wanted to have Barbie’s minuscule waist and flawless skin. She became my unattainable obsession. After re-watching “Barbie as Rapunzel,” I recognized the distorted definition of girl power that was communicated throughout the film. Rapunzel was allowed to feel empowered, as long as it fit into the convenience of the male gaze. Rapunzel was robbed of her empowering ending and tossed into the pit of convenient and conventional cinematic marriage.

“Barbie as Rapunzel” begins with Barbie, playing herself, serving as the narrator of the story. She tells the story of Rapunzel to her younger sister, Kelly, in order to reveal that her ideas are wonderful and powerful because they are uniquely hers. This is a blatant attempt to promote the girl power culture that was spreading like wildfire in the early 2000s. Hit teen movies like “Mean Girls” worked to reveal the toxic culture that surrounded popularity, but also promoted the mysterious, shy, sweet, smart, and most im-

portantly, conventionally attractive girl as the ideal. The main character in “Mean Girls,” Cady Heron, played by Lindsey Lohan, recognized after being consumed by social status that she lost her sense of personal identity and spent the end of the movie reestablishing it. Like Cady, Rapunzel is depicted as overcoming her own loss of self-identity after escaping Gothel. However, both women end up in relationships with men and succumb to the convenience of a marriage and relationship plot. These endings communicate that a woman’s identity must be dependent on a man.

The girl power movement also aimed to promote the idea that girls can be smart, pretty, and kind – shocker, right? However, its impact was seriously hindered by the concurrent rise of an intense diet culture during the early 2000s. It became challenging to see Cady Heron without seeing Lindsey Lohan, who, just two years after the release of *Mean Girls*, openly admitted to struggling with an eating disorder and drug use. Lohan revealed in a 2006 *Vanity Fair* article, “I was sick. Everyone was scared. And I was scared, too. I had people sit me down and say, ‘You’re going to die if you don’t take care of yourself’” (Peretz). Hollywood has a reputation for tearing apart talented women like Lohan for profit, and unfortunately, this criticism spills over into the general population. Personally, I found it difficult to feel unique and powerful with tabloids featuring headlines like “Get Slim Fast,” “Perfect Skin Secrets,” and “Best Body Ever” peering down at me like hungry vultures in the Giant Eagle checkout line. Despite the girl power movement’s active fight against bimbo stereotypes that were often used against conventionally attractive and intelligent women, it ended up gatekeeping girl power for only



the ideal woman.

Culturally, these standards are disappointing yet not surprising, considering the time of the movie's production. "Barbie as Rapunzel" was released in 2002 and directed by Owen Hurley. In addition to this film, Owen directed three other fairytale-themed Barbie movies including "Barbie in the Nutcracker", "Barbie of Swan Lake", and "Barbie in the Pink Shoes." Owen also worked in video game cinematics for the "Company of Heroes" series. His stylistic choices consistently involve computer-generated animations. The film's screenwriter is Elana Lesser, who has written scripts for many successful children's shows including "Arthur," "Curious George," and "Dragon Tales." In addition to these shows, Lesser has also written for eight other Barbie projects. She worked with director Owen Hurley for a second time in "Barbie of Swan Lake." As a child who did not have access to cable TV until I began my middle school years, shows that aired on PBS Kids served as my after-school specials. Barbie movies were watched nightly before bed on DVD. The earliest movies served as my sleep aids, encouraging dreams filled with princes, princesses, and somewhat unsettling talking animals.

In the movie "Barbie as Rapunzel," Rapunzel takes on the role of a Cinderella-style character, serving her magical yet evil Mother Gothel by working to "keep the manor in perfect order," with no help besides her two animal friends: a sparkly purple dragon with extravagant eyelashes and a small male rabbit. For a character who is expected to sweep, wax, and polish the floors amongst dozens of other chores, Rapunzel's extravagant pink gown remains flawless throughout the film. While making tea for Mother Gothel, she stumbles upon a secret basement and discovers a secret passage below it. After finding a hairbrush that her birth parents gifted to her for her first birthday, she follows the underground tunnel to a nearby village. The village is populated by kind, happy, white people preparing for the young prince's upcoming 18<sup>th</sup> birthday celebration. The severe lack of diversity in this film speaks for its time. The animation demonstrates the director's deliberately exclusionary choices.

Outside of the village, Rapunzel encounters a little girl named Katrina and her sisters. Katrina falls into a hole dug by the enemy kingdom, and Rapunzel attempts to save her. Unfortunately, Katrina slips back into the trap, dragging Rapunzel down with her. Predictably, a handsome young man dressed in blue saves Rapunzel and his little sister. Herein lies the catch to the notion of girl power – misogynistic social standards are always involved, especially when they are unnecessary to the story's plotline. After the rescue, the man explains the kingdom's rivalry with the neighboring kingdom. Rapunzel asks him why the two kingdoms could not communicate and solve their differences. This reveals the theme of kindness as a universal solution. However, she is immediately shut down and told that things are too complicated to be solved through simple conversation. Rapunzel is naive and lacks knowledge of current political events, which piques the young man's interest. She is inno-

cent, malleable, and different from most girls. Rapunzel has now become the embodiment of the "cool girl."

When Gothel discovers that Rapunzel went to the village, she reacts by destroying all of her paintings, which served as Rapunzel's only sense of identity besides being a servant in the manor. Gothel then demands that Rapunzel reveal the name of the man she met, but since Rapunzel never asked for his name, she cannot tell her. Gothel calls her a liar and turns her bedroom into a tower, casting a spell to trap all with a lying heart inside forever. Banishing Rapunzel from town and destroying her prized possessions parallel Disney's adaptation of "The Little Mermaid," released in 1989. Parental control is a common theme in these fairytale adaptations, as most of the princesses are children or teenagers. Notably, it is the female characters in these fairytales and retellings who are closely monitored, perpetuating the idea that women are mere accessories and prized possessions to be owned and diminished.

Meanwhile, the viewer learns that the young man whom Rapunzel met in town is the prince, and he has been sending his knights all over the kingdom to search for her. Overnight, the hairbrush Rapunzel found in the secret basement turns into a magic paintbrush. With her paintings destroyed, she attempts to brighten her spirits by painting on her walls with the magic paintbrush. To her surprise, she paints what is revealed as a magic portal that allows her to return to the village. She finds the prince and asks if he can lead her to the maker of her magic paintbrush. The two discover that its maker lives in the neighboring kingdom. The prince then invites her to the palace for a ball that evening, but Rapunzel needs to be made aware of his true royal identity. When she tells him that she does not want to know his name as it would be in her worst interest, he refers to her as "mysterious." Rapunzel is a puzzle to the prince, and he enjoys toying with the idea of her. She is inherently objectified.

According to journalist Julia Tabach, "the manic pixie dream girl helps to romanticize the control of women's body and thoughts" (Tabach, 2020). Rapunzel is appealing to the prince because she embodies his own personal version of the manic pixie dream girl fantasy. He likes that she doesn't know his royal social status and that she doesn't care to. The attraction to the manic pixie dream girl trope lies not only in effortless beauty but in mystery. Manic pixie dream girls are given a minuscule amount of personal autonomy to attract male suitors without intimidating them. Rapunzel is a perfect balance.

When Rapunzel returns to her tower with the help of Penelope the dragon and her rabbit friend, she styles her hair and makes a beautiful gown with her new magic paintbrush. Unlike Cinderella, Rapunzel uses her own resources to create a beautiful gown to wear to the prince's ball. The lack of a fairy godmother character is intentional as it showcases another girl power moment for the viewer to enjoy. Rapunzel's power is connected to her magic paintbrush, which is laced with the undying love of her parents. Unfortunately,

Mother Gothel discovers Rapunzel's plans to attend the prince's ball from her evil pet otter and destroys Rapunzel's magic hairbrush. She also cuts Rapunzel's hair and uses it as a disguise to attend the prince's ball herself.

Fortunately, Penelope, the dragon, saves Rapunzel from the tower and takes her to the prince's ball. It is refreshing that a prince does not come to her rescue, let alone plummet into a patch of thorns as he did in the original Grimm's fairytale. It is a heartwarming moment, showcasing the power of female comradery. However, I couldn't help but notice the strategic use of animal companionship. The evil Mother Gothel has an otter, who serves as her evil henchman. She asserts power and dominance through her control over him. This film reveals a common theme in fairytale film adaptations. Snow White had woodland creatures, Cinderella had mice and birds, and now Rapunzel has a talking rabbit and dragon. Yet, in none of these films do we as the viewers see any depiction of strong female friendships or comradery between human characters. While there are mentorships and elder relations that are kept with the princesses, these do not equate to strong female friendships. How can a film truly promote girl power and "uniqueness" without showing meaningful relationships between different women?

In the final few scenes of the film, Gothel is shown attempting to attack the prince and his siblings. Whenever the prince's younger siblings try to fight back, Gothel expresses her distaste for children. In fairytales, matronly qualities are seen as protagonist characteristics, and this comment serves to reinforce Gothel's villainous nature. The movie resolves with the two kingdoms reuniting by defeating Mother Gothel and discovering that Rapunzel is King Wilhelm's long-lost daughter. With the source of the feud resolved, the two rival kingdoms are finally at peace. Rapunzel then marries the prince shortly after this resolution. In the Grimm's fairytale version, Rapunzel agrees to marry the prince as soon as he invades her tower. Although she was terrified, she states in the story that he was "much better than old Mother Gothel." The prince takes advantage of Rapunzel's innocence in both versions of the story. In the Barbie retelling, the prince takes away Rapunzel's chance of achieving full autonomy through self-discovery by trapping her in the ultimate marriage plot.

This marriage plot is not only unsatisfying but completely dismantles any autonomy that Rapunzel gains after escaping the tower. Throughout the movie, Rapunzel's honesty and integrity are portrayed as moral virtues. However, when the prince finally reveals his identity to Rapunzel at the end of the movie, his lie is not viewed as moral corruption. The happily ever after in this film is based on a lie, and the prince wins his game. He was able to secure his mysterious dream girl. This is problematic because the prince lied about his royal identity to appeal to Rapunzel. He saw her as a peasant until the end of the film, so he acted as a common citizen to convince Rapunzel that he was safe and trustworthy. This would raise the question if there

was tension between the monarchy and the common citizens of the kingdom which were not revealed in the film. The prince's lie immediately eliminates any chance of political opposition from Rapunzel and communicates a distorted sense of socioeconomic relations to a young audience. It also highlights the double standard where men are excused from certain standards that women are unjustly held to.

After the resolution between the two kingdoms, Mother Gothel is banished to Rapunzel's tower after refusing to accept Rapunzel's forgiveness for kidnapping her as a child. This ending left me confused and unfulfilled because Rapunzel's complacency was completely unrealistic. Despite suffering years of trauma and verbal abuse from Gothel, she was willing to forgive her much too easily. In the original Grimm's Rapunzel tale, there was no resolution to the relationship between Gothel and Rapunzel. The Barbie retelling attempts to add a resolution and lesson but fails terribly at doing so. The ending sends a message to children everywhere that forgiveness is always the key. However, this message is harmful, especially for survivors of abuse, as it completely disregards the power of acknowledging and processing anger as part of the healing process.

I remember falling in love with Rapunzel's room as a child. I wanted to live in her tower, dedicated to my artistic pursuits, surrounded by pink walls, and sleeping in purple bed sheets. I wanted to be divinely feminine. However, after analyzing the movie's failed attempt to promote girl power and the subsequent destruction of Rapunzel's chance at personal freedom, I cannot recommend this film. I enjoyed certain moments of "Barbie as Rapunzel" that promoted empowerment, such as Rapunzel acting as her own fairy godmother and banishing her abuser to the magic tower. However, the severe lack of diversity in this film is intolerable. Rapunzel appears too perfect within the eyes of the male gaze. Young girls deserve a princess that they can look up to without expecting a marriage plot. Barbie could have pursued her painting or become an esteemed ruler, but instead, she becomes passive. When women face abuse, they do not have to endure it with a smile and prioritize forgiveness. The concept of girl power and the emphasis on uniqueness seem to have been used merely as marketing tools to promote Barbie's early 2000s brand shift toward a false projection of female empowerment. "Barbie as Rapunzel" falls short of empowering its audience and serves as a prime example of the powerlessness of the girl power movement.

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# God the Mother and the Feminine Christ: Representations of the Madonna and Jesus as Divine Maternal Nurturers in Medieval and Renaissance Art

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**Abstract:** Visual depictions of the Virgin Mary and Jesus Christ throughout the Medieval and Renaissance periods frequently highlight and celebrate key characteristics commonly associated with femininity: compassion, nurture, and sacrifice. Although canonical scriptural language employs the usage of “father” and “son” to denote the gender of God and Jesus, subsequent archetypal artistic interpretations produced during these periods expressed the divine feminine energy of God manifested within the earthly bodies of the Madonna and Christ. Their intrinsic maternal natures serve as a counterbalance to God’s authoritative masculine qualities. This presentation examines a selection of works which portray Christ as anatomically male but spiritually female and elevates the Madonna from humble bearer of the savior into the feminine God incarnate. While modern Catholicism remains institutionally patriarchal, early Christological iconography shows a consistent pattern of glorifying the feminine qualities present within the Madonna and Christ. These depictions exist as visual reminders of spiritual unification between masculine and feminine energies, which reflect a more complete image of God’s divine nature. Iconographic paintings of the Virgin Mary and Jesus venerate and sanctify the relationship between mother and child and stand in contrast to the androcentric gendering of the holy trinity that permeates Christian theology.

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Visual depictions of the Virgin Mary and Jesus Christ throughout the Medieval and Renaissance periods frequently highlight and celebrate key characteristics commonly associated with femininity: compassion, nurture, and sacrifice. Although canonical scriptural language employs the usage of “father” and “son” to denote the gender of God and Jesus, subsequent archetypal artistic interpretations produced during these periods expressed the divine feminine energy of God manifested within the earthly bodies of the Madonna and Christ. The all-powerful, dominant, and authoritative qualities of God have become the standard dogma to which modern Catholic leaders adhere. However, these masculine ideals run counter to the core tenets of Christ’s teachings of love, charity, sacrifice, submission, and nurture which are commonly classified as “feminine,” as seen in early Medieval theological texts. Caroline Bynum notes that Medieval spiritual writers characterized maternal imagery with consistent gendered sexual stereotypes (*Jesus as Mother* 148). Across these texts writers labeled traits like gentleness, love, compassion, and nurturing as “female” or “maternal” while authority, judgement, and strictness are gendered as “male” or “paternal” (*Jesus as Mother* 148). Bynum argues that male Medieval writers, leaders, and theologians originated the use of feminine maternal imagery and allegory to reference both God and Jesus, citing figures like Anselm, Bonaventure, Aquinas, and Julian of Norwich as examples of male spiritual leaders

feminizing religious language (140). In Scripture, Jesus refers to himself as a mother hen who shelters her chicks (1) and the good shepherd who gathers lost sheep (2), traits which writers in this period characterized as feminine. The interpretation of these passages indicate that Jesus Christ’s maternal nature exists within an exterior of the physical masculine form. These more fluid expressions of gender within early Medieval scripture and theological writings differ dramatically from how the modern Catholic church interprets and transmits aspects of God and Christ’s nature, often overemphasizing the masculine, authoritative aspects of both figures.

The patriarchal nature of the institution of Christianity creates a hierarchal division between male and female congregants, with Catholicism having a deep-rooted history of excluding women from holding positions of power within the clergy by creating sanctions against any possibility for ordination. On the history of gender bias and the Catholic Church, Cheryl Haskins argues that while Christianity promotes concern for female congregants it remains unwilling to allow these members to serve the Church in equal or higher stations over men (100). Under Pope Paul V, the Sacred Congregation for the Vatican (3) issued an official declaration barring women from priesthood, maintaining that the act of conferring priestly ordination exclusively to men remains an unbroken tradition of the Church, and cites the absence of female apostles selected to minister as scrip-

tural validation for their argument (Seper). Cardinal Franjo Seper, who authored the declaration on behalf of the Sacred Congregation asserts, “Although the Blessed Virgin Mary surpassed in dignity and in excellence all the Apostles, nevertheless it was not to her but to them that the Lord entrusted the keys of the Kingdom of Heaven” (Seper). The official and unwavering position of the Vatican dictates that their normative character of exclusively ordaining men into priesthood can be traced to Christ’s denial of women into apostleship roles in scripture. Preventing the ordination of female priests creates a limitation for a woman’s ability to be regarded on equal footing as their male counterparts within the institutional practices of Catholicism.

The Church maintains a cognitive dissonance in its view of the role of women within the structural framework of ministry, recognizing the importance of feminine figures like the Virgin Mary and Mary Magdalene within the Bible while relegating female congregants to a lesser station compared to their male counterparts. In fact, it was Mary Magdalene who was chosen by Christ to deliver the news of the resurrection to the apostles (4). These gendered divisions create an environment where the male-dominated leadership of the Church projects females as lesser and therefore subservient to males, contrary to the Biblical assertions that women were equally created in God’s image (5). Scripturally, the androcentric gendering of both God and Jesus Christ has impacted and limited the station of women within the Church, creating a divisive hierarchy which places women subservient to men. In the Old Testament, humankind was created devoid of these socio-cultural concepts. Genesis indicates, “So God created mankind in his own image, in the image of God he created them; male and female he created them” (*Genesis* 1:27). Using allegory and poetic language, scripture depicts God with both masculine and feminine aspects reflected in the body of each person, and different biblical texts emphasize and glorify the feminine spirit (6). The book of Proverbs portrays Divine Wisdom—the first of God’s creations before humankind—as feminine, and she refers to believers as her children. She calls out, “For those who find me find life and receive favor from the Lord” (*Proverbs* 8:35). This passage, ascribed to Wisdom, is reminiscent of the teachings of Christ on Earth, who preaches that salvation comes from knowing him (7). Often referred to as “Sophia,” the Greek word for wisdom (8), Divine Wisdom represents the Word of God which is made flesh (9). In his 4<sup>th</sup> century work *Orations Against the Arians*, Bishop Athanasius of Alexandria continually connects the Wisdom (*Sophia*) with the Word (*Logos*), which was delivered unto the world in the body of Christ (Athanasius 1). These theological interpretations of scripture suggest that the immaculate conception transforms the feminine *Sophia*—who existed alongside God in Heaven—into the masculine body of Christ on Earth birthed through the Virgin.

Despite normative traditional roles upheld by the Vatican and disseminated by exclusively male Catholic leaders, Christological iconography from the Medieval through Early Renaissance period frequently portray the Virgin Mary

as the Divine Mother, equal to God, and Jesus Christ as feminine nurturer, physical embodiment of *Sophia*. Both figures become representations of God’s feminine energy incarnate through thematic symbolism across culture and over centuries. These allegorical feminine representations of God’s image and word incarnate serve as a counterbalance to God’s authoritative masculine qualities and offer a more rounded and robust reflection of the scripturally androcentric Holy Trinity.

The veneration of Mary began in the early Medieval period (10), when St. Proclus delivered a homily during the Council of Ephesus (11) proclaiming, “The reason we have gathered here today is the holy *Theotokos* (12) Virgin Mary, immaculate treasure of virginity, spiritual paradise of the second Adam, workshop of the union of [Christ's two] natures, [...] bridal chamber in which the Word was wedded to the flesh, living bush that was not burned by the fire of the Divine birth” (Alessio). St. Proclus’ homily both defined the hypostatic union (13) of Christ’s dual nature and confirmed Mary as the mother of God and intercessor between humankind and the divine. Marian theology developed and grew from this council and by the late Medieval (14) period Christian art deified and celebrated her as a figure of absolute purity, born outside of original sin (15). From this point forward she was recast from the humble bearer of the Christ child to the nurturing and merciful Divine Mother.

Mary’s significance within Christian ideology can be seen in the artistic portrayals throughout these periods. Italian artist Olivuccio di Ciccarello’s *Madonna of Humility with the Temptation of Eve*, painted circa 1400 CE., uses proportion, color, and scale to emphasize the importance of the Virgin Mary (Fig. 1). Depictions of the “Madonna of Humility” were common in Italian art during the 14<sup>th</sup> century, and show Mary seated on a low cushion or directly on the ground holding the Christ child (“Madonna of Humility”). Ciccarello’s painting presents the Madonna in this traditional pose surrounded by twelve golden circular inlays, each containing one of Christ’s apostles. Contrary to the Church’s patriarchal practice of exclusively male leadership, the sheer dominance and scale of Mary compared to the surrounding Apostles creates a visual hierarchy signifying her as the pinnacle of virtue, purity, and worthiness above all others. Below the Virgin and Child in a panel segregated by darkness lies Eve whose consumption of the forbidden fruit cursed humanity to hardship and temporal life (16). The artist, like the Church, uses the constant comparison between Eve and Mary to emphasize the necessity for salvation.

The Virgin Mary, full of God’s grace, bears the savior of humankind and breaks the curse of Eve, allowing Christian souls the opportunity for redemption and eternal life. Ciccarello uses rare blue pigments and inlaid gold paint throughout the Virgin’s robe and mantle which further accentuates her divine nature and distinguishes her apart from the naked and shamed Eve. Artists working within these periods used color as a visual indicator of status and significance, with ultramarine blue—a rare pigment made from



the lapis lazuli stone (17)—frequently employed when painting the Madonna, Christ, or God. Paintings portraying the Virgin Mary and God within the same panel routinely depict both figures in similar dress, drawing a visual parallel between the two beings. Giovanni del Biondo's *Crucifixion with God the Father* (Fig. 2) and Albrecht Durer's *Adoration of the Trinity* (Fig. 3) are two examples, across period and location which feature this divine mirroring of garments between the Virgin Mary and God. The use of rare ultramarine blue pigment to depict these figures communicates a sense of equality and similarity between the two, with Mary being elevated to a station beyond mother of Christ but also the mother of humankind, counterpart to God.

Along with the use of color to present the Virgin Mary as divine, the late Medieval period (18) marked the prevalence of the *Madonna Lactans*—or the “Nursing Madonna”—a series of specific Marian imagery depicting the Christ child nursing at his mother's breast. Examples of these *Madonna Lactans* motifs can be seen in Barnaba de Modena's *Madonna and Child* (Fig. 4), Jan Van Eyck's *Lucca Madonna* (Fig. 5), and Gerard David's *Rest on the Flight into Egypt* (Fig. 6). These depictions, although distinct in both style and technique, maintain a thematic resonance. Mary sits with the child nursing in her lap, often with her hand cupped over her breast and her head bowed, signifying a reverence for the child savior. She maintains a soft and knowing expression, sharing an intimate moment between mother and child. The Virgin Mary, divine intercessor and mother, must raise and nurture a child for the salvation of humanity. These works show a gradual shift away from the Byzantine period's distinct, highly embellished, and stylized representations of Madonna and Child iconography. Unlike Modena and Van Eyck, David's figures are firmly rooted in the realm of realism, with the Virgin Mary seated not on a throne surrounded by halos and gold, but humbly set on the ground with her infant child. In David's work the signifier of status comes not from a golden halo but her defining blue robes, emphasizing the sacred relationship between the mother and child without the gilding. Clothed in the traditional red and blue robes which denote her sanctity, the *Madonna Lactans* iconography depicts the hypostasis of Mary as both physical and divine mother: God's wisdom and will enfleshed. This union of the human and divine parallels the dual nature of Christ—the living word of God within the body of a man—and elevates Mary to the status of a co-redeemer of humanity through the physical acts of birth and nurture.

St. Augustine reflects on the act of nursing in his *Confessions*, writing, “The comforts of human milk were waiting for me, but my mother and my nurses did not fill their own breasts; rather you [God] gave me an infant's nourishment through them [...]” (Augustine *Confessions* 1:6). St. Augustine regards the milk of a mother as a spiritual fluid which God provides within the breast to nourish a child. The act of nursing then becomes both a physical and divine act, creating a sacred bond between the mother, child, and God. The Madonna embodies the same characteristics of Christ

and his teachings: divine love, charity, and obedience to God's will. The iconography of the nursing Madonna connects the virginal milk which nourished the Christ child to the salvific sacrificial blood Jesus would later shed on the cross. In the New Testament, the Apostle Peter details how the “new birth”—also referred to as being “born again”—is achieved not through empty things like silver and gold, but “with the precious blood of Christ” and directs followers to crave the “pure spiritual milk” provided by the Lord which leads to salvation (*1 Peter* 1:18-19, 2:2). The scripture specifies that Christ's sacrificial blood acts as the essential fluid which is required for a spiritual rebirth and ultimate salvation. The conceptual rebirth of the spirit alongside the iconography of the *Madonna Lactans* create a visual parallel between the Passion of the Christ and the Passion of the Virgin, co-redeemers and idealized maternal nurturers.

Catherine Bynum discusses the Medieval biological theory of bodily fluids in her essay *The Body of Christ in the Later Middle Ages*. She notes, “Ancient biologists thought that the mother's blood fed the child in the womb and then, transmuted into breast milk, fed the baby outside the womb as well” (420). Early scientific understandings of biological functions created analogous descriptions of body fluids in both visual iconography and theology, drawing direct correlations between blood and breastmilk as methods of both physical and spiritual nourishment. The Medieval conceptions of bodily fluid and transmutation furthered the ideology that Christ's body and blood could then become the sacrament for the salvation of the Ecclesia (19). Transitioning from infancy to resurrection, Christological iconographic painters create a visual equivalency between Mary's breastmilk and Christ's blood by depicting Jesus cupping his wound—located just below his right breast—with head slightly bowed. This positioning mirrors the *Madonna Lactans* depictions, highlighting the ultimate maternal virtues associated with the act of nurture: infinite love and charity (20). Examples of the specific imagery of Christ displaying his sacrificial blood, commonly referred to as the *Man of Sorrows* iconography, can be seen in Meister Francke's *Man of Sorrows* (Fig. 7) and Hans Memling's *The Virgin Showing the Man of Sorrows* (Fig. 8). Memling depicts the agony and suffering of the co-redeemers, recalling images of the Virgin and Child in his infancy. In Medieval theology, St. Catherine of Siena refers to the blood of Christ as “essential milk” which flows from the breast, echoing the *Man of Sorrows* iconography and the transubstantiation from blood to sacrament (Catherine 38). These images, paired with earlier depictions of Mary, show the mutual suffering of the mother in the form of the Madonna and the adult Christ. In Memling's painting, Mary presents her child for the nurturing of the Church instead of her breast for the nourishment of the infant savior as seen in earlier *Madonna Lactans* images, directly connecting the breastmilk of the Madonna to Christ's blood, creating a visual equivalence signifying physical and spiritual nurturing. As the Virgin nursed the Christ child, Christ will then nurture the ecclesia through his breast wound and blood.

Depictions of the *Man of Sorrows* throughout the Renais-

sance period often include a chalice which captures the sacrificial blood of Christ, sometimes held by angels as seen in Giovanni Bellini's *Blood of the Redeemer* (Fig. 9), or freestanding as in Jacob Cornelisz van Oostsanen's *Man of Sorrows* (Fig. 10). These examples, along with many other *Crucifixion* icons, use the chalice to collect the sacred blood which, through the act of transubstantiation conducted by a Priest, becomes the salvific Eucharist (21). The holy milk-blood of the savior demands an honorable and pure golden vessel for the eventual salvation of humankind. Representations of Christ as the *Man of Sorrows* are consistently delicate in their rendering, contrasted with the graphic imagery of sacrificial blood flowing—or often spurting—from the wound. Christ gently holds open the wound in a manner that seems presentational, a visual offering of nourishment and charity. His maternal act translates visually into the divine love for humanity, depicted in graphic detail paired with tears of compassionate understanding.

Medieval and Renaissance artists frequently depicted Jesus as a maternal figure for the Church, whose physical act of submission and bodily sacrifice ushered in the birth of Christianity. Artistic expressions of this maternal nature are explored in the interpretation and depiction of the wound of Christ. Medieval illustrated manuscripts and prayer books present Jesus' wound as a disembodied vertical gash, making a direct comparison to the vagina (Fig. 11.1, 11.2, 11.3). These illustrations break from the traditional normative gendering of Christ to portray a fully realized feminine wound which gives birth to Christianity. The French *Psalter and Prayer Book of Bonne de Luxembourg* and English *Book of Hours* feature these eschatological vaginal wounds, often surrounded by the implements of Christ's crucifixion, which would remind the reader of the Passion. The *Bible Moraliseé* (Fig. 12) juxtaposes two images to illustrate Christ as the divine mother of the Church. The top image depicts Eve being birthed from Adam's side while the lower shows the Ecclesia emerging from Christ's wound before the deposition. In both illustrations God acts as midwife for the delivery, witnessed first by the animals in the Garden of Eden and then by a small collection of Church leaders. These artistic interpretations express less rigid and dichotomous conceptions of gender which contradict the strictly androcentric scriptural language of Christ as both physically and conceptually male.

Images of the vertical wound of Christ not only tie his blood and sacrifice to breastmilk and birth, but also reference the assumption (22) of Mary and Christ into Heaven. The shape of the wound transitions from vaginal to divine through artistic renderings of the assumption of Mary. Although only alluded to in scripture, Pope Pius XII confirmed the dogma of the assumption of Mary in the Apostolic Constitution (23) encyclical *Munificentissimus Deus*, outlining the unique assumption of Mary as the will of God (24). The mandorla, an almond-like shape, became an important symbol for visually indicating the high status of divinity, tied to the mathematical perception of the circle as

a perfect form. This shape was derived from the Pythagorean geometric lens called a "vesica piscis" or "fish bladder," formed by the intersection of two circles with the same radius (Sparavigna 1). This shape was transformed into the Christian "mandorla" in art, becoming a symbol of God's Divine Glory in the same manner other neo-Platonic ideas were adopted into Christian concepts (5). Not only does this shape perfectly mirror the vaginal wound of Christ, but also the universally recognized "ichthus" fish which became a secret symbol for Christ during the age of persecution (25). Unlike the more commonly used halo to denote holy figures, artistic interpretations of the assumptions use the mandorla to encapsulate the entirety of the bodies of both the Virgin Mary and Christ in a way that visually links the shape to Christ's wound. Reiterating the connection between blood, birth, and divinity in a single geometric form.

Seen throughout the late Medieval and Renaissance periods in art, notable examples of these mandorla assumptions are found in Don Silvestro dei Gherarducci's *Assumption of the Virgin* (Fig. 13), Pietro Perugino's *San Francesco al Prato Resurrection* (26) (Fig. 14), and Bartolomeo Vivarini's *Death of the Virgin* (Fig. 15). Gherarducci *Assumption* and Perugino's *Resurrection* each depict their figures hovering above opened and empty stone tombs, encased in the mandorla, and surrounded by angels. Although distinctly different in style—one more Byzantine and the other closer to traditional Renaissance realism—these organization of figures and elements share a definitive consistency in their glorification of these two maternal figures within the divine vaginal shape of Christ's wound. Unique to the three examples, Vivarini's *Death of the Virgin* offers a more complex depiction of Mary's assumption. At the base of the image Mary's body lies surrounded by the twelve mourning apostles along with Saint Lawrence and Saint Stephen (Vivarini). Above these figures Christ sits with a miniature Mary in his lap, carrying her body into Heaven inside the holy mandorla. This image recalls the familiar Virgin and Child iconography in reverse. Christ has become the mother who protects her child from death, wearing pink robes and enclosed in a blue mandorla, mirroring the earthly Mary's garments. From the Divine Wisdom of infancy into the afterlife, across scripture and the visual arts, Christ reflects the divine feminine in all aspects.

Abstractions of gender exist within scripture and subsequent theological discussions surrounding Christ and his teachings. However, the Vatican's immutable stance on patriarchal leadership seems to ignore and constrict the physical feminine over the divine feminine characteristics of Christ's word. Relegating women into a lower station within the structure of the Church and deeming them unequal to men in their capacity to minister diminishes the significant role divine feminine energy plays in reflecting the full and robust image of God. An ideology which espouses an exclusively male trinity neglects the original interpretations of both God and Christ who are scripturally outside of normative gender constructs.

The pre-translated Hebrew language used to describe the essence of the Old Testament God incorporates both masculine and feminine imagery in equal measure. The word “Ruach” is a feminine gendered word used to describe the spirit while the word for God is the masculine “Elohim” (Schaupp). The *Ruach Elohim*—which translates to “holy spirit,” defining one third part of the trinity—combines the gendered masculine and feminine into one entity, signifying the divine unification of both essences through language. According to Hebrew scholars, the Spirit cannot be identified with the gendered *He* pronoun, signifying a linguistic necessity to communicate the concept of God outside of gender (Schaupp). Scripture frequently uses feminine allegorical language and imagery to balance the androcentric language of God the Father and Christ the Son, using symbolism to untether both entities from the constrictive categorizations of human gender (27).

Later Neoplatonic philosophical concepts further described and defined the soul as a genderless/neutral entity. Theologians like St. Augustine would refer to this Platonic ideal that the soul and especially its highest, intellectual part is not gendered (Tornau). Citing the promise of the Apostle Paul that in Christ “there is neither male nor female” (28) Augustine argues that women are equally like men because the genderless intellectual soul, not the physical body, is the true reflection of God’s image (Augustine *Genesis*). Throughout the bible God acts as both the spiritual Father and Mother of humankind, with the Virgin Mary and Christ enacting his will on earth. Although translations define God’s gender as male, the recurring use of feminine allegory within scripture poetically infuses the maternal aspects into the essence of his spirit. The figures of Mary and Christ are God’s gender incarnate, each acting as co-redeemers and intercessors between humankind and the divine, reflected in both scripture, theology, and the visual arts. While the Church’s practices and ideology remained institutionally patriarchal, in actuality Christological iconography during these periods shows a consistent pattern of glorifying the feminine qualities present within the Madonna and Christ. These depictions exist as visual reminders of spiritual unification between masculine and feminine energies, which reflect a more complete image of God’s divine nature. Iconographic paintings of the Virgin Mary and Jesus venerate and sanctify the relationship between mother and child and stand in contrast to the androcentric gendering of the holy trinity that permeates Christian theology.

(1) *Matthew 23:37*, New International Version, *Bible Gateway*, <https://www.biblegateway.com/>

(2) *Ezekiel 34:12-16*.

(3) Established by Pope Paul III in 1542, the Sacred Congregation is a permanent committee of cardinals in the Vatican who are tasked with handling the business of the Church (“Sacred Congregations”).

(4) *John 20: 11-18*.

(5) See *Galatians 3:26-28*.

(6) For examples of feminine allegory and God see: *Numbers 11:12*, *Deuteronomy 32:18*, and *Isaiah 42:14*, *49:15*, *66:13*.

(7) For examples of these teachings see: *1 John: 11-12*, *John 14:16*, *John 8:12*, *Acts 2:38*.

(8) The Greek *Sophia*, grammatically feminine, translates to divine wisdom, holy wisdom, or wisdom personified (“Sophia”).

(9) Examples in scripture: *John 1: 1-4*, *14*, *1 Corinthians 1:24*.

(10) 400-700 CE., with the homily of St. Proclus occurring around 428 CE.

(11) Council of Ephesus: Three assemblies held by bishops to address problems in the early Christian Church (“Council of Ephesus”).

(12) Greek: “God-Bearer.” Eastern Greek Orthodox designation of the Virgin Mary as the mother of God.

(13) In Christian theology, the hypostatic union refers to the biblical doctrine that within Christ exists two distinct yet inseparable natures: human and divine (Slick). For scriptural evidence see also *John 1:14*, *John 10:30*, *Colossians 2:9*.

(14) 1300-1500 CE.

(15) Pope Pius IX decreed in his encyclical *Ineffabilis Deus* that, according to the scripture “[...] the soul of the Blessed Virgin, in its creation and infusion into the body, was endowed with the grace of the Holy Spirit and preserved from original sin” (Pius IX). For scriptural example see *Luke 1:28*.

(16) See *Genesis 3:16-22*.

(17) Earliest known use as a pigment date back to the 6<sup>th</sup> century, however lapis lazuli gained popularity during the 14<sup>th</sup> and 15<sup>th</sup> century paintings, often reserved to color the garments of the Virgin Mary, Christ, and God (“Ultramarine”).

(18) Although Madonna and child imagery has been found dating as early as the 2<sup>nd</sup> century, the Madonna Lactans iconography was popularized and widely disseminated between the 1300-1500s in the form of both paintings and manuscripts (Schaefer 4).

(19) *Ecclesia* is the Ancient Greek word for an assembly or community. In Christianity it refers to the congregants of the Church, faithful to the word of God (“Ecclesia”).



(20) In St. Catherine of Siena's *Dialogue* on the manifestation of God's mercy she writes, "I showed you this in my open side, where you discover the secret of my heart: namely that I love you more than what I could show you with the finite torment" (Catherine).

(21) Also referred to as the Holy Communion or Lord's Supper. It remains a formal rite in Christian practice. Depending on denomination, the Eucharist is considered either a symbolic communion, or as in the Roman Catholic doctrine, the true presence of the body and blood of Christ ("Eucharist").

(22) In Eastern Orthodox and Roman Catholic theology, the assumption occurs when both the body and soul are taken into Heaven after death ("Assumption").

(23) Collection of Ecclesiastic law and treatises on Christian doctrine, worship, and discipline meant for the clergy and other Church leaders (Peterson).

(24) God willed that the Virgin Mary, through the act of Immaculate Conception, be exempt from the law of bodily corruption in the grave. This proclamation confirmed that when God filled Mary with his grace and conceived Christ she was freed from the curse of Original Sin (Pius XII).

(25) The "ichthys"—the Greek word for "fish"—is a type of *vescis picis*, with the ends extended slightly beyond the base on one end of the lens shape. This shape became a way for Christians during the persecution to identify one another as part of the same faith. The original Greek "ΙΧΘΥΣ" translates to "Jesus Christ God's Son's Savior" ("Ichthys").

(26) This painting is a depiction of Christ's resurrection; however, the title is taken from the church of San Francesco al Prato where the image was originally housed.

(27) See note 6.

(28) *Galatians* 3:28

## Figures

Fig. 1. Ciccarello, Olivuccio. *The Madonna of Humility with the Temptation of Eve*. 1400, *Cleveland Museum of Art*, Cleveland. [Click here to see the image.](#)

Fig. 2. del Biondo, Giovanni. *Crucifixion with God the Father*. 1375-1380. Memorial Art Gallery, Rochester. [Click here to see the image.](#)

Fig. 3. Durer, Albrecht. *Adoration of the Trinity*. 1509-1511. Kunsthistorisches Museum, Vienna. [Click here to see the image.](#)

Fig. 4. Modena, Barnaba. *Madonna and Child*. 1370. Louvre Museum, Paris. [Click here to see the image.](#)

Fig. 5. van Eyck, Jan. *Lucca Madonna*. 1437. Stadel Museum, Frankfurt. [Click here to see the image.](#)

Fig. 6. David, Gerard. *Rest on the Flight into Egypt*. 1512-1515. Metropolitan Museum of Art, New York. [Click here to see the image.](#)

Fig. 7. Meister Franke. *Man of Sorrows*. 1435. Hamburger Kunsthalle, Hamburg. [Click here to see the image.](#)

Fig. 8. Memling, Hans. *Virgin Showing the Man of Sorrows*. 1480. National Gallery of Victoria, Melbourne. [Click here to see the image.](#)

Fig. 9. Bellini, Giovanni. *Blood of the Redeemer*. 1460-1465. The National Gallery, London. [Click here to see the image.](#)

Fig. 10. Cornelisz van Oostsanen, Jacob. *Man of Sorrows*. 1510. Museum Mayer van den Bergh, Antwerp. [Click here to see the image.](#)

Fig. 11.1. le Noir, Jean. *Prayer book of Bonne de Luxembourg*. 1349. Metropolitan Museum of Art, New York, Cloisters Collection. [Click here to see the image.](#)

Fig. 11.2. Unknown artist. *Book of Hours (England or Netherlands)*. 1410. Oxford Bodleian Manuscript Library, England. [Click here to see the image.](#)

Fig. 11.3. Unknown Artist. *Book of Hours (Latin)*. 1369. Biblioteque Nationale de France, Paris. [Click here to see the image.](#)

Fig. 12. Unknown Artist. *Bible Moralisee (French)*. 1220-1230. Österreichische Nationalbibliothek, Vienna. [Click here to see the image.](#)

Fig. 13. Gherarducci, Don Silvestro. *Assumption of the Virgin*. 1365. Pinacoteca Vatican, Italy. [Click here to see the image.](#)

Fig. 14. Perugino, Pietro. *San Francesco al Prato Resurrection*. 1499. Pinacoteca Vatican, Italy. [Click here to see the image.](#)

Fig. 15. Vivarini, Bartolomeo. *Death of the Virgin*. 1485. Metropolitan Museum of Art, New York. [Click here to see the image.](#)

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# Found: Creative AI

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**Artist Statement:** In an attempt to escape from the grip of creative AI, I wrote a poem discussing themes prevalent in discussions by computational creativity researchers. The gripe AI has on creative communities internationally stems from the belief that it will be able to replace, or rather reduce humanity's creative capabilities to null. Many people believe AI can rob of us the valuable skill, seemingly reserved for humans as a species, our creativity. If AI can become creative will art be valued with the same level of appreciation as before? This question is usually addressed by people within the art community with the response that, AI cannot ground its art in personal experience and therefore has no sentimental value. This is where computational creativity researchers address levels of AI capability. Currently, AI can study existing patterns to make predictions; however, with the capability to use input from the environment in real-time, will AI then be considered creative? These questions have been at the forefront of our discussion regarding the sanctity of our society with the development of AI. I see this as an issue only if we allow it to become one. We are the species that “found art” and devised creativity as a notion of human experience. Therefore, our definition of creativity has to come into question if we believe AI can “steal” our creativity. We must realize that AI should be used to benefit society, a tool to expand our creative and scholarly capabilities.

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AI produces, in “uncanny detail,”  
to benefit society? creating,  
ethically? justly?  
using Our work... to a certain degree  
a network of Our art...  
deep-learned from a neural lattice.  
Not autonomously creative, quite yet,  
AI merely wrought Level 5.

Worthless, unvalued  
by the human heart.  
No gravity, in its words,  
no narrative to AI, it lacks creative spark.  
An instrument to be used,  
in tandem with us *creatives*,  
so that we can once more— find Our art.

AI emulates creatives, practitioners of fine arts.  
Critiquing, not stealing,  
to appropriate— justly— Our art.  
Assemblage—  
ready-made, found-poetry  
Superposing fairly, citing,  
for the beneficence,  
of creativity? of art?  
All to establish it is humanity that “found” art.



# To be a Tree

CRISTA FIALA

*University of Saint Joseph*

**Artist Statement:** With this poem, I set out to play with the inextricable relationship between language and nature. We often see this relationship when we reflexively talk about our own languages, such as with linguistics. I designed this poem so that the readers can interpret each line in two different ways. These lines describe how the term “to be” functions in English at the same time that they describe how a tree functions in our environment. Overall, “To Be a Tree” unveils how not only are language and nature vitally interconnected but that we must take care of both to maintain a world full of life.

**A** copula, sometimes an auxiliary for existence  
 Life always in its starting form: infinitive  
 A compound morpheme  
 An individual “be,” free; The root(s) affix (in)to “being”  
 To be - a structure for recursion:  
 To be a tree is to be a tree is to be...  
 Be a tree - the imperative  
 So that the tree may continue to be - what *is* imperative?  
 To answer the interrogative, as the imperative may be too much to bear  
 [*the weight of the leaves, the flowers & the fruits*],  
 The subjunctive may need to be considered first.  
 If it *were* no longer here as the generative structure of life, such as when  
 “The tall tree quickly grew,” as a simple sentence mapped out on a branched syntactic diagram.  
 We would then witness a return to the indicative, a final alteration in conjugation  
 A termination to its infinitive nature  
 A suppletion: *was*.





# Stars

ANGELINA LAMBROS

*Brooklyn College*

**Artist Statement:** As an artist, singer, writer, and poet, I love being creative and imaginative. I have been writing stories and designing my own characters since my early childhood. I spend much of my time reading, writing, making art, and learning new things. I like to learn about history, art history, and social sciences.

My poem "Stars" is a poem I wrote in 2015, at the age of 11, and included in a poetry collection I self-published in July 2022, *Imagination and a World of Dreams*.

The poem represents the imagery of lights in nature, such as the moon and stars. The poem itself focuses on a star, a powerful light that shines and breaks the still darkness. Its enemy is time, that construct that governs us all, and every passing minute on the clock is a passing minute in the star's own life. The star has its place in the universe, as do all of us. "We are all made of star-stuff." Carl Sagan.

I feel the wind is blowing.  
I see the stars are showing.  
When the moon shines bright,  
Light up the darkest night.  
There's still a little light.

I see a star.  
It's shining real high.  
This one is very old.  
Pretty soon it's going to die.

Oh, the fate of the dying star  
Is a fate that can't be changed.  
So the star wrestles against time.  
Bold, alone, and estranged.

Against a sky of darkness,  
That makes us all feel blind,  
The star transcends and illuminates;  
It gives us the hope we find.

So we shall stand, all joining hands,  
In a forever camaraderie that unites the lands.  
Like stars against a sky of dark,  
Fellowship to ignite a spark.

So when the star's time has come,  
And it returns to where it came from,  
We brothers and sisters will carry the light,  
Like dreamers, like artists, like those who write.



# The Effects of Modeling a Ketogenic Diet on the Neurological Development of *Drosophila Melanogaster*

SAMANTHA BISEINERE

*Westfield State University*

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**Abstract:** The ketogenic diet has been used as a treatment for medication-resistant epilepsy in children since the 1920s. Due to the restrictive diet, the neurological development of the children placed on the diet is a concern. We gave *Drosophila melanogaster* food that was supplemented with beta-hydroxybutyrate (BHB), a ketone body created as a byproduct of the ketogenic diet, and analyzed their motor function, survival, and synapse staining. We hypothesized that BHB supplementation would result in increased motor function and altered brain anatomy, but that survival rate would not change. Interestingly, we found no significant difference in the motor function or survival rate of the *Drosophila*. There was a small increase in the amount of synapses in the brain; however, no statistical analyses were performed to confirm this finding due to small sample size. These results suggest that there may not be a strong effect of BHB supplementation on neurological development. Future research can implement a true ketogenic diet on *Drosophila* to determine if the results would be the same.

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## Introduction

The ketogenic diet (KD) is a high-fat, low-carbohydrate diet which is intended to induce ketosis by making the body use fat as the primary energy source. The reduction in carbohydrates leads to an increase in lipolysis which increases ketones, an acidic byproduct of lipolysis, in the blood (The Nutrition Source, n.d.), and has been used since the 1920s to help reduce epileptic seizures in children (Golabek et al., 2022). In more recent years this diet has been used to lose weight as low-carb diets have become more popular (The Nutrition Source, n.d.). The ketogenic diet is very restrictive and without proper supplementation can lead to deficiencies in different nutrients such as Vitamin D, selenium, copper, and magnesium (Armeno et al., 2019). Therefore, the neurological development of children at a young age who have been placed on this diet has become a concern. Previous research has looked at altered brain metabolic pathways, brain volume (Mayengbam et al., 2021), and body mass (Wojciech et al., 2021). However, very few studies have assessed motor functions, survival and brain volume using *Drosophila melanogaster* as a model organism. There are many unanswered questions regarding how the ketogenic diet affects children. This study aims to answer the question: When administered soon after eclosion, or emergence from pupal case, how does the ketogenic diet affect the neurological development of *Drosophila melanogaster*?

Past research studies have assessed the brain volume and metabolic difference in juvenile mice when given a ketogenic diet (KD) (Mayengbam et al., 2021). The experi-

mental group, who had received the ketogenic diet, had a decreased brain volume and altered brain metabolic profiles and metabolic pathways compared to the control group who was fed a standard diet. There were various metabolic differences noted between the two groups, as there was a lower level of amino acids in the brain such as methionine. Further, the level of carnitine, an amino acid synthesized from methionine and lysine, was also lower in KD-fed mice. Lastly, there was an increase in glutamate in the brain, the precursor to GABA synthesis which was noted in other studies as well (Mayengbam et al., 2021).

Another study had similar results when assessing the effects of the ketogenic diet on pregnant mice and their offspring (Wojciech et al., 2021). The brain mass of the female mice who were pregnant and fed a ketogenic diet, decreased compared to the controls who were fed a standard diet. However, the long-term effects and whether the results can be reversed are unknown. Additionally, the offspring from the pregnant females fed the ketogenic diet had a significant decrease in body mass compared to the normal diet group. The offspring that were later switched to a normal diet began to restore their body weight quickly (Wojciech et al., 2021). Through all of the research reviewed, none have reported any decrease in survival rate of the mice fed the ketogenic diet compared to the groups fed a standard diet.

The ketogenic diet has shown neuroprotective effects on different neurological diseases such as in patients who suffer a traumatic brain injury (TBI) (reviewed in Barry et al., 2018). After a TBI, there are various metabolic changes and dysfunctions in the brain that can last for many days.

There is an increase in glucose uptake within 8 days of the injury, followed by a period of glucose metabolic depression. Cerebral ketone metabolism has been shown to help with TBI recovery as the brain is able to bypass the issue of glucose metabolic depression that occurs early on. Additionally, ketone metabolism is also more efficient and decreases the production of free radicals in mitochondria and cytosol. After moderate injuries, adult rats fasting for 24 hours showed a decrease in oxidative stress, cortical tissue sparing and mitochondrial calcium loading (Prins & Matsumoto, 2014).

As mentioned above, the KD has shown great benefits to helping reduce seizures in children with medication resistant epilepsy. Epilepsy is a brain disorder where an individual may have seizures throughout their life (Center for Disease Control and Prevention ([CDC], 2020). A seizure is a random and temporary burst of energy in the brain that can cause involuntary changes in the body such as changes in movement or function (Kiriakopoulos, 2019). There are many medications that are used to control the number and severity of seizures an individual may have; however, for some individuals, medications alone do not work well to manage symptoms (Golabek et al., 2022). Researchers have found that most seizures are caused by issues with  $\gamma$ -Aminobutyric acid (GABA). GABA is an inhibitory neurotransmitter which reduces the excitability in the nervous system (Treiman, 2001). In ketosis there is an increase in glutamate in the brain, and due to the increase in ketone bodies, this glutamate can be more readily available to synthesize GABA (Yudkoff et al., 2008). Overall, GABA synthesis is increased in the presence of ketone bodies such as acetoacetate (Yudkoff et al., 2008). With increased presence of GABA in the brain, there is a decrease in seizures as the GABA is able to inhibit neuronal excitation, the main cause of a seizure to occur (Treiman, 2001). These anticonvulsant effects have been shown in individuals who are placed on the ketogenic diet (Freeman et al., 1998).

Past research has shown that the ketogenic diet can be effective at treating neurological issues such as epilepsy and even possibly protecting the brain against damage in TBIs. Studying the effect of the ketogenic diet on neurological development is important to provide a complete understanding of the safety and effects on the ketogenic diet for both healthy brains and different neurological disorders. *Drosophila melanogaster*, commonly known as fruit flies, are a model used in a wide range of different research topics. They are also able to model different diseases such as Alzheimer's (Giaimo, 2020) and traumatic brain injuries (Bloomer et al., 2021). Scientists have a great understanding of the genome of *Drosophila melanogaster* and have found that humans share over half of their genome with them (Giaimo, 2019). Additionally, they have a very short period of development compared to other organisms where after just 1 day there is a fully functional instar larvae and after an additional 10 days a full adult emerges (Crews, 2019). This makes them a great model system, as multiple different experiments and replicates can be performed under a relatively short period of time. In this study, beta hy-

droxybutyrate (BHB) was used to supplement the *Drosophila* medium. BHB is a ketone body that is naturally abundant in organisms who are actively using the ketogenic diet (Newman & Verdin, 2017). Supplementation of this ketone body can help to resemble similar effects to a true ketogenic diet (Stefan et al., 2021). We were able to test motor function by performing multiple replicates of the rapid iterative negative geotaxis (RING) assay, which is used to assess the ability of *Drosophila* to climb vertically in response to gravitational cues (Gargano et al., 2005). The survival of the *Drosophila* were monitored and brain dissections were performed to assess the survival rate and the amount of synapses in the brain by evaluating mean gray value, respectively.

The main purpose of this study is to assess the negative geotaxis, synapse staining, and survival rate of *Drosophila melanogaster* when given Beta-hydroxybutyrate (BHB). I hypothesize that *Drosophila*, who are fed a diet supplemented with BHB, will have an increase to their motor functions, specifically negative geotaxis; however, there will be no difference in the survival rate between the experimental and control groups, and there would be altered brain anatomy.

## Methods

### Set-up and Care

Over the course of the study, 4 experiments were performed using different groups of *Drosophila melanogaster*. A RING analysis was performed on all 4 experiments. In addition to the RING analysis, experiment 3 included measuring survival, and experiment 4 included measuring the mean gray value of the brain. Each experiment was set up and monitored in the same manner. The *Drosophila melanogaster* used were Oregon R wild type flies from Carolina Biological (Burlington, North Carolina) and maintained in vials in a cabinet with regulated twelve hours of light and twelve hours of darkness. Ambient temperature of the vials ranged from 70°F - 79°F. Once flies were approximately 1 to 3 days post-eclosion, male flies were selected, as their mating habits and reproductive hormones would not affect the results. These male flies were then transferred

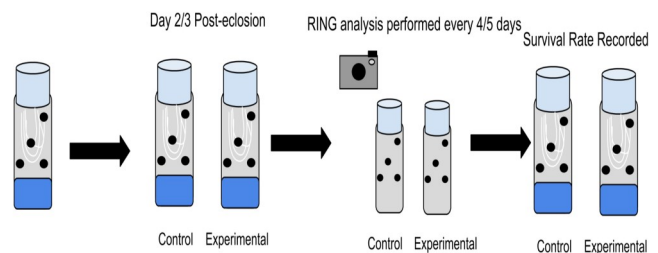


Figure 1. BHB setup and timeline. Male *Drosophila* were selected at the start of the setup of the vials. *Drosophila* were monitored using the RING analysis for changes in motor function, and survival rate was noted over the course of the experiment.

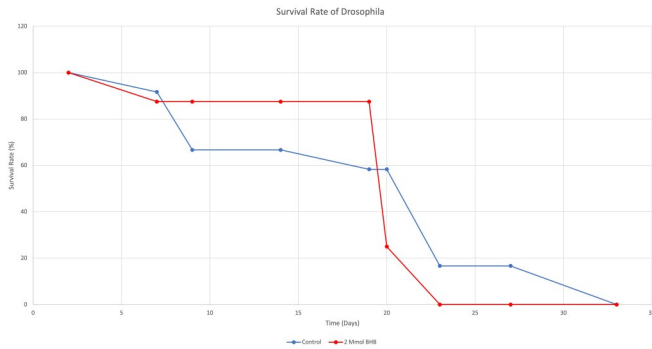


Figure 2. The survival of *Drosophila* was monitored until day 33 post-eclosion when all flies were dead. Flies were rehousing on day 9, day 14, and day 19. Survival was graphed as a percentage of individuals alive at any given time.

to new vials. *Drosophila* were anesthetized by placing them in the freezer between 3 to 5 minutes. Both vials were set up with Carolina 4-24 instant *Drosophila* medium, yeast and netting in order to have the same environment for both sets of flies. The control vials contained a regular diet consisting of only instant *Drosophila* medium and distilled water. The experimental vials also contained instant *Drosophila* medium and 2 Mmol of Beta-Hydroxybutyrate (BHB, Sigma Aldrich, St. Louis, Missouri). Survival was monitored by recording the number of flies alive once to twice a week. Figure 1 illustrates the timeline for the experiments. A Log Rank Test was performed to determine the significance in survival of the *Drosophila*.

## RING Analysis

The Rapid Iterative Negative Geotaxis (RING) analysis was performed before the diet was introduced and multiple times after between 4 to 5 days apart. The RING analysis is a method for testing the locomotor functions in *Drosophila*. The setup included a light box, vial, ruler, camera, tripod, and books to place vials on top of. The camera was set up 30 cm from the position of the vial. A picture of an empty vial with a ruler next to it was taken in order to have a scale for statistical analysis. Once that was done, the *Drosophila* were anesthetized for 3 minutes in the freezer. The flies were transferred to an empty vial and allowed to recover for 30 minutes at room temperature. Then they were placed in front of the camera. In rapid succession, the vial was tapped against the table, and a picture was taken after 3 seconds. The *Drosophila* were allowed to rest for 30 seconds, and using the same group of flies, the process was repeated 5 times for each RING analysis. These photos were uploaded to Image J and were assessed manually in order to record the positions of the *Drosophila* in the vials (Gargano et al., 2005). Statistical analysis of the RING using a two-way ANOVA was performed using SPSS.

## Brain Dissections and Staining

Brain dissections were performed on the fruit flies 5 days after diet initiation. Once the brains were removed from the

fruit fly they were placed in 4 percent Paraformaldehyde (PFA, Sigma Aldrich) for at least 30 minutes. This was repeated until there were 3 to 4 brains. The brains were then fixed utilizing a nutator and washing the brains using Phosphate buffer saline solution, 0.1% tween (PBT) 3 times. Immunostaining of the brains was performed using primary and secondary antibodies diluted in PBT and 5% normal goat serum (Fisher Scientific, Hampton, New Hampshire). The primary antibody used was mouse anti-nc82 (Developmental Studies Hybridoma Bank, Iowa City, Iowa) in order to label presynaptic active zones. The secondary antibody used was goat anti-mouse (ThermoFisher Scientific, Waltham, Massachusetts) in order to bind to the primary antibody. Immu-Mount (Fisher Scientific) was used for immunostaining; the procedure was adapted from Wu and Luo (2006) and Kelly et al. (2017). Finally, the brains were mounted on a glass coverslip and examined through an Olympus IX-73 inverted fluorescence microscope (Center Valley, Pennsylvania) and camera SP-27. They were analyzed using image J in order to determine the mean gray value (Brightness) of the brains.

## Results

### Survival

The flies in both groups were monitored over the course of the third experiment, and the survival rate was recorded. There were 11 flies in the control group, and there were 8 flies in the BHB group. After 33 days post-eclosion, all the flies were dead in both groups. In Figure 2, the survival rate was recorded and showed a decline over time in both the control and experimental group. On days 4, 9, and 14 post-eclosion the flies were rehousing in both groups in order to refresh the BHB in the experimental vial. Both groups had a similar trend downward, and there was no statistical difference in the survival rate for either group ( $p$ -value = 0.339).

### Negative Geotaxis

For experiment 1, there were 6 male flies placed in each vial. A RING analysis was performed on the flies before the diet was started in order to have a reference for the second RING analysis that was performed 4 days later. This data is reflected in Figure 3. There was a significant difference between the control and the BHB group on day 3 ( $p < 0.05$ ), but not on day 7 ( $p > 0.05$ ). Additionally, there was no significant difference between day 3 or day 7 for either group ( $p = 0.865$ ). Eight days post-eclosion, a majority of the flies were dead in the vials, and there was apparent mold, so the vials were discarded.

For experiment 2, there were 10 original flies that were divided equally into 2 new vials. Two RING analyses were performed on day 7 and day 14 post-eclosion and this data is reflected in Figure 3. There was a significant difference between day 7 and day 14 ( $p = 0.004$ ); however, there was no significant difference between the control group and the BHB group on day 7 or on day 14. On day 6 there was 1



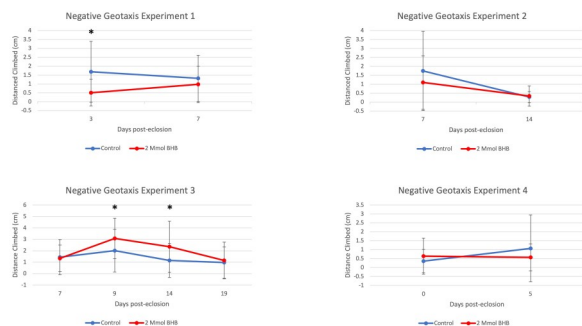


Figure 3. The Negative Geotaxis of *Drosophila* in all 4 experiments. The RING analysis was analyzed using Image J Software. Experiment 1 had 5 flies in each group, experiment 2 had 5 flies in each group, experiment 3 had 11 flies in the control group and 7 flies in the experimental group, experiment 4 had 11 flies in each group. There was no significant difference between the control and the experimental group at the end of each experiment. \* $p < 0.05$ . Error bars indicate the standard deviation in each trial.

dead fly found in the control group and after 30 days post-eclosion, all flies were dead in both the control and the experimental group.

For the third experiment, the control vials contained 12 male flies and the experimental vial contained 8 males. Four RING analyses were performed in total at 7 days, 9 days, 14 days, and 19 days post-eclosion as seen in Figure 3. There was a significant difference between Day 7 and Day 9 ( $p = 0.005$ ), there was also a significant difference between Day 9 and Day 19 ( $p = 0.001$ ); however, no other differences in time were significant. Additionally, there was a significant difference between the control group on Day 9 and Day 14 ( $p < 0.05$ ), but not on Day 7 or Day 19.

In the fourth experiment, the *Drosophila* in the experimental group were on the diet for 5 days before the brain dissections were performed. There were 11 flies in each group before the diet, 5 days after the diet was started, there were only 4 flies alive in the BHB group. There was no significant difference between either group ( $p = 0.589$ ) at any time point ( $p = 0.092$ ) as seen in Figure 3.

### Brain Dissections and Staining

In experiment 4, there were 2 partial brains in each group; therefore, brain volume was not able to be assessed. However, the cell death, or brightness of the brain was measured as seen in Figure 4. Using Image J, the mean gray value was measured indicating the amount of synapses in the

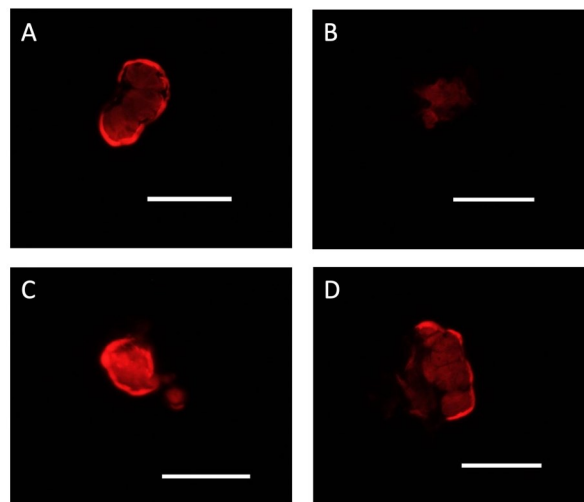


Figure 4. The synapses in the brain were stained using the primary antibody mouse anti-NC-82 and the secondary antibody goat anti-mouse. The mean gray value, determined by the brightness of the image, was recorded using Image J. The higher the mean gray value indicates a higher level of synapses in the brain. A- brain 1 of control; B- brain 2 of control; C- brain 1 of BHB; D- brain 2 of BHB. The scale bar is 50 micrometers in length.

brain. The control group had an average mean gray value

of 21.6995, and the BHB group had an average mean gray value of 25.691, which indicates the BHB group was brighter, as seen in Table 1. Due to the small sample size in each group, no statistical analysis was run.

### Discussion

In the present study, there were 4 different experiments that analyzed the negative geotaxis of the *Drosophila*. There was no difference found in the *Drosophila*'s climbing ability when comparing their normal *Drosophila* medium and *Drosophila* medium with Beta-Hydroxybutyrate (BHB) by the end of the experiments. Further, the survival of the third experiment was recorded over the course of 33 days. Similar to the negative geotaxis, there was no difference in the survival rate between the two groups of *Drosophila*. This indicates that the diet supplemented with BHB did not have an effect on their overall survival. The brain dissections performed on experiment 4 showed a slight trend of increased mean gray value in the BHB group, which appears to show a higher concentration of synapses in the brain.

	Control	BHB
Brain 1	31.472	28.944
Brain 2	11.927	22.438
Average	21.6995	25.691

Table 1. The mean gray value of the brain dissections was determined using Image J.

This study did not note any lasting differences in climbing ability of the *Drosophila*, this indicates that there is little to no effect on the neurological functions after the BHB had been introduced to the *Drosophila*. Further, the

mean gray values indicate a potential trend that the *Drosophila* who were given the medium supplemented with BHB had an increase in synapses in the brain. Further research would need to be performed to validate this, as there was not enough data to perform statistical analyses. This is contrasted to other studies that did find a difference in neurological development when using a mice model. The diet had affected both the pregnant female and the neurological development of the offspring (Wojciech et al., 2021). The offspring that were given a ketogenic diet in utero and during lactation had a delayed response to most of the reflex tests performed, such as opening their eyes and the righting test. Further, Mayengbam et al. (2021) noted a change in the volumetric development and the metabolic profile of inbred juvenile mice. While there was this noted difference, further research was needed in order to determine whether these changes had consequences affecting the functional capabilities of the mice. This indicates while there can be changes to the brain, this may not correlate to changes in function of the animal. There are many differences between a *Drosophila* model and a mice model as well. The mice in the previous study were given the diet while still in utero; however, that is not possible with *Drosophila*. The *Drosophila* were given the BHB after eclosion and after they have developed, as this is the most compatible part of the life cycle of *Drosophila* as a model for the current study. Further, our study used BHB as an additive into their current food, rather than controlling a true ketogenic diet like in the previous study.

Survival rate was not noted in many other studies. When assessing survival rate for healthy *Drosophila* there was no difference between each group. In other studies, a difference was found when assessing the ketogenic diet's effect on survival rate of a certain disease or trauma. Bloomer et al. (2021) found that the ketogenic diet reduced early mortality following a TBI. The *Drosophila* that were fed a ketogenic diet immediately after the injury had a higher chance of surviving, and they had a higher median lifespan (Bloomer et al., 2021). Another study looked at a mice model, and the effects of the ketogenic diet on survival of mice with systemic metastatic cancer. The mice fed a ketogenic diet had slowed tumor growth and an increase in mean survival of 56.7%, this increase in mean survival increased to 77.9% when the ketogenic diet was used with HBO2T (hyperbaric oxygen therapy) (Poff et al., 2013). These previous studies have shown a difference in survival rate with different neurological problems; however, none of them looked at healthy groups. Our present study found no difference in survival rate when comparing both healthy groups, and while supplementing their diet with BHB.

My original hypothesis was that the motor functions of the *Drosophila* would increase, the survival rate would stay the same, and there would be altered brain anatomy. Through the current data from this study, this hypothesis was not fully supported. The survival rate was measured, and as predicted, there was no difference between the two groups. This study helped to determine if there was any effect on the neurological development of *Drosophila* if the ketogen-

ic diet was administered earlier in their life span. The results of the study show that when you supplement with BHB, which can mimic the effects of a ketogenic diet, there is no large effect on the neurological health of *Drosophila*. Future studies can assess brain volume and determine if there is a difference. A true ketogenic diet could also be used to determine if you would get the same results as using BHB. While there was no change seen in this study, actually analyzing any differences in brain metabolic profiles may provide a fuller picture of the changes in the brain. The length of the study may also provide clearer results, as in a mice model, the mice would be able to be on the ketogenic diet for a longer period of time generally starting in the womb.

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# The Importance of Body Fluid Identification in a Court of Law

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**Abstract:** The establishment of legal systems alongside crime investigation has led to the intersection of law and science. Forensic science, at its core, is the application of scientific knowledge to questions pertaining to the law. One of the most important questions in an investigation of a crime and the proceeding court case is the identity of a suspected body fluid. Body fluid stains are found at crime scenes, and the identification of these stains is an important aspect of forensic science. Many tests currently exist to identify body fluids; however, they lack efficiency. Due to this limitation, many forensic laboratories across the country are choosing to eliminate body fluid stain identification unless requested from outside agencies. In response, other means of stain identification are under extensive research to help establish more reliable and efficient methods. With the advancement of DNA analysis, the importance of body fluid identification becomes even more crucial in a court of law. Knowing the identity of a body fluid can provide significant context to a past event and can aid in the reconstruction of the event which is always the central focus of forensic science. Without the crucial piece of stain identification, a proper reconstruction of an event cannot be achieved, even with the information provided from a DNA profile. This has been demonstrated in multiple court cases worldwide. The identification of a body fluid is an extremely important piece of information that is vital to understanding a past occurrence, especially in a court of law.

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## Body Fluids

Forensic science begins at the crime scene. To understand and study past events, the recognition of physical evidence is a crucial step. Physical evidence is any evidence that can provide useful information for the investigation of a crime (Lee & Pagliaro, 2013). It can be classified based on its physical state, the type of crime, and the nature of the evidence. There are multiple types of evidence that can be found at the scenes of crimes. One such type is transfer evidence which is produced through physical contact between people, objects, or people and objects. Body fluids are one of the most common types of transfer evidence encountered at crime scenes and on other pieces of evidence (Lee & Pagliaro, 2013).

The detection and identification of body fluids is an important aspect of forensic science. Blood, semen, saliva, menstrual blood, vaginal material, and skin are some of the body fluids and tissues of interest in forensic science with the first three being the ones most encountered at crime scenes (Virkler & Lednev, 2009; Harbison & Fleming, 2016). Each body fluid has a unique chemical composition and the differences between those components and/or the relative proportion of each is the primary basis for their identification (Virkler & Lednev, 2009). The identity of the body fluids can be essential for providing context to a criminal investigation and facilitating the prosecutor and/or the defense attorney in court (Harbison & Fleming, 2016).

## Current Body Fluid Identification Methods

Body fluid identification was once a vital part of crime scene investigation, but with the increased use of DNA analysis, the focus has shifted, and less time has been dedicated to this important aspect of forensic science, even though many methods have been developed. Body fluid identification is still a developing area of research, with novel methods paralleling advancements in molecular biology, but time and resource limitations are causing crime laboratories to abandon body fluid identification (Forensic Scientist, Lab A & B, March 16 & 21, 2023).

There are two types of tests that are performed to identify a body fluid. The first type of tests are presumptive tests, which are simply screening tests that cannot definitively indicate the presence of a specific body fluid due to a high likelihood of false positives. There are many such tests and analysts have an extensive number of methods to choose from for most fluids. Once the presence of a body fluid is presumptively identified, a confirmatory test may be performed to conclusively indicate the presence of a body fluid. There are far fewer confirmatory tests, with only the presence of blood and semen able to be definitively confirmed (Virkler & Lednev, 2009).

### Blood

Blood is the most common body fluid found at crime scenes, and many presumptive and confirmatory tests have

been developed to identify it. One of the first, most important, and well-known presumptive tests is the luminol test (Virkler & Lednev, 2009; Barni et al., 2007). This test relies on the ability of several hemoglobin derivatives found in blood, to enhance the chemiluminescence of luminol when it is oxidized in an alkaline solution creating an intense blue chemiluminescence (Gaensslen, 1983). It is one of the most sensitive presumptive tests used and can even be used on areas that have been cleaned. Despite its effectiveness, there are practical limitations to its use, such as only being able to use it in dark areas (Virkler & Lednev, 2009). Another popular presumptive test is the Kastle-Meyer test. This test depends on the peroxidase activity of hemoglobin in the blood that will cause phenolphthalein in an alkaline solution to turn pink through oxidation. A huge limitation of the test is that there are many other substances, such as vegetable extracts and some body fluids (e.g., saliva), that result in a false positive (Gaensslen, 1983). While each of these presumptive tests have a value in suggesting crime scene samples may contain blood, further confirmatory analysis is needed before a definitive identification can be made.

The first commercially available confirmatory test for blood is the Rapid Stain Identification of Human Blood (RSID-Blood) which is an immunochromatographic strip test. It is designed to detect human glycophorin A, which is expressed specifically in red blood cell membranes (Independent Forensics, 2016). It utilizes the formation of an antigen-antibody-colloidal gold complex which migrates up the strip and, if glycophorin A is present, will be captured by immobile antibodies at the test and control line, resulting in a red line at both spots (Independent Forensics, 2016). Microcrystal tests are a second type of confirmatory test used to identify blood, with the most common ones being the Teichmann test and Takayama test. The Teichmann test results in the formation of the hematin derivative when blood is heated in the presence of glacial acetic acid and a halide. The resultant crystals are usually rhombic in shape and brownish in color and visible via microscopy. The Takayama test results in the formation of hemochromogen when blood is heated in the presence of pyridine and glucose under alkaline conditions. The resultant crystals are shaped like X's and require microscopy for viewing (Greenfield et al., 2014).

### Semen

The other most encountered body fluid at crime scenes is semen. Using an alternative light source (ALS), semen as well as some other body fluids, can be presumptively located and identified at a crime scene. Current ALS products on the market, however, lack either specificity or sensitivity (Santucci, 1999). The most popular presumptive test for semen identifies the presence of seminal acid phosphatase (SAP), which can catalyze the hydrolysis of organic phosphates, such as alpha-naphthyl phosphate. The product of this reaction causes a color change when combined with a diazonium salt chromogen, such as Brentamine Fast Blue (Virkler & Lednev, 2009). The test for SAP is considered

presumptive due to false positives that can occur from some plant materials as well as vaginal acid phosphatase (VAP). Other issues with this test arise due to SAP degrading when exposed to heat, mold, putrefaction, or chemicals (Virkler & Lednev, 2009).

Semen can be confirmed through the microscopic identification of sperm cells. This is the most reliable and widely accepted confirmatory method for semen. Sperm cells are only found in semen and the heads contain a large amount of DNA which can be treated with a stain to make the sperm visible (Virkler & Lednev, 2009). The Christmas tree stain is the most popular stain used and gets its moniker from the resulting colors, red for the sperm heads and green for the sperm tails. A limitation of this test is that if a semen donor is azoospermic, lacking sperm in their semen, then there will be no sperm cells to identify. Quicker and easier test kits that rely on antibody-antigen reactions like RSID – Blood, have been developed (Virkler & Lednev, 2009). One such test is the One Step ABA card which utilizes a conjugation of monoclonal anti-human PSA antibodies and dye particles that can then bind human PSA. The resulting complexes migrate on the membrane of the test to a reaction and control zone. When human PSA is present, immobile antibodies at the reaction and control zones will capture the complex creating red lines. A positive test for human semen is when a red line develops at both the reaction and control zone (Hochmeister, 1999).

### Saliva

Saliva is another commonly encountered body fluid on evidence. The most widely accepted presumptive tests for saliva relies on the activity of amylase (Virkler & Lednev, 2009). One of these tests is the starch-iodine test. In the presence of iodine, starch will appear blue in color. Amylase will break down the starch causing the color to change and subside. A limitation of this test is that other proteins like the albumin and gamma-globulin that are found in other body fluids will compete with the starch for the iodine, resulting in false positives (Greenfield et al., 2014). Another presumptive test relies on the activity of amylase as well as an insoluble starch-dye complex. Procion red amylopectin (PRA) reagents are used in tube tests where the amylase cleaves the starch from the dye resulting in a colored solution or in press tests where the PRA reagent is dissolved on filter paper and pressed on an item being tested to map the location of amylase-containing stains (Greenfield et al., 2014). A limitation of all these presumptive tests is that amylase is found in trace amounts in other body fluids and even in common household products, thus resulting in false positives. There are no confirmatory tests that are saliva specific, so there is no way to distinguish between true and false positive presumptive tests (Martin et al., 2006; Virkler & Lednev, 2009).

### Limitations

The various current methods for body fluid identification each have their own specific challenges and problems,

however, there are four big limitations that several of the methods have. The main limitation is the destructive nature of many of these tests (Virkler & Lednev, 2009). As the body fluid identification scheme is followed from presumptive tests to confirmatory tests, some of the sample is consumed for each test. If the sample is small to start, there may not be enough remaining to perform a DNA analysis. Another limitation is that all the current methods are designed to detect a specific body fluid. This means the analyst must decide which test is going to be performed, causing even more sample consumption if the results are negative. There is a need for the development of a universal test that can be applied to an unknown stain and can identify the body fluids present (Virkler & Lednev, 2009). Speaking to a couple forensic scientists across the country reveals another limitation which is the efficiency of the tests. Comparatively to DNA analysis, the body fluid identification process is much longer which results in a cost of effort and expense. The cost of the analysts' time to perform these tests is huge. If forensic scientists are using most or all their time identifying body fluids, they are not performing DNA analysis as quickly (Forensic Scientist, Lab A & B, March 16 & 21, 2023). This can cause a serious backlog of cases which is already an issue in forensic science (Houck, 2020). These limitations are causing a shift in the field of forensic science in relation to body fluid identification.

### Current Policies

Despite the multitude of current methods for body fluid identification and the prevalence of them at crime scenes, many crime laboratories in the United States are choosing to eliminate body fluid testing entirely from standard crime scene investigation. This decision is rooted in the previously discussed limitations of these methods as well as the advancements of DNA analysis. By choosing to forego body fluid stain identification, the essence of forensic science and obligations as forensic scientists to fully investigate a crime are being lost.

Forensic science is a mainstay of the criminal justice system and has a long history, however, the overall purpose of forensic science and its essence is still being redefined and debated today. A group of forensic scientists from around the world recently came together to revisit the essence of forensic science to define it and identify its fundamental principles. They determined that forensic science is a case-based, research-oriented, science-based endeavor to study the remnants of past activities through their analysis to understand unexpected events of public interest (Roux et al., 2022). These remnants or traces are the pieces of evidence collected at crime scenes and it is through their analysis that crimes can be better investigated and understood.

A key component for defining forensic science is knowing that the fundamental pieces that make up the physical record of an event are traces. Since traces are remnants, they are indicative of a former action and provide a link between the source and how it was left or the activity (Roux et al., 2022). A DNA profile found at the scene of a crime is just

one example of a trace. Crime laboratories in the United States consider a DNA profile the top priority and may elect to do no other testing (Forensic Scientist, Lab A & B, March 16 & 21, 2023), however, this is failing to completely understand the DNA profile as a trace. A DNA profile on its own can provide valuable information for crime scene investigation, but to properly assign it meaning in relation to a case, the creation of the trace must be considered. One of the several important components that goes into consideration of the creation of the trace is the nature of the source (Roux et al., 2022). For a DNA profile, this is asking the question of where the DNA came from. The true answer requires more than the name of the person it originated from; it requires the specific biological material that was deposited along with the DNA. Knowing the identity of the body fluid a DNA profile originated from can help answer other questions that arise during the investigation and following court case. The DNA profile paired with its known body fluid source can provide more meaning to a case.

Traces as remnants allow for the reconstruction of past activities to better understand them. Logic and reasoning are then applied to the reconstruction to determine the actions that took place based on the information provided by traces. These findings acquire meaning in context. They do not have an intrinsic value on their own (Roux et al., 2022). A DNA profile, by itself, cannot provide all the answers necessary to help properly reconstruct an event. Crime labs across the country that choose to solely focus on obtaining DNA profiles are failing to accept the impact of context, considering body fluid identification as irrelevant information rather than recognizing it as contextual information that is necessary to provide meaning to the DNA profile.

### Developing Methods

To address some of the limitations present with current body fluid stain identification methods, researchers have started exploring new techniques and methods that are based on the differential expression of genes in the cells found in each of the body fluids. The ultimate goal is to find a method that works for all body fluids. With the advancement of technology, this goal is becoming more of a reality.

#### RNA Typing

There are multiple types of RNA being explored to identify body fluids. Two of these kinds are messenger RNA (mRNA) and micro RNA (miRNA). The adult human body contains around two hundred distinct cell types that are specialized for each of their unique functions. The cell type is determined during gene expression with the transcription of DNA to RNA. Each specialized cell type only expresses a subset of all coding genes, and this mRNA set is what serves as the blueprint to produce proteins (Sijen, 2015). Only about two percent of the genome is translated into proteins, but at least eighty-five percent is transcribed. Various methods have been used to obtain RNA expression

level information and tissue-specific mRNA profile information has been compiled in different expression portals (Hangauer et al., 2013; Lonsdale et al., 2013). miRNAs also contribute to cell differentiation and are involved with regulating mRNAs. The genes that code for miRNAs are found in introns, intergenic regions, and exons which results in them being expressed co-transcriptionally and controlled by regulatory sequences. This results in tissue-specific expression patterns (Sijen, 2015; Gomes et al., 2013). Since specialized cell types carry distinct mRNA and miRNA signatures, RNA-based methods can be used to identify body fluids found at crime scenes and on evidence.

Studies have identified multiple mRNA and miRNA markers for body fluids, allowing for identification of fluids without current identification methods. These markers may also serve as a method of organ identification which is not performed routinely in forensics (Sijen, 2015). mRNA is stable in body fluids dried on different surfaces and can be recovered with enough quality and quantity to be analyzed. miRNA is exceptionally stable postmortem and has been successfully isolated from forensically relevant samples (Harbison & Fleming, 2016). An advantage of using RNA over previously discussed protein-based methods is that it can be extracted simultaneously with the DNA used for profiling (Sijen, 2015). Some countries have begun integrating RNA typing in their forensic casework, and it has been used in the courtroom as well. This shows the ultimate value of RNA typing and that it can be applied to not only forensic casework, but also has held up in court and provided valuable information (Sijen & Harbison, 2021).

### DNA Methylation

DNA methylation occurs at the 5'-position of cytosine in a dinucleotide pattern of 5'-CG-3'. These sites are known as CpG sites and are genetically programmed DNA modifications in mammals. These markers are important for gene expression in eukaryotic organisms and thus the differentiation of cells and their subsequent development into tissues, organs, and organ systems (Ohgane et al., 2008). The pattern of DNA methylation may change during early in utero development, however, once cellular differentiation occurs, these patterns become more established. DNA methylation patterns in differentiated cells show a limited dynamic range in normal conditions (Lee et al., 2012). This gives various cells and tissues a specific methylation profile of tissue-dependent differentially methylated regions and these profiles provide a way to distinguish between cell and tissue types (Ohgane et al., 2008). Due to this distinguishability between cell types, DNA methylation analysis is an emerging technique to identify body fluids in forensic science.

Recent studies have found multiple CpG markers in various body fluids that only produce a methylation signal in the target body fluid (Park et al., 2014). This also allows for the identification of body fluids that currently do not have other identification methods. These markers have been applied to actual forensic casework and demonstrated that

DNA methylation analysis can be used in a real-world setting. DNA methylation analysis also works on older cases, providing an invaluable tool for when body fluids could not be identified at the time of the crime, but can now be analyzed to identify the DNA source through DNA methylation assays (Choung et al., 2021). An advantage of DNA methylation is that there is only one extraction required for both methylation and DNA profiling analysis, which allows for an easier process and shorter preparation time. When using RNA methods, DNA and RNA must be extracted simultaneously, providing an issue when there is a limited amount of evidence. The analysis of RNA uses complex methods and is more unstable than DNA, therefore methods utilizing RNA are not as practical in areas of the world that have mandated timelines of when results are needed (Choung et al., 2021). The application of DNA methylation analysis to actual forensic casework and its compatible methods shows the potential of its implementation into forensic labs across the country.

### The Courtroom

Understanding what occurred during a past event is a crucial part of a lawyer's role in the courtroom. Crime scene reconstruction is taking the various pieces of evidence and developing a scenario of what could have occurred before, during, and after the commission of a crime. In a courtroom, the prosecution and the defense will both present different scenarios (Sijen & Harbison, 2021). These hypotheses need to be well thought out, describe the supposed events, and be mutually exclusive. Body fluid identification provides a critical link between the donor and the activities that occurred. This link is important because it adds evidence to the investigation, and subsequent court case (Sijen & Harbison, 2021).

Most of the cases that come to court involving any cellular material do not revolve around the dispute of the presence of it, but rather what caused the deposition of such material. The central focus is how that individual's DNA got to the crime scene. These questions are approached through activity-level evaluations by forensic scientists (Sijen & Harbison, 2021). When considering activity-level evaluations, three fundamental principles are considered. The findings should be assessed within a framework of circumstances, the probability of the findings based on the propositions is assessed, not the probability of the propositions themselves, and the findings should be evaluated against two competing, mutually exclusive scenarios (Taylor et al., 2018). The activity-level evaluations weigh the likelihood of one scenario over the other. These different scenarios are known as the prosecution and defense scenarios (Sijen & Harbison, 2021).

The analysis of the evidence is used to relate the cellular material that either matches the victim or suspect to one of the following scenarios. Under the prosecution scenario, the suspect is the offender and the evidence found and analyzed is indicative of an offensive activity (Sijen & Harbison, 2021; Gill, 2014). For example, blood on the blade of



the knife matching the victim and cellular material on the handle matching the suspect supports the scenario that the suspect conducted the stabbing. Under the defense scenario, a different, unknown person is the offender and there are alternative scenarios that explain the findings related to the analysis of the evidence (Sijen & Harbison, 2021; Gill, 2014). Using the previous stabbing example, an alternative scenario would be that the suspect's cellular material is the result of secondary transfer. Being able to identify the source of a DNA profile is critical to address the various hypotheses detailed in a courtroom (Sijen & Harbison, 2021).

Identifying the presence of body fluids at crime scenes and on evidence, as well as determining the source of a DNA profile, can significantly impact a case. Body fluid identification is just one vital piece in understanding and contextualizing the scene. Without knowing what body fluids are present, then the location, pattern, and amount of cellular material become obsolete (Sijen & Harbison, 2021). This information then would not be available to assess the different scenarios presented. A crucial link between the evidence and the alleged crime can be provided through body fluid identification. It can also provide more context to what occurred during the commission of a crime, which is then used to confirm or deny the differing scenarios presented in court (Sijen & Harbison, 2021). In the instance of secondary transfer, knowing what body fluids are present allows analysts to assess the likelihood of those body fluids being present at the primary location (Bouzga et al., 2020). Without body fluid identification, a crime might not be fully or falsely contextualized which would be detrimental in a courtroom.

When it comes to presenting a case in court, understanding the different scenarios that could have occurred during a past event is critical for a lawyer. Body fluid identification is an important piece of an investigation that helps reconstruct a past event (Sijen & Harbison, 2021). It provides a link between the suspect, victim, or both to the alleged crime as well as provides context for the evidence and what activities might have occurred. Knowing what body fluids are present at a crime scene supplies significant information and has the potential to influence a court case (Sijen & Harbison, 2021).

### Case Studies

#### **Neill-Fraser v Tasmania (Neill-Fraser v Tasmania, 2021)**

On January 27, 2009, some locals noticed a yacht sitting lower in the water than expected and notified the police department. When the police boarded the yacht, they found signs of a violent altercation. There were reddish brown stains located around the yacht as well as a knife. Robert Chappell, one of the owners of the yacht could not be found, however, a DNA profile obtained from one of the stains was consistent with his profile.

Deborah McHoul, forensic scientist, used luminol to presumptively identify blood on the yacht. One of these stains provided a DNA profile matching an unknown female. In March 2010, this profile was found to be consistent with a young girl from the area. Due to luminol's sensitivity and limitations, it was possible that there was a tiny amount of blood mixed in with some other body fluid and the DNA's source could not be concluded as blood. The girl stated that she had never been on the yacht nor been to the other areas where it had been docked but would go on to change her statement various times in the following years.

Despite Chappell's body never being recovered, the victim's wife was found guilty of killing her husband at the original trial in October 2010. She tried to appeal her case twice, most recently in 2021. Both times, the defense relied heavily upon the discovery of the girl's DNA. Carl Grosser and Maxwell Jones, two forensic scientists, each testified at one of the appeals. Grosser testified that a person's DNA profile could be deposited through secondary transfer if, for example, someone had stepped into a body fluid and transferred it to the deck on their shoe. While he had never worked on a case where this occurred, he testified that it was theoretically possible, however, he could not make any assessment about the possibility of transfer due to not knowing the DNA's source. Both Jones and Grosser concluded that based on the electropherogram, the girl's DNA profile was a strong one, with characteristics inconsistent with a contact DNA scenario. Due to its strength, they also concluded that her DNA profile was indicative of a large amount of DNA which was more likely to come from a body fluid than a touch event. Using Grosser's example of transfer, Jones went on to say that another stain resulting in the same DNA profile would have been expected to be deposited as the person moved about the yacht. Since no similar stain was located, he concluded that there was nothing to support the hypothesis of secondary transfer due to foot traffic.

The circumstantial evidence indicating the wife's guilt was compelling, however, the presence of the girl's DNA profile was not considered strongly, and the idea of secondary transfer was highly regarded. Had more body fluid identification methods been used, a more accurate conclusion of the source of the girl's DNA profile and her involvement could have been obtained. This could have altered the outcome of the original trial or the following appeals.

#### **Case Number 20-002409-13 (2014)**

In February of 2012, the victim was found dead in his car with multiple gunshot wounds to his head and upper body area. During the initial search of the vehicle, investigators noted snow on the bottom of the victim's shoes and on the passenger's side floor. Where the victim's car had been found, it had recently snowed, and they concluded that the victim and another person had gotten in the victim's car after walking through the snow. Through the victim's cell phone data, they established that he had called the suspect



several times the night he died, and cell towers placed the suspect in the area where the victim's car was found. Investigators seized a jacket worn by the suspect and analyzed it for gunshot residue and body fluids. They confirmed the presence of gunshot residue as well as traces of blood. A DNA profile generated from the blood was consistent with the victim. The suspect was eventually charged and went to court. During the trial, the defense tried to argue that if the suspect had been the shooter, then more blood would have been found on the sleeves of his jacket. Further testing using RNA typing was conducted on the traces of blood. Scientists were able to confirm not only the presence of blood, but skin cells and brain tissue as well. The blood, skin cells, and brain tissue all had a DNA profile consistent with the victim. The identification of the brain tissue was able to disprove the defense's scenario and the suspect was eventually charged with manslaughter. Tissue typing specifically played a vital role in the prosecution of this case.

## Conclusion

Body fluids are some of the most common types of transfer evidence found at crime scenes and on other pieces of evidence (Lee & Pagliaro, 2013). This makes their detection and identification a crucial aspect of crime scene investigation and forensic science. Currently, there are many methods for the identification of body fluids, however, these methods have severe limitations. Due to these limitations, body fluid identification is being considered less important than other investigative leads like DNA analysis, and crime laboratories in the United States are choosing to forgo these assays (Forensic Scientist, Lab A & B, March 16 & 21, 2023) and failing in their obligations to fully investigate a crime. To alleviate the limitations associated with current testing methods, researchers are developing new methods. This research is incredibly important because conserving body fluid identification as a critical part of standard crime scene investigation procedures will help assist the investigation and subsequent court case. Knowing the identity of a body fluid and thus the source of a DNA profile, allows the jury to better contextualize and understand the case. It can also provide information that is important for confirming or denying scenarios presented in court for how the evidence was deposited or what had occurred at the scene of a crime. In numerous cases, the identity of a body fluid or tissue has played a significant role in the prosecution of court cases. Alternatively, when such testing was omitted, the outcome of the court case suffered from lack of information. This demonstrates how vital and important body fluid identification is to crime scene investigation, legal proceedings, and forensic science as a whole.

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# The Effect of Family Factors on a Student's Grit

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**Abstract:** Research on the effect of parenting styles on a child's education and career choices has shown that a more involved and emotionally supportive parent tends to result in children with higher grades. Some researchers have argued that this type of parenting style increases a child's "grit." Grit is a positive personality trait distinguished by perseverance and passion for achieving long-term goals. Research about grit and parenting style has focused on the role of gender, the difference between how mothers and fathers treat each child. However, no study has investigated whether a traditional household structure (mother and father) or a non-traditional household structure (other arrangements) affects grit. This study aimed to examine if parenting styles (permissive, authoritative, and authoritarian) and family factors, such as household type, influenced grit. The results from using the Parental Authority Questionnaire and the Grit-O scale showed that none of these factors had any significant impact on grit.

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An individual with grit strives to overcome challenges, maintaining effort and interest over the course of many years despite failure and adversity. Grit is defined as the perseverance and passion for achieving long-term goals despite setbacks, difficulties, and plateaus in progress (Duckworth et. al, 2007). A person's grit is essential to accomplish a task when there is a strong temptation to give up while undertaking an incredibly difficult task. Grit is a key factor in achieving success, and it is something that can be developed and nurtured. Developing grit requires practice and a willingness to push through difficult moments. Having a growth mindset is essential for developing grit and staying motivated to achieve goals. Fernández et. al (2022) investigated the impact of parenting behaviors on grit sustainability. Finding that behaviors linked to warm and supportive parenting showed a positive relationship with the child's grit, Fernández et. al (2022) inferred that the child would have long-term success maintaining high levels of grit. The researchers also inferred that parenting behaviors linked to psychological control would potentially cause long-term problems in the effectiveness and sustainability of grit building in children.

A number of researchers have argued that a parenting style that emphasizes parental involvement in a child's life and emotional support is associated with a higher level of "grit" in children (Dunn, 2018, Fernández et al., 2022, Mushtaq et al., 2019, Yang, 2021). According to Baumrind's (1971) parental authority prototypes, this emotionally supportive nature is also parallel to authoritative and permissive parenting styles. In Baumrind's (1971) model of parental authority, there are three types of parenting styles: permissive, authoritarian, and authoritative. These parenting styles are characterized by specific parenting behaviors. Parents who practice authoritative parenting are nurturing, respon-

sive, and supportive of their children, yet they set firm boundaries for them. Rules are explained, discussions are held, and reasoning is used to control children's behavior. A child's viewpoint is often heard, but not always accepted. In the permissive parent's perspective, a child should be allowed to be true to his or her nature and should not be limited by others. A permissive parent does not demand anything from their children. A child has few responsibilities and can regulate most of their behavior and choices. An authoritarian parent is not responsive to the emotional needs of their child. Authoritarian parenting is characterized by its extreme strictness. It demands a lot of children without providing them with a lot of support. Rather than nurturing a child, an authoritarian parent focuses more on obedience, discipline, and control.

Research conducted by Dunn (2018) examined the relationship between parenting styles and students' grit, using a questionnaire that included questions about the participants' gender. The study found that females exhibited a higher level of grit when compared to males. Lan and Wang (2020) investigated the relationships between problematic internet use, parental attachment, and grit. The attachment a child has to both mother and father making the child feel safe, secure, and protected are important deterrent factors against addiction to internet use. When a child has a higher level of grit, they will have a lower affinity for problematic internet use (PIU) and vice versa. "In general, PIU is defined as a maladaptive behavior characterized by an insatiable desire for Internet use, which results in significant distress or impairment as a result of the behavior. As youths rapidly adopt new technologies but have relatively immature cognitive control abilities, there is an increased risk of developing PIU during adolescence. As a result, adolescents' daily lives may be disrupted by the onset of PIU, resulting in a wealth of psychosocial problems as well as un-

derachievement at school.” (Lan & Wang, 2020). PIU is defined as a serious public health concern among Chinese adolescents when concerning the increase of internet addiction and the decrease of grit in schoolwork. There was evidence that increased levels of grit buffered against boys' PIU under paternal attachment security conditions and girls' PIU under paternal attachment insecurity conditions.

“Adolescents with attachment security have an internal working model in which they view themselves as deserving of love and support, and others as reliable and responsive. As a result, the sensitive and responsive care provided by attachment figures to adolescents may reduce adolescent psychological distress and reduce the possibility of adolescents developing PIU. The risk of PIU in adolescents is associated with attachment insecurity.” (Lan and Wang, 2020). Adolescents who experience parental attachment insecurity are more likely to use the Internet excessively in order to seek comfort and belonging. Steele and Levy (2011) examined the links between grit and attachment styles. The key questions the authors addressed were: Do adults with positive memories of their childhood relationships with parents have higher grit scores? Do individuals with adult romantic relationships characterized by less anxiety, less avoidance, and more security have higher grit scores? The main hypotheses or predictions of the study were that adults with positive memories of their childhood relationships with parents and secure adult attachment styles will have higher grit scores. Steele and Levy (2011) conclude that individuals reporting lower avoidance and lower anxiety in current adult relationships and higher care experiences in past childhood relationships with mother and father score higher on grit scales. The limitation of the study is that the results of the questions asked are based on the person's perception of current and past attachments to parents and in adult relationships. Steele and Levy's (2011) research suggests that a parenting style that provides structure and guidance while also holding the child's emotional needs in high regard would have the most positive impact on grit. While the bulk of the literature focuses on gender and parenting style in relation to grit, very few studies have focused on family structure in relation to grit. This study aims to investigate the relationships between parenting style, family structure, and gender, and their impact on grit. It also is designed to assess the hypothesis that an authoritative parenting style will produce higher levels of grit in students and that family structure will have little to no effect on grit.

### Methods

The purpose of this study was to investigate whether factors such as parenting style, family structure, and gender cause higher levels of grit among the participants. Family structure was characterized by the participants' self-reporting of parental involvement and the relationship status between the participant's parents. The participants attested to their parent's involvement in their childhood by identifying whether they were raised by both parents or a single parent. Participants also clarified whether their parents were together or separated to testify to the relationship

status between their parents. The parent's relationship status was classified as either a single-parent family, a family headed by two partners, either married or unmarried, or a two-parent family where the parents were separated or divorced.

### Participants

Students studying psychology at Dominican University New York, specifically those taking general psychology courses, were the sample group for this study. At the end of the fall semester in December 2022, all participants were surveyed through Dominican University's online SONA system, which manages the student pool of test subjects. Studies are posted to the SONA system, and participants can log in to learn more about current studies and sign up to participate in the ones they find interesting. Participants were informed that they would be giving implied consent when agreeing to do the survey.

### Instruments

Demographic questions (gender, age, parental involvement, and parent relationship status), the Grit-O Scale, and the modified Parental Authority Questionnaire (PAQ) were completed by participants. The Grit-O Scale used a 5-point Likert-type scale ranging from 1 (not at all like me) to 5 (extremely like me). The modified parental authority questionnaire used a series of binary questions/closed questions (Appendix B).

### The Grit-O Scale

The Grit-O scale consists of 12 items (Duckworth et al., 2007) that form three subscales: perseverance of effort, consistency of interest, and adaptability to situations. Perseverance of effort (four items) measures the degree to which an individual persists in accomplishing tasks (e.g., “I have overcome setbacks to conquer an important challenge”). Consistency of interests (four items) measures the degree to which an individual persists in pursuing interests (e.g., “New ideas and new projects sometimes distract me from previous ones”). Adaptability to situations (four items) measures the degree to which an individual's ability to adjust effectively to changing circumstances in life (e.g., “I am able to cope with the changing circumstances in life”). In this scale, some of the statements are reverse coded. The reverse coding of survey items refers to the rephrasing of a “positive” item in a “negative” manner. The purpose of this method is to determine if respondents provide consistent responses.

### Modified Parental Authority Questionnaire

The Parental Authority Questionnaire (PAQ) has been widely used in various contexts and with a variety of participants. PAQ was developed to measure Baumrind's (1971) permissive, authoritarian, and authoritative parental authority prototypes. The PAQ consists of 30 items per parent and yields permissive, authoritarian, and authoritative scores for both the mother and the father; each of these



scores is derived from the lived experience evaluation of the parent's authority by their child (Buri, 1991). "Authoritarian" (ten items) assesses whether the individual believes their parent(s) exhibits behaviors consistent with the characteristics of an authoritarian (e.g., "My parental figure has always felt that most problems in society would be solved if we could get parents to strictly and forcibly deal with their children when they don't do what they are supposed to as they are growing up."). "Authoritative" (ten items) determines whether the individual believes their parent(s) behave in a manner consistent with the characteristics of an authoritative parent (e.g., "My parental figure gave me direction for my behavior and activities as I was growing up and they expected me to follow their direction, but they were always willing to listen to my concerns and discuss that direction with me"). "Permissive" (ten items) identifies whether the individual believes that their parent(s) exhibits permissive behaviors (e.g., "As I was growing up my parental figure allowed me to form my own point of view on family matters and they generally allowed me to decide for myself what I was going to do").

### Proposed causal model and data analysis

Based on the literature review, the present study proposed a causal relationship between grit as the dependent variable and gender, parenting style, and two of the family structure variables (i.e., the participants' self-reports regarding parental involvement in their childhood and the relationship status of parents) as independent variables. T-tests and ANOVAs were used to examine the relationships among variables.

### Results

An ANOVA was used to examine the mean differences in Grit-O scores among the three groups of self-reported information. Previous studies report that female participants average higher grit scores than male participants (Dunn, 2018), and that participants raised by authoritative parents tend to have higher grit scores than participants raised by the other two parenting styles (Dunn, 2018, Fernández et al., 2022, Mushtaq et al., 2019, Yang, 2021). These results were not replicated in this study.

Based on the grit scores of both males and females, an ANOVA was conducted. The average grit scores of the female participants were 3.32, while the average grit scores of the male participants were 3.42. There was no significant difference between the grit scores of males and females. This study also examined the grit scores of the participants based on family structure. The average grit score of participants raised by both mother and father within the same household was 3.40. Participants raised by divorced/separated parents achieved an average grit score of 3.31. Participants raised by a single parent achieved an average grit score of 3.24. This study found that the grit scores based on the participants' family structures did not differ significantly. An ANOVA showed that family style did not have a significant impact on grit scores ( $P=0.69$ ).

The participants were often raised by parents with different parenting styles, so the grit scores between the parenting styles were assessed for the fathers and mothers of the participants separately. Based on the mother's parenting style, the authoritarian mother had an average grit score of 3.25, the authoritative mother had an average grit score of 3.47, and the permissive mother had an average grit score of 3.36. An ANOVA was used to compare grit scores based on the mother's parenting style and showed no significant difference ( $P=0.38$ ). The grit scores of the three parenting styles based on the fathers of the participants were also analyzed using an ANOVA. Based on the father's parenting style, the authoritarian father had an average grit score of 3.30, the authoritative father had an average grit score of 3.40, and the permissive father had an average grit score of 3.33. Results indicate that the parenting styles of the participants' fathers did not significantly affect their children's grit ( $P=0.86$ ).

### Discussion

There were no significant differences in grit scores between the participants, regardless of their gender, family relations, or parenting style of either their mother or father. However, the grit scores for the participants raised in single-parent households had a slightly lower average grit score than the scores produced by the two other types of families. Although the difference between the average grit scores of the three family types was not statistically significant, it should be noted that the sample size for the participants raised by a single parent was small, consisting of only six participants. There is a contradiction between the finding of this study and what has been demonstrated in previous studies. Many of these studies (Fernández et al., 2022, Lan & Wang, 2020, Lin & Chang, 2017, Mushtaq et al., 2019, Yang, 2021) were conducted in foreign countries, which may suggest that factors such as cultural and social differences may play a role. These factors were not included in the present study.

### Cultural implications

Grit may be affected by cultural factors and sociocultural context. Several studies analyzing grit in their participants were (Lan & Wang, 2020, Lin & Chang, 2017, Mushtaq et al., 2019, Yang, 2021) conducted in Asian countries which point to the cultural emphasis on discipline, work commitment, academic achievement, the balance of individual and societal needs, and deference to authority. In Asian cultures, authority deference is highly valued, so demanding parenting styles may also be more highly valued. Values regarding success and perseverance in achieving long-term goals may differ depending on the culture. According to Mendez (2015), "cultural values embedded in society and the family context provide children and adolescents with interests, habits, and personality traits such as perseverance, responsibility, independence, and hard work" (as cited in Lin & Chang, 2017, p. 2199).

## Social factors

Social factors may also have played a confounding role in the present study. The current study's participants were adults with an average age of 19.50, so parental influence remains prevalent. Parental control tends to be more significant in the adolescent and pre-adolescent periods. According to Albert et al., (2013), peers have a significant impact on an individual during adolescence. Since many of our participants are exiting adolescence and entering adulthood, their passion for attaining their goals might also reflect that of their peers. Vaterlaus et al. (2015) point to the increased influence of social media on the behaviors of young adults as well. In addition to parents, there may be other influences that contribute to grit.

This study sought to determine whether parenting style and the household environment affected grit, but coaches, teachers, and mentors may also influence grit. These other influences, however, were not accounted for in the study. Forty-nine of the fifty-five participants were raised by both parents. It should be noted that fifteen of the participants who were raised by both parents had divorced parents. The remaining six participants were raised by a single parent. According to the United States Census Bureau (2023), 23% of U.S. children under the age of 18 live with a single parent, which represents nearly a quarter of all children under 18. In future studies, it is recommended that a more diverse group of participants be recruited in order to represent the group of individuals raised by a single parent.

## Limitations and future directions

Future studies should increase the number of questions regarding participants' family structure. The participants were asked which parents raised them and whether or not they were separated in order to determine whether they were raised in a two-parent household. As a result of this line of questioning, uncertainty was raised, in particular when many of the participants raised by both parents reported that their parents had different parenting styles. Future studies might ask participants which parent played a primary role in raising them (if applicable), and when parents separated in order to determine which parental authority had the greatest impact.

Earlier, it was stated that the research done in preparation for the examination consisted mostly of studies conducted on participants raised in Eastern cultures, which are motivated by parental obedience, whereas Western cultures tend to believe that this will negatively impact their child's development. It would be beneficial to study how different parenting styles encourage grit within an individual based on his or her cultural background. Future studies might include questions about participants' cultural or ethnic background in order to study whether cultural background plays a role in grit scores.

Participants were asked to indicate their perception of their

parents' parenting style during the survey. As a result, the success of the parental authority questionnaire depends solely on the participants' memories of their parent(s) as a guide to completing the questionnaire. A questionnaire was distributed to participants via the SONA student portal, which is used by students who have taken general psychology courses or are enrolled in such courses. During general psychology, students are introduced to parenting styles and the effects these styles can have on their children. Since the participants likely have existing knowledge of these parenting styles, bias may have played a role in how they answered the questions.

## Conclusions

The current study found no significant correlations between grit and family structure and no significant difference between male and female participants when comparing their average grit scores. There was also no significant difference between the average grit scores of the authoritative, permissive, and authoritarian parenting styles.

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## Appendices

### Appendix A

#### Three Part Questionnaire

What is your gender?

- Female
- Male
- Non-Binary
- Not listed, please explain
- Prefer not to answer

What is your age?

Who raised you?

- Both Mom and Dad
- Same-sex parents
- Only Mom
- Only Dad
- Other, Please Explain.

Are your parents divorced/separated?

- Yes
- No

### Appendix B

#### Modified Parental Authority Questionnaire

Directions for taking the Perceived Parenting Styles Questionnaire: Please respond to the following 30 items. Be honest – there are no right or wrong answers! Fill out one set for each parental figure.

1. While I was growing up my parental figure felt that in a well-run home, the children should have their way in the family as often as the parents do.

- Yes
- No

2. Even if their children didn't agree with them my parental figure felt that it was for our own good if we were forced to conform to what they thought was right.

- Yes

-No

3. Whenever my parental figure told me to do something as I was growing up they expected me to do it immediately without asking any questions.

- Yes
- No

4. As I was growing up, once the family policy had been established, my parental figure discussed the reasoning behind the policy with the children in the family.

- Yes
- No

5. My parental figure has always encouraged verbal give-and-take whatever I felt that the family rules and restrictions were unreasonable.

- Yes
- No

6. My parental figure has always felt that what children need is to be free to make up their own minds and to do what they want to do even if this does not agree with what their parents might want.

- Yes
- No

7. As I was growing my parental figure did not allow me to question any decision they had made.

- Yes
- No

8. As I was growing up my parental figure directed the activities and decisions of the children in my family through reasoning and discipline.

- Yes
- No

9. My parental figure has always felt that more force should be used by parents in order to get their children to behave the way they are supposed to.

- Yes
- No

10. As I was growing up my parental figure did not feel that needed to obey rules and regulations of behavior simply because someone in authority had established them.

- Yes
- No

11. As I was growing up, I knew what my parental figure expected of me in my family, but I also felt free to discuss those expectations with my parental figure when I felt they were unreasonable.

- Yes
- No

12. My parental figure felt that wise parents should teach their children early just who is the boss in the family.

- Yes  
-No
13. As I was growing up my parental figure seldom gave me expectations and guidelines for my behavior.  
-Yes  
-No
14. Most of the time as I was growing up my parental figure did what the children in the family wanted when making family decisions.  
-Yes  
-No
15. As the children in my family were growing up, my parental figure consistently gave us direction and guidance in rational and objective ways.  
-Yes  
-No
16. As I was growing up my parental figure would get very upset if I tried to disagree with them.  
-Yes  
-No
17. My parental figure feels that most problems in society would be solved if parents would not restrict their children's activities, decisions, and desires as they are growing up.  
-Yes  
-No
18. As I was growing up my parental figure let me know what behavior she expected of me and if I didn't meet those expectations, they punished me.  
-Yes  
-No
19. As I was growing up my parental figure allowed me to decide most things for myself without a lot of direction from them.  
-Yes  
-No
20. As I was growing up my parental figure took the children's opinions into consideration when making family decisions, but she would not decide on something simply because the children wanted it.  
-Yes  
-No
21. My parental figure did not view themselves as responsible for directing and guiding my behavior as I was growing up.  
-Yes  
-No
22. My parental figure had clear standards of behavior for the children in our home as I was growing up, but they were willing to adjust those standards to the needs of each of the individual children in the family.  
-Yes  
-No
23. My parental figure gave me direction for my behavior and activities as I was growing up and they expected me to follow their direction, but they were always willing to listen to my concerns and discuss that. direction: with me.  
-Yes  
-No
24. As I was growing up my parental figure allowed me to form my own point of view on family matters and they generally allowed me to decide for myself what I was going to do.  
-Yes  
-No
25. My parental figure has always felt that most problems in society would be solved if we could get parents to strictly and forcibly deal with their children when they don't do what they are supposed to as they are growing up.  
-Yes  
-No
26. As I was growing up my parental figure often told me exactly what they wanted me to do and how they expected me to do it.  
-Yes  
-No
27. As I was growing up my parental figure gave me clear direction for behaviors and activities, but they were also understanding when I disagreed with them.  
-Yes  
-No
28. As I was growing up my parental figure did not direct the behaviors, activities, and desires of the children in the family.  
-Yes  
-No
29. As I was growing up I knew what my parental figure expected of me in the family and they insisted that I conform to those expectations simply out of respect for her authority.  
-Yes  
-No
30. As I was growing up if my parental figure made a decision in the family that hurt me, they were willing to discuss that decision with me and admit it if they had made a mistake.  
-Yes  
-No

## Appendix C

### 12-Item Grit Scale

Directions for taking the grit scale: Please respond to the following 12 items. Be honest – there are no right or wrong answers!

1. I have overcome setbacks to conquer an important challenge.

Very much like me  
Mostly like me  
Somewhat like me  
Not much like me  
Not like me at all

2. New ideas and projects sometimes distract me from previous ones.

Very much like me  
Mostly like me  
Somewhat like me  
Not much like me  
Not like me at all

3. My interests change from year to year.

Very much like me  
Mostly like me  
Somewhat like me  
Not much like me  
Not like me at all

4. Setbacks don't discourage me.

Very much like me  
Mostly like me  
Somewhat like me  
Not much like me  
Not like me at all

5. I have been obsessed with a certain idea or project for a short time but later lost interest.

Very much like me  
Mostly like me  
Somewhat like me  
Not much like me  
Not like me at all

6. I am a hard worker.

Very much like me  
Mostly like me  
Somewhat like me  
Not much like me  
Not like me at all

7. I often set a goal but later choose to pursue a different one.

Very much like me  
Mostly like me  
Somewhat like me  
Not much like me  
Not like me at all

8. I have difficulty maintaining my focus on projects that take more than a few months to complete.

Very much like me  
Mostly like me  
Somewhat like me  
Not much like me  
Not like me at all

9. I finish whatever I begin.

Very much like me  
Mostly like me  
Somewhat like me  
Not much like me  
Not like me at all

10. I have achieved a goal that took years of work.

Very much like me  
Mostly like me  
Somewhat like me  
Not much like me  
Not like me at all

11. I become interested in new pursuits every few months.

Very much like me  
Mostly like me  
Somewhat like me  
Not much like me  
Not like me at all

12. I am diligent.

Very much like me  
Mostly like me  
Somewhat like me  
Not much like me  
Not like me at all

Note. The three-part questionnaire that was distributed to the participants, which contained demographic questions, the modified parental authority questionnaire, and the 12-item grit scale.





# Modeling Bacterial Resilience: Simulation of Environmental Antibiotic Exposure to Substantiate the Predictive Power of Mathematical Model

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**Abstract:** Antibiotic resistance has been a growing public health crisis made evident by the emergence of antibiotic resistant strains in clinical cases and environmental isolates. Overuse of antibiotics and their persistence in the environment provides a constant selective pressure that encourages the growth of resistant strains. The degree to which extended exposure leads to sustained resistance against antibiotics is a question that can be explored via mathematical modeling. Many models have been developed to predict the emergence of resistance, specifically utilizing derivative models over time to represent the rate of emergence of resistant isolates. The purpose of this project was to test the predictive power of published mathematical models by Ibarguen-Mondragon et al., 2014:

$$\frac{dS}{dt} = \beta_s S \left(1 - \frac{S+R}{K}\right) - \sum_{i=1}^n (\bar{q}_i + \bar{\alpha}_i) C_i S - \mu_s S \quad \text{and} \quad \frac{dR}{dt} = \beta_r R \left(1 - \frac{S+R}{K}\right) - \sum_{i=1}^n \bar{q}_i C_i S - \mu_r R$$

by simulating environmental exposure of a type-strain to the antimicrobial, triclosan. Using a 96-well plate design, we selected random individuals in a larger population of growth and monitored their growth in the presence and absence of triclosan. After confirming the predictive capabilities of the model, we broadened the scope of the study to explore both gram-positive and gram-negative bacterial species and included additional antibiotics. The ultimate goal of this project is to attain realistic modeling procedures, utilizing power series functions to depict change in bacterial growth more accurately over time.

## Introduction

Antibiotic resistance has been an ongoing global health crisis as emergence of resistant strains increase and persevere in response to antibiotic exposure. Urgency on this issue has increased as the effectiveness of antibiotics commonly utilized for hospital-based infections decreases (Frieri et al., 2017). The emergence of resistant strains is due to genome alterations that lead to intracellular changes in biochemical pathways or extracellular changes that impact how the cell interacts with its environment. The high diversity of such resistance mechanisms has made it challenging to fully understand how acquired resistance in bacterial species occurs, especially when short term exposure to an antibiotic or multiple antibiotics results in novel resistance. There is no current solution for the resulting global health crisis due to antibiotic-resistant bacteria.

Combatting antibiotic resistance requires the discovery of novel drugs. In assessing the cost-benefit analysis of funding the discovery of new antibiotics, the initial cost is upwards of \$55 billion for early drug target research (Dodds, 2017). Unfortunately, this investment has not yielded new classes of antibiotics in the past 50 years (Mutalik and Ar-

kin, 2022). Additional countermeasures include the expansion of research in bacteriophage to bridge gaps in understanding of phage mechanisms and further expand applications of phage therapy (Mutalik and Arkin, 2022). It is also crucial that scientists have committed to a clear understanding of the precise mechanisms that lead to antibiotic resistances, especially those that result from constant exposure that serve as a selective pressure for microbes.

Antimicrobials found in a wide variety of consumer products have been targeted as causative agents driving antibiotic resistance due to their constant presence in the environment. This is observed with the antimicrobial, triclosan, which was previously found in many cleaning, cosmetic, plastic, and textile products (FDA, 2019). Due to the non-biodegradable nature of triclosan, it has collected in wastewater and groundwater systems in the United States, and thus the Food and Drug Administration (FDA) deemed the antimicrobial as a non-qualifier for “generally recognized as safe and effective” designation (FDA, 2016). Following this new classification of the drug, it was banned from FDA-approved products in 2017, however, due to its constant usage starting from the 1970’s, accumulation in the environment has resulted in resistance in environmentally isolated microbes (Welsch and Gillock, 2014; Ma-

rotta, 2018). Research on molecular mechanisms that lead to triclosan resistance has been conducted for decades. The initial mutation of the triclosan target site was documented in 1999, as the FabI[G93V/S] mutation (Heath et al., 1999). Additional resistance mechanisms such as efflux pump overexpression, specifically that of the *acrAB* operon, and overexpression of the multiple antibiotic resistance gene regulator, *marA*, have been documented (McMurry et al., 1998). While it is important to understand the molecular mechanisms that allow for antimicrobial resistance, it is crucial also to better understand the timeline of resistance.

Mathematical modeling can be used to predict required exposure periods before microbes develop resistance to antimicrobials. Logistic growth equations have been utilized to model many biological systems, and continuations of these equations have served to model population reducing or enhancing factors such as predator-prey interactions, interspecific competition, and intraspecific competition (Tsoularis and Wallace, 2002). Further, models utilizing residual power series methods have shown high accuracy and efficiency in modeling non-linear population growth patterns (Dunnimit et al., 2020). In bacterial species, the Lotka-Volterra model has been utilized to model interactions amongst bacterial species where resistance emergence in a given species of interest could be determined (Stein et al., 2013). Proposed continuation models have emphasized essential components required to model resistance effectively, including antibiotic consumption, concentration of antibiotic, and bacterial species relationships (Areyyava et al., 2017; Stein et al., 2013). A mathematical model capturing a wide variety of such variables and factors was introduced by Ibarguen-Mondragon et al. (2014) where the following models were utilized to determine antibiotic resistance in *Mycobacterium tuberculosis*:

$$\begin{aligned} \frac{dS}{dt} &= \beta_s S \left(1 - \frac{S+R}{K}\right) - \sum_{i=1}^n (\bar{q}_i + \bar{\alpha}_i) C_i S - \mu_s S \\ \frac{dR}{dt} &= \beta_r R \left(1 - \frac{S+R}{K}\right) - \sum_{i=1}^n \bar{q}_i C_i S - \mu_r R \end{aligned}$$

Utilizing this modeling pair, resistance to antibiotics was predicted and further documented as an accurate modeling procedure in determining emergence of resistant bacterial strains.

This study seeks to identify a mathematical model which displays population change over time in presence of an antibiotic as a selective pressure. The model displayed above was identified from paper by Ibarguen-Mondragon et al., 2014. We aim to dissect the model and identify variables and values that can be modeled in real time. Further, we want to derive the model and identify/calculate variables identified. We would also like to mimic experimental parameters outlined in literature by designing growth experiments for microbes of interest. In addition to deriving the model, we want to apply model and experimental parameters to fast growing microbes as compared to slow growing microbes utilized in literature and model population chang-

es over time to determine trends between different species and antibiotics.

#### Derivation of Proposed Mathematical Model:

The models introduced by Ibarguen-Mondragon et al. (2014) are displayed below:

$$\begin{aligned} \frac{dS}{dt} &= \beta_s S \left(1 - \frac{S+R}{K}\right) - \sum_{i=1}^n (\bar{q}_i + \bar{\alpha}_i) C_i S - \mu_s S \\ \frac{dR}{dt} &= \beta_r R \left(1 - \frac{S+R}{K}\right) - \sum_{i=1}^n \bar{q}_i C_i S - \mu_r R \end{aligned} \quad \text{To}$$

understand how the models were assembled, we started deriving an exponential growth model:

$$N(t) = N_0 e^{rt} \quad (1)$$

Where  $N$  is the current population size at time  $t$ ,  $N_0$  is the starting population, and  $r$  is the growth rate. Taking the derivative and introducing the concept of carrying capacity, we end with the following logistic growth model:

$$\begin{aligned} \frac{dN}{dt} &= r(N_0 e^{rt}) \left(1 - \frac{N}{K}\right) \quad (2) \\ \frac{dN}{dt} &= rN \left(1 - \frac{N}{K}\right) \quad (3) \end{aligned}$$

For competing populations, a competition coefficient must be introduced as the effect of one population on another. So, for coexisting populations in the same environment, call them  $N_1$  and  $N_2$  with competition coefficients  $a_{12}$ , which is the effect of population 1 on population 2, and  $a_{21}$ , which is the effect of population 2 on population 1.

Incorporating this into the model, we have:

$$\frac{dN_1}{dt} = rN_1 \left(1 - \frac{N_1 + a_{12}N_2}{K}\right) \quad (4)$$

$$\frac{dN_2}{dt} = rN_2 \left(1 - \frac{N_2 + a_{21}N_1}{K}\right) \quad (5)$$

Note, for our experimental purposes, we are deriving one population from another. That is, we are designing our experiment such that we are starting with a single uniform population, and introducing a selective pressure that will cause the emergence of another population that can grow in the presence of the selective pressure. This emergence is recorded over a short period of time (~16 hours) where it is highly unlikely that one population will have any notable advantage over the other. Considering both the source of one of the populations and considering the short period of selective pressure introduction, we can assume the following:

$$a_{12} = a_{21} = \sim 1 \quad (6)$$

Therefore, we are left with:

$$\frac{dN_1}{dt} = rN_1 \left(1 - \frac{N_1 + N_2}{K}\right) \quad (7)$$

$$\frac{dN_2}{dt} = rN_2 \left(1 - \frac{N_1 + N_2}{K}\right) \quad (8)$$

If we replace  $N_1$  with  $S$ , and  $N_2$  with  $R$ , we have:

$$\frac{dS}{dt} = rS \left(1 - \frac{S + R}{K}\right) \quad (9)$$

$$\frac{dR}{dt} = rR \left(1 - \frac{S + R}{K}\right) \quad (10)$$

We are left to consider death rate, ( $\mu$ ) and mutation rate, ( $q$ ). These two variables can be introduced at the end of each model as follows:

$$\frac{dS}{dt} = rS \left(1 - \frac{S + R}{K}\right) - \mu_S - qS \quad (11)$$

$$\frac{dR}{dt} = rR \left(1 - \frac{S + R}{K}\right) - \mu_R + qS \quad (12)$$

Now comparing this to the initially proposed models, we are left with the exclusion of death by antibiotic ( $\alpha$ ) and multiplying the concentration by the mutation rate, ( $qCS$ ).

$$\frac{dS}{dt} = rS \left(1 - \frac{S + R}{K}\right) - \mu_S - (q + \alpha)CS \quad (13)$$

$$\frac{dR}{dt} = rR \left(1 - \frac{S + R}{K}\right) - \mu_R + qCS \quad (14)$$

### Methods:

Three strains were utilized in this study. The strain descriptions and storage conditions are as follows: *Enterobacter cloacae* ATCC 13047 (denoted ENC). Stocks were maintained in Luria-Bertani liquid broth at 37° C to achieve saturated culture/maximum growth. *Staphylococcus aureus* Wards Science 0299 (denoted SA). Stocks were maintained in Luria-Bertani liquid broth at 37° C to achieve saturated culture/maximum growth.. *Escherichia coli* ATCC 25922 denoted (EC). Stocks maintained in Luria-Bertani liquid broth at 37° C to achieve saturated culture/maximum growth with 700  $\mu$ L culture placed in 300  $\mu$ L 50% glycerol and stored at -80° C.

### Determination of Model Variables and Values:

Variables introduced in the models are defined in the tables below, first what their symbol represents, (Table 1) and specific mathematical values fit in each variable's place as determined by the researcher to best fit this study (Table 2).

**Table 1.** Variable Definitions. Each variable was introduced and defined by Ibarguen-Mondragon et al. (2014).

Species	<i>Escherichia coli</i>	<i>Enterobacter cloacae</i>	<i>Staphylococcus aureus</i>	Source
Variable				
$\beta$	x3/hr	x3/hr	x3/hr	Gibson et al, 2018
S	--	--	--	Calculated at each step
R	--	--	--	Calculated at Each step
K	~2.4 E 9 cells/mL	~2.4 E 9 cells/mL	~2.4 E 9 cells/mL	Voklmer & Heinemann, 2011
q	10 <sup>-5</sup> to 10 <sup>-8</sup> mut/gen	10 <sup>-5</sup> to 10 <sup>-8</sup> mut/gen	10 <sup>-5</sup> to 10 <sup>-8</sup> mut/gen	Warrington, 2022
$\mu$	~0.1 cells/hr	~0.1 cells/hr	~0.1 cells/hr	Calculated from LB growth (Exponential decay)

**Table 2.** Variable Calculations and Value Determination (s). Variables either indicated as constants calculated (as indicated) or sourced from literature. Further explanation of variable sources/calculations outlined in sections below.

Antibiotic	Triclosan (TCS +/-)	Chloramphenicol (CHL -)	Erythromycin (ERY +)	Source
Variable				
C	0.5-200 $\mu$ g/mL	0.5-200 $\mu$ g/mL	0.5-200 $\mu$ g/mL	Known concentrations
$\alpha_{SA}$	1.199 $\mu$ g/cm	0.982 $\mu$ g/cm	1.260 $\mu$ g/cm	Calculated via disk diffusion
$\alpha_{EC}$	1.635 $\mu$ g/cm	1.135 $\mu$ g/cm	1.233 $\mu$ g/cm	Estimated from <i>En. cloacae</i>
$\alpha_{ENC}$	1.635 $\mu$ g/cm	1.135 $\mu$ g/cm	1.233 $\mu$ g/cm	Calculated via disk diffusion

### Calculation of Antibiotic Uptake Rate ( $\alpha$ ) via Disk Diffusion:

Antibiotic uptake rate (death by antibiotic) calculations were done using disk diffusion assays with incrementally increasing concentrations of antibiotic on a 6 mm paper disk. This assay follows a traditional Kirby-Bauer (disk diffusion) set-up, with additional antibiotic disks utilized on the same plate to develop a linear relationship between concentration and death by antibiotic. Type strains of each species of interest (*E. coli*, *En. cloacae*, *S. aureus*) were grown in 5 mL Luria-Bertani (LB) broth to OD<sub>600</sub> of 0.5 (mid-log). Using a cotton swab, each strain was separately plated on a Mueller-Hinton agar plate by soaking the swab with liquid culture and streaking the entire plate. Disks (6 mm) containing antibiotic(s) of interest (one antibiotic per plate) in varying concentrations ( $\mu$ g/mL) were placed on their designated plate. Disks were separated accordingly to allow proper and complete diffusion of each disk without interference of disks with each other. The plates were placed in 37° C incubator overnight (~16-24 hours). Afterwards, plates were removed, and zones of inhibition were measured. Zone of inhibition was the diameter across the circular zone where growth of the bacteria was inhibited. To graph the relationship between concentration and zone of inhibition, the log (base 10) of the concentration on the antibiotic disk was graphed against the zone of inhibition measurements (cm). A trendline was then designed to fit the data points output from each run. The slope of the line indicated the uptake rate as  $\mu$ g/cm. To properly convert this to cells taking up and dying from antibiotic exposure, cell size was considered. Both *E. coli* and *En. cloacae* cells fall in the range of 1.0-2.0  $\mu$ m in cell diameter, where *S. aureus* falls around 1.0  $\mu$ m in diameter (Riley, 2013). Therefore,

the death by antibiotic calculation indicates the quantity of cells that did not survive due to antibiotic exposure (Table 3).

**Table 3.** Antibiotic uptake rate (death by antibiotic) values determined from slope values of disk diffusion assays as outlined above.

Variable	Definition
$\beta$	Bacterial birth rate (growth rate)
S	Sensitive population (susceptible to antibiotic)
R	Resistant population (resistant to antibiotic)
K	Carrying capacity (Maximum growth)
q	Bacterial mutation rate (random mutation rate)
$\alpha$	Antibiotic uptake rate/death by antibiotic
C	Concentration of antibiotic
$\mu$	Natural death rate

#### Calculation of Natural Death Rate ( $\mu$ ) via Exponential Decay:

The exponential decay formula found in the literature (Assadian et al., 2011) is recorded as:

$$N = N_0 e^{-\mu t}$$

Variables were altered to maintain uniform trend in variable identifications. Here “N” is a general population. Solving for  $\mu$ ,

$$\ln(N) = \ln(N_0) - \mu t$$

$$\ln\left(\frac{N}{N_0}\right) = -\mu t$$

Death rate was reported in cells/hr.

#### Sources: Determining values of $\beta$ , K, and q

$\beta$ , K and q were determined from literature values. The birth rate ( $\beta$ ) was determined from the exponential growth rate of *E. coli* in Luria-Bertani broth. The growth rate of *E. coli* was recorded in time it takes to double the number of *E. coli* cells, which is 20 minutes (Gibson et al., 2018). *Escherichia coli* and *En. cloacae* are both from the *Enterobacteriaceae* family and their growth rates were recorded as relatively similar (Khleifat et al., 2008). The growth rate of *Staphylococcus aureus* was documented as a doubling time every 20 minutes (Missiakas and Schneewind, 2018).

#### Determining Antibiotic Concentrations:

The lowest concentration of an antimicrobial that will inhibit the visible growth of a microorganism after overnight incubation is the minimum inhibitory concentration (MIC) (Andrews JM, 2001). Triclosan solution was made in 8M NaOH and distilled water. NaOH was re-

quired to maintain the compound in solution in water. An additional note was that NaOH, in high amounts, made liquid LB broth very cloudy, rendering any absorbance readings as a means of growth essentially useless since the opacity of the NaOH + LB was much higher than that of a saturated culture. With this in mind, low concentrations of triclosan were utilized to ensure little to no effect on absorbance readings collected throughout the experimental process. The maximum concentration of triclosan utilized was 200 ug/mL, and the minimum concentration was 0.5 ug/mL. A starting stock solution of 20 mg/mL was maintained at 4° C. Antibiotic was diluted directly in LB broth to ensure no background NaOH was added to the solution. As a threshold for measure, the minimum inhibitory concentration (MIC) of triclosan was documented as 0.5 ug/mL in *E. coli*, and 0.125 ug/mL in *S. aureus* in ATCC derived strains (Assadian et al., 2011).

Chloramphenicol solid was diluted in 100% EtOH. To maintain consistency, the starting stock solution of chloramphenicol was at a concentration of 20 mg/mL. The maximum concentration of chloramphenicol used was 2 mg/mL, and the minimum concentration was 0.5 ug/mL. The MIC of chloramphenicol against *E. coli* was documented as 8 ug/mL (Pitsiniaga and Sullan, 2022). Chloramphenicol is light sensitive, so additional precautions were taken to ensure tubes were not left out in the light, and stock solutions (as well as diluted solutions) were stored at 4° C when not in use (Sigma Aldrich).

Erythromycin solid was diluted in 100% EtOH. To maintain consistency, the starting stock solution of erythromycin was at a concentration of 20 mg/mL. The maximum concentration of chloramphenicol used was 2 mg/mL, and the minimum concentration was 0.5 ug/mL. The MIC of erythromycin against *S. aureus* was documented as 0.25 ug/mL (Mikliasinska-Majdanik et al., 2022). Erythromycin is light sensitive, so additional precautions were taken to ensure tubes were not left out in the light, and stock solutions (as well as diluted solutions) were stored at 4° C when not in use (Sigma Aldrich).

#### Designing Growth Plate:

All samples in this experiment were initially grown at 37° C with constant shaking until the mid-log phase was achieved as determined by spectrophotometric measurement of the optical density of the culture via absorbance at 600 nm (OD<sub>600</sub> of 0.5). The cultures were then combined 1:1 with LB or LB/antibiotic in a 96-well culture plate. These samples were incubated at 37° C with constant shaking to ensure uniform distribution of the cells and circulation of oxygen across the given time period (approximately 16 hours). During with OD<sub>600</sub>-measurements were recorded every five minutes.

#### Converting Optical Density to Cell Count:



To convert to cells/mL, a reference measurement of  $OD_{600}=1$  was utilized. At an OD of 1, the documented cell count was  $8 \times 10^8$  cells/mL (Agilent). The remaining calculations for readings between and OD of 0 and 1 were calculated using the conversion factor:

$$\frac{8 \times 10^8 \text{ cells/mL}}{OD 1}$$

Determining Expected Growth Values: Excel Design:

The expected growth values were calculated in Excel by modeling change in population over time given the determined variables. Each determined variable was placed in a starting cell at the top of the Excel sheet, and equations for each variable were shown below where population development was modeled continuously as t, R, and S changed. Ending calculations were in terms of total population size, R+S.

The terms that were initially introduced in the Excel sheet were:

1. Starting population à  $OD_{600}=0.5$ , which yielded  $4.0 \times 10^7$  cells/100  $\mu$ L
2. Further, the starting population was diluted by 100  $\mu$ L from the starting media in the plate, setting our starting population at  $2.0 \times 10^7$  cells in 200  $\mu$ L.
3. The birth rate in the exponential growth equation,  $N=N_0e^{rt}$ , “r” was calculated as  $\ln(2)/t_D$ , where “ $t_D$ ” is the desired time interval of growth, where this term would be 16 hours. Therefore, the bacterial growth rate would be  $r=0.02$  after performing this calculation (Widdel, 2010). This was considered in each step of the population growth.
4. The mutation rate was set in a range, between  $10^{-8}$  and  $10^{-5}$  mutations per generation. The emergence of resistant individuals was set to either the upper or lower bound mutation rate(s) as separate experimental simulations. The genome length was incorporated into the mutation calculation, however, since the genomes differed by only a few hundred thousand base pairs, (*E. coli* 5,209,985 bp; *En. cloacae* 5,608,020 bp; *S. aureus* 2,729,352 bp), the approximation of genome length utilized was 5.5 million bases. The ending population (expected) did not change noticeably due to the low mutation rate being incorporated.
5. The carrying capacity was determined at  $2.4 \times 10^9$  cells/mL (Vokmer and Heinemann, 2011). In an experiment being run in 200  $\mu$ L, our new carrying capacity would fall at  $4.8 \times 10^{-8}$  cells.
6. The death rate, as explained previously, was incorporated as cells lost per hour and were subtracted off each population size before total population size was determined.
7. Knowing that bacterial growth hits stationary phase after 10 hours of growth, the Excel Design was

marked to hit maximum growth at 10-11 hours of growth. This assumption is based on previous LB growth assays to help determine when growth would flatline.

Determining Ending Population Size (R+S): Growth Curve Analysis:

The final population size (R+S) in each experiment was determined by inputting known variables into Excel, and the total S and R individuals at each time point were calculated and then computed as a total population size. This calculation resulted in our expected growth. The actual growth values were determined via observing the pattern of change in each growth curve. Knowing we have limited resources in these experiments, the final population was determined when the growth curve flatlined after its observed exponential growth phase.

The final population was determined by subtracting the blank LB+ antibiotic well from the wells containing growth. Since each experiment was conducted in triplicate, the three were averaged after subtracting the blank from each experimental run. Then, the initial absorbance value was subtracted off each absorbance value at each time point. To convert the absorbance to cell count, we established in the “Converting Optical Density to Cell Count” the conversion factor of  $OD_{600}=1=8 \times 10^8$  cells/mL.

Analysis of Population Growth: Polynomial Representation:

Modeling population dynamics was done in three time frames for each experiment. To model population dynamics, three distinct regions of the growth curve were identified in each experiment and correlated to the three phases of bacterial growth: exponential growth phase, lag phase, and stationary phase. Observing the characteristics of the curve, exponential growth phase and lag phase can be modeled using different quadratic formulas. The transition of lag into stationary phase can be modeled using a cubic polynomial.

To do this, there were three to four points selected within each designated time frame. Using these points, a system of equations was set using fixed coefficients and constants. For example, selecting three points:  $P_1, P_2, P_3$  would have respective x and y values, where  $P_1=(x_1, y_1); P_2=(x_2, y_2); P_3=(x_3, y_3)$ . With these defined points, we can define fixed coefficients and constants a, b, c, ..., z. So, for a quadratic representation, we had a system similar to the following:

$$\begin{aligned} ax_1^2 + bx_1 + c &= y_1 \\ ax_2^2 + bx_2 + c &= y_2 \\ ax_3^2 + bx_3 + c &= y_3 \end{aligned}$$

Similarly, for a cubic representation, we had:

$$\begin{aligned} ax_1^3 + bx_1^2 + cx_1 + d &= y_1 \\ ax_2^3 + bx_2^2 + cx_2 + d &= y_2 \\ ax_3^3 + bx_3^2 + cx_3 + d &= y_3 \end{aligned}$$

Solving for a, b, c, and d can be done by separating the known variables into a matrix, and the unknowns (coefficients) into a coefficient matrix. For example, we would have the following matrix representation for a quadratic system:

$$\begin{bmatrix} x_1^2 & x_1 \\ x_2^2 & x_2 \\ x_3^2 & x_3 \end{bmatrix} * \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} y_1 - c \\ y_2 - c \\ y_3 - c \end{bmatrix}$$

For a cubic system, we had the following representation:

$$\begin{bmatrix} x_1^3 & x_1^2 & x_1 \\ x_2^3 & x_2^2 & x_2 \\ x_3^3 & x_3^2 & x_3 \end{bmatrix} * \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} y_1 - d \\ y_2 - d \\ y_3 - d \end{bmatrix}$$

**CoCalc®: Designing & Solving for Polynomial Coefficients:**

CoCalc® utilizes Sage Math (which is an open library for coding with Python) to process codes entered by a user and generates a response, displayed below the entry box. In our case, we can solve our system of equations utilizing the “solve” function. The “solve” function in CoCalc® allows us to type in a system of equations after defining our variables, and simply typing in the variables CoCalc® should solve for. To define our variables, we simply input var (‘a, b, c’) to indicate these are variables we are solving for. The integers in the equation above would be our three points (P1, P2, P3) in each given time frame where each x value would be multiplied by the a, b, or c coefficients and the y value would be on the right side of the equation.

Three representations for each population were determined, at three different time frames as described above. When inputting the starting data values, the y values of each experiment were reduced by a factor of 10<sup>8</sup> to ensure coefficients were calculated within reasonable range.

## Results

### Growth Analysis: Expected Growth (Raw Values) vs. Actual Growth (Population Capacity):

The expected growth values were determined in Excel, as determined prior, the only difference between each of the microbes that could be calculated for was their genome length, and the final population growth determined at the end of the exponential growth phase entering into lag phase was between 2.36 x 10<sup>8</sup> cells/mL and 2.86 x 10<sup>8</sup> cells/mL. These raw growth values were compared against the expected growth values, averaging these values landed a final

expected population growth value of 2.61 x 10<sup>8</sup> cells/mL. This ending population size is the total of the sensitive strain and resistant strain growth. The actual population growth of each experiment was determined at the final population growth in each experiment. The final population size was determined at the final cells/mL value after 16 hours of growth. Table 4 shows all ending population sizes for each experiment.

**Table 4.** Ending population size for each experiment in presence of each specified antibiotic and its concentration

Species	Antibiotic	Final Population Size (cells/mL)
<i>E. coli</i>	Triclosan (0.5 ug)	3.57 x 10 <sup>8</sup>
<i>En. cloacae</i>	Triclosan (0.5 ug)	1.02 x 10 <sup>8</sup>
<i>En. cloacae</i>	Chloramphenicol (0.5 ug)	2.46 x 10 <sup>8</sup>
<i>S. aureus</i>	Triclosan (2 ug)	2.81 x 10 <sup>8</sup>
<i>S. aureus</i>	Erythromycin (2 ug)	4.42 x 10 <sup>8</sup>

Comparing expected and actual growth values, we see that expected growth fell around 2.61 x 10<sup>8</sup> cells/mL. The general trend in each population representation shown above related closely to the expected growth values for each experiment, as shown, where *En. cloacae* was the closest in growth with chloramphenicol, and *S. aureus* with triclosan.

### Polynomial Representations: Numerical Analysis:

In each of the experiments below, the polynomial representations are plotted against the experimental results shown in Table 4. Numerical analysis of each polynomial will be shown in the tables below within each time frame listed. In each time frame, the following times were used to generate all of the polynomials in the tables below. At time frame (0,4) hours 1, 2, and 3 were used. In frame (4,10) times 6, 8, and 10 were used. At frame (10,16) the times 12, 14, 16 were used. This follows for each polynomial generated. Three polynomials were developed against the growth curve for this experiment as shown in the table below, on the left is the time interval the polynomial represented, on the right is the polynomial representing the growth of this population (cells/mL) within that given time range.

#### *Escherichia coli*

In *E. coli*, polynomial representations were developed against the actual growth values collected in the presence of triclosan.

#### **Triclosan**

Time (hours, x)	Polynomial (cells/mL, y at time, x)
(0,4)	$f_1(x) = \frac{-39}{50}x^2 + \frac{87}{20}x - \frac{213}{100}$
(4,10)	$f_2(x) = \frac{9}{450}x^2 - \frac{277}{900}x + \frac{4421}{900}$
(10,16)	$f_3(x) = \frac{59}{33600}x^3 - \frac{3}{50}x^2 + \frac{5611}{8400}x$

*Enterobacter cloacae*

In *En. cloacae*, polynomial representations were developed against the actual growth values collected in the presence of triclosan, chloramphenicol, and erythromycin. Note, erythromycin should not impact the growth of *En. cloacae* since it is a gram-positive specific antibiotic placed in the presence of a gram negative microbe.

**Triclosan**

Time (hours, x)	Polynomial (cells/mL, y at time, x)
(0,4)	$f_1(x) = \frac{-31}{100}x^2 + \frac{73}{50}x + \frac{12}{25}$
(4,10)	$f_2(x) = \frac{1}{100}x^2 + \frac{-43}{200}x + \frac{119}{50}$
(10,16)	$f_3(x) = \frac{-17}{960}x^3 - \frac{197}{400}x^2 - \frac{4013}{1200}x$

**Chloramphenicol**

Time (hours, x)	Polynomial (cells/mL, y at time, x)
(0,4)	$f_1(x) = \frac{-7}{20}x^2 + \frac{33}{20}x + \frac{3}{10}$
(4,10)	$f_2(x) = \frac{1}{80}x^2 + \frac{-1}{8}x + \frac{23}{10}$
(10,16)	$f_3(x) = \frac{-493}{26880}x^3 + \frac{65}{128}x^2 - \frac{11209}{3360}x$

*Staphylococcus aureus*

In *S. aureus*, polynomial representations were developed against the actual growth values collected in the presence of triclosan, chloramphenicol, and erythromycin. Note, chloramphenicol should only mildly impact the growth of *S. aureus* since it is mostly effective against gram-negative microbes and *S. aureus* is a gram-positive microbe.

**Triclosan**

Time (hours, x)	Polynomial (cells/mL, y at time, x)
(0,4)	$f_1(x) = \frac{-1}{80}x^2 + \frac{169}{400}x + \frac{13}{40}$
(4,10)	$f_2(x) = \frac{-1}{160}x^2 + \frac{61}{400}x + \frac{151}{100}$
(10,16)	$f_3(x) = \frac{-2291}{134400}x^3 + \frac{1511}{3200}x^2 - \frac{51701}{16800}x$

**Erythromycin**

Time (hours, x)	Polynomial (cells/mL, y at time, x)
(0,4)	$f_1(x) = \frac{-7}{8}x^2 + \frac{1019}{200}x + \frac{-313}{100}$
(4,10)	$f_2(x) = \frac{7}{400}x^2 - \frac{51}{200}x + \frac{499}{100}$
(10,16)	$f_3(x) = \frac{-243}{12800}x^3 + \frac{3327}{6400}x^2 - \frac{5187}{1600}x$

**Model Limitations**

Variable Compatibility:

An initial note made was the lack of evidence supporting the multiplication of the mutation rate and antibiotic concentration. The variables were deemed incompatible, and it was further concluded that the product of the two variables does not necessarily follow the trend suggested by the model. That is, higher antibiotic concentrations would mean more sensitive individuals would mutate and become resistant. The three antibiotics researched in this project, as well as the antibiotics identified initially in literature are not mutagenic. That is, they do not induce DNA damage or mutations in the bacterial genome. However, although the evidence supporting the product of these variables is lacking, ignoring this aspect of the model was only a temporary approach until further clarification is developed.

Additionally, the death by antibiotic variable was introduced into the model in simplified form, a potential solution to this would be to expand the equation in order to effectively exclude the concentration times mutation rate calculation without excluding additional variables:

$$\frac{dS}{dt} = \beta S \left(1 - \frac{S + R}{K}\right) - \mu_S - (q + \alpha)CS$$

$$\frac{dS}{dt} = \beta S \left(1 - \frac{S + R}{K}\right) - \mu_S - qCS - \alpha CS$$

$$\frac{dS}{dt} = \beta S \left(1 - \frac{S + R}{K}\right) - \mu_S - \alpha CS$$

Including this death rate, along with the intrinsic death rate may help better model the emergence of resistant individuals while modeling the death of sensitive individuals.

Newly Proposed Model (Excluding Antibiotic Concentration):

Using the initial derivation, we performed to reach the model we investigated in literature, our initial proposed model for resistant and sensitive individuals were:

$$\frac{dS}{dt} = \beta S \left(1 - \frac{S + R}{K}\right) - \mu_S - qS$$

$$\frac{dR}{dt} = \beta R \left(1 - \frac{S + R}{K}\right) - \mu_R + qS$$

After determining a workaround to exclude the “qCS” variable while also including as many variables as was first introduced in the model as possible, we ended with:

$$\frac{dS}{dt} = \beta S \left(1 - \frac{S + R}{K}\right) - \mu_S - \alpha CS$$

Credibility & Limitations of New Model:

The limitations of this new model do not include all varia-

bles that were initially introduced by Iburgüen-Mondragon et al. (2014). Due to the concerns initially presented as having incompatible variables combined into a single term, there was no proper reasoning developed or found as to why the “qCS” term was incorporated in both the  $dR/dt$  and  $dS/dt$  model.

## Modeling Population Dynamics

### Accuracy of Polynomial Representations:

Each polynomial representation generated for each population was cross tested with each population of interest, yielding expected accuracy in the time frame it was meant to model. Initial plans to cross test representations across different species and different populations within similar species were developed and in progress of investigation. To cross test these polynomials, the outputs of each polynomial were cross-referenced with actual experimental growth.

### Discussion

The initial derived model for  $dS/dt$  and  $dR/dt$  excluding the qCS term was relatively accurate in determining emergence of resistance by effectively maintaining similar ending R+S population sizes. While this model does not indicate how fast a bacterial strain can become resistant to an antibiotic, it can tell us how many resistant microbes can emerge within a given time range, effectively determining the ease of resistance given proper selective pressures and growth conditions. With high antibiotic concentrations, the derived model would not have accurately modeled emergence of resistant strains since there would be no growth observed due to the selective pressure being too high. Since none of the antibiotics investigated in this study were involved in mutagenic pathways, high concentrations of antimicrobials would serve to simply kill the entire bacterial population investigated. Therefore, the initially proposed model by Iburgüen-Mondragon would be more feasible if the studied antimicrobials were mutagenic. However, due to the nature of our selected antimicrobials, the model without the “qCS” term served to follow a more reasonable modeling method.

Exposing microbes to lower antibiotic concentrations was necessary in ensuring the emergence of resistant individuals would occur. In these experiments, the MIC of each antibiotic on each specific species was determined and used to create a range that was large enough to establish a range of proper experiments where resistant emergence was at high level enough to be noted (Wistrand-Yuen et al., 2018). Initially, Iburgüen-Mondragon, et al. (2014) had utilized this model in resistant strains of *Mycobacterium tuberculosis*, which is a slow growing microbe. The microbes investigated in this study were fast growing microbes and were effectively modeled regardless of their alternative growth nature. We were able to establish proper experimental procedures as well as predict resistance emergence over time effectively with derived logistic growth models, and thus are confident in the predictable nature of these growth models and can attest to its malleability in use against dif-

ferent populations.

Future work will develop more efficient methods in modeling population changes instead of using multiple polynomial representations. Although this technique is highly effective and accurate, it can be time consuming, especially if different populations tend to follow similar trends. We would also like to extend experimental parameters. The experiments in this project were designed in a 96-well plate that holds a maximum of 200  $\mu$ L volume. To allow for more variation and potential uniqueness in each population’s trend, we would like to run experiments in much larger volumes such as 50 mL. This parameter extension may also serve to extend the time of experiments to last days instead of hours. Finally, we would like to increase the different types of microbes investigated to further increase the diversity of this experiment.

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# The Role of Morality in Reporting Indiscretions

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**Abstract:** In this study, a benign behavioral intervention investigates the variables of fairness and empathy in participants' moral reactions and willingness to "snitch" or report. An initial pilot study that tested whether a student was likely to whistle blow on cheating suggested that participants were more likely to keep it to themselves (75% said they would not report). Based on this pilot, a set of narrative scenarios were created to test the role of empathy and fairness in reporting behavior. Participants were presented with one of four different narrative scenarios and asked how they would respond. The first scenario tested the variable of empathy: after reading a description of a situation of verbal harassment, participants were asked whether they would report the verbal harassment to an authority figure. The second scenario was identical except for one detail: the victim of the verbal harassment was someone they knew. The third scenario tested fairness by asking participants whether they would tell on students who were cheating in class. The fourth scenario was identical to the third except for one detail: it was specified that future scholarship and prestigious graduate school opportunities were at stake. The overall hypothesis predicted that participants would respond to their given scenarios with either fairness or empathy in cases where a personal connection formed after reading and that this would provoke action. More specifically, the researcher hypothesized that participants who received scenarios two and four, where a personal relationship or personal stakes were involved, would be more likely to report than those who received scenarios one and three. The results of the calculated test were statistically significant indicating that fairness and empathy play a role in morality.

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## Introduction

While reporting behavior can be described as snitching, whistleblowing, or reporting, the terms are not interchangeable and carry significant differences in connotation. The definition of the term "snitch" is to inform or tattletale on someone else; the word has a negative connotation in society. Crocker (1912) defines snitching as a connection of themselves or a group to the trouble in question. Snitching is not typically a goal for individuals as it is seen as a social crime against their own communities. It creates a temporary socioemotional barrier between both the snitch and the victim that can prevent future communication. For example, in the *American Bar Association Journal*, Smith (2008) describes snitching as a mentality of inherent distrust of the government's protection from the backlash of one's community. To snitch is to utilize one's own morality in the absence of an authority figure who is then placed at risk for their decision within that community.

By contrast, whistleblowing carries a positive connotation because it indicates advocacy for societal justice. Ordinary civilians whistle blow to prevent crime and uphold standards set by both themselves and the government. In "Whistleblowing," Ting (2008) reveals whistleblowers are legally protected by the government upholding the Whistleblower Protection Act of 1989. Whistleblowers are held in

higher regard than snitches as there is a subconscious universally recognized confidence that is perceived in speaking out against an observed injustice. The United States Department of Justice and Department of Labor uphold laws for whistleblowers to speak out against the corrupt internal practices by filing complaints to the Federal Occupational Safety and Health (OSHA) Offices by state. Both whistleblowers and snitches report unethical behavior, yet they are evaluated differently under the societal expectations of their communities.

Reporting indiscretions is the action of reporting any form of behavior that includes variables of empathy and fairness. Reporting indiscretions is the most neutral term of the three and allows room for a middle ground. To report an indiscretion is to meet the societal threshold in which a sociological observation becomes a physical action guided by morality. Trevino and Victor (1992) report indiscretions as when a peer goes outside their level of comfort to report another member's misconduct. This very same vocal expression of morality and the physical necessity of fairness becomes strengthened by ideations of equitable treatment for everyone and social acceptance by everyone. It is essential that each of these terms are defined in an effort to understand how reporting behavior affects morality.

## The Pillars of Morality

As noted by the primatologist and ethologist Frans de Waal, fairness and empathy are regarded as the twin pillars of morality. Both pillars of morality investigate the levels of treatment expressed between different members of the same community. According to Frans de Waal (2003) fairness requires a biological understanding whereas empathy requires an emotional reasoning when investigating morality. A single study conducted by Frans de Waal and Brosnan (2003) entitled “Monkeys Reject Unequal Pay” suggests the biological and sociological factors of morality are connected to the concept of inequality. The study showed this by giving two different capuchin monkeys two different incentives for completing the same task of returning a rock for the reward of food (Brosnan & De Waal, 2003). As a result, the monkey receiving the new incentive of the grape was satisfied, whereas the other monkey receiving the old incentive of the slice of cucumber was dissatisfied. Both pillars—fairness and empathy—served as fundamental factors when exploring morality.

### **The Pillar of Fairness**

De Waal anchors the pillar of fairness in biology and evolution. The biological basis of fairness was derived from The Kin Selection Theory and Darwin’s Theory of Evolution. The Kin Selection Theory determines fairness by a species genotype, phenotype, and social interaction. According to this theory, the largest animals would succeed, and the smallest animals would fail to survive. Michod (1982) identifies that a species behavioral phenotype influences their overall level of fitness and social interaction. Fairness was ensured in the wild through the animal hierarchy and the food chain as a direct result of kin selection. Reproduction between two different species required altruistic behaviors for greater chances of evolution. Wilson (2005) further states that genes are responsible for predisposing species to altruistic behaviors. Thus, fairness has a biological basis rooted in the evolutionary aspects of altruism and socialization.

Charles Darwin’s Theory of Evolution hypothesizes that the most advantageous traits are passed on, thus ensuring the survival of the fittest. Howerth (1917) extends this point and argues that for natural selection to take place there must be an organic world, variational environments, and a struggle for existence. This would indicate that fairness was directly rooted in morality through survival and competition between species. Furthermore, species may alter in their physical appearance and genetics, but they all share the chance for variation during their evolution if the species survival is under threat (Beatty, 1984). The evolutionary aspects of variation and survival are instinctual characteristics of fairness. Thus, the pillar of fairness requires a scientific biological explanation of morality, while the pillar of empathy describes a more intimate social connection.

### **The Pillar of Empathy**

The pillar of empathy is rooted in the cognitive connection

between individuals. The sociological effect empathy has on morality can be observed when applying the concept of reciprocity and the Machiavellian justification principle. Hartley (2014) defines the concept of reciprocity as producing balanced exchanges to sustain advantageous relations. Hence, to show empathy means that someone else would have to feel empathy in reciprocating emotions. Decety and Cowell (2014) argue that an aspect of empathy called emotional contagion is a fundamental role which generates motivation to care for those in distress. In addition, empathy encourages action after observation as the anterior cingulate cortex (ACC) becomes activated after observing individuals in distress or pain (Decety & Cowell, 2014). Thus, empathy proves fundamental in turning observation into action.

The Machiavellian justification principle asserts that the ends always justify the means. Burgoon et al. (1972) define a Machiavellian as one who uses others for his own purpose. Empathy can be used selfishly because for someone to succeed that means others must lose. Achievement and morality clash when striving for success, yet the risk taken for those goals must be balanced with the reward. Burgoon et al. (1972) explain that the goals for success are set by the individual’s underlying personality. One study (Johnson, 1981) of the factors that influence reporting suggests that high-need achievers in school are more concerned with cheating and success than low-need achievers. Empathy was an important factor in transforming observation into action, but Johnson (1981) found that the type of action can waiver from good to bad. This information proves consistent when considering the role of morality in reporting indiscretions.

### **The Present Study**

This study investigates the role of empathy and fairness in decisions to report unethical or unkind behavior. The sample included 94 undergraduate university students. The material presented to the students included a packet with a demographic questionnaire, brief scenario, several closed-ended questions, and one open-ended question. The results were examined by utilizing a statistical two-sample t-test.

### **Methods**

#### **Procedure**

Participants were students from the Human Subject Pool System (approximately 94 participants) of a small university. Participants indicated their consent to participate in deceptive research on the Human Subject Pool System’s Pretest that they would participate in future deceptive studies. Participants were led to believe the study was about the effect helpfulness had on academic achievement. The goal of this experiment was to test what triggered a participant’s moral intervention by studying the variables of fairness and empathy. The researcher hypothesized that participants who received scenarios two and four where a personal relationship or personal stakes were involved would be more likely to report than those who received scenarios one and

three. Both variables of empathy and fairness each had two independent conditions in which one condition included a control, and one condition included an experimental variable. The study thus included four different possible conditions to test participant's morality.

### Empathy Conditions

The first condition tested the variable of empathy by testing to see whether someone would report verbal harassment to an authority figure. This empathy condition should test the initial gut-response of participants and serve as a form of control variable for empathy. The second condition involved the same scenario, but it was manipulated by specifying that the victim receiving the verbal harassment was someone that they knew. It was hypothesized that this condition would manipulate participants to answer "Likely" in reporting this activity to an authority figure.

### Fairness Conditions

The third condition tested fairness by asking participants whether they would tell on students who were cheating in class. This fairness condition should test the initial gut-response of participants and serve as a form of control variable for fairness. The fourth condition involved the same scenario, but it was manipulated by specifying that the quizzes people were cheating on would help them with future scholarship opportunities in addition to granting them prestigious graduate school opportunities. It was hypothesized that this experimental condition of fairness would manipulate participants' responses in making them feel more inclined to report this to an authority figure.

### Rating Conditions

The purpose of this study was to test how fairness and empathy affect morality. Each of the participants in the study would only read one condition and then score their responses on that single condition. There was a total of four different conditions. Two conditions asked about fairness and two conditions asked about empathy. A questionnaire was added to determine the local demographic of this study's participants. A 7-point Likert-Scale was used to test the likelihood each participant would either snitch or remain silent. The open-response section was added to further investigate additional factors of reporting indiscretions. The larger impact of this study was to help identify a moral line of demarcation for what causes passive observers to stay silent or tell on the transgressor.

### Safety & Confidentiality

Each of the participants' remained anonymous. Participants were assigned a number label (1-94), and their responses were labeled with this identifying number in compliance with the university's Institutional Review Board (IRB). Only the student's demographic, closed-ended, and open-ended responses were reviewed and assessed. In further attempting to protect the well-being and safety of the university's students, each of the participants received, read,

and acknowledged a debriefing form at the end of the experiment.

### Measures

The measures of this experiment involved a standard 7-point Likert Scale that served as a functional rating system that measures beliefs, opinions, and attitudes on the given conditions of empathy and fairness. In addition, participants were asked to provide a circled handwritten closed-ended response. A large space was also provided for handwritten open-ended responses to further explain their reasoning. The demographic questionnaire asked participants about their race, gender, and age as a tool for investigating external validity and any possible limitations of the experiment relative to its accuracy in sample diversity.

### Demographic

Participants were asked to voluntarily provide information regarding their age, gender, and ethnicity through a questionnaire before the experiment. The average age of each participant was approximately 20 years old. The gender demographic of participants consisted of 58 females, 36 males, and 1 self-identified as other. Participant racial demographic was as follows: 47 White, 19 Black or African American, 8 Multiple/Mixed, and 12 Asian. A total of 54 participants were non-Hispanic, while 41 participants of that same sample were Hispanic.

### Findings

#### Results

A two-sample t-test (pooled variance) was utilized as the statistical test when comparing both the empathy group and the fairness group in testing morality. The results of the calculated test identified that there was a statistical significance between the averages of both independent variables being investigated. A two-sample t-test was used because two or more variable's data were being compared. This test determined whether the two pillars of morality played a role in participant's responses to the scenario.

The sample size consisted of 94 total participants that were split evenly into two groups of 47 participants per variable. In the fairness scenarios, the experimental condition had a sample average of 2.54 whereas the controlled condition had a sample average of 2.24. In the empathy scenarios, the experimental condition had a sample average of 5.25 whereas the controlled condition had a sample average of 5.55. These sample averages between both variable's conditions suggest that empathy and fairness were not significant in testing morality. Yet, when the variables averages were compared against each other the data was statistically significant. The total sample average of both empathy conditions was 5.42 whereas the total sample average for both fairness conditions was 2.38. Participants objectively understood what actions were good and bad, but they had subjectively decided whether to partake in that condition's ma-

nipulated form of social involvement.

The results suggest that the moral line exists at the point an individual decides to physically act based upon the moral standards intrinsically determined by themselves and extrinsically reinforced by society. In conclusion, the participants given scenarios one and two testing the variable of empathy were more than 50% more likely to report an indiscretion compared to those participants given scenarios three and four for the variable of fairness. This can be interpreted as empathy being a stronger predictor for reporting indiscretions than fairness. These results suggest that there was not a correlation between the manipulated and controlled conditions, but rather between the variables themselves.

## Discussion

The results of this experiment suggest that fairness and empathy do play a role in the decision to report an indiscretion. Empathy was more likely to trigger the action of reporting an indiscretion than fairness. This suggests people are more likely to act when they can empathize with other people. Empathy's impact on morality remains unclear as there are many plausible explanations involved in describing its role in the decision-making process.

Empathy could be considered a stronger predictor for morality in reporting indiscretions due to Hoffman's theory of empathy and moral development. This theory mainly encompasses the factors of empathy involved in human arousal including direct association, mediated association, and role-taking. Direct association is an emotional connection the observer makes with the distressed stranger. Krzesni (2015) explains that direct association is when the observer associates a similar experience directly to their current situation with feelings of empathy. It is not merely the sight of the distressed person or the situation but the visceral feelings and emotions that follow, urging the body to act morally.

Mediated association causes empathetic arousal in the form of a verbal expression of pain and discomfort. This level of empathy creates a call for action in which the surrounding area was made aware of the cry for help. Observers who process this information may feel empathetic distress and act in response to the verbalization of the victim. The act of real physical harm against the victim becomes surreal and other emotions surface depending on whether the victim was helped or hurt. Guilt is most associated within the process of reciprocal altruism and serves as a form of intrinsic motivation (Krzesni, 2015). Mediated association describes the process to act with intentional purpose, without expectation.

Role-taking is the process of understanding how someone else may feel and in that moment reciprocating those same emotions. This can be practiced in many different settings and form an emotional connection and understanding be-

tween two or more people. Hoffman states that empathetic distress motivates prosocial and helping behaviors that are associated with feelings of guilt (as cited in Krzesni, 2015). There must be an intrinsic desire for an observer to act altruistically, evoked by the internal empathetic arousal response.

## Limitations

The study had several limitations related to its construction. The study was based on a convenience sampling of participants taken from the Human Subject Pool System of a small university. This method of sampling is both time and cost-efficient, but it is a biased method of sampling as it is not reflective of an actual population. Another limitation is the demographic that was offered as most of the students were predominantly white and female.

The conditions of empathy and fairness were presented in two different settings: one set of scenarios was set in a school environment while the other set of scenarios was set in a real-world setting. This may have produced a confounding factor. In hindsight, each variable should be controlled for the same external variables to avoid bias and the creation of confounding variables. In addition to the type of setting, the deception that was used within the study of academic helpfulness could account for intentional outliers or skewed data. Both closed and open-ended responses were helpful but would not necessarily reflect whether that person would perform those actions listed on the survey.

The methods for collecting the data included a mixed methods approach as the survey was distributed in one of three ways: handed out personally by the researcher, handed out by the professors, or provided within a digital format. Some of these methods for data collection provided an incentive for the participant's participation by receiving psychology research credits and others included gift cards or potential extra credit opportunities if applicable. If these limitations were moderated throughout the entirety of the experiment, it would provide an even greater statistical significance in explaining not only empathy and fairness but also accurately measure the manipulations.

## Future Research Directions

This study investigated the role of morality in reporting indiscretions. Overall, this study lacked a large and representative sample size. Future studies could expand both the size of the participant pool and the demographic. In promoting diversity, the experiment should have offered research credits not only in psychology classes but in all majors to promote both inclusion and diversity when collecting data. In developing the framework of the survey, the instrument should have asked follow-up questions to record both their initial response to the condition and then the change after the experimental condition. Stronger deception would have avoided false responses and could have provided more accurate data. These future research directions are



an accumulation of very small errors that could more accurately be accounted for in the future.

## Conclusion

The societal law or demarcation that makes a passive individual into a snitch, whistleblower, or reporter is action. The line for morality in reporting indiscretions is not enough to mouth words of injustice or develop feelings of empathy without revealing their true intention. In conclusion, the role of morality in reporting indiscretions occurs when thoughts become action. This experiment's data concludes that participants are 50% more likely to speak out against an injustice due to empathy rather than fairness.

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# Sex, Sun, and Stigma: The Serpentine Underbelly of Globalized Sex Tourism

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**Abstract:** Sex tourism, a burgeoning international sector, involves travelers seeking sexual services from locals in destination countries. This complex phenomenon blurs the lines between leisure and exploitation, highlighting the way in which politics and ethics can clash. While some see it as a form of fantasy or economic empowerment, others condemn it for exploiting vulnerable populations, such as women and children. This paper aims to discuss the global issue of sex tourism by assessing its causes, consequences, and potential solutions.

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An expanding industry, sex tourism has seized the attention of the global community, inciting controversy and debate. Sex tourism is defined as leisure travel with the purpose of purchasing sexual services offered by the locals of tourist destination countries (Ryan & Kinder, 1996). Sex tourists travel to countries where prostitution is legal with a larger pool of sex producers compared to their own countries, where sex work may be limited or socially restricted. The sex tourism industry has been dominated by male tourists from economically developed nations or regions such as the United States, Europe, and Australia traveling to developing countries such as Cuba, Kenya, Thailand, and Cambodia (Wonders & Michalowski, 2014). Some experts, however, have recognized the increasing role that female client-travelers have played in the growth of the industry (Taylor, 2006). The basis of sex tourism remains to be the sexual interaction between a tourist and a local, which is solely dictated by the exchange of money or material goods.

The global phenomenon of sex tourism is a complex, multi-faceted issue that demands awareness. A source of both captivation and abhorrence, sex tourism depicts the convergence between prostitution and tourism (Wonders & Michalowski, 2014). The complexities that arise from the political and moral nuances of sex tourism as a liminal behavior create much debate within the global community (Ryan & Kinder, 1996). Sex tourism is well received when thought of as a form of fantasy and indulgence or a path for economic independence. However, sex tourism is viewed as unethical when faced with the grim reality of exploitation of vulnerable local populations, such as women and children. Judgment on sex tourism must be examined judiciously with a far-reaching lens of its many forms, causes,

consequences, and solutions. The social and economic merits are opposed by the unethical practices of sex tourism, which obscure the overall determination of sex tourism as beneficial or exploitative.

Sex tourism flourished with the advent of globalization, facilitating the movement of knowledge, goods, and people across the world. Increasing awareness and contact with new parts of the world is rooted in the rapid acceleration of the tourism industry, which gives rise to the globalization of sex tourism. Tourism has generally stimulated the movement of privileged peoples from industrialized nations into less developed ones in search of new and exotic experiences (Wonders & Michalowski, 2014). A general trend is that many source countries of tourists are Western nations while many destination countries are developing nations in Asia, Africa, and Latin America (“Exploring the Industry of Sex Tourism”, 2019). Globalization has promoted sex tourism for centuries. In the modern world, however, the practice continues to be sustained through the rise of social media. Instantaneous digital connections across continents contribute to the dissemination of sex tourism. Perhaps even connecting travelers to locals one-on-one, social media provides a seamless method of personal interaction. A globalized movement, aided by the modern adaptation of online networking, has promoted opportunities for sex work with an expanded pool of sex consumers and producers.

Globalization has given rise to a dominating capitalistic mindset, which has seized the global economy and contributed to the commodification of all aspects of life. The ever-expanding prostitution and tourism industry created a lucrative niche for sex tourism (Wonders & Michalowski, 2014). The consumption of sex tourism is fueled by the desires of privileged consumers, shaping the sexualization

of exotic people and places (Omodi & Ryan, 2017). Certain populations, such as women and children in developing nations, are more vulnerable to globalized effects than others. The feminization of global migration results in many women entering new social and economic settings where sometimes the only option for survival becomes sex work. For example, some Southeast Asian women migrate to Japan for better opportunities only to be subjugated to sex work (Leheny, 1995). Whether these women turn to sex work to support themselves and their families or are tricked and forced through the capitalistic greed of tourism management, women are more likely to be at risk of endangerment. Additionally, an annual estimate stated that more than 250,000 people travel overseas to engage in sex tourism with children (IAMAT, 2017). Evidently, the globalized nature of sex tourism endangers vulnerable populations. The overwhelming expanse of sex tourism is a result of a supply and demand framework, intensified by global interconnectivity, primarily affecting women and children in emerging nations.

The cultural and moral implications of sex tourism vary by locale and by the situation. Forms of sex tourism that govern the industry and society's outlook on it range from romance tourism, prostitution tourism, and child sex tourism. Interpreting the nuances between them is compounded simultaneously by universal expectations but also how societies differ in their behaviors and beliefs on enjoyment, exploitation, and human rights—all factors that influence the global perception of sex tourism.

A form of sex tourism that exemplifies fantasy, wish fulfillment, and social companionship is romance tourism (Ryan & Kinder, 1996). This type of sex tourism is motivated by the same factors as the socially acceptable form of leisure and travel. Both types serve as a desire for something different from the ordinary, which questions people's intolerance of sex tourism. For example, in Kenya, sex tourism is viewed as progressive, enabling women to gain sexual pleasure as well as economic independence (Omodi & Ryan, 2017). This suggests that the condemnation of sex tourism should be considered a result of social conditioning, which can vary across different countries and locales.

Another form of sex tourism, prostitution tourism, is excessively dictated by money, many times giving rise to extortion and coercion of vulnerable people. When money becomes the sole focus, sex tourism becomes dominated by the privileges of industrialized nations. Prostitution tourism is most commonly controlled by men within a capitalistic system that subjugates women and forces sex work upon them due to limited employment opportunities (Omodi & Ryan, 2017). Such subordination of women due to economic constraints is seen in the Netherlands, where discrimination prevents ethnic minorities from employment (Wonders & Michalowski, 2014). Under these forced conditions, sex work is often the only option, trapping many unsuspecting female migrants. The causes and subsequent impacts of prostitution tourism are frowned upon by many. However, it continues to occur throughout the world and differs by

practice and extent, making it difficult to address universally.

Lastly, the most exploitative and intolerable form is child sex tourism. The sexual exploitation of minors is especially prevalent due to sex tourism, as perpetrators can travel to countries where children are conveniently obtainable for illegal purposes (Newman et al., 2011). The sexual exploitation of children by tourists and travelers, abbreviated as SECTT, is most common in Asian, African, and South American nations (Kosing & Wilsem, 2022). Countries such as Mexico, Kenya, Thailand, and India have been key players in the international sex tourism industry while also being a destination of SECTT, emphasizing how sex tourism magnifies child sex abuse. Child sex tourism exacerbates the criticism against the industry because of the immoral infringements on children's rights.

Emerging nations seeking ways to advance their economy leads them to employ sex tourism as a means of capital and global standing. Sex tourism is supported by tourist nations because of the potential for economic advancement as it generates investment in public services, infrastructure, and living standards (Mekinc & Music, 2015). As wealthy, industrial nations expand, they recognize tourist nations' dependence on sex tourism revenue and take advantage of their flawed legal and economic frameworks (Chemin & Mbiekop, 2015). When capitalist countries are motivated solely by self-interest and invest in the sectors of weaker nations' economies, they contribute to the nations' risky dependency on foreign capital, which magnifies the sex tourism industry (Leheny, 1995). The relationship between Japan and Thailand echoes a similar foundation. The Japanese government promoted overseas investment in the tourism industry, especially in Thailand, making the latter more receptive to Japanese interests. Despite Thailand's initiatives to limit sex tourism due to a growing AIDs threat, they are held captive by the widespread desire of Japanese men to engage in sex tourism in Thailand. In such a sense, foreign investment can be viewed as a proverbial "double-edged sword," as it can be a source of development but also of power imbalances between tourists from wealthy nations and locals in aid-receiving countries, raising concerns about whether economic advancement justifies the exploitation of developing nations by more affluent ones.

The economic notion that the sex tourism industry is lucrative has influenced people's perceptions of sex tourism as a viable source of income. In addition to their government's dependence on the industry for economic growth, individuals themselves seek sex tourism to escape poverty and unemployment. While the exact earnings of sex workers in tourism destinations remain uncertain, it is evident that the industry generates over \$20 billion in revenue for these countries, solidifying sex tourism as a profitable sector that offers both individuals and the national economy financial advantages (IAMAT, 2017). Whether sex work is coerced or willingly sought, sex tourism provides a means to a better life. Many people find sex work the most remunerating, preventing them from finding other professions. For exam-

ple, local Kenyan women offer “romantic safaris” to attract foreign clients (Omondi & Ryan, 2017). The idea that a foreigner can fulfill aspirations of a good life with material comforts motivates them to find a tourist to secure prestige and high class. Kenyan culture emphasizes the importance of a good husband as a key for women to have a good life, encouraging many to rely on romance tourism for economic security and independence.

Power relations that form the basis of sex tourism align with existing cultural patterns that prompt both individuals to seek and offer sex tourism. Cultural outlook forms one’s perception of femininity or masculinity. Because sex tourism is greatly concerned with bolstering power dynamics that arise from cultural definitions of gender, it becomes an attractive option for individuals looking to reinforce or challenge cultural norms. The desire to reinforce traditional conceptions of male dominance and female passivity is seen in the case of many male tourists pursuing sex tourism in developing nations (Omandi & Ryan, 2017). Growth in women’s education and employment opportunities has increased their independence. Women may no longer require a male counterpart’s support or companionship as they have in the past half-century. Gender norms equating masculinity with control over women provoke men, who feel discomposed by changes in power dynamics, to pursue sex tourism as an outlet for power. Moreover, destination countries may be perceived as underdeveloped and inferior, allowing male tourists to feel justified in taking advantage of local women. Therefore, when sex tourism entails a male visitor and a local female, issues of race, gender, and prejudice appear to play a pivotal role in both the origins and outcomes.

Increasingly, the traditional exchange of a male traveler seeking sexual services from a female has been challenged by more local men entering the industry for tourist women. Women’s access to increasing independence, the sexual liberation movement, the opportunity for independent income, and annual leave have all contributed to the female sex tourism industry, with generally European women traveling to African destinations and Canadian and American women traveling to the Caribbean (Bauer, 2014). Reconsidering gender roles within the context of sex tourism can enlighten the causes of female sex tourism as well, which takes advantage of similar power imbalances (Taylor, 2006). Caribbean men, such as those in Jamaica and the Dominican Republic, are highly sexualized and attract the likes of affluent women, who use social and economic inequalities to gain sexual advantages. In this sense, themes of racism and the “eroticization of the cultural other” contribute to the prevalence of sex tourism as well (Taylor, 2006). Women who associate colored men with animalistic attributes tend to seek out local men in tourist destinations where male honor is highly sexualized. Perhaps these women derive pleasure from the sense of empowerment they experience in a country that is typically seen as subordinate, which provides a satisfying reversal of traditional norms. Once more, sex tourism transforms into a multi-faceted

concern, where the distinction between victimization and exploitation becomes obscured across both genders.

The sexual exploitation of children also, in part, arises from cultural conceptions. Perpetrators rationalize their behaviors by citing their belief that girls mature quicker in destination countries (Mekinc & Music, 2015). Moreover, inhumane notions stemming from centuries of negative stereotyping of these countries may dictate abusers’ beliefs that children of underdeveloped countries are inferior, so sexual exploitation is not morally wrong. By seeking sexual services from children, perpetrators even feel benevolent for financially supporting them (Newman et al., 2011). Perpetrators from the United States describe disturbing accounts of sexual encounters with minors in countries like Colombia and Mexico, often justifying their actions by citing the deprived conditions faced by women and children and even expressing a sense of pride in having supposedly helped them escape poverty. Feelings of superiority and dominance incite tourists to seek sex tourism in nations where men, women, and children are culturally held as inferior and lack protection.

Though sex tourism provides respite from poverty, it contributes to a destructive cycle of economic, psychological, and physical dependence. The implications of widespread sex tourism are that it becomes an easy way of life and diminishes the ability of individuals to pursue other professions (Omondi & Ryan, 2017). For example, local Kenyan women resort to violence and deceit by employing witchcraft to attract wealthy tourists and harm competitors. These women are incentivized to employ such harsh means in order to find a potential husband who will provide for them. For many of these women, a tourist, most often a white man, is what stands between them and a good life. As such, many of these local women employ sex tourism not simply for fast earnings but rather for a relationship that can secure them material comforts and high class. However, psychological dependence on the wealthy foreigner as a savior and means to attain prestige and honor degrades the individual’s sense of self-worth. The consequence of this type of motivator is women becoming dependent on this lifestyle and sacrificing their potential to pursue alternative careers. When money and validation become the sole focus for these individuals, excessive dependence on the profits of sex tourism generates destructive and inhumane behaviors.

The most pressing issue that arises as a result of sex tourism is the conditions of exploited children. Victims of child sex tourism consist of children from impoverished and neglected families, children subject to psychological or physical abuse, and orphaned and homeless children (Mekinc & Music, 2015). For survival and bare means of subsistence, children are forced into sexual exploitation and are pulled into a vicious cycle of violence, disease, and substance abuse (Newman, 2011). It was found that children are more susceptible to AIDs and infection, and the illegality of child sex work makes it much more difficult for children to seek



medical treatment (Mekinc & Music, 2015). For instance, an NGO group reported that 50% to 90% of children rescued from brothels in Southeast Asia were infected with HIV (Newman, 2011). The physical, sexual, and mental torment that sexually exploited children are subjected to delegitimizes the sex tourism industry and garners widespread opposition from the global community. Still, child sex tourism continues to be rampant, especially in countries with corruption, organized crime, and inadequate police enforcement. The dire moral and ethical transgressions of child sex tourism render sex tourism treacherous and debilitating for children, in particular.

The various forms, causes, and consequences of sex tourism are not the same in any country or locality, which makes it increasingly difficult for standardized, effective measures to be taken against the illegalities of sex tourism without restricting the freedoms of individuals and economies of nations. Solutions to child sex tourism have taken the lead, endorsed by NGOs, tourist stakeholders, and the governments of destination countries to combat and ultimately eliminate the sexual exploitation of children (Mekinc & Music, 2015). The need for public investment to offer child protection is a must. In India, the National Child Labour Project aimed to remove children from the labor market to protect them from offenders (Chemin & Mbiekop, 2015). Source countries have also enacted extra-territorial child sex tourism laws and organized criminal data on known offenders. The coordinated efforts between source and destination countries will enhance the protection and policing of at-risk people and places. With adequate oversight and funding, the pressing issue of child sex tourism may finally be controlled.

The many factors that simultaneously rely on and shape sex tourism, such as economy, employment, and global patterns, make this issue too elaborate to develop an unequivocal stance. For some, sex tourism is empowering, granting individuals the freedom for self-exploration and independence from financial struggles. For others, sex tourism is a deplorable and exploitative industry that threatens one's tradition and morality. However, upon closer examination, it becomes evident that there are more negatives than positives associated with sex tourism in the current day. Sexual exploitation, most often leading to human trafficking and forced prostitution, seems to outweigh any economic benefits, either on an individual or sectoral basis, that can be attained from the industry. Having exploited vulnerable individuals and countries, sex tourism can marginalize already disadvantaged populations. If legislators in their respective countries were more cognizant of the local patterns and consequences of sex tourism, they could create effective policies that benefit sex workers and tourists. However, this initiative requires controls on corruption, adequate funding, and helpful governance to be truly successful. It is unrealistic that sex tourism will ever be eradicated, but it can become a more ethical industry, void of violence, abuse, and corruption. When that is achieved, sex tourism can become a socially acceptable form of respite, relaxation, and fantasy.

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# Gilgamesh, Scientism, and the Search for Immortality

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**Abstract:** The idea of immortality has widely been misinterpreted from a historical and scientific view. From a historical standpoint, one of the first stories ever recovered, the Epic of Gilgamesh, has often been misinterpreted as a story emphasizing human desire for immortality, however, this analysis misses the main message of the story. Furthermore, popular culture largely focuses on either the immortality aspect of the story or other themes of the story, often missing how the literary work reveals meaning to us. This misinterpretation of Gilgamesh's quest for immortality is also present in the scientific realm in the form of scientism. Scientism, an aspect of popular culture that ascribes miraculous powers to science, falsely believes that science can one day make humans immortal. It misinterprets scientists' quest for lengthening human lifespan and reducing the impact of disease on humans. Scientism enthusiasts fail to see that science itself indicates that immortality can never exist. An examination of the mechanisms behind aging, reversal of immunosenescence, tissue rejuvenation and stem cells, telomerase activation, and nanotechnology, science has only shown us that immortality is a work of fiction. While popular culture attempts to make immortality a reality, the Epic of Gilgamesh and science reveal the meaning of the human quest for immortality.

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## Introduction

The question of immortality is timeless. It was even present in the oldest surviving story with origins in 3,000 B.C. (Sadigh, 2010). The Sumerian work the *Epic of Gilgamesh* details the journey of the tyrant king Gilgamesh of Uruk attempting to attain immortality (Harvard Museum of the Ancient Near East 2017). As Gilgamesh committed many atrocious acts against the people of Uruk, the townspeople complained to the gods to help. The gods then created a wild man, Enkidu, who was strong enough to challenge Gilgamesh. Enkidu meets Gilgamesh and, after a brief battle, they become the best of friends. Gilgamesh then convinces Enkidu to accompany him in a battle against Huwawa, who they subsequently kill. The gods become angry with the killing of Huwawa, and thus make Enkidu so sick that he dies. Gilgamesh becomes very upset with the death of Enkidu, and his refusal to accept the inevitability of death motivates him to go on a quest for immortality. Many consider this tale to be about just a quest for immortality; however, this quest is where Gilgamesh discovers the inevitable nature of individual human mortality, leading him to reflect on the meaning of his own life. While people may reduce this to a story of the past, we can still witness humanity's desire for immortality in our world today. In the present day, the desire for human immortality is clearly seen through the concept of scientism, which gives science the power to do anything, even make humans immortal.

Scientism supporters gain this optimism through seeing the research done by scientists exploring how to extend the human lifespan; however, carefully uncovering the research can reveal to one the unlikely possibility of human immortality. Scientism presents a distorted view of science that perpetuates humanity's desire for immortality while scientific research, revealing the complexity of the human body, has shown immortality to be far from our reach.

## Immortality in Science

As a subject rooted in factual evidence, science would likely have no place for a concept such as human immortality. Although scientists realize the implausible nature of human immortality, misinterpretation of science in a concept known as scientism highlights humanity's greed for immortality. Popular culture's misinterpretation of science is rooted in periods of history like the Enlightenment. The Enlightenment from the 17<sup>th</sup> to the early 19<sup>th</sup> century saw the concept of science and reason overpowering faith (White, 2018). This concept was emphasized by French philosophers, who even claimed that science could be a substitute for religion (Burnett, 2012). In the 19<sup>th</sup> century, the idea of positivism rose, which believed that all human knowledge would come from science and if not, then this knowledge is a myth. In the 20<sup>th</sup> century, positivism was altered into logical positivism. In this new form of positivism, logic, mathematics, and anything that can be tested experimentally was meaningful and everything outside this realm, such as reli-

gion, was not a true concept. These positivisms giving utmost importance to science were precursors to the modern concept of scientism. Scientism gives science the highest and only power to advance knowledge, dismissing other fields. It focuses highly on humans and gives exaggerated powers to science, introducing the idea that science will be able to make anything possible, even human immortality. This is a foolish goal that science does not support. Although science has continuously worked to lengthen the life span of humans, immortality of the human body is believed to be impossible and thought of as fiction. Science, in contrast to scientism, works to explore and expand our understanding of the world (Burnett, 2012). Therefore, in the world of science there is no room for the concept of human immortality.

In the scientific realm, immortality is often explored at the cellular level. As Hayflick (1989) states in “Antecedents of Cell Aging Research,” one of the first reports of cellular immortality began with an experiment by Alexis Carrel. In this experiment, Carrel extracted chick heart cells and grew them in culture, outside the whole living organism for an indefinite period. This discovery of cellular immortality intrigued scientists and has led them to believe that the mortality of cells is due to the cells being part of a living organism (in vivo) and not because of processes within each individual cell. People believed that if they were able to create the right conditions for cellular immortality in vivo, they could make humans live forever. Establishing these right conditions for cellular immortality in vivo has been referred to as the search for the “fountain of youth,” in reference to a real-life search by Ponce de Leon, a Spanish explorer who sought an actual “fountain of youth” in the early 1500s. The concept of immortal cells was reinforced in the 1950s when cultures of HeLa cells, cervical cancer cells, were shown to infinitely divide (Hayflick, 1989). In fact, HeLa cells, isolated from the cancer cells of Henrietta Lacks in the 1950s, are still used in research labs today for biomedical research (Lyapun, 2019). In 1961, Hayflick and Moorhead introduced the concept of aging at a cellular level by showing the finite number of divisions (known as the “Hayflick limit”) in normal human fibroblasts, thus disproving all cells are immortal in culture (Hayflick, 1989). While Hayflick and Moorhead recognized that some cells were able to divide indefinitely, they also note that these immortal cells could produce a tumor in a living organism. They discussed that normal cells with finite replication could become immortal if they acquired cancer cell-like properties. The cells in our bodies are mortal unless they become cancerous, causing damage in the body, and ultimately leading to death of the organism. Thus, we reach this paradox of cellular immortality in the body becoming the reason for human mortality.

Apart from cancer cells, bacteria and stem cells are other cell types that are thought to be immortal. Bacteria are thought to be immortal because they can replicate until external factors outside the cell lead to its death. However, internal mechanisms of bacteria have been found to contribute to its aging (MG Gomez, 2010). Bacteria divide

through binary fission in which one cell replicates its contents and splits into two cells. Also, bacteria undergo replicative aging during these divisions. When a bacterium replicates its material and divides into two, the center of division incorporates a newly synthesized cell wall while the ends of the cell are the old poles. Therefore, the daughter cell that gets the old pole has a decreased replicative capacity and increased damage which contributes to the daughter cell’s aging (Steiner, 2021). This shows that bacteria are not immortal because they go through the process of aging.

Stem cells are another cell type that are also considered to be immortal. Stem cells are cells that have a self-renewal ability and can turn into multiple cell types; a process known as differentiation (Keith 2004). Stem cells found in adult tissue usually have a limited replicative ability; however, stem cells found in the embryo, known as embryonic stem cells (ESCs), have the ability to replicate indefinitely (Miura, Mattson & Rao 2004). ESCs turn into the multiple different cell types that are needed for mammalian life (Keith, 2004). A comparison between stem cells and cancer cells illustrates an important difference between the two, focused on the stem cell’s ability to differentiate. Once a stem cell turns into another cell type with finite ability to replicate, it loses its ability to self-renew (Miura, Mattson & Rao, 2004). A balance is made between the self-renewing stem cells and differentiating cells that have a finite number of divisions, limiting the potential of stem cells to turn into cancerous cells (Clarke & Fuller, 2006). In addition, there are multiple genes whose protein products prevent unlimited stem cell expansion, blocking the formation of a tumor (Clarke & Fuller, 2006). When this regulation of stem cell renewal and differentiation becomes abnormal, cancerous stem cells can result (Clarke & Fuller, 2006). This concept of immortal cells comes with risks as this abnormal renewal of cells, or cell immortality, is the hallmark of cancerous cells.

Now that we have discussed immortality on a cellular level, we can expand out to immortality on a human level. As previously discussed, immortality at the cellular level results in development of cancerous cells. If cellular immortality cannot be obtained, human immortality becomes impossible to perceive and only exists in the scientism realm. Recently, we see scientism disguised as concepts like transhumanism in which people believe that advanced biotechnological advancements can enhance the human species and may be able to reverse the aging process (Ostberg, 2022). Transhumanists believe that brain chips or computerized systems will be able to extend human consciousness leading to human immortality. While scientists around the world may be discovering the mechanisms of aging (Mc Auley et al., 2017), stimulating tissue rejuvenation (de Keizer, 2017), and using genetic engineering to lengthen human life (Noonan, 2016), they never suggest that human immortality is possible. The complexity of multicellular organisms shows us that while humans may be able to extend their lifespan, human immortality is highly unlikely to occur.



## Lengthening Lifespan in Science

Research into the extension of the human lifespan can be seen most clearly in the biological sciences where scientists attempt to better understand living organisms. The study of genes, cells, plants, animals, bacteria, and disease all work together to explain how we can improve the quality of human life and therefore extend the lifespan of humans. Medications and therapies that prevent disease are in turn extending the human lifespan. Research into the mechanisms of aging, reversing immunosenescence (decline of immune system function with increasing age), tissue rejuvenation and stem cell, and telomerase (the enzyme that functions in extending telomeres) activation may show the potential for lifespan extension, but they also illustrate the unlikely nature of immortality.

### Molecular Mechanisms of Aging

In order to find solutions for extending the human lifespan, scientists have focused on determining the molecular mechanisms of aging in order to better understand how processes including DNA damage, telomere shortening, protein degradation/dysfunction, mitochondrial damage and reactive oxygen species (ROS), longevity genes, and cytokine signaling contribute to disease and death (Mc Auley et al., 2017).

DNA damage contributes to aging as DNA encodes the proteins essential for cellular processes that in turn are essential for human life. When DNA damage is recognized in the cell, the cell activates DNA damage response mechanisms that can repair the damage before cell division occurs and the damage is passed on to the newly divided cell (Yousefzadeh et al., 2021). If the damage is unable to be corrected, the cell can activate mechanisms leading to cell death, so that damage does not accumulate, which can increase its potential to become a cancerous cell. Therefore, mutations in these DNA repair mechanisms that prevent them from functioning correctly are especially harmful. It is through diseases which we see harmful mutations in the DNA repair mechanisms that the correlation of DNA damaging and aging is clearly seen. For example, in the case of the disease Ataxia telangiectasia, a mutation in the *ATM* gene which functions in DNA damage response, leads to aging associated symptoms such as premature bone marrow exhaustion, diabetes, and neurodegeneration (Yousefzadeh et al., 2021). Furthermore, in the disease state of Cockayne syndrome, mutations in genes that affect DNA repair, cause ataxia (loss of muscle control), cataracts, muscle atrophy (decrease in muscle size), and neurodegeneration, which are all symptoms of aging (Yousefzadeh et al., 2021). DNA damage plays an important role in aging since if DNA damage response mechanisms do not function correctly, it can lead to aging associated diseases.

DNA encodes the proteins needed to carry out cellular processes, so if DNA damage contributes to aging, it comes as no surprise that protein dysfunction/degradation can also contribute to aging associated diseases. Protein dysfunction

also affects aging since protein function is important to carry out normal cellular processes that are essentially important for life. If proteins are altered, in addition to decreased functions of the protein, altered proteins can become toxic through their accumulation in the cell (Goto et al., 2001). For example, in the case of the aging associated disease, Alzheimer's, there is accumulation of an altered

form of  $\beta$ -amyloid resulting in problems with brain function.

Mitochondrial damage is another factor that contributes to aging. The mitochondria are components of the cell that supply the cell with energy and have their own mitochondrial genome separate from the nuclear genome (Singh, 2006). When mitochondria and their genome become damaged, they will be unable to perform their functions effectively which can affect cellular processes (Mc Auley et al., 2017). Damaged mitochondria also release reactive oxygen species (ROS) causing more DNA damage in the cell contributing to aging associated diseases. Accumulating mutations in the mitochondrial DNA itself can lead to mitochondrial dysfunction and are associated with aging (Singh, 2006). In a study referenced by (Singh, 2006), when mitochondrial DNA was removed from cells grown in culture, it quickly led to cell senescence in which the cells were unable to divide. This shows that researchers have been studying the importance of the damage to mitochondria and its DNA contributing the aging.

Researchers have also studied genes that encode proteins that have been associated with longevity. It has been studied that FOXO proteins have been shown to play a role in cellular signaling pathways that affect longevity (de Keizer, 2017). FOXO proteins also play a role in longevity in nematodes, flies, and mammals, as they mediate antioxidant response and DNA damage repair and activate genes involved in pro-survival functions. Antioxidant response is important as it helps reduce amount of reactive oxygen species therefore reducing DNA damage. As we saw earlier, DNA damage repair is important since mutations in DNA damage response can contribute to aging associated diseases. In addition to FOXO proteins, another group of proteins, sirtuins, play a role in cell response to stress and cell metabolism, which can also contribute to longevity (Grabowska, Sikora & Bielak-Zmijewska, 2017). This shows there are many complex molecular mechanisms that contribute to aging, and manipulation of these mechanisms may be able to help slow the processes of aging.

### Lifestyle Mechanisms of Aging

In addition to the many molecular mechanisms that play a role in aging, researchers also study lifestyle changes that can increase an individual's lifespan. For example, improved antioxidant activity helps reduce reactive oxygen species which decreases damage of DNA and proteins which in turn can lead to a longer lifespan (Bartke et al., 2004). Furthermore, reduced body temperature and metabolic rate may also contribute to antioxidant activity pro-

moting longevity. In addition, a positive correlation exists when comparing concentration of antioxidants and lifespan of organism (Cutler, 1991). As a result, lifestyle changes, such as eating antioxidant-rich foods, are often advertised to help lengthen lifespan. There has also been evidence suggesting that antioxidants in fruits and vegetables can prevent diseases such as cardiovascular disease, cancer, and neurological diseases (Wootton-Beard & Ryan, 2011). By preventing disease, antioxidants are in turn able to lengthen human lifespan.

Calorie restricted diets are also lifestyle changes that have been associated with contributing to lifespan increase. In one study, individuals on a calorie-restricted diet had a lower body temperature and this lower body temperature, and not changes in body composition, contributed to an anti-aging effect (Soare et al., 2011). It has also been seen that a calorie-restricted diet increased levels of most sirtuins, which shows that sirtuins could potentially play a role in the anti-aging effect (Watroba & Szukiewicz, 2016). From these studies examining the anti-aging mechanisms, we are able to witness scientists' quest to extend human lifespan. In addition, the complexity of all the different factors that influence the aging process shows that science is still far from defeating mortality.

### Reversing Immunosenescence

One of the mechanisms of aging of the human body is the aging of the immune system, also known as immunosenescence. A working immune system is needed for the human body to defend against pathogens it encounters in the environment everyday (Aw, Silva & Palmer, 2007). However, as the human body ages, there is increased risk of infections, cancers, and autoimmune diseases due to a declining immune system function. In addition, immunosenescence results in abnormal pro-inflammatory cytokine release, increasing inflammation in the body, which can damage tissue and increase rate of disease and death (Mc Auley et al., 2017).

There are also different methods to counter immunosenescence, such as manipulating the microbiome inside the human body (Capri et al., 2006). In one study, peripheral blood mononuclear cells from healthy donors were taken out and incubated with DNA from different strains of bacteria (Lammers et al., 2003). Cytokine production was then measured since it is known that cytokines such as IL-10 can control inflammation and help with immune function. From this study, it was seen that DNA from a species of *Bifidobacterium* bacteria increased production of anti-inflammatory cytokines such as IL-10. Another example would be to use genetic engineering methods to deliver anti-inflammatory cytokines, components of the immune system that help reduce inflammation and promote healing. By promoting the number of anti-inflammatory cytokines in the body, it may be able stop or reverse the effects of senescent cells releasing pro-inflammatory cytokines that cause inflammation in the body causing damage to tissues. Another method involves the generation of T-cells in culture

and their subsequent transplantation into the body, creating an immune system that only consists of young immune cells. In another review, they discuss the possibility of targeting different immune regulation signaling pathways to counter immunosenescence (Fulop et al., 2017). For example, inhibition of mTOR, a protein that plays a role in regulation of immune cells, helped improve immune response of elderly patients to the influenza vaccine. Improving immune function could in turn have benefits to increase lifespan, and so by studying immunosenescence, scientists' once again display their curiosity in the possibility of human longevity. However, the immune system is not the only aging system in our bodies. The ability to reverse immunosenescence will not give scientists the power to significantly lengthen human lifespan; therefore, they will not be able to make human immortality possible.

### Tissue Rejuvenations and Stem Cells

Scientists are studying stem cells and tissue rejuvenation as a potential therapy to reverse aging and prevent disease. In order for us to understand tissue rejuvenation, it becomes important to first understand cell senescence. Senescence of a cell refers to the inability of the cell to divide (de Keizer, 2017). Senescent cells are able to secrete proteins that can disturb the function of other nearby cells. As a result, senescent cells can play a role in aging and disease. In order to further examine the effect of senescent cells on aging, a group of researchers cleared senescent cells in mice (Baker et al., 2011). To do this, they used a marker that is specifically expressed in senescent cells to detect senescent cells in the mice. They then designed a method for the elimination of cells positive for the senescent marker with drug treatment. Their results concluded that drug-induced removal of senescent cells increased the lifespan in mice. Further analysis in this study was done by suggesting tissue rejuvenation upon clearance of senescent cells (de Keizer, 2017).

In addition to clearing senescent cells, tissue rejuvenation also becomes important as senescent cells release proteins that negatively influence stem cell differentiation blocking the potential for renewal of damaged cells (de Keizer, 2017). Therefore, improving stem cell function through tissue rejuvenation after removal of senescent cells may potentially play a role in the aging process. For this tissue rejuvenation stimulation, targeting FOXO protein signaling may be beneficial (de Keizer, 2017). While tissue rejuvenation after senescent cell clearance may not lead to human immortality, it can increase the period of time an individual lives without disease (de Keizer, 2017). By preventing disease for a longer time, an individual has a better chance to live longer.

Stem cell research has also been used in the field of organ transplantation where a population of stem cells are taken from a patient, differentiated into cells of a specific organ, and then placed back into the body the patient (Ratajczak et al., 2014). This procedure would be done to replace damaged organs, such as the brain, heart, or liver. By replacing

damaged organs that are essential for life, we are in turn able to expand the lifespan of humans, but the possibility of human immortality is still far from reality. Although scientists, and society, continue to chase after the concept of living longer, if not immortal lives, scientific research shows scientists and society that the complexity of our human bodies is a major obstacle when it comes to making human life immortal.

### Telomerase Activation

Another target of longevity research is the study of telomeres and telomerase. Telomeres are DNA-protein structures located at the end of a chromosome that shorten every time the cell divides because of a phenomenon referred to as the End Replication Problem (Ungar et al., 2009). In DNA replication, the ends of the chromosome fail to replicate due to complications that arise from their linear nature, the directionality of replication, and the removal of RNA primers that were used in the initiation of the process. Once the telomeres become too short, the DNA is unable to be replicated without losing important genomic DNA; thus, the cell is unable to divide and enters a state of senescence or cell death. This is part of what contributes to the finite number of cell divisions known as the Hayflick limit.

To counteract the shortening of telomeres in cells, such as skin cells, that must continue to actively divide in the body, our cells have an enzyme known as telomerase that is able to lengthen the telomere sequence. Since many studies have shown that shorter telomeres can result in multiple aging-associated diseases and overall death (Boccardi & Paolisso, 2014), researchers have hypothesized that reactivation of telomerase could reverse cell senescence or death, which can contribute to increasing human lifespan (Boccardi & Paolisso, 2014). However, as mentioned in our discussion regarding the Hayflick limit, cellular immortality often coincides with the acquisition of cancer-like properties. One of these cancer-like properties includes uncontrolled telomerase activation, again connecting the search for cellular immortality with a reason for our mortality.

Research into ways to activate telomerase in cells while not increasing cancer risk in these cells has been conducted. For example, researchers examined the effect of telomerase-based gene therapy in one and two-year-old mice (Bernardes de Jesus et al., 2012). In the experiment, they expressed part of the telomerase enzyme that functions in telomere length regulation, known as TERT, in the mice using a viral vector. Their results showed that the TERT expression had beneficial effects on the health of the mice and reduced ageing associated diseases such as osteoporosis and insulin sensitivity. Furthermore, the median lifespan of the mice increased by 24% for the one-year-old mice and 13% for the two-year-old mice without increasing cancer incidence as compared to the control group not expressed with TERT. While this study suggests potential for human immortality, this therapy has not been tested on humans, and so any off-target effects are unknown. Furthermore, as discussed previously, there are so many other fac-

tors that contribute to aging and just focusing on telomerase activation may not be enough to extend human lifespan to a significant extent. While scientism uses this research to boost optimism regarding the possibility of immortality, science itself has shown that human immortality is highly unlikely.

### Conclusion

Scientism often misinterprets scientists' quest to lengthen human lifespan, which includes research into mechanisms of aging, reversing immunosenescence, tissue rejuvenation and stem cell research, and telomerase reactivation. While these research areas can lengthen human lifespan or delay the onset of aging associated diseases, it is highly unlikely that they will make humans immortal. This was most clearly seen when we explored the concept of cellular immortality, as immortal cells inherit cancer-like properties, leading to this idea of the consequence of cellular immortality being the reason for human mortality. Furthermore, though we are able to help our organs function more effectively, and therefore increase our lifespan, the intriguing complexity of our bodies make human immortality far from possible.

Similar to how scientific research is able to challenge the ideas presented by scientism, in the *Epic of Gilgamesh*, Gilgamesh's journey to dive deeper into his quest for immortality, reveals to him the pointless nature of his desires. In one version of the story, when Gilgamesh searches for immortality, he first meets Siduri, a tavern-keeper, who tells him that mortality is inevitable for humans and that he should focus on making the best of his life instead of searching for immortality (Abusch, 2001). In another version, Gilgamesh finds a plant of rejuvenation that can restore one's youth, however he loses this plant to a snake on his way back to Uruk (Harvard Museum of the Ancient Near East, 2017). Society often sees the end of the *Epic of Gilgamesh* when Gilgamesh loses the plant of rejuvenation. The minds of the audience may become frustrated with Gilgamesh's foolishness to leave the plant out in the open while he went to bathe in the river. However, that is not the end. As Gilgamesh travels back to Uruk after losing the plant of rejuvenation, he is forever changed from his quest to find immortality. From the violent king he once was, he becomes a good king and devotes his life to serving his people. After finding that immortality is impossible, he decides to make the most out of his mortal life. Gilgamesh may not have made this transformation if he were to become immortal, and the realization of death gave him his meaning of life. From the perspective of literature, it is revealed that our lives are made meaningful knowing there is an end to it. Just as fascinating, from the scientific perspective, is to see that the human body's complexity, a characteristic that separates the human race from all the other species in the world, is one of the major reasons that human immortality cannot exist. Science and literature, two subjects often thought of as poles apart, may take different paths to make sense of human immortality, but both conclude the futile nature of the search for immortality.

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# Rewards and Accolades

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**Abstract:** "Rewards & Accolades" is a creative nonfiction piece on the value of mothering, or parenting. It is from a small self-designed and published chapbook, "Transcendence: from Truth to Power to Beauty," containing two poems and four creative non-fiction pieces on finding truth and power as a woman, with an impact piece on overcoming the legacy of childhood rape. I started to write around the age of 12, when we start to define ourselves as individuals. My writing is my journey to courageously define myself as someone other than the violence I experienced as a child and echoes my journey to empower myself as a woman and mother. In writing, I both find and create myself. My writing is personal, intimate, and vulnerable. It is the place where I excavate my voice, and discover the truth, power, and beauty of transcendence.

**M**y toddler is cranky and wants to reconnect with me after spending the night with his father.

So, we stay home and keep the day simple. We do laundry, sweep and mop floors, cuddle and have "mee-mees" (breastfeeding), read books, take baths and naps, and if we can get it in, we make beans or soup.

Nobody gets any kind of "30 Under 30" or "40 Under 40" awards for *this* sort of work. Silent. Unnoticed. Behind the scenes. The rewards must be inherently intrinsic. Or so *they* say. The pay is love. And the hours are atrocious. But what do *they* know. About the everyday, one by one, seconds, hours, days, that come together to make or break another human being.

I wonder, who gets to, or who got to, determine how the thousands of minutes, hours, and days add up. To nothing. Or what *the worth* of these thousands of *seemingly* insignificant, inconsequential moments amount to. *They* say or imply that love is a pay that can't be quantified or given a dollar value. Yet, caretaking is a role, just like all the rest of them. Doctor, lawyer, politician. Yes, I assert, the job is in that category. More so. Above. The most essential of essential roles to play in any society.

So, again, who gets to, or who got to, decide that moving digits across the screen to represent an imaginary value, great, but meaningless, was, or is, more valuable than the *real*, tangible work of *mothering*, of parenting. I wonder. Which is the greater contribution to society? Think about it. And be honest.

Perhaps, it had, or has, something to do with who was, and who is, in power and who has and is deciding, what is most valuable to our society. Perhaps, it has something to do with who has traditionally done this work. And the value,

or lack of, that is placed on that person. That particular gender of a person.

Women. Women's work. The *work* behind the *work*. That gets unseen. *The other shift*. The work that is done, after the so-called *real* work is done. Ha! As if, *this* work didn't matter.

I wonder, what would happen to the world, should that most essential of essential roles, just stop? Behind the scenes. Unnoticed. Yet vital. Would then the unseen be seen? The missing of it would *finally* be noticed. The world would not run. Not so smoothly, anyway.

There once was a women's strike in Iceland. One day, October 24, 1975, to be exact, thousands of women walked off the job. The importance of their work was noticed. Only by the lack of it. Only a day. And all was chaos. Imagine that. The unseen work seen. From that day on, things have been different there. Not perfect by any means, but much closer to the lines of equality.

Imagine that... Every woman in the world. Every mother. Or person that takes on the mothering role. Realized their value. Their worth. Their essential contribution to society. I wonder. What would happen? One day, if all of us. Nearly 4 billion of us. 49.58% of the world population. (Of course, there are less of us than there should be. Is it femicide or genocide? But we'll leave that topic for another page.)

Again, *they* yoke us with a term called love. But I call it subjugation. Exploitation, of the most extreme. You have the role "women," and your work is called *mothering*, or caretaking. So, your value is \$0, and your pay is love. That is what *they* say. I say, don't believe that lie. Your *work* is *real*, tangible. It has a value, magnitudes greater than \$0. Think about that.

## 2023 ILLUMINATE AUTHORS & CONTRIBUTORS

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**David Guariglia** is a fourth-year student enrolled in Dominican University's 5-year occupational therapy program where he currently serves as the Vice President of SOTA. David is a graduate of Dominican's Honors College graduating in 3 years magna cum laude as a member of Phi Gamma Mu. Serving as a teacher's assistant for Research Methodology sparked David's interest in academic research. While majoring in social science, David simultaneously completed his pre-medical studies. He remains engaged within healthcare with the long-term goal of bringing accessible and affordable health care to the underserved as part of his Catholic University's mission statement towards a more just and human world.

**Sydney Grandison** is a student at Dominican University New York. Currently pursuing a Bachelor's degree in biology with a minor in psychology. She participates in her school's honors club/program and enjoys volunteering as an EMT. In addition to being a member of TriBeta, she tutors students in mathematics and science. She hopes to pursue a career in medical research and is passionate about helping others. She plans to attend graduate school to continue her studies and eventually earn a Ph.D.

**Khouloua Jaber** is a recent graduate from Cedar Crest College earning dual B.S. degrees in Genetic Engineering and Mathematics. She is currently attending Cornell University as a Ph.D. student in their Genetics, Genomics and Development program. In addition to her honors research project, Khouloua has also conducted research investigating molecular mechanisms conferring triclosan resistance in gram-negative microbes since her first year at Cedar Crest College. As a growing researcher, Khouloua also had the opportunity to participate in an intensive research program, the MBG-REU at Cornell University. Her research experience fostered growth as a scientist where she took advantage of several opportunities to share her research at local, regional, and national conferences. When she was not in class or conducting research, Khouloua was involved in the community at Cedar Crest, where she served on several executive boards including her roles as the president of Math Club, vice-president of the Beta Beta Beta honors society, and treasurer of Science Club.

**Logan Lankford** is a rising sophomore at Salisbury University majoring in exercise science and pursuing a minor in disability studies. She is a proud member of the Clarke Honors College and an Honors Ambassador. She currently works as an orientation leader for incoming freshmen, a tour guide during the year, and was recently hired to start working as a writing consultant at the University Writing Center. She's a member of Salisbury's student UnitedWay and volunteers with the Chesapeake Housing mission. After graduation, she plans on attending Towson University to pursue a master's in pediatric occupational therapy.

**Angelina Lambros** is an undergraduate student at Macaulay Honors College at CUNY Brooklyn College. She is majoring in History and minoring in Human Resources Development and Management as well as Creative Writing. She has interned in the archives. She is a member of the Writer's Circle at Brooklyn College and Scribe: Creative Writing Club at Macaulay Honors College, and has had her work featured in their publications. Angelina is an artist, singer, writer, and poet. She is the author of the poetry collection, *Imagination and a World of Dreams*. She enjoys drawing and sharing her artwork on Instagram, Pinterest, and her store on Redbubble.

**Cloe Loosz** is a junior Creative Writing Major minoring in both Public Relations and Gender Studies at Point Park University in Pittsburgh, Pennsylvania. Cloe is an active member of the Honors College and serves as the Vice President of the Point Park Writer's Club. Thus far in her writing career, she has interned for longtime LGBTQ+ activist, journalist, and co-producer of the "Queerly Defiant" series on Out-FM (Pacifica/WBAI, 99.5 FM), Bob Lederer, by helping him collect research for his upcoming book and periodically cohosting the radio show. She has also interned as a community communications fellow for Regen Network where she applied her strong communication, writing, and social media skills to promote an innovative blockchain-based platform revolutionizing the Carbon Credit and Ecocredit Market. Cloe's passion for writing is intertwined with her desire to make a difference. She lives by the words of James Baldwin, "You write in order to change the world...if you alter, even by a millimeter, the way people look at reality, then you can change it."

**Rithika Padyala**, a pre-medical student at Thomas Jefferson University, is a dynamic campus leader and scholar. As the founder and editor-in-chief of the inaugural Philadelphia University's 1884: Honors Academic Journal, she champions academic excellence within her Honors Community. Beyond her academic commitments, Rithika serves as a Resident

Assistant, holds key positions in student organizations like the South Asian Student Association and TEDxJeffersonU, and is actively engaged in molecular biology research at Sidney Kimmel Medical School, focusing on neurotoxicity. Her advocacy work centers on substance abuse issues among adolescents. In her rare moments of leisure, she finds solace in the pages of novels and a cup of green tea. Post-graduation, Rithika aspires to attend medical school and pursue a career in cardiac surgery, driven by her unwavering dedication to the field of medicine.

**Rita Rin** is a senior at Monroe College, majoring in Computer Networks and Cybersecurity. Within the Monroe College community, she actively participates in the Monroe Honors Program and holds the position of an editorial board member for the honors newsletter, *The Experience*. Additionally, she serves as the president of the school IT club. Apart from her academic pursuits, she is deeply engaged in independent studies and exploring the potential for creating secure and robust software. With that, she sees this as the perfect opportunity to advance her studies in the field of software systems, with a goal of making a contribution to the dynamic field of cybersecurity and system architecture by seeking solutions to its evolving challenges.

**Allison Rhea** is a student at Frederick Community College, where she is pursuing her Associate's in both STEM and Psychology. Allison pursues her passions for science and psychology outside of the classroom, serving as the president of the Psychology Club and as a summer intern in the Chemistry department. She is also an active member of the Honors College, serving both as an Honors Peer Mentor and an officer in the Honors Student Association. When not at school or working her job as a physical therapy technician, she enjoys baking, playing volleyball, and learning new trivia facts. After graduating from Frederick Community College, she plans to transfer to a four year university to get her Bachelor's and eventually pursue a career in the medical field.

**Demir Schroyer** is a senior majoring in both History and Religion at Thiel College. He has remained on the Dean's List, is a member of the Dietrich Honor Institute, the Theta Alpha Kappa National Society for Religious Study and Theology, and the Phi Alpha Theta historical honor society. Demir is also an Eagle Scout, maintains a healthy work ethic, and is a big brother to his five brothers and two sisters. In his spare time, he enjoys playing guitar, listening to music, drawing, reading, and learning more about history and theology. After graduating from Thiel College, Demir plans to attend graduate school and continue pursuing his goal of earning his doctorial in both History and Religion in order to obtain a professorship position.

**Ahimsa Shakti** is a 42-year-old single mother with a 19-year-old, a 15-year-old, and a 3-year-old. She recently graduated with her associate degree in general studies from the Community College of Allegheny County. At CCAC she created a self-designed and self-published chapbook: "Transcendence: from Truth to Power to Beauty" where she blends elements of poetry and prose to share an intimate piece about overcoming the legacy of childhood rape. She is continuing her education at Carlow University and will be working on her BFA, then MFA in Creative Writing. She is using her time at Carlow to develop herself as a writer and literary artist. She aspires to write a memoir about her extraordinary life and healing journey from extensive childhood neglect and trauma.

**Grace Shartle** is a rising junior at Loyola University Maryland double majoring in International Business and Sustainability Management in the Sellinger Scholars Business Honors program. She is on the executive board for the Scholars Society serving as a class representative. After completing the World Trade Center Institute's Albrecht Fellowship with the cohort of 2023, she will be spending the Fall abroad in Rome, Italy interning for the International Network for Small and Medium Sized Enterprises (INSME).

**Rebecca Soriano** recently transferred from Monroe Community College (MCC) to Rochester Institute of Technology as a hybrid Studio Arts and Art History major. While attending MCC she developed a passion for academic research writing and presented her research on art history and literature at several conferences like the Community College Humanities Association in 2022 while also earning distinctions at the Beacon Conference and MCC's Scholars' Day in 2023. In between coursework Rebecca works full-time as an artist and actively exhibits her work in upstate New York. She is currently in her senior year of undergraduate studies and plans to pursue a master's in art history with a special interest in the Dutch Golden Age and Renaissance art.

**Vanessa Stolstajner** is a rising junior at Loyola University Maryland where she is pursuing a BBA in Marketing and



Information Systems and Data Analytics. Vanessa is a student in the Sellinger Scholars Program at Loyola, and just completed an internship with Nash Performance Marketing, a startup marketing agency in Baltimore, MD. This fall she will be studying abroad in Rome, Italy.

**Khushali Vyas** graduated from Cedar Crest College in December 2022 as an honors student earning a bachelor's degree in Genetic Engineering and a minor in chemistry. At Cedar Crest College, she worked on independent research in the field of cancer biology. She also had the opportunity to be a lab assistant for freshman biology labs. In addition, she was a Writing Consultant at the Writing Center at Cedar Crest. She is currently a 1st year PhD student in the Biochemistry, Structural, and Molecular Biology program at Thomas Jefferson University.

**Ezra Wingard** is a recent graduate of the Honors Program at SUNY Oswego with a B.A. in Cognitive Science and Psychology. He is a member of the Psi Chi honors society in Psychology and the Pi Delta Phi honors society in French. In his senior year, he was awarded two awards: the Excellence in French Award, and the Distinguished Cognitive Science Senior Award. He plans to attend graduate school in 2024 to pursue his career goal in becoming a research scientist and professor in Psychology or Cognitive Science with a focus on implementing diversity, equity, and inclusion practices within his research.

## 2023 ILLUMINATE EDITORIAL BOARD

**Zachary Aidala, Ph.D.** is an Associate Professor of Psychology at Bloomfield College, and has served as Honors Program Director since 2018. He earned a B.S. in Psychobiology from Binghamton University (SUNY), an M.A. in Psychology from Hunter College (CUNY), and a Ph.D. in Biopsychology and Behavioral Neuroscience from The Graduate Center (CUNY). His area of expertise is in neuroethology and sensory ecology. His research focuses on the coevolution of host-parasite interactions between avian brood parasites and their hosts, specifically the visual sensory processes mediating parasitic egg ejection in hosts of obligate brood parasites. In addition to coordinating Bloomfield College's Honors Program, he regularly teaches Statistics, Research Methods, Biopsychology, Sensation and Perception, Drugs and Behavior, and Animal Behavior. Dr. Aidala has recently served as Faculty Representative and now holds the position of President-Elect on the NRHC Executive Board.

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**Autumn Barszczowski** is a public relations graduate from Point Park University. She is currently the Personnel & Finance Analyst at the City of Pittsburgh's Department of Permits, Licenses, and Inspections. During her time as a student, she filled multiple roles within her honors program and Honors Student Organization including serving as a mentor, board member, and eventually as President. She was also an active participant in the national and regional honors councils, where she acted as a moderator and presenter at conferences. She even served for one year as Student Representative for NRHC and helped to plan the 2018 conference in Providence, Rhode Island. She loves having the opportunity to continue playing an active role in honors education and seeing the work that students are producing.

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**Matt Baran** is the Assistant Director of the Muriel A. Howard Honors Program at Buffalo State University. He teaches the introductory seminar course to all first-year Honors students each fall, plans weekly Honors events, and coordinates leadership opportunities for students among other tasks related to building a robust Honors community. In Fall 2022, he launched a new peer mentoring program matching upper-level Honors students with first-year Honors students to aide in their transition to college. Matt earned a B.S. in Architecture at the University of Maryland, College Park (2017), and an M.A. in Higher Education & Student Affairs at The Ohio State University (2019).

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**Chris Brittain** is the Operations Manager of the Workforce and Professional Education Department at Ocean County College. He graduated from Lock Haven University of Pennsylvania in 2010 with a Bachelor's degree in English and Communication Media and in 2012 with a Master's degree in Liberal Arts with a concentration in Higher Education Administration. He has been working with Honors Programs in the Northeast Region for fourteen years, and served as the NRHC Web Coordinator from 2016-2019 and NRHC President and Conference Chair in 2021. In addition to his involvement with the Northeast Regional Honors Council, he spends much of his time pursuing interests in photography and event-planning. Chris's email address is [cbrittainnrhc@gmail.com](mailto:cbrittainnrhc@gmail.com).

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**AnnMarie DelliPizzi** is a Professor of Biology, the Coordinator of the Health Sciences Program, the Health Professions Advisor and the Director of the Honors Program at Dominican University New York, where she has worked for the past 19 years. She also holds adjunct positions in the Department of Pharmacology at New York Medical College and the Department of Nursing at Lehman College, where she teaches pharmacology to both undergraduate and graduate nursing students. From 2019-2021, she served as the Faculty Representative on the NRHC Executive Board.

Dr. DelliPizzi earned a BS in Biology from Manhattan College and an MS and PhD in Pharmacology from New York Medical College. Her doctoral research focused on the role of constrictor eicosanoids in the implementation of calcium-dependent basal tone in models of angiotensin II-dependent hypertension. She has co-authored two anatomy and physiology lab manuals and has published many peer-reviewed articles in journals such as the American Journal of Physiology, Journal of Pharmacology and Experimental Therapeutics and Hypertension.

When she's not in the lab or in a classroom with her students, Dr. DelliPizzi loves traveling the world and exploring new places. She also enjoys baking delicious treats with her daughter and dabbles in cake decorating.

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**Kyle Dineen** is biotechnology clinical researcher specialized in the application of orthobiologics to treat musculoskeletal degenerative diseases. His research focuses on affecting the biochemical pathways of injured connective tissues through the use of blood-

based molecules and advanced mesenchymal stem cellular procedures. Kyle is a four year veteran editor for Illuminate and a 1st edition author for the journal. He has presented research at the 2019 Northeast Regional Honors Conference and the 2018 Maryland Collegiate Honors Conference.

Kyle has extensive experience in teaching and research within higher education. He worked as an assistant faculty instructor and teaching fellow within the University of Maryland, College Park Department of Biological Sciences, as well as a course designer and guest orthopaedic lecturer within the Department of Kinesiology. A designer of curriculums and educational training modalities, he is passionate about improving training and educational pipelines for students to ensure success both academically and professionally. Kyle's range of interdisciplinary interests is also reflected in his work experience in business, state government, and policy. He worked as Executive Chair of the The Maryland Higher Education Commission's Student Advisory Council and within the University System of Maryland on government relations and strategic policy advising.

Kyle previously attended Frederick Community College where he served as SGA President, authored the FCC Honors College handbook, and was the recipient of the John and Ethel Portz Award for honors research. He was also awarded the Coca-Cola New Century Maryland Transfer Scholarship, and was selected to the Phi Theta Kappa All-Maryland 1st Academic Team. He then graduated from the University of Maryland, College Park with Latin Honors on a full-tuition scholarship

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**Helen Fallon**, professor emeritus and former director of Point Park's Honors Program, has taught and served as an administrator at Point Park University since 1986. She was chair of the Department of Journalism and Mass Communication from 1999 to 2008 and was the acting dean of the School of Communication from 2008 to 2009. She then became director of the Honors Program until 2020.

Fallon remains an active journalist, working as a copy editor for the Pittsburgh Post-Gazette, where she's been gathering real-world materials for her classes since 1990. Earlier in her career, Fallon worked as a reporter, copy editor and editor for several papers in the Pittsburgh area for six years and did public relations for a university and a community hospital for five years.

She is active in journalism professional organizations, serving currently as the president of the Press Club of Western Pennsylvania, and on the board of the Pennsylvania NewsMedia Foundation. Fallon has been a member, officer and board member of the Women's Press Club of Pittsburgh as well.

Service has been an important to her, as it is to all who love honors, and Fallon became a member of the Jefferson Regional Foundation's board. The grantmaking foundation is dedicated to investing in the health and vitality of the communities served by Jefferson Hospital in the South Hills and lower Mon Valley of Pittsburgh.

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**Irina V. Ellison**, Ph.D. is the Associate Dean of the School of Health and Natural Sciences and Co-Director of the university-wide Global Honors Program at Mercy University. At Mercy, she also serves in a variety of leadership roles on several federal grants and various university-wide committees. Her research focuses on strategies to improve equity, inclusion and student success in the health professions and in honors. Dr. Ellison is actively involved in the Northeast Regional Honors Council where she served as President from 2020-2021 and currently co-chairs the Diversity Equity Inclusion Justice (DEIJ) Committee. At the national level, Dr. Ellison co-chairs the National Collegiate Honors Council (NCHC) committee on Science, Mathematics and Sustainability.

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**Morgan Harrington** is a senior honors student earning a bachelor's degree in psychology as well as a bachelor's degree in criminal justice at Buffalo State University. She is not only a part of the Muriel A. Howard Honors program at her college, but she also is an Honors Leader, helping to welcome in incoming Honors students and assist with their transition into college. Morgan is incredibly involved within the Psychology department as a member of the Psychology Club and actively participating in research within the McKay Laboratory and the Relationship and Social Development Laboratory. Outside of school labs Morgan also assists with studies at the Center for Integrated Healthcare Laboratory at the Veteran Affairs Hospital and ran an independent study utilizing data she had access to at her internship with Peaceprints of WNY. Her love for research takes up most of her time but she makes room to be the Philanthropy Chair and Treasurer for her sorority: Sigma Delta Tau – the Gamma Zeta chapter. Outside of also working two jobs, Morgan enjoys reading and working out. She is hopeful of making the Dean's List once again for her last semester at Buffalo State and is currently applying to PhD programs for clinical psychology.

**Gwen Kay** is the Director of the Honors Program at SUNY Oswego State University. Dr. Kay has a B.A. in Biology and History from Bowdoin College (1991) and a Ph.D. in History of Medicine and Science from Yale University (1997). After three years as visiting assistant professor in Tennessee, Chicago and Ohio, she arrived at SUNY Oswego in 2000. She teaches social history of the United States, as well as history of medicine.

Dr. Kay has been involved in faculty governance, both on her campus, and representing her campus, including serving as president of the SUNY University Faculty Senate. In her community, she serves on several boards. In the profession, she is treasurer of the History of Science Society, and a Faculty Representative to the NRHC.

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**Kat MacDonald** is the Director of the Honors Program and a faculty member in the English Department at Monroe College. She holds a Master's degree in Mass Media and Communication from Fordham University and bachelor's degrees in English, Communication Arts, and Women's Studies from the College of New Rochelle. Before coming to Monroe College as a full-time faculty member (she was an adjunct first) in 2010, she served on the editorial team of *Reader's Digest*. Kat currently serves in her second term as the Executive Secretary of the Northeast Regional Honors Council (NRHC). Kat also completed a four-year stint on the Executive Board of NRHC (she rotated through Vice President, President-Elect, President, and Immediate Past President). Kat is also a member of the NCHC Publication Board.

Serving the students in her college's Honors Program has been most rewarding. She believes NRHC gives students the opportunity to present their research, collaborate with their peers, and become exposed to new ideas and places. She has had the pleasure of mentoring the Student Reps since 2013, when her first student served in Niagara Falls. Subsequently, two students from her institution served at Cambridge in 2015. Her students also served as Student Representative in Pittsburgh in 2017, Baltimore in 2019, and Philadelphia in 2022. One of her students will serve in at the 2024 conference in Albany. She is also proud of her students who have been published in *Illuminate* in 2019, 2021, and 2022. Watching the students grow and learn is extremely satisfying.

Kat has been proud to serve as the Editor-in-Chief of *Illuminate* since its inception in 2019.

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**Hans Mach** is an international student from Germany pursuing a double major in Education and Psychology at the Community College of Allegheny County (CCAC). He received a Bachelor of Science in Nutritional Sciences and plans to transfer to a four-year institution next year to do his master's degree in counseling psychology with the ultimate goal of combining his passion for nutrition, exercise science, and mental health. Hans is the president of the World Cultures Club at CCAC and got elected to be the Honors Leadership Assistant at his campus, where he supports his fellow honor students. He will also serve as one of the NRHC student representatives at next year's conference in Albany and is currently planning the student events and handling the Instagram Account for NRHC. In his spare time, Hans gives art lessons to children in his community, as he enjoys drawing and painting, helping them prepare their portfolios for high school applications.

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**Jessica McCort**, Ph.D., is an associate professor in the Literature, Culture, and Society Department at Point Park University, as well as the Director of the Honors Program. She earned her Ph.D. in English and American literature from Washington University in St. Louis, specializing in American literature and women's writing. McCort's scholarship focuses largely on the appropriation of children's literature, particularly Grimm's and Andersen's fairy tales and Lewis Carroll's Alice books, by American women writers. She was also the editor of a compilation of essays concerning the intersection of the horror genre and children's and young adult literature and culture, titled *Reading in the Dark: Horror in Children's Literature and Culture*. Her favorite courses to teach are Honors College Composition, *Haunted America*, and *Feminist Fairy Tales*.

From her first trip to the NRHC Conference in Philadelphia, Dr. McCort recognized what an important formative experience participating in NRHC events is for both faculty and students. Since that time, she has become increasingly involved in the NRHC, and she is very excited to work with the other officers in NRHC leadership this year as the organization's Vice President.

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**Marcella McCoy-Deh**, PhD is the Director of the Philadelphia University Honors Institute at Thomas Jefferson University and Associate Professor of American Studies. She has served in this role for the past 21 years. Her undergraduate degree in Broadcast Journalism was earned as an honors program scholar at Morgan State University. She earned both Master of Arts and Doctorate of Philosophy degrees at Bowling Green State University in Mass Communication Research and American Culture Studies, respec-

tively. Dr. McCoy-Deh is a Fulbright Scholar and serves as campus Fulbright Program Advisor. Over the years, she has served on the Northeast Regional Honors Council (NRHC) as Faculty Representative, National Collegiate Honors Council Site Visitor, and currently serves on the NRHC Executive Board as President.

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**Amy McMillan** is the Director of the Muriel A. Howard Honors Program at Buffalo State University. Dr. McMillan has a B.S. in Zoology from North Dakota State University (1988) and an M.A. (1991) and Ph.D. (1998) from the University of Kansas, where she studied animal behavior and population genetics. After teaching at the University of Southern Maine and completing a postdoc at the U.S. EPA in Narragansett, RI and Cincinnati, OH, she started at Buffalo State in 2003 in the Biology Department. Here she taught Genetics, Population Genetics, and Evolution and conducted research that focused on species of conservation concern including the Hellbender Salamander and Common Loon. At Buffalo State, Dr. McMillan has received awards for Excellence in Advisement, Undergraduate Research Mentorship, Equity and Campus Diversity, and Service. She served on the College Senate for six years and as chair of the Senate for two years. She now is a Faculty Representative for NRHC.

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**Alyssa Politi** is a junior honors student majoring in media studies: journalism and minoring in business administration at Mercy University. She serves as the Managing Editor of her University's newspaper, The Impact, the Student Government's Director of Communications, the Global Honors Program Assistant, and an Honors Student Council Officer. She was awarded by Mercy University with the Outstanding Junior Award, multiple Quill Awards that honored her outstanding achievements in journalism, radio, and acting, and was also published in Mercy's literary journal, Red Hyacinth. When not using her journalism skills for communicative leadership, Alyssa serves as Mercy's CEO Club Marketing Director to utilize her marketing skills from business administration. In her free time, Alyssa can be found taking up modeling, acting, photography, and micro-influencing on social media. Alyssa's time on the Illuminate Editorial Board has allowed her to strengthen other writers' work as well as her own writing. She aspires to continue making the Dean's List as she graduates from Mercy University in 2024 and attend graduate school for journalism.

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**Tanya Radford** is Assistant Professor of English and Co-Director of Honors at Dominican University, where she teaches beginning and advanced writing courses, early American literature, Enlightenment literature, and children's and young adult literature. She completed her BA and MA degrees at the University of Utah and then earned a PhD in English from the City University of New York's Graduate Center. Her PhD research focused on affective response in 18th Century literature, and her current research continues that work by considering the cognitive and social benefits of leisure reading and the representation of reading, books, and libraries in works for young readers.

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**Michael Tasto**, Ph.D., is a Professor of Economics and Chair of the Department of Finance and Economics at Southern New Hampshire University. His primary research fields of interest is urban and regional economics and has been an Excellence in Teaching Nominee at SNHU in 2009 and 2010.

He received his B.S. in Economics from St. John's University in 2001, his M.A in Economics in 2006 and his Ph.D. in Economics in 2007 from Georgia State University. He has given numerous presentations at academic conferences, published peer-reviewed journal articles, and co-edited 3 books on entrepreneurship.

He currently serves as Treasurer for the SNHU Northeast Regional Honors Council.





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