

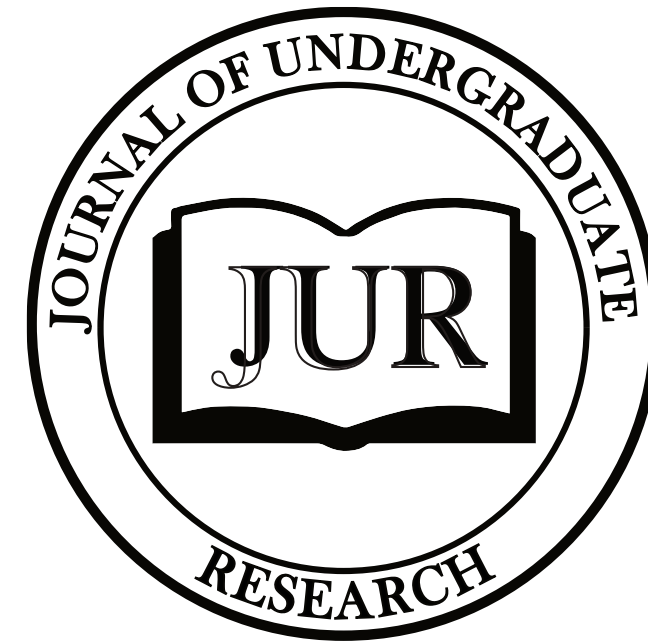


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The Journal of Undergraduate Research (JUR) is dedicated to providing the student body with intellectual perspectives from various academic disciplines. JUR serves as a forum for the presentation of original research, thereby encouraging the pursuit of significant scholarly endeavors.

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Letter from the Editors

To all of our readers, faculty, and staff, we would like to express our utmost gratitude for providing us the opportunity to showcase the exceptional work done by undergraduate students here at the University of Rochester. It has truly been an honor to serve as Editors-in-Chief of the Journal of Undergraduate Research for the past year. Although the COVID-19 pandemic has certainly brought unprecedented challenges upon our community, we have found that is only more reason to celebrate the academic successes that have persevered in the face of adversity. We have always been impressed by the passion and drive of the research community here at the University of Rochester, but the resilience of our fellow undergraduate students over the course of the past year has never been so evident. As we have adjusted to an ever-changing sense of normalcy, the Rochester community has forged on with grace, continuing to explore uncharted territory in the name of innovation.

In our Spring 2021 issue, we highlight four articles and several abstracts from our institution's research exposition that truly capture the interdisciplinary realm of research being conducted at Rochester. From Dominique Dorvil's examination of the intersection between race and beauty in social media to Lia Rodriguez's investigation on the pathology of Alzheimer's disease, we believe that the research in this issue serves as a testament to the potential of undergraduate scholarly pursuits to chip away at the diverse and unique problems facing our world. We hope that the work showcased in the coming pages serves as a source of inspiration for our readers to continue to pursue their academic passions in the face of unexpected challenges.

We extend our sincerest gratitude once again to all of our authors, faculty, and editorial team that have made this publication possible. We could not do this without all of your contributions to and unwavering support for JUR's exploration of the research done at our institution. To our readers, we hope you enjoy and draw inspiration from the snapshot of our academic community displayed in this issue.

Sincerely,

Shelby Sabourin & John Roy Lozada

Editors-in-Chief



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Professor Interview

Llerena Searle, PhD

Associate Professor

Director of Undergraduate Studies

Department of Anthropology

University of Rochester



JUR: Could you tell us about your education and professional background and how you became involved in research?

Searle: My undergraduate degree is an art history actually. Then I started a PhD program in urban geography but found it a little too statistical and was interested more in qualitative research. So, I joined an anthropology PhD program. I've always had really wide-ranging interests and thus my work has always been a little bit interdisciplinary, but I've found both the theoretical frameworks and the methods of anthropology fit the way that I want to do research the best. So I finished my PhD and now I'm teaching anthropology here at the U of R.

JUR: How did you get involved in research during undergrad?

Searle: I'm a very visual thinker and visual person, so it was fairly easy to write somewhat original term papers based on visual data that professors were providing in my art history courses. I remember I took a seminar where we had to write about Giotto's frescoes at the Scrovegni Chapel outside of Padua in Northern Italy. I got really into it, and I felt like I was coming up with my own contributions, however small, to something that many people had studied before. I could go to the library, look at representations and think about them on my own and try to piece things together. That process was really exciting.

I also took a lot of geology classes and all sorts of things in college. But whenever they had a hands-on component, that was the bit that I really enjoyed. I took a geology class where we had to draw rocks. There was no classroom component to the class, so we were out in the field every week doing field trips, and that was stunning and fun. I knew since high school that I wanted to teach, but in college it was those hands-on moments where I got to put things together for myself that made research seem really exciting.

JUR: How did you get involved in researching India?

Searle: I got to go on a mini study abroad program for four weeks to India. I had always wanted to go to India but didn't ever think that I would get there. This was a winter session

program to study village-level, small-scale craft and textile production in Rajasthan and Gujarat. It was really fascinating but was also very uncomfortable. India is a very different and complex place, and I found the trip intriguingly uncomfortable, enough for me to feel like if I was going to research a particular place, this is the place that I could work for the rest of my life and maybe not fully understand it. And so that's how I got interested in it. Also on that trip, we'd go to places like Ahmedabad, which has this amazing industrial history and the city itself is so interesting in terms of ethnic and religious tensions and industrial history. I just felt like, "Oh, there's so much more here that I as a scholar want to understand," in the small-scale craft area, and how that's related to other things like industrial history and urbanization.

JUR: How does this connect to your Fulbright experience? And on your Fulbright, what did you learn as a researcher?

Searle: I had already done significant language work in India and research for my dissertation, which was funded by the National Science Foundation and the American Institute of Indian Studies. I then published the book based on that work. I'm now working a new project on the material culture of home and domesticity. I am thinking about the changes in marketing, design, and production of goods for people's homes. I worked on that project on the Fulbright, where I was in Delhi interviewing designers and trying to get a sense of the lay of the land. I went to some trade fairs, hung out at a design office for a week, and stuff like that.

That was also a very interesting experience because I had my family with me. It was the first time that I had traveled to India with my kids (who were then two and seven), so that was really interesting. Finding time to do the research was tricky, but I really enjoyed the way that having kids changed my relationships with people there. We spent quite a bit of time at the beginning trying to find a daycare center for my daughter who was two. I'd never really thought about the ways that people talk about what women should be doing, whether kids should be in daycare, or what is education like for kids in India. It was so interesting, and it's like every time I go, I learn new things. Sometimes those aren't the things I think I'm going to be learning, but bringing the kids definitely changed that.

JUR: And when was your Fulbright experience?

Searle: The Fulbright was in the fall of 2018.

JUR: And you published your book before going on the Fulbright. What was that process like? What did you wish you learned before going through the process of publishing a book?

Searle: I don't know if there's anything that I wish I knew before. Anthropology has a particularly long process of doing the field work. I had done my field work in 2006 to 2008, and then I wrote my dissertation by 2010. So even by other disciplines, that itself is a long process. And then I was doing the revisions on the final book in 2015, so it was just a very long process. But I think it's good because it really gives you the time to pour over one's data, reconsider it, and think about it in new ways. Sometimes it takes time to figure out a new language for articulating what it is you're finding, and that revision process really helped me help me to do that.

JUR: I know you mentioned the design project that you're working on, but are there other specific things that you're working on as a researcher right now?

Searle: It is a little tricky right now because of COVID, since I didn't get to go to India last summer and I won't be able to go this summer. There are little spinoff things that I currently do in relation to the first book. The book was about this period between 2006 and 2008 when there was this boom in real estate in India and got me thinking about financialization. Then of course in 2008, there was a global financial crisis. I have written since about what happened after the crisis and thinking about how if we think of financialization as also networks of brokers. If we look at the networks of people that mobilize in order to make land and buildings into financial assets, then what happens to those networks when a crisis happens? You're trying to liquidate assets instead of creating, and so I've written about that. That research taken me far from the materiality of the city and into reading the quarterly reports of various real estate funds and doing a little bit of forensic economic work. So that was something that was taking up my time.

I'm also continuing to trace what designers are doing on Instagram and other social media platforms. But I've also been thinking quite a bit about labor. One of the things that designers were saying was that it was one thing to design something, and it was another thing to get it made. So, I've been really interested in the class dynamics of getting things made in India, particularly at this time when the government has really been touting "Made in India." I've been exploring the questions, "How is labor organized?" and "How is the work that people do with their hands valued or not valued?" Be-

cause often the designers are upper class, upper caste, and have particular professional educations, so they see themselves as quite distinct from the people who would actually be building or making the things that they're designing. So this has become an interest of mine while I haven't been in the field. I've been doing a lot of reading on labor in India, labor organization, informal labor.

JUR: So it seems like the quality of investigative analysis is quite helpful in being a researcher. Can you think of other traits that are good for a researcher to have?

Searle: Curiosity and perseverance are the ones that I can think of, and a willingness to follow what's going on and where it leads. I feel like every time I go to do field work in a place, there's things happening that I didn't think about when I was at home. Even though we have the web and social media, the way people are talking about things and what's happening on the ground is always different from what I anticipate. Being flexible enough to say, "Okay, I thought I wasn't doing a project on this, but actually here's the really interesting thing," is a good trait to have.

JUR: How do you suggest that U of R undergraduates get involved in research?

Searle: First of all, sometimes professors don't know that they are looking for research assistants. But if you learn about a professor's research and find it interesting, you should just approach them. In the anthropology department specifically, we have some courses that help students get involved in research. So we have our majors take a methods class, which is really helpful. But actually many of our classes offer the opportunity to do some original research and especially our advanced topics courses. In a class setting, it can be fun to start some research because then at least you are structured or scaffolded by the other readings and the professor there. So I think that can be a really great way to get started on something. Another thing is (and this is difficult right now), but bringing experiences in travel, an internship, or study abroad to scholarly research gives it depth. If you're passionate, intrigued, or curious about something, then that's going to be really interesting research.

JUR: Do you have any last words of wisdom or advice for undergraduates in general?

Searle: Try to find ways to do what you love. We live in economically and socially uncertain times now, so there's a lot of pressure to do certain things in college or to have a plan for your career. But if you can, finding ways to do the things that you really enjoy and taking the chance to experiment a little to find out what those things may be can be really beneficial.

Abstracts from the Annual Undergraduate Research Expo 2021

University of Rochester, Rochester, NY

April 16th, 2021

Describing Community Health Worker Implementation of WORTH Transitions, an Evidence-Based Program for Justice Involved Women with Substance Use Disorders and HIV Risk

Author: Zainab Shah '22, *Psychology & Religion*

Mentor: Dr. Diane Morse, *Psychiatry*

Women recently released from incarceration are at greater risk for HIV, Hepatitis C, substance use, trauma, and mental health disorders. To address these problems, we aimed to assess community health worker (CHW) and client participant perceptions in the context of implementing WORTH Transitions, an integration of two evidence-based programs: Women on the Road to Health (WORTH) and Transitions Clinic (TC). WORTH is a structured five-session intervention, efficacious in decreasing HIV risk behaviors, intimate partner violence episodes, and substance use among justice-involved women. TC provides culturally-informed primary care and peer navigation to those reentering from incarceration, and is efficacious in improving health and retention in care. We utilized the Consolidated Framework for Implementation Research (CFIR) “characteristics of individuals” construct by focusing on the three CHWs and who implemented the WORTH Transitions program, and nine clients that they served. As peer CHWs, they shared socioeconomic status and life experiences with the women recently released from incarceration that they served. We conducted and used thematic qualitative analysis of CHW and client interviews in the course of the project in a pragmatic design to inform intervention and retention strategies. CHWs were able to learn and implement an evidence-based intervention for women with whom they share life experiences. Clients responded favorably to their CHWs having shared experiences and were able to access necessary resources through their CHWs. These findings support implementation of needed evidence-based programs for justice-involved women and build the knowledge base for needed research on efficacy of peer-driven and implemented approaches in this population.

Amidst Violence: Community and Catharsis at the Site of Protest

Author: Amanda Liang '21, *Interdepartmental Studies: Argument and Advocacy*

Mentors: Kristin Doughty, *Anthropology*; Joshua Dubler, *Religion*

Based on 9 months of auto-ethnography as a Street Medic, semi-structured ethnographic interviews, and participant

observation at the Rochester (NY) Black Lives Matter protests following the murder of Daniel Prude in March 2020, this project details how participants navigate viscerally the dialectic between the beautiful and the horrific which occurs at the site of protest. Using Miranda Fricker's Epistemic Injustice as a framework for understanding the embodiment of community at the site of protest, I argue that the acquisition of epistemic resources through solidarity enables left-aligned protest subcultures to understand, feel, and give language to their own experiences of violence, trauma, and alienation—thus experiencing catharsis. Fricker's socially situated epistemic injustice is then relieved because the harm done to someone in “their capacity as a knower” is resolved with knowledge experienced through community and mutual aid. By contextualising the embodiment of community as a set of strategies for confronting epistemic injustice, we are able to understand how alienation from community results in a catastrophic detachment from the catharsis necessary to sustain direct engagement with structural and physical violence over time. As such, I conclude that community and catharsis are instrumental in allowing us to reimagine and recontextualise our relationship with violence.

Manganese Promoted Oxidative Radical Addition Reactions

Author: Yeonseong Seo '21, *Molecular Genetics & Chemistry*

Mentor: Shauna Paradine, *Chemistry*

Single electron transfer (SET) chemistry refers to reactions initiated by one-electron redox events that proceed through radical intermediates. Due to the short-lived nature of these intermediates, such reactions typically proceed with kinetic selectivity, hence less sensitive to steric and stereoelectronic effects compared to their two-electron counterparts. These characteristics have led to recent studies on the applicability of SET chemistry in generating congested stereocenters and constructing complex polycyclic molecular frameworks. Among various transition metal complexes that have been employed to carry out such reactions, the Paradine group has identified manganese carboxylate complexes as promising mediators for enantioselective oxidative radical reactions. The group envisions that designing a series of chiral ligands with varying steric and electronic properties may enable catalyst control over reaction outcomes with regard to stereoselectivity.

Oxidative radical reactions are complementary to their reductive counterparts because the oxidation of radical intermediates to their corresponding cations enables diverse

pathways of termination. In particular, reactions with heteroatom donors may result in highly functionalized, versatile products. The foundation for employing manganese(III) acetate, a one-electron oxidant, in oxidative radical reactions was laid in the late 1960s when the carboxymethyl radical generated from heating the reagent in acetic acid was added to alkenes. At first, the resulting radicals were further oxidized with an additional equivalent of the manganese reagent, but within the next few years, copper(II) acetate was found to be an efficient cooxidant, standardizing the pair in promoting similar reactions. Efforts towards elucidating the mechanism of this newfound reactivity resulted in the discovery of the rate-determining step: the enolization of acetic acid promoted by the oxo-centered manganese(III) triangle. This suggested that the SET pathways mediated by manganese(III) acetate proceeded with manganese-bound α -acetate radicals, revealing the potential for stereocontrol using ligands bound to the metal.

Inspired by these findings, the Paradine group launched this project by investigating potentially enantioselective intramolecular cyclization reactions of β -keto esters and malonate esters with an alkene tethered to either ends of the molecule. Malonate ester substrates that form a lactone moiety upon radical cyclization were subjected to stoichiometric amounts of manganese acetate and copper acetate in acetic acid. The initial substrate bearing a trisubstituted alkene suffered from poor product yields and chemoselectivity issues despite several optimization efforts. A few strategies to improve these results were devised: removing an α -hydrogen via substitution was imagined to prevent further oxidation, and attaching a phenyl group to the alkene instead of a gem-dimethyl group was assumed to promote lactone-trapping. With the α -methyl derivative of the initial substrate, which afforded improved yields, an array of polar aprotic solvents were screened. Eliminating the risk of ligand exchange by replacing acetic acid was a critical step for the incorporation of chiral manganese carboxylate complexes. Unfortunately, no product formation was observed in the presence of chiral manganese methyl-mandelic acid complex when monitored via gas chromatography. In addition, a handful of malonate esters bearing a phenyl-substituted alkene were prepared to construct a bicyclic lactone moiety upon radical cyclization and internal nucleophilic attack. These molecules, however, did not exhibit the desired reactivity in the presence of achiral metal complexes; only cleaved fragments and decomposed debris were isolated regardless of the reaction temperature or duration.

In an effort to converge this work with ongoing projects within the group, the focus of this project was shifted to intermolecular addition reactions between β -keto esters and aryl-substituted alkenes under catalytic conditions. Cobalt(II) acetate was introduced to the reaction conditions to achieve the regeneration of active metal species and complete the proposed catalytic cycle. Similar trends from previous studies were observed with these substrates regarding the number of acidic α -hydrogens that were available on the es-

ters; the collective yields of radical addition products were improved with α -methyl substitution. However, these reactions resulted in a handful of products with quite unpredictable chemoselectivity. Varying mixtures of elimination and lactonization products were formed from different substrates, rendering it difficult to extrapolate trends for further investigation, especially with chiral metal species.

The series of unfruitful results motivated the search for a new class of manganese-mediated or catalyzed reactions. Inspired by recent reports on manganese-catalyzed cyclopropanol and cyclobutanol ring-opening reactions in the literature, the group decided to investigate the applicability of the manganese/copper/cobalt system to these reactions. Oxidative ring-opening reactions of aryl cyclobutanols with various aryl enones are currently under investigation. The introduction of stereodirecting elements to these substrates or the ligands complexing with manganese is anticipated to elucidate unexplored trends in chemo-, regio-, and stereoselectivity.

Bayesian Analysis of Ambient Noise Cross Correlation Functions using a Low-Quality Seismic Network

Author: Siyu Xue '22, *Anthropology & Data Science*

Mentor: Tolulope Olugboji, *Environmental Science*

Although ambient noise dispersion measurements are being published on the African continent, how these measurements compare to previous results, affect updates to global lithospheric models, or should be used in joint inversion schemes, is not well understood or often rarely investigated. In this study, we apply a hierarchical Bayesian technique to extract ambient noise phase dispersion and its uncertainties using station-pairs within sub-arrays from different classes of networks on the continent. Unlike iterative schemes, this approach requires limited a-priori constraints, and employs a global search for constraining the measurement uncertainty during the inversion for phase and group velocity dispersion using the ambient noise cross correlation functions. Since data quality varies across the entire region, we report on how the uncertainties in phase dispersion measurements depend on structural and non-structural parameters: i.e., duration of operation, metadata quality, and sediment or low-velocity zones. A continent-wide reference dataset with uncertainties derived from data will be useful for updating lithospheric models during joint inversions with other seismic datasets. For example, global lithospheric models are heavily cited and widely used across the broader geoscience community, so ensuring that they fully incorporate short-wavelength, short-period ambient noise surface wave measurements, especially in regions that have only recently been instrumented, e.g., Africa, will be beneficial.

Resisting Gentrification: Then & Now: A Virtual Conference to Facilitate Conversations about Gentrification in the City of Rochester

Author: Casey Ryu '22, *Linguistics & Archaeology, Technology, and Historical Structures*

Mentor: Lauren Caruso, *Center for Community Engagement*

This project involved partnering with 540WMain, a local virtual antiracist education platform that promotes justice for all within the City of Rochester, to develop and deliver a virtual conference about the effects of gentrification with the theme of Resisting Gentrification: Then & Now to explore the historical roots of policies and practices that still exist in the present.

The Impact of Weather Shocks on Crop Yields: Evidence from India

Author: Pramod Manohar '23, *Economics & Mathematics*

Mentor: Travis Baseler, *Economics*

Agriculture is highly dependent on weather conditions, and previous research at the country-level suggests that poorer countries are more significantly affected by climate change than richer countries. Moreover, evidence from climate science research suggests that extreme weather events are more likely to occur and that temperature and rainfall is becoming more volatile. This will have wide-ranging and damaging effects in poorer countries as a large proportion of the population in poorer countries are dependent on the success of agriculture. By exploiting annual variation in temperature, rainfall, crop yields, and crop prices within 313 apportioned Indian districts, I test whether higher temperature and less rainfall significantly decreases the aggregate output value of 13 major crops. I find that a 1°C deviation above the temperature trend line leads to a 27% decrease in output value within a state for a given year, indicating massive losses from large fluctuations in temperature.

Maternal Executive Functioning Partially Mediates Effects of Early Socioeconomic Risk on Child Executive Functioning

Author: Grace Messina '21, *Psychology & Brain and Cognitive Sciences*

Mentor: Melissa Sturge-Apple, *Psychology*

Development of children's executive functioning (EF) can be influenced by socioeconomic status (SES) and maternal EF, particularly in early childhood. In a diverse, socioeconomically stratified sample of 152 mother-child dyads, this longitudinal study found that maternal working memory mediates associations between SES and child EF, but inhibitory control does not.

Dance and Movement Patterning: A Tool to Explore the Physical Symptoms of Autism Spectrum Disorder

Author: Alydia Meinecke '21, *Biology & Dance Studies*

Mentor: Rose Pasquarello Beauchamp, *Program of Dance and Movement*

Autism Spectrum Disorder is a developmental disorder that affects communication, behavior, and is expressed through various emotional, social, and physical characteristics. In efforts to further explore the physical symptoms, a series of three surveys were administered to evaluate participants' balance, coordination, and proprioceptive abilities. These physical deficits influence movement patterns experienced by individuals with Autism Spectrum Disorder (ASD). The participants of this study were members at AutismUp, a non-profit organization whose facility offers classes and workshops for people with ASD. The participants who were enrolled in a weekly dance class at AutismUp were observed and their movement qualities and tendencies were notated using Laban/Bartenieff Movement Studies' Efforts and Patterns of Total Body Connectivity. The results of the observations were correlated to the results of the survey to determine the relationship between the physical symptoms and the resulting movement patterns presented by the participants. These movement patterns were then used to generate a movement vocabulary to inform the choreography of a dance film that served as an artistic interpretation of the data and an exploration of what is creatively possible in the presence of physical restrictions. Therefore, this study investigated the relationship between the physical symptoms and the movement patterns of children with Autism Spectrum Disorder and how these patterns can be expressed through dance.

Effects of Prenatal Stress on Cytokine Levels and Placental Vascularization

Author: Lejla Sose '22, *Neuroscience & Psychology*

Mentor: Allison Ciesla, *Psychiatry*

Stress has been associated with increased pro-inflammatory and decreased anti-inflammatory cytokine levels, which have been shown in previous research to negatively affect pregnancy and child development. Additionally, pro-inflammatory cytokines have been shown to negatively impact placental vascularization which has been associated with poor peri- and post-natal child outcomes. In this study, I examined the relationship between stress, levels of IL-6, IL-10 and TNF- α cytokines in the first trimester, and the placental surface area/vascularization ratio in 130 normal pregnancies within the Understanding Pregnancy Signals and Infant Development (UPSIDE) cohort study in Rochester, NY. Multiple linear regression analyses showed that stress did not significantly affect the levels of cytokines or the surface area/vascularization ratio of the placenta, but several trends were observed. Cytokines alone did not significantly affect the surface area/vascularization ratio. Age, family poverty income

ratio and education were significant predictors of stress scores, but not of cytokines or surface area/vascularization ratio. The results suggest that other mechanisms are at play and provide opportunities to expand the research question to include different cytokines and placental measures across trimesters.

Toll-Like Receptors and Viral Persistence in *Xenopus laevis*

Author: Vignya Dontu '23, *Health, Behavior, and Society*

Mentor: Jacques Robert, *Microbiology and Immunology*

Previous research with *Xenopus laevis* adult frogs revealed an unexpected association between the stimulation of toll-like receptor 5 (TLR 5), recognizing bacterial flagellin, and a resurgence in quiescent infection by the ranavirus frog virus 3 (FV3) persisting in asymptomatic frogs, leading to systemic, often lethal, infection. In contrast, TLRs 7 and 22, that both detect RNAs from pathogens, did not play critical roles in reactivation of infection in asymptomatic FV3 carriers. This raised the question as to whether these TLRs that are usually involved in host antiviral responses are involved during the primary FV3 infection. To determine whether TLR7 and TLR 22 participate in early *X. laevis* host response against FV3, we monitored their gene expression response in different tissues of adult frogs following infection with wild type FV3 and different recombinant FV3 deficient for putative immune evasion genes. It was hypothesized that the frogs infected with FV3 KO (Δ 64R- or Δ 18K- FV3) strains would show higher expression of TLR 7 and 22 compared to the frogs infected with the WT-FV3 or mock infected with APBS. The data from this study indicates a rapid and significant increase of TLR 22 transcripts upon FV3 infection, but not TLR 7. Furthermore, we found that viral loads and macrophage recruitment at the site of infection was higher in the frogs infected with the WT strain compared to the recombinant KO FV3 strains. However, no other significant differences in gene expression response of immune or TLR genes were detected among the groups.

Collagen: Fibronectin Interaction Inhibitor Regulates Angiogenesis

Author: Elizabeth Rath '21, *Biomedical Engineering*

Mentor: Angela Glading, *Pharmacology & Physiology*

Angiogenesis, the formation of new blood vessels, is a crucial part of development and wound healing. Abnormal angiogenesis is present in various diseases, and is accompanied by an increase in the levels of the cellular fibronectin, an extracellular matrix protein. The overexpression of cellular fibronectin results in the up-regulation of collagen I deposition allowing for disease progression, a process that requires binding of fibronectin and collagen. Angiogenesis is also required for tumor growth, and the increase in collagen deposition due to overexpression of fibronectin can promote

the growth of tumor cells. We hypothesized that the interaction between fibronectin and collagen could regulate angiogenesis. We therefore tested the ability of R1R2, a peptide inhibitor of the collagen: fibronectin interaction for its ability to block angiogenesis in vitro and in vivo, as well as explored its effect on pro-angiogenic signaling in endothelial cells.

Dead and Unburied: Human Remains in Museums

Author: Julia Granato '22, *Ecology and Evolutionary Biology & Archaeology, Technology, and Historical Structures*

Mentor: Elizabeth Colantoni, *Religion and Classics*

Human bodies, usually no longer living, have been the subject of spectacle and intrigue for centuries. Before modern museums, early collections of curiosities, called "Wunderkammer" or "wonder rooms," housed human remains alongside magical stones, paintings, sculptures, and taxidermy animals. In the 15th and 16th centuries, anatomical collections with vast human osteological specimens were assembled, studied, and put on display to be viewed by anthropologists, physicians, anatomists, phrenologists, other students of science, and even the general public. Today, both antique and fresh corpses can be found in nearly every museum and in countless exhibits across the United States and all over the world. Despite the popularity of such attractions, there is still discourse surrounding the display of human remains. This research project explores the archaeological and philosophical perspectives of the treatment of human remains in museums today, particularly those who do not fall under NAGPRA's jurisdiction. After establishing a broad historical backdrop of the collecting and display of human remains in the Western world, this project investigates a single case study: the Hyrtl crania at the Mutter Museum in Philadelphia, PA. Using this case study, the topics of dark tourism, structural violence, and the implications of such dealings with the dead are examined. Additionally, the complex and meaningful relationship between society and their dead is illuminated.

Grand Challenge-Engineer the tools of scientific discovery- Robotics and discovery

Author: Madhavan Murali '21, *Mechanical Engineering*

Mentor: Emma Derisi, *CCAS Hajim Advisor*

When the National Academy of Engineers decided upon the Grand Challenge of "engineering the tools of scientific discovery", for many people, space jumped into their minds. But the act of discovery encompasses a wide variety of fields, from oceanography to geography and, perhaps most importantly, robotics. For my presentation, I hope to show the growing influence of robotics and mechanical design in scientific experimentation and exploration, including robotics applications for clearing space debris for future space missions and analyzing samples for deep-sea expeditions.

A Photonic Electro-Optic Modulator for On-Chip Quantum Frequency Processing

Author: Benjamin Nussbaum '21, *Optics*

Mentor: Joe Lukens, *Oak Ridge National Lab*; Nick Vamiakas, *Optics*

Quantum logic gate operations are central to quantum computing and quantum information processing. Whereas a fiber-based system covers optical table space on the scale of square meters, an integrated photonic counterpart takes up only a few square millimeters at most. In addition, since the field of integrated photonics builds on the established technology of integrated electronics, photonic devices have the potential to be more cost-effective than bulky fiber-based systems. Further, with proper tuning, photonic integrated circuits offer lower internal optical losses compared to fiber-based optical systems. This benefit makes integrated photonics all the more important to the growth of quantum information science—where every photon counts. This project will explore the use of a frequency mode space for quantum information processing in the mature platform of silicon photonics, focusing on the fundamental operation of a Hadamard transformation.

All About the Green: Supporting Green Energy and Green Grant Projects For Taproot Collective

Author: Christina Krewson '21, *Public Health and Environmental Studies*

Mentor: Lauren Caruso, *Center for Community Engagement*

Taproot Collective is a nonprofit organization committed to urban agriculture and neighborhood development in the city of Rochester. While Taproot Collective writes grants and seeks properties for future programming, they also evolve their original garden space. This capstone project consists of two stages, one tied to future expansion of the organization (research), and the other tied to developing the present farm infrastructure (green energy). In the research stage, I compiled data about neighborhoods surrounding potential farm sites that Taproot can use for grant-writing and stakeholder investment. In the green energy stage, I helped manage and document communications with Engineers without Borders about a solar energy project to ventilate the greenhouse.

ROS Generation and Antioxidant Defense in Bowhead Whale

Author: Ena Haseljc '22, *Molecular Genetics*

Mentors: Denis Firsanov, Vera Gorbunova, & Andrei Seluanov, *Biology*

Few model organisms with exceptional longevity have been used to understand molecular mechanisms responsible for long lifespan and resistance to cancer. One of the model or-

ganisms is bowhead whale (*Balaena mysticetus*), the longest-lived mammal on Earth with maximum lifespan 211 years. Although there is a big progress with some model organisms, such as naked mole rats, molecular mechanisms leading to longer lifespan in bowhead whale is still a mystery. Few factors believed to be essential for aging are effective DNA repair, lower level of oxidative stress and more efficient mitochondria. Data from our lab showed several unique features of whale fibroblasts in comparison to human cells: resistance to oxidative stress, lower total level of reactive oxygen/nitrogen species (ROS/RNS) but higher level of superoxide. In attempt to address molecular mechanisms responsible for these phenotypes, we measured total mitochondria mass in bowhead whale cells and checked functional activity of mitochondria. We showed that bowhead whale has much less mitochondria per cell comparing to human, but cellular respiration parameters were comparable to human cells, potentially indicating more active mitochondria in the bowhead whale. We also measured the activities of superoxide dismutase (SOD) and glutathione peroxidase (GPx) in cellular extracts of both species. We observed lower activity of both SOD and GPx in whale cells. Lower SOD activity together with more active mitochondria in whale cells could explain the previously observed phenotype of an increased level of superoxide. But lower GPx activity cannot explain the lower total ROS level in bowhead whale cells as well as their resistance to oxidative stress. Therefore, additional assays like measurements of catalase and peroxiredoxins activities are required to get a better picture of ROS/antioxidants and their role in bowhead whale longevity.

The Interaction between Dlg and GPSM2/Pins: an evolutionary perspective

Author: Emily Schiller '21, *Cell and Developmental Biology*

Mentor: Dan Bergstralh, *Biology*

The spindle orientation complex is a conserved set of proteins that orient metaphase spindles. This complex is important in animal development as the orientation of cell division contributes to tissue shape and determines cell fate. In Bilaterian animals, the complex component GPSM2 (G-protein signaling modulator) is thought to interact directly with Dlg (Discs large) in a manner dependent on GPSM2 phosphorylation at the linker region. The functional consequence of this interaction is unclear. I am using an evolutionary approach to address this problem. Using next generation bioinformatic techniques, I have identified the amino acid sequences of GPSM2 and Dlg in Cnidarians, Placozoans, and Porifera, basal animals outside the Bilaterian clade. I show that a functional GPSM2 linker arose in cnidarians demonstrating that the interaction between GPSM2 and Dlg appeared in this phylum. Interestingly, neurons also originated in Cnidaria and spindle orientation is necessary for proper development of neural, but not all epithelial, tissue. Additionally, I show that Dlg diverged in organisms with unique requirements for

spindle orientation including *C. elegans* and the syncytial sponge *O. minuta*. This work is revealing the evolutionary history of the GPSM2/Dlg interaction and suggesting new possibilities for its importance in spindle orientation during epithelial and neural tissue development.

Shadows and Delusions: The "Indian Burial Ground" Superstition

Author: Eddie Hock '21, *History & Archaeology, Technology, and Historical Structures*

Mentor: Brianna Theobald, *History*

A hallmark of horror cinema, campfire ghost stories, and bad omens in general, the "Indian burial ground" superstition emerged in something resembling its modern form during the early 1970s and has been a staple of American suburban folklore ever since. The central idea of the myth is malleable but distinctive: the presence of an "Indian burial ground" beneath white-picket-fence America holds the power to bring bad luck, produce supernatural phenomena, and/or cause unsuspecting non-Native people to become violent or murderous toward one another. The superstition is fundamentally married to the world of seventies and eighties horror, but it has proven resilient in the decades since, and it engages with powerful questions about place, indigeneity, colonialism, and violence that have been present in the American zeitgeist for centuries. My history honors thesis, *Shadows and Delusions: The "Indian Burial Ground" Superstition*, evaluates portrayals of indigenous grave sites in fiction, academic literature, and especially film throughout American history to understand the contemporary burial ground superstition, the issues it raises, and what it is to live on stolen land.

Investigating the Role of the Tight Junction Protein, Claudin-1, in Differentiation and Viral Infection of Human Epidermal Cells

Author: Huishan Shi '22, *Microbiology*

Mentor: Lisa Beck, *Dermatology*

Atopic dermatitis (AD) is an itchy, inflammatory skin condition that is the most prevalent skin disease in the world, affecting 20% of children and 9% of adults in the US alone. Studies have shown that AD patients are more susceptible to skin infections from multiple virus families including Poxviridae, Herpesviridae, and Picornaviridae. One of the most severe viral complications AD patients suffer from is called eczema vaccinatum, which is caused by vaccinia virus (VV). Our lab has previously shown reduced levels of the tight junction (TJ) proteins claudin-1 (CLDN1), -4 and -23 as well as occludin in AD patient's skin. We hypothesize that barrier disruption in AD epidermis, specifically impaired TJ function, promotes susceptibility to cutaneous viral infections. To address this hypothesis, we knocked down (KD) CLDN1 in an immortalized primary human foreskin ker-

atinocyte (KC) cell line called N/TERT2G using CRISPR/Cas9 technology to determine whether reduction in CLDN1 alters TJ barrier function and/or susceptibility to viral infection. Western blot analysis demonstrated a loss of CLDN1 expression in the KD cells compared to control cells and transepithelial electrical resistance (a method to measure barrier) indicated a substantial reduction in barrier function, suggesting that CLDN1 KD disrupts TJ barrier formation and function. Inference of CRISPR editing (ICE) analysis is a web-based tool that determines CRISPR/Cas9 gene editing efficiency. This analysis indicated ~50% editing efficiency in our CLDN1 KD cells suggesting at least partial KD of CLDN1 in all cells. Using qPCR, we analyzed whether loss of CLDN1 alters KC differentiation or TJ protein expression. Results from our qPCR studies show that CLDN1 KD cells do not have altered gene expression of early differentiation markers or TJ proteins. Furthermore, we used KD cells to examine whether stage(s) of VV infection are altered by CLDN1 KD. Genome replication and the amount of virions produced from infected cells were unchanged in CLDN1 KD cells. Understanding the function of TJ proteins in epidermal barrier function and the connection between TJ proteins and viral infection is key in identifying the role that TJ play in the pathogenesis of AD. Importantly, these results can be relevant for other cutaneous viral infections such as warts (human papillomavirus), Molluscum (molluscum contagiosum) and cold sores (herpes simplex virus 1 and 2).

Mẹ ơi!: A collection of transgenerational narratives from Vietnamese American mothers and daughters in Little Saigon in Garden Grove, California

Author: Anh-Thơ Antoinette Thị Nguyễn '21, *Anthropology & English Literature*

Mentor: Kristin Doughty, *Anthropology*

This research project is an ethnographic study of Vietnamese women living in Little Saigon in Garden Grove, California. It begins as a collection of transgenerational life-histories of Vietnamese women who are grandmothers, mothers, and/or daughters and transitions into an analysis of how these kin relations work in a contemporary American context in light of the Vietnam War and subsequent diaspora. My major research question is as follows: what are the sociocultural and geopolitical histories and climates that shape the lives of Vietnamese refugees in America and how do they influence how Việt kiều women mother their children? My analysis encompasses the construction of motherhood, of identity, of community for Vietnamese women living in a microcosm of their home country of Vietnam – a Little Saigon. Using the anthropological frameworks of refugee, rescue, and immigrant and diasporic kinship studies, I attempt to reconcile notions of American and Vietnamese kinship, and how those harboring novel hyphenated identities (Vietnamese-American) must adapt. I use life-histories – intimate personal narratives – to understand what it means to be a mother, to make kin, to find belonging as a Vietnamese woman in America.

Creation of a Novel, Noninvasive Diagnostic for Endometriosis using Menstrual Effluent

Authors: Emily Laskey '21, *Biochemistry & Psychology*, Emily Schiller '21, *Cell and Developmental Biology*, Hanwen Gu '21, *Biomedical Engineering*, Isabel Lopez-Molini '22, *Biochemistry*, Meghan Martin '22, *Biochemistry & American Sign Language*, Zivile Vebrate '21, *Cell and Developmental Biology*, Ethan Chen '21, *Biomedical Engineering*, Gabriel Isaacson '21, *Microbiology*, Helen Shammass '22, *Biomedical Engineering*, Huishan Shi '22, *Microbiology*, Jinghong Tang '21, *Cell and Developmental Biology & Economics*, Linh Hoang '22, *Biomedical Engineering*

Mentor: Anne Meyer, *Biology*

The 2020 University of Rochester international Genetically Engineered Machines (iGEM) Team, Team UteRus, sought to create a novel, non-invasive diagnostic for endometriosis using menstrual effluent. Endometriosis is a chronic disease that causes abnormal endometrial-like tissue growth outside of the uterine cavity. It affects more than 200 million women worldwide and can lead to severe symptoms impacting reproductive health. No diagnostics are currently available except for exploratory surgery. A test panel that detects all known endometriosis biomarkers would be expensive, inconvenient, and time-consuming to develop and perform. Therefore, we used combined log odds ratios analysis to find the best combination of biomarkers that contribute the most to the diagnostic accuracy of our test panel. We identified three biomarkers with the highest correlation to endometriosis to include in our test panel which includes IGFBP-1 (insulin growth factor binding protein-1), CA125 (cancer antigen 125), and IL-6 (interleukin). We also included TNF- α (tumor necrosis factor), IL-1 β , and IL-8 as these biomarkers have great therapeutic potential for the treatment of inflammatory symptoms. We created lateral flow immunoassays that can both qualitatively and quantitatively measure the presence of these biomarkers in menstrual effluent. By creating Plug and Play antibody plasmid constructs, our team designed expression plasmids for low-cost antibody production in SHuffle strain *Escherichia coli* and therefore reduce the cost of our diagnostic by 60%. This work was supported by a lateral flow assay model to computationally optimize our assay design, including test line position and reagent concentrations, reducing the time and efforts spent on wet-lab exploration. Additionally, we created a menstrual cup best suited for the collection of menstrual effluent and the comfort of endometriosis patients as well as inexpensive laboratory equipment for clinics without easy laboratory access, reducing the total cost of diagnosing endometriosis by 96%. Our team also created a machine-learning-based predictive model as an endometriosis diagnostic based solely on clinical and demographic variables with 85.02% accuracy, 84.21% sensitivity, and 85.84% specificity. Throughout our project, our team worked with endometriosis advocates, physicians, researchers, and patients to ensure that our designs were informed by the people it directly impacts. Overall, we were

able to create simple diagnostic tools for endometriosis that can be employed in a variety of clinical settings, resolving the gap of knowledge and funding for female reproductive healthcare.

Technology for Enabling Haptic Interaction with Panel Displays

Author: Charles Fleischmann '23, *Mechanical Engineering*

Mentors: Mark Bocko & Tre DiPassio, *Electrical and Computer Engineering*

Smart interactive surfaces that display images and video, radiate and receive sound, and respond to user touch are an emerging trend in human-computer interfaces. However, employing large flat panel displays with touch interfaces remains a challenge, as capacitive touch screens are impractical and prohibitively expensive for displays larger than a tablet or laptop computer. We have demonstrated that by affixing a small array (3-5 sensors) of inexpensive accelerometers to a panel one can infer the user touch location employing sensor array processing and machine learning algorithms. The collection of a large volume of training data is necessary to improve the accuracy of the predicted touch location. This project focused specifically on the development of a computer-controlled "robot" that can repetitively and controllably touch a panel at any point on its surface. A linear actuator affixed to the robot arm can touch or tap the panel with varying levels of force, while the acoustic response of the panel can be measured by the sensor array. Employing large amounts of consistent training data obtainable from this device is proving to be a critical step in the development of a low-cost panel touch-sensing system.

The role of *Staphylococcus aureus* nitric oxide reductase (Nor) on biofilm formation

Author: Peri Goldberg '22, *Biology*

Mentor: Dr. Steve Gill, *Microbiology and Immunology*

Staphylococcus aureus is an opportunistic pathogen that is responsible for a variety of infections in both healthcare and community settings. Clonal complex 30 (CC30), a particular lineage of *S. aureus* grouped based on genetic similarities, is known to be especially virulent and encodes a nitric oxide reductase (Nor). Located upstream of nor in the *S. aureus* genome lies lrgA, a gene which acts similar to an antiholin in order to regulate cell lysis and biofilm formation. Previous studies have investigated the effect of lrgA on biofilm adherence and structure, but the effect of nor has yet to be clearly defined. This study will determine the role of lrgA and nor on biofilm formation in aerobic and anaerobic conditions. To examine the dependence of *S. aureus* on nor for biofilm formation and the potential interactions between lrgA and nor, Δ lrgA and Δ lrgA/ Δ nor mutants were constructed by allelic deletion. A static biofilm assay was performed to determine

the ability of Δ lrgA, Δ nor, and Δ lrgA/ Δ nor mutant strains to form biofilms. Lastly, RNA isolation and RT-qPCR were conducted to evaluate the expression of nor and lrgA as a function of biofilm growth and time.

Computational Model for Epithelial Cell Reintegration

Author: Mimi Jung '22, *Biomedical Engineering*; Christian M. Cammarota, PhD Student, *Physics & Astronomy*

Mentor: Dan Bergstralh, *Biology*

The tightly-packed organization of component cells is critical to the function of epithelial tissues. As these tissues develop and densify, the addition of new cells can present a challenge to tissue organization; mitotic cells typically change shape and increase in size before dividing, causing them to crowd and potentially displace their neighbors. One way for a cell to alleviate crowding is to move apically to divide. After protruding from the layer and dividing, the daughter cells can reincorporate basally into the parental layer through an adhesion-based process called reintegration. In the *Drosophila* follicular epithelium, reintegration failure causes tissue disruption. I hypothesize that reintegration is a passive process that emerges from the physical properties of cells. An alternative possibility is that cells play an active role in reintegration, potentially through migratory or contractile behavior. We are developing a computational model, composed of polygonal cells in the XZ plane which simulate passive cell-cell and cell-substrate interactions, to distinguish between these hypotheses.

Observational Study of the Vaping Cessation Resources on North American Quitline Consortium Websites During the Covid-19 Pandemic

Authors: Astghik Baghinyan '22, *Public Health: Health, Behavior, and Society*, Derek Guo '22, *Epidemiology*, Dianna Caccace '22, *Bioethics*, Mufida Asmar '22, *Biology*, Hong-Lun Tiunn (graduate student); Alumni and faculty involved in this research at the Department of Public Health Sciences at the URM: Manpreet Kaur, Krystalyn Bates, Jacqueline Attia, Philip M Vaughan, Holly Widanka, Deborah J. Ossip

Mentor: Scott McIntosh, *Public Health Sciences*

Vaping (e-cigarette use) among youth has reached epidemic proportions despite steady declines in traditional smoking. Research increasingly indicates that many of the appealing vaping product flavorings are toxic, but dissemination of these harms remains limited. In the United States vaping has recently turned deadly with thousands of cases of e-cigarette or vaping associated illness (EVALI) and death. More resources for vaping cessation are needed to combat this newer epidemic of nicotine addiction among youth. In a previous study (September, 2020), the authors examined all NAQC (North American Quitline Consortium) member "quitsites" to identify and characterize information pertaining to vaping

cessation across all 50 U.S. states, all 13 Canadian provinces, 3 U.S. territories and Washington D.C. Currently, there are additional concerns that e-cigarette users may be at greater risk for succumbing to Covid-19, which is an acute respiratory disease that attacks the lungs. The present study further analyzed the NACQ quitsites 1) to identify updates to information and resource related to vaping cessation, and 2) to determine whether or not quitsites provide information about COVID-19 concerns in relation to vaping. Although 42 of 66 quitsites (63.7%) presented information on the harms of vaping, only 26 (47.3%) had messaging to indicate that flavors are harmful, and 43 provided information related to COVID-19 and vaping. Of the 66 sites, 22 (33.3%) recommended speaking to a health care provider, although some websites included information and resources targeting healthcare providers and patient referral. Although ongoing research is needed to track this trend, an increase in the number of quitsites that include information on the harms of vaping (and specifically vaping flavors) and resources for vaping cessation was observed. The inclusion of information about the association between vaping and COVID-19 may also continue to increase as new research comes to light.

Thematic Analysis of Facebook Advertising Messages for Tobacco Products Before and After a Statewide Ban of Flavored Tobacco

Authors: Astghik Baghinyan '22, *Public Health: Health, Behavior, and Society*, Matthew Quick '21, *Political Science*, Ahona Shirin '22, *Public Health: Health, Behavior, and Society*; Alumni and faculty involved in this research at the Department of Public Health Sciences at the URM: Manpreet Kaur, Liane Schneller, Krystalyn Bates, Jacqueline Attia, Zidian Xie, Dongmei Li, Philip M Vaughan, Holly Widanka, Deborah J. Ossip

Mentor: Scott McIntosh, *Public Health Sciences*

Over the past few years vaping prevalence has increased in the U.S. as people either switch to electronic cigarettes from traditional cigarettes thinking they are safer or due to influence by tobacco companies' strategic marketing efforts. In addition to an increase of electronic nicotine delivery systems (ENDS) the nicotine vapor industry itself has boomed with thousands of new "vape shops". The majority of consumers who use ENDS also use social media networks and follow ENDS brands. With the rise of vape shops and successful marketing strategies to create a trusted community of vapers, it is important to study observable social media strategies to better understand their impact on consumer behavior and addiction. The present study explored vape shops' Facebook marketing strategies in the Rochester, New York Metropolitan area before and after a state wide flavor ban that went into effect May 2020. Another key secular trend greatly impacting marketing strategies and success is the COVID-19 pandemic. In the preliminary study, we examined 15 vape shops' Facebook pages in or around Rochester

from January 31, 2020 to July 1, 2020. Using open coding thematic analysis, Facebook posts were theme coded into eight major themes with subthemes and categorized into two time frames - before and after the May 2020 flavor ban. Identified Facebook theme categories were "Promotion", "Flavor", "Community", and "Regulations". After the flavor ban, vape shops promoted, via "Promotion" posts on Facebook, their products 21.39% more than prior to the flavor ban (84.36% vs. 105.75%). Most of this increase is observed due to the increase in all sub-themes of "Promotion": "Accessories", "Brands" and "Drugs" which increased by 13.12%, 4.77%, 3.91% respectively. There was also a substantial decrease in posts about vaping "Flavors": from 17.70% to 12.64%. This is likely due to their inability to legally sell flavored nicotine products. Substantially fewer posts, post-ban, were observed in theme categories "Community" (decrease by 7.39%) and "Regulations" (decrease by 7.01%), which likely reflects a decreased need to challenge flavor regulations and a decreased need to ask their customer communities for support for such challenges. Interestingly, a decrease in the prevalence of COVID-19 related posts (22.22% vs. 9.77%) was observed over time, likely reflecting the various retail re-opening phases in New York State. Future studies will further examine misleading posts that target youth and/or promote vape products via false health claims.

The Mediterranean Diet on Cancer-related Fatigue

Author: Lisadine Cherubin '23, *Public Health*

Mentor: Amber Kleckner, *Department of Surgery & Division of Supportive Care in Cancer*

The purpose of this study is to assess the effects of the Mediterranean Diet as it relates to cancer-related fatigue. The hypothesis proposed is that due to the liberalized format of the Mediterranean Diet given to the intervention group, the participants would experience a change in their cancer-related fatigue at a higher rate than those in the control group. This study is a randomized control trial, where participants complete a baseline assessment before being randomized. Those in the intervention group are provided with meals for 4 weeks based on the Mediterranean diet and encouraged to supplement those diets according to their needs. The control group continues to receive usual care and both are reassessed at 4 weeks, after which the intervention group provides food on their own using a Mediterranean cookbook. They are educated on how to properly implement a Mediterranean Diet into their homes and lifestyles and are encouraged not to stress about wanting to eat something that's not a part of their diet. All participants undergo an exit interview to assess their experience and as the Research Assistant, I transcribe these interviews and identify patterns within the control and intervention groups. We transcribed a total of 7 interviews: all being female breast cancer patients ranging from 41-74 years old. Two were in the control group and five were in the Mediterranean intervention group. The purpose

of this analysis was to qualitatively assess participants' experience. Based on our results we found that participants enjoyed the major components of the intervention like nutritional education they received. Based on their feedback, the intervention will be refined and adapted for further use of understanding cancer related fatigue.

Quantifying Rehabilitation: A Video Survey of Occupational Therapy Exercise Sessions During Acute Rehabilitation for Stroke

Author: Madeline White '22, *Neuroscience*

Mentor: Ania Busza, *Neurology*

Objective: To perform a survey of upper extremity (UE) exercises performed by patients with recent stroke in our inpatient rehabilitation gym in order to count number of exercise repetitions, identify active and inactive time, categorize exercise type, and assess the relative use of the affected and unaffected limbs during therapy sessions.

Background: Both animal and human studies suggest that repetitive exercises improve motor outcomes after stroke, however which features of an exercise regimen are critical for optimizing recovery remain to be determined. Our lab is using wearable sensors and machine learning to develop a system to classify and quantify therapy exercise repetitions performed during the inpatient rehabilitation period as a step towards our greater goal of understanding stroke rehabilitation. As part of this study, we are performing a video survey of occupational therapy sessions occurring in our inpatient rehabilitation gym.

Design: Individuals with UE weakness due to recent (<4 weeks) unilateral stroke admitted to our inpatient rehabilitation unit gave permission to have their routine clinical occupational therapy sessions video recorded. The video data set was reviewed by 2 independent study investigators and the activity for each frame was labeled to identify the exercise/activity being performed, role of the affected arm, level of difficulty for the patient, type of exercise (active, passive, functional-salient, and functional-exercise), and number of repetitions. The total duration of each exercise was calculated as well as the amount of inactive time spent not performing any exercise.

Results: The mean percent active time over total time in therapy was normally distributed around a mean of 57%, while mean percent of active time spent performing challenging exercises was highly skewed to the right with a mean of 69% and median 74%, and the total number of repetitions was highly skewed to the left with a mean of 203 and median of 139. The total session time was normally distributed with a mean of 30 minutes and the total active time was also normally distributed with a mean of 17 minutes. Repetitions/30 minutes was calculated using the total number of repetitions divided by the number of minutes and standardized to a 30-minute session, the mean session time.

Conclusions/Future Direction: Similar to prior studies, we see a wide range of number of repetitions performed during a

standard rehabilitation session, indicating that time spent in therapy is a poor indicator of rehabilitation dose. There was also a wide range of time spent in therapy: mean session length was 30 minutes (IQR 22-40) and mean 50% active time compounds this range. In addition, we found that there was minimal adaptive therapy occurring; the mean percent of exercises performed with the affected arm in the primary role was 74%, with the healthy arm in the primary role only 7%. Investigators concluded there was an emphasis on functional exercises over ROM (Range of Motion) exercises. The mean percent of functional activities was 66%, the mean percent of range of motion activities was 34%. Future studies will continue to investigate the role the affected arm and attempt to classify all exercises into 10 broad categories.

Metabolomics Studies Reveal Altered Gut Metabolites in Metabolic Syndrome Mice that Disrupt Pparg Gene Expression

Author: Eduardo Peralta-Herrera '23, *Molecular Genetics*

Mentor: Eliseo F. Castillo, *Department of Internal Medicine, University of New Mexico School of Medicine*

Metabolic syndrome (MetS) is a cluster of conditions including high blood pressure, high blood sugar, abdominal obesity, and abnormal cholesterol levels that increases an individual's risk to heart disease, stroke, diabetes, and non-alcoholic fatty liver disease. MetS affects about one-third of the US population and one-fourth of the world population. Currently, there are no medications to treat MetS, so identifying contributing etiological factors for future therapeutic targets is critical. The goal of this study was to determine the functional role of the gastrointestinal (GI) tract in MetS. Therefore, we examined the GI tract of healthy controls (C57BL/6J) to mice with MetS (MS Nash). MS Nash mice were obese, had more peritoneal fat, fatty livers, and longer colons. Further examination of the MS Nash colon revealed decreased Peroxisome proliferator-activated receptor gamma (Pparg) gene expression, a major gene that maintains intestinal homeostasis through fatty acid oxidation (FAO), maintenance of the microbiota and dampening of inflammatory pathways. Metabolomic analysis of colonic samples revealed significant differences in concentrations of metabolites allantoin and phosphorylcholine, which can be produced by bacterial species in the phylum Firmicutes and are upstream of PPAR γ , to be decreased in MS Nash mice. Additionally, we found propionic acid, a short chain fatty acid and its precursor threonine, that are involved FAO also decreased in MS Nash mice. Overall, our results show factors (e.g. PPAR γ , FAO metabolites) that are crucial for intestinal homeostasis are dysregulated in MetS mice suggesting a dysfunctional GI tract may be a contributing etiological factor in MetS.

Characterizing efferocytosis in multipotent stromal cells (MSCs) using confocal time-lapse imaging

Author: Ivana Pacar '22, *Biomedical Engineering*

Mentor: Laura M. Calvi, *Department of Medicine*

Housed within the bone marrow microenvironment, multipotent stromal cells (MSCs) are known for their tri-lineage differentiation into chondrocytes, osteoblasts, or adipocytes and their ability to support hematopoiesis. While macrophages serve as the primary agents of efferocytosis, a specialized form of phagocytosis in which apoptotic cells are cleared, recent discoveries in our lab have demonstrated that MSCs can also participate in facultative efferocytosis. Preliminary data in our lab suggests that there are time-dependent differences in levels of efferocytosis, from as early as 3 hours. Flow cytometry and confocal imaging show that loss of the efferocytic receptor Axl results in a decreased level of efferocytosis in bone marrow MSCs but not macrophages. Using confocal time-lapse imaging we aim to better characterize the dynamics of phagocytes within the bone marrow microenvironment during the loss of Axl. Using WT and Axl $^{-/-}$ mice, we created two in vitro culture systems; one in which primary MSCs and macrophages were co-cultured and the second in which MSCs were isolated using tri-marker magnetic depletion (CD45+/F480+/Ly6C+). The confocal time-lapse imaging procedure is currently being optimized to confirm previously obtained results in primary murine (mMSCs) and to further characterize the dynamics of efferocytosis in MSCs. Thus far, both the dye type and concentration have been selected through a series of dose-response trials to minimize cell death while simultaneously optimizing the optical parameters to maximize image quality. Following the 24hr time-lapse using the optimized cellular and optical parameters, we plan to use imaging analysis to quantify the number, type, speed, and duration of interactions between MSCs and apoptotic targets.

The Aum Affair: Censorship, Scholarship, and the Mass Media in Japanese Reactions to Terrorism

Author: Eleanor Lenoe '21, *History & Japanese*

Mentor: Laura Smoller, *History*

Despite the fact that Aum Shinrikyo's 1995 sarin gas attack occurred in Tokyo, Japan, there are significantly fewer publications on the incident in Japanese than in English. Further, Japanese scholars and mass media treat the Aum Affair much differently than do their English-language counterparts: instead of investigating cultural or societal factors that caused Aum Shinrikyo's rise and turn to violence, Japanese authors tend to focus on internal explanations, such as Aum's use of brainwashing techniques, leaving any criticism of the Japanese government's slow response to Aum out. Japanese scholars' and journalists' relative silence regarding the root causes of the Aum Affair points to a greater issue. Through an in-depth analysis of developments in Japanese scholarship and

mass media reactions to Aum Shinrikyo, I suggest that the government's relationship with the Japanese press resulted in news coverage that favorably portrayed the government's response to the affair while condemning religious studies scholars for failing to warn the public about Aum's dangers. This resulted in widespread self-censorship within the study of religion and a climate where both mainstream reporters and scholars shied away from deeper discussions about the societal problems that resulted in Aum Shinrikyo's rise in the first place. These issues include a widespread mental health crisis, the sensationalism of news, and a culture of overwork. The lack of discussion on these issues also meant that journalists and scholars overlooked the ominous signs that trouble may be ahead, including teenage fangirls of Aum Shinrikyo and the rise of Aum's splinter groups.

About the Expo

The Undergraduate Research Exposition is a College-wide event in which University of Rochester students at all levels and in all areas of study are invited to present their investigative and creative work. The Expo reflects the passion for research that represents a significant part of the University of Rochester campus, in both professors and students alike. As shown by the work displayed here, which only represents a portion of all the work presented at the Expo, research comes in varied forms, in every area of study. Due to the COVID-19 pandemic, the Expo was held virtually this year. All of the work presented at the Expo can be found at the link below. With JUR's commitment to serving as a platform for the amazing research done by undergraduate students at the University, we are pleased to display the abstracts from authors who chose to publish their work with us. As always, we hope that these works may inspire our readers on their paths of learning and discovery.

<https://app.virtualpostersession.org/e/592d12f7d6d1206e94e7d4453d029338>

The Direct and Indirect Effects of Calcium Dyshomeostasis on the Amyloidogenic BACE1 Enzyme in Alzheimer's Disease

Lia Calcines-Rodriguez '20, Neuroscience

Advised by Renee Miller, Department of Brain and Cognitive Science

Introduction

Alzheimer's disease (AD), a debilitating neurodegenerative disease affecting 50 million people worldwide, is the 6th leading cause of death in the United States.^{1,2} AD is also the most common form of dementia and its major risk factor is aging, placing geriatric populations at higher risk of developing the disease. There are two major types of AD: sporadic AD (SAD) and familial AD (FAD).³ SAD is the predominant form of AD and is mainly identified in the elderly population, whereas FAD can be genetically inherited and appears earlier in life.^{4,3} Early-onset AD can manifest itself due to various genetic mutations in the genes encoding the proteolytic enzymes that process the amyloid precursor protein (APP) or mutations in the substrate itself.³ The enzymes involved in the amyloidogenic pathway include β -secretase, also known as β -site APP cleaving enzyme 1 (BACE1), and γ -secretase.³ Mutations in these enzymes can cause them to cleave APP erroneously, thus enhancing the emergence of amyloid-beta ($A\beta$) peptides which are known to have serious consequences.³

AD is characterized by a significant loss of CA1 hippocampal neurons.⁵ Although this loss eventually propagates across brain regions causing symptoms such as cognitive decline as well as various functional, physiological, and behavioral changes, the most prominent symptom is memory loss.^{6,7} Researchers are attempting to understand the pathways leading to neuronal loss in order to find methods of therapeutic intervention with the goal of preventing memory loss and other cognitive impairments characteristic of AD. For this reason, it is crucial to understand the etiology of AD, including the propagating factors that lead to neurodegeneration. For instance, calcium (Ca^{2+}) has been implicated in the etiology of AD due to its many roles in neuronal function.⁸ Dysregulation of Ca^{2+} homeostasis has been shown to lead to excitotoxicity, which can ultimately be lethal to the cell.⁹ In conjunction with excitotoxicity, Ca^{2+} has been implicated to cause cellular stress in affected neurons.^{4,10} Endoplasmic reticulum (ER) stress, for instance, can be caused by elevated levels of Ca^{2+} .¹¹ Elevated Ca^{2+} further activates pathways that can be amyloidogenic and, ultimately, apoptotic.¹⁰ Furthermore, Ca^{2+} has been shown to directly interact with the proteolytic enzyme (β -secretase) and enhance amyloidogenesis.¹²

The erroneous processing of APP can result in the oligomerization and further aggregation of $A\beta$ peptides to form plaques that hinder proper neuronal transmission and func-

tion.³ As a consequence, toxic $A\beta$ peptides can ultimately lead the cell to undergo apoptosis.¹⁰ In addition, hyperphosphorylated tau proteins also contribute to AD pathogenesis. These tau proteins can aggregate and form neurofibrillary tangles (NFTs) that hinder proper neuronal functioning.¹⁰ However, this review will focus on the direct and indirect mechanisms by which calcium regulates the amyloidogenic pathway through the enzyme responsible for the rate-limiting step of this reaction: BACE1.

Translational Regulation of BACE1 in Response to Endoplasmic Reticulum Stress

The ER is responsible for the proper synthesis and folding of proteins in the cell.¹⁰ In an AD-affected brain unfolded proteins, including $A\beta$ and NFTs, trigger the ER stress response.¹⁰ ER stress can be induced by many other stressors such as reactive oxygen species (ROS) and energy deprivation. In addition, the dysregulation of Ca^{2+} , which is an important secondary messenger that is tightly regulated by organisms, has been implicated in the activation of the ER stress response.¹¹

The stress response entails the activation of the unfolded protein response (UPR) which has three main pathways: IRE1, ATF6, and PERK.^{10, 11, 20} The activation of such pathways is an adaptive response that the cell utilizes as a way to recover from this stress. Specifically, the protein kinase RNA-like endoplasmic reticulum kinase (PERK) pathway is responsible for decreasing global protein synthesis and increasing translation of primary transcripts involved in stress response. While, these pathways have slightly different functions, when active for a prolonged period of time, they converge to activate the apoptotic pathway, constituting a maladaptive response.¹⁰

BACE1 is the proteolytic membrane-localized enzyme responsible for the first step in the amyloidogenic pathway.^{4,12} Interestingly, BACE1 production is increased under cellular stress.⁴ APP is cleaved first by β -secretase then by γ -secretase to make $A\beta$.³ Moreover, β -secretase is in constant competition with α -secretase, another proteolytic enzyme that cleaves APP and forms part of the non-amyloidogenic pathway.¹² It is reasonable to think that if there are elevated BACE1 protein levels, β -secretase prevails which ultimately leads to the degeneration of the CA1 hippocampal neurons.

A study by O'Connor et al. shows that ER stress is seen to regulate BACE1 levels through an intricate mechanism involving a eukaryotic translation initiation factor. O'Connor

et al. first induced stress by energy deprivation in HEK-293 cells to investigate stress response mechanisms. Energy deprivation was also induced by the lack of glucose in the culture medium.⁴ First, the authors observed an increase in BACE1 protein levels in the energy deprivation group.⁴ Next, the researchers sought to understand why BACE1 levels were increased under cellular stress. By inhibiting ER stress using tauroursodeoxycholic acid (TUDCA), a compound known to alleviate ER stress, and by inhibiting the PERK pathway using p58, they saw a significant decrease in BACE1 expression.⁴ This indicated that BACE1 was both regulated by ER stress and downstream of the PERK pathway.

Following these results, the authors sought to investigate whether this regulation was transcriptional or translational. To address this, they focused on the BACE1 mRNA transcript which contained a 5' untranslated region (5'-UTR) that had three upstream open reading frames (uORFs).⁴ These premature upstream start codons tend to sequester the ribosome, thus preventing the downstream coding region from being translated.^{4,13,14} Importantly, one of the targets of PERK is the eukaryotic initiation factor 2 α (eIF2 α).^{4,10} This factor is involved in the assembly of the pre-initiation complex and the recruitment of the small ribosomal subunit required for protein synthesis.^{4,13,14} For instance, when eIF2 α is phosphorylated by PERK under ER stress, it is unable to carry out its regular function, resulting in the downregulation of global mRNA translation, but not stress response mRNA translation.^{4,13} Phosphorylated eIF2 α (eIF2 α -P) decreases global protein synthesis and increases stress transcripts due to the delay in the reassembly of the aforementioned complex, eIF2 α .^{4,13,14} This allows the small ribosomal subunit to continue scanning until it finds the true AUG start codon, and the stress response gene can then be successfully translated.¹³

In this study, the amount of phosphorylated eIF2 α was significantly increased in the energy deprivation group.⁴ Furthermore, they used salubrinal to inhibit phosphatase 1 (PP1), the enzyme responsible for de-phosphorylating eIF2 α -P, resulting in elevated levels of eIF2 α -P.⁴ As a consequence of this elevation, they observed a significant increase in BACE1 protein levels.⁴ The opposite experiment was also carried out: they treated the energy deprivation group with GADD34, which forms a complex with PP1 and de-phosphorylates eIF2 α -P.⁴ This resulted in a decrease in eIF2 α -P levels and consequently, BACE1 levels. These results support an eIF2 α -mediated regulation of BACE1.

As previously stated, BACE1 has the characteristic 5'-UTR which contains three uORFs. This allows for it to be highly translated during the stress response period when eIF2 α is phosphorylated by PERK. To examine whether BACE1's 5'-UTR was the region of translational repression, researchers deleted it from the BACE1 mRNA.⁴ They observed that BACE1's translation was no longer repressed under normal conditions and that it was being expressed to a similar degree as in the energy deprivation group.⁴ This further supported

the mechanism proposed: ribosomes are no longer sequestered by 5'-UTR ORFs upstream of the BACE1 mRNA due to the delay presented by phosphorylated eIF2 α .

Despite this, researchers found that mRNA levels had decreased.⁴ This unexpected finding further supported the idea that BACE1 regulation was taking place translationally and not transcriptionally.⁴ The authors stated that the decrease in BACE1 mRNA could be due to the depletion of ATP during cellular stress.⁴ This decrease was also observed when they used primary neurons from Tg2576 transgenic AD mice.⁴ The same BACE1 protein increase was found in both the neurons under the energy deprivation as the BACE1 HEK-293 cells. Furthermore, they measured the levels of A β oligomers and saw an increase as increasing concentrations of salubrinal were added.⁴ This suggested that more phosphorylated eIF2 α was increasing BACE1 levels and that β -secretase was actively processing APP.

The previous experiments were carried out *in vitro* to validate the mechanism of BACE1 regulation. Next, O'Connor et al. wished to investigate whether these results were also taking place *in vivo*. They did this by generating an *in vivo* energy deprivation model using a series of compounds such as 2DG (a competitive inhibitor of hexokinase) and 3NP (an inhibitor of the Krebs cycle and electron transport chain).⁴ As a result, they saw a significant increase in A β peptide levels and the number of A β plaques.

Despite their proposed energy deprivation model that induced ER stress, it is known that Ca²⁺ dysregulation also leads to ER stress.¹¹ It is reasonable to suspect that during dyshomeostasis of Ca²⁺, there is an activation of the UPR pathway.^{10,11,20} As previously mentioned, UPR consequently leads to PERK activation which, in turn, phosphorylates eIF2 α and ultimately leads to higher levels of BACE1.^{10,20} Ca²⁺ dysregulation has an indirect effect on BACE1 through ER stress; however, a more direct pathway exists.

Direct Interaction between BACE1 and Ca²⁺ Increases its Proteolytic Activity *in vitro*

Hayley et al. conducted a novel investigation into whether Ca²⁺ directly interacts with BACE1. The authors performed a series of biophysical and biochemical characterizations of the BACE1 interaction with Ca²⁺.¹² First, they purified the BACE1 protein from isolated membranes and performed circular dichroism (CD); an absorption spectroscopy method used to measure the secondary structure content of a protein.¹² Here, they measured the percentages of α -helical and β -sheet contents of the active (pH 4.8) and inactive (pH 7.4) form of the BACE1 protein as the Ca²⁺ concentration (in μ M) was increased.¹² They observed a 20% decrease in α -helical content and a 10% increase in β -sheet content which was suggestive of a calcium-induced conformational change.¹² Additionally, they saw that the active (pH 4.8) form of BACE1 was more sensitive to Ca²⁺ than the inactive form.¹² The finding that Ca²⁺ is able to induce a conformational

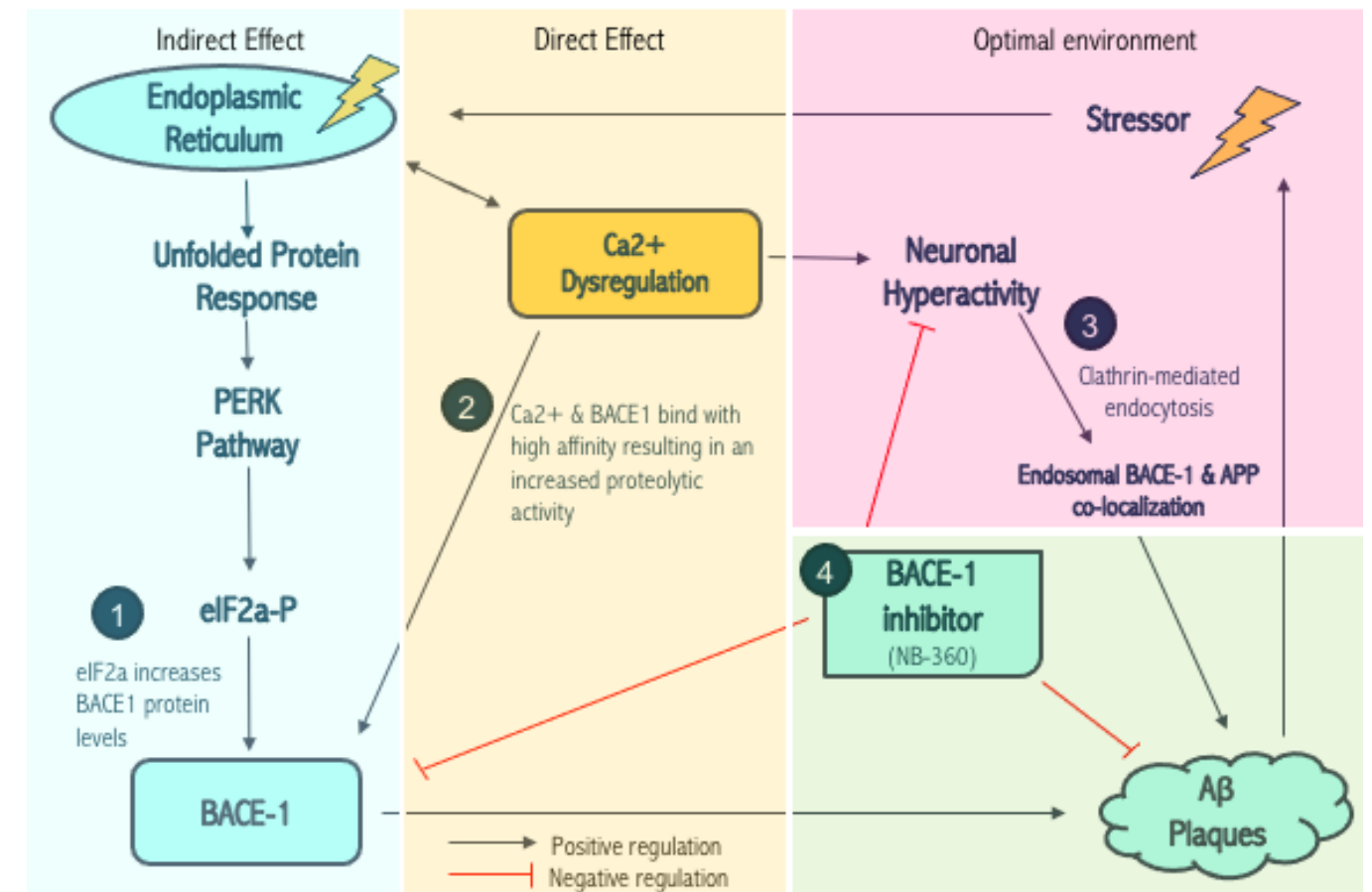


Fig. 1 The effects of calcium on the amyloidogenic pathway. (1) Indirect Effect: Calcium can activate the ER stress response which in turn activates the unfolded protein response. This mechanism leads to the increased protein synthesis of stress transcripts such as BACE-1 by the phosphorylation of eIF2 α . (2) Direct Effect: Elevated cytosolic Ca²⁺ levels increases the proteolytic activity of BACE-1 and thus enhances the generation of A β plaques. (3) Elevated Ca²⁺ levels cause neuronal hyperactivity which leads to a higher rate of vesicle recycling resulting in the co-localization of BACE1 and APP in acidic endosomes. (4) BACE-1 inhibitors rescue neuronal hyperactivity back to normal WT levels, reduce A β plaques formation, and rescue memory deficits.

change in the rate-limiting enzyme of the amyloidogenic pathway is, in itself, remarkable.

Furthermore, the authors sought to comprehend the nature of this binding. To this end, Hayley et al. performed isothermal titration calorimetry where they titrated BACE1 with Ca²⁺ and measured the energy released (in Kcal/mol) in the form of heat. This data provided not only the reaction enthalpy ($\Delta H^\circ = -3.5$ Kcal/mol), but also the dissociation constant ($K_D = 2.0$ μ M).¹² The values obtained suggested that the binding of BACE1 and Ca²⁺ was an exothermic and spontaneous binding, as the free energy of binding was also a negative value ($\Delta G^\circ = -3.36$ Kcal/mol). Furthermore, the dissociation constant had indicated that BACE1 binds to Ca²⁺ with a high affinity.¹² In order to elucidate the outcome of this interaction they performed a Ca²⁺ binding assay by incubating BACE1 with a fluorogenic APP substrate in the presence of varying Ca²⁺ concentrations.¹² This measure of BACE1 activity as a function of Ca²⁺ showed an increase in activity in the 1-7 μ M range.¹² To better understand this in the context of Ca²⁺ dysregulation, this term must be defined. The cytosolic

Ca²⁺ concentration during disruptions in Ca²⁺ homeostasis lies in the 1-3 μ M range.¹² This suggests that under ER stress, where Ca²⁺ homeostasis is disrupted, BACE1's proteolytic activity is higher. This ultimately yields more product, thereby, more A β oligomers. These findings have great implications in understanding how Ca²⁺ dysregulation *in vivo* regulates BACE1's activity. Although these experiments were carried out *in vitro*, it is reasonable to suspect that this interaction also takes place *in vivo*, especially during ER stress. Thus, Ca²⁺ may be having a more direct effect on BACE1's enzymatic activity in a brain affected by AD.

Elevated Calcium Levels Lead to the Neuronal Hyperactivity Responsible for the Endosomal Co-Localization of BACE1 and its Substrate

Neuronal hyperactivity is a pathophysiological hallmark of early-stage Alzheimer's disease in both mice and humans.⁷ Lerdkrai et al. used an APP^{swe}/PS1^{G384A} AD mouse model

to investigate hyperactivity in cortical neurons. The authors induced Ca²⁺ transients with caffeine, an agonist of the ryanodine receptor found on the ER. They observed that endogenous hyperactive AD cells had significantly longer-lasting caffeine-induced Ca²⁺ transients compared to their wild-type (WT) counterparts.¹⁵ Furthermore, treatment with cyclopiazonic acid (CPA), an inhibitor of ER Ca²⁺ pumps, abolished these caffeine-induced Ca²⁺ transients and significantly reduced neuronal hyperactivity in the AD mice.¹⁵ These findings suggested that intracellular Ca²⁺ stores were contributing to neuronal hyperactivity in AD.¹⁵

Having established that the dysregulation of intracellular Ca²⁺ stores is contributing to hyperactivity in AD, the next step is to determine the relationship to amyloidogenesis. Hyperactive neurons are constantly firing and releasing neurotransmitters. Ca²⁺ is needed for vesicle fusion and, in hyperactive AD neurons, there are high levels of cytosolic Ca²⁺.^{12,16} Due to this excessive rate of vesicle fusion, the axon terminal becomes abnormally enlarged.¹⁶ As a method to keep synapses at a steady and functional size, the neuron performs clathrin-mediated endocytosis.¹⁶ It has been previously reported that clathrin-mediated endocytosis is the rate-limiting step in the internalization of APP.¹⁷ It has also been reported that BACE1's active site is found in the N-terminal extracellular region.¹² Hence, in the event of an internalization, this active site is relocated to the inside of the endosomes.¹² Endosomes have an acidic environment and BACE1 is in its active form at an acidic pH of 4.8.^{12,16} Additionally, the outer leaflet of endosomes contain negatively charged lipids that attract Ca²⁺ to its surface and, as previously shown, Ca²⁺ enhances the proteolytic activity of BACE1.¹² Hence, not only is BACE1 in an environment where it can perform optimally, but it is also colocalized with its substrate, APP, due to the excessive vesicle recycling that takes place in hyperactive AD neurons.^{16,18}

BACE1 Inhibitor Reduces Amyloidogenesis and Rescues Neuronal Hyperactivity and Memory Deficits

Excessive Ca²⁺ levels lead to hyperactivity which increases amyloidogenesis by colocalizing APP and active BACE1 in acidic endosomes following clathrin-mediated internalization.^{7,16,18} As expected, when an active enzyme binds to its substrate, more product is made. In this case, A β peptide levels are higher in hyperactive AD-affected neurons. Furthermore, it has been shown that A β itself induces hyperactivity.¹⁹ Zott et al. used two-photon Ca²⁺ imaging to visualize Ca²⁺ transients in CA1 hippocampal neurons after A β administration.¹⁹ They observed that administering 500nM of soluble A β isoform 40 to WT mice induced hyperactivity similar to that of the APP transgenic mice.¹⁹ It can be hypothesized that neuronal hyperactivity is induced by A β since this erroneously cleaved peptide tends to oligomerize and create plaques that hinder the reuptake of glutamate, an excitatory neurotransmitter. As it is well known, high levels of intrasy-

naptic glutamate are the source of excitotoxicity in the post-synaptic cell which ultimately leads to Ca²⁺ dysregulation and the activation of the apoptotic pathways.^{9,10}

As a way to combat the progressive degeneration of neurons in an AD-afflicted brain and rescue proper activity levels as well as behavioral functions, researchers have chemically developed BACE1 inhibitors.⁶ Keskin et al. used AP-P23xPS45 transgenic mice that exhibited strong A β pathology.⁷ As expected, the authors observed a significant decrease in both A β isoforms, A β -40 and A β -42, as well as A β plaques following treatment with NB-360, a BACE1 inhibitor.⁷ In order to detect whether the reduction of these toxic peptides had any effects on physiological or functional recovery, the researchers performed two-photon Ca²⁺ fluorescence imaging and the Morris water maze test to assess neuronal activity and memory impairment, respectively.⁷

From the physiological studies, the researchers observed that AD neurons exhibited Ca²⁺ transients characteristic of hyperactive neurons.⁷ Following treatment with NB-360, this hyperactivity was restored to normal WT activity levels.⁷ They also examined impaired slow brain oscillations which correlate with the accumulation of A β .⁷ In this study, they placed an electrode in the frontal cortex of each mouse and another in their occipital lobe and detected an impaired and disorganized pattern of slow-wave activity.⁷ Following NB-360 treatment, they observed a significant recovery showing coherence in the activity pattern.⁷ After training for five consecutive days, the transgenic AD mice exhibited longer latency to find the hidden platform in the Morris water maze test indicative of memory impairment.⁷ After NB-360 administration, the researchers observed that the time it took for these transgenic mice to find the platform was significantly lowered. In fact, this time did not significantly differ from healthy WT mice, suggesting that the BACE1 inhibitor had successfully rescued memory functions.

Despite these results being incredibly successful in mice, in humans there has been no such luck. For instance, the potent BACE1 inhibitor, MK-8931 (with an IC₅₀ of 2.2 nM) was discontinued from phase-III clinical trials due to its inability to improve cognitive functions.⁶ Other BACE1 inhibitors have also been discontinued due to their adverse side effects such as rashes and injury, even though they were once shown to reduce A β levels.⁶

Discussion

ER stress can be induced by a number of stressors, namely energy deprivation, ROS, A β deposition, and Ca²⁺ dysregulation.¹⁰ As a way to battle these A β aggregates, the ER activates the UPR which in turn activates the PERK pathway (Fig.1.1). It was a remarkable finding to see that BACE1 was downstream of this pathway and that its levels were regulated translationally by eIF2 α just like any other stress response transcript. This leaves researchers with multiple targets along the pathway to intervene and decrease BACE1 levels. For in-

stance, salubrinal could be used to decrease the amount of phosphorylated eIF2 α which would consequently also decrease BACE1 protein levels.⁴ Furthermore, buffering proteins that bind Ca²⁺ could be used to reduce the myriad of effects Ca²⁺ dyshomeostasis has on an AD-affected neuron. This would resolve many problems such as the elevated BACE1 protein levels, BACE1 increased proteolytic activity, and excessive vesicle recycling following hyperactive vesicle fusion. Ca²⁺ buffering proteins would also lower the colocalization of BACE1 and its amyloidogenic substrate. Moreover, excitotoxicity due to the toxic deposition of A β plaques would be more manageable since this second messenger would now be sequestered by the buffering proteins.

As observed in Keskin et al., inhibiting BACE1 showed remarkable results in mice, however, these results have not been reproduced in humans. Some speculate that BACE1 inhibitors do not ameliorate symptoms because of the formation of AB plaques prior to the diagnosis of AD.⁶ Preventing the further deposition of these oligomers is not enough to allow for a successful recovery of the lost functions. This method would only be effective if BACE1 inhibitors were administered at the early stages of the disease or to people with a high risk of developing it. However, this is not the only problem researchers are facing; BACE1 inhibitors are also affecting the additional non-amyloidogenic functions that BACE1 performs. For instance, BACE1 has a higher affinity to cleave neuregulin-1 (NRG1) than APP.⁶ Cleavage of NRG1 by BACE1 is necessary for its proper functioning during development, namely neuronal myelination. However, this non-amyloidogenic substrate (NRG1) is not endocytosis-dependent like the amyloidogenic substrate (APP) is.⁶ Obtaining a comprehensive understanding of the subcellular compartmentalization of reactions can be useful to researchers in order to specifically target the amyloidogenic functions of BACE1 while leaving its other functions intact.⁶

An additional complication in this process is how BACE1 is being purified and how inhibitors are synthesized. Hayley et al. provide a purified BACE1 in a membrane-like conformation that is different from the purified crystal structure commonly used as the model to test BACE1 inhibitors.¹² The crystal structure model poses a problem of true specificity. Researchers have been testing inhibitors on an *in vitro* crystal structure and not on a structure that resembles BACE1 under physiological conditions *in vivo*. This might mean that the BACE1 inhibitors are not working specifically or optimally because of an error in their structural development.¹² Further research is needed in this field in order to design a specific BACE1 inhibitor that is as successful in humans as it has been in mice.

Overall, some of the mechanisms by which Ca²⁺ dyshomeostasis regulates the rate-limiting enzyme of the amyloidogenic pathway have been elucidated in this review. Ca²⁺ has both indirect (Fig.1.1) and direct (Fig.1.2) effects that regulate BACE1 protein levels and its proteolytic activity, respectively.^{4,12} Furthermore, the mechanism by which BACE1 colocalizes with its substrate (APP) in an optimum performance

environment (Fig.1.3) has been discussed.^{12,16,18} This mechanism is attributable to the excessive Ca²⁺ levels that lead to neuronal hyperactivity (Fig.1) and, as a result, a higher rate of vesicle recycling.^{7,15,16} Additionally, it has been established that hyperactivity leads to higher A β levels which in turn contributes to hyperactivity in a vicious feed-forward cycle.^{7,19} Finally, it has been reported that memory functions were recovered and that hyperactivity was abolished upon treatment with the BACE1 inhibitor (Fig.1.4), NB-360.⁷

It is imperative to understand how the rate-limiting step of the amyloidogenic pathway is regulated under cellular stress so that researchers can target and intervene pharmacologically at the different steps in these pathways. Needless to say, the ultimate goal is to ameliorate AD pathology and symptomatology as well as to recover the lost functions. To this end, further investigation of the complex, vicious cycle that gives rise to neurodegeneration in AD is necessary.

References

1. "2020 Alzheimer's disease facts and figures". (2020). Alzheimer's & dementia: the journal of the Alzheimer's Association, 10.1002/alz.12068.
2. "Alzheimer's Disease Fact Sheet." 2019. National Institute on Aging, U.S. Department of Health and Human Services.
3. Dorszewska J., Predecki M., Oczkowska A., Dezor M., Kozubski W. Molecular Basis of Familial and Sporadic Alzheimer's Disease. 2016. Current Alzheimer Research. 13(9):952-63.
4. O'Connor, Tracy et al. 2008. Phosphorylation of the translation initiation factor eIF2 α increases BACE1 levels and promotes amyloidogenesis. Neuron Vol. 60,6: 988-1009.
5. Padurariu M., Ciobica A., Mavroudis I., Fotiou D., Baloyannis S. 2012. Hippocampal neuronal loss in the CA1 and CA3 areas of Alzheimer's disease patients. Psychiatria Danubina. 24(2):152-8.
6. Moussa-Pacha N.M., Abdin S.M., Omar H.A., Alniss H., Al-Tel T.H. 2020. BACE1 inhibitors: Current status and future directions in treating Alzheimer's disease. Medicinal Research Reviews. 40(1):339-384.
7. Keskin, Aylin D., et al. 2017. BACE Inhibition-Dependent Repair of Alzheimer's Pathophysiology." PNAS, National Academy of Sciences. 114 (32) 8631-8636
8. Wang Y., Shi Y., Wei H. 2017. Calcium Dysregulation in Alzheimer's Disease: A Target for New Drug Development. Journal of Alzheimer Disease & Parkinsonism. 7(5):374.
9. Arundine M., Tymianski M. 2003. Molecular mechanisms of calcium-dependent neurodegeneration in excitotoxicity. Cell Calcium. 34(4-5):325-37.
10. Gerakis, Y., Hetz, C. 2018. Emerging roles of ER stress in the etiology and pathogenesis of Alzheimer's disease. FEBS Journal, 285:995-1011.
11. Bahar E., Kim H., Yoon H. 2016. ER Stress-Mediated Signaling: Action Potential and Ca(2+) as Key Players. International Journal

- of Molecular Sciences. 17(9):1558.
12. Hayley M., Perspicace S., Schulthess T., Seelig J., 2009. Calcium enhances the proteolytic activity of BACE1: An in vitro biophysical and biochemical characterization of the BACE1-calcium interaction, *Biochimica et Biophysica Acta (BBA) - Biomembranes*, Vol.1788,9, pp.1933-1938.
 13. Ohno, Masuo. 2014. Roles of eIF2 α Kinases in the Pathogenesis of Alzheimer's Disease." *Frontiers*, *Frontiers*. Vol.7, pp.22
 14. Vattem K.M., Wek R.C. 2004. Reinitiation involving upstream ORFs regulates ATF4 mRNA translation in mammalian cells. *PNAS*, National Academy of Sciences. Aug 3;101(31):11269-74.
 15. Lerdkrai, Chommanad, et al. 2018. Intracellular Ca²⁺ Stores Control in Vivo Neuronal Hyperactivity in a Mouse Model of Alzheimer's Disease." *PNAS*, National Academy of Sciences. 115 (6) E1279-E1288
 16. Stargardt A., Swaab D.F., Bossers K., 2015. The storm before the quiet: neuronal hyperactivity and A β in the presymptomatic stages of Alzheimer's disease. *Neurobiology of Aging*, Vol. 36,1, pp.1-11.
 17. Wu F., Yao P.J., 2009. Clathrin-mediated endocytosis and Alzheimer's disease: An update. *Ageing Research Reviews*. Vol. 8,3, pp.147-149.
 18. Sun J, Roy S. 2017. The physical approximation of APP and BACE-1: A key event in alzheimer's disease pathogenesis. *Developmental Neurobiology*. 78(3):340-347.
 19. Zott, Benedikt, et al. 2019. A Vicious Cycle of β Amyloid-Dependent Neuronal Hyperactivation. *Science*, American Association for the Advancement of Science. 365(6453): 559-565
 20. Plácido A.I., Pereira C.M.F., Duarte A.I., Candeias E., Correia S.C., Santos R.X., Carvalho C., Cardoso S., Oliveira C.R., Moreira P.I. 2014. The role of endoplasmic reticulum in amyloid precursor protein processing and trafficking: Implications for Alzheimer's disease, *Biochimica et Biophysica Acta (BBA) - Molecular Basis of Disease*, Vol.1842,9, pp.1444-1453.

The Pakistani Constitution: in Pursuit of Justice

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In deeply divided societies and deeply flawed democracies such as Pakistan's, one might wonder if there exists a principle that could effectively address the structural issues present. After some consideration, I believe that in order to truly represent democratic ideals, a state and its constitution must embody the principle of justice. Although justice may be defined in any number of ways, and arguably forms the basis for all other moral virtues, I will be defining it as equity, or as John Rawls puts it, "justice as fairness."¹ This paper will present Pakistan as a case study for diverse, divided and developing countries with long-prevailing status quos and power structures that hinder democratic activity. By examining the critical institutional choices made in the 1973 Pakistani Constitution and crafting a hypothetical constitution that places the utmost importance on the pursuit of justice, I will be suggesting changes that can enable democratic institutions in the country to function fairly and equitably.

Defining Equity

Equity is a concept which originates from the Greek word *epieikeia* (meaning appropriateness, exceptionality, and justice) and the Latin word *aequitas* (meaning evenness, sameness, and fairness²). Equity is primarily defined as the fair treatment of individuals according to their respective needs and requirements. This is in contrast with the principle of equality, which implies that all individuals must be treated the same, regardless of their position in society, thus putting certain individuals at a disadvantage. Although, as I shall examine, equality is important for certain aspects of a democracy, an indiscriminate dependence on it can often lead to injustice.

Considering the subject of my analysis – a Muslim-majority Islamic state – this experimental constitution would benefit greatly from the inclusion of Islamic political theory, especially the principle of 'Adalah (justice as equity). However, for the purposes of this particular paper, I will only be co-opting the concept of justice as outlined in John Rawls's *A Theory of Justice*,¹ and Eleanor Curran's *Comments on Larry May's "Limiting Leviathan,"*³ and leave an expanded examination of Islamic principles for a more comprehensive future discussion.

Rawls, in his landmark book, defines justice as the "first virtue of social institutions," asserting that there is no space in a just system for "sacrifices imposed on a few" that are outweighed by a "larger sum of advantages."¹ This is the very foundation of both of our arguments: that no individual should ever benefit at the expense of another. His definition of justice as fairness is based on two basic tenets. The first, as

outlined in Chapter Two, is for every person to have an equal right to basic liberties, or "constitutional essentials,"⁴ including political liberty, freedom of speech and assembly, freedom of thought, freedom of the person, the right to hold personal property, and freedom from arbitrary arrest and seizure. These freedoms, of course, exemplify the principle of equality, and according to Rawls, are "not subject to political bargaining or to the calculus of social interests."¹ A similar idea is furthered by Hobbes in *De Cive*, where he states that the "safety of the people is the supreme law," defining safety as "everything necessary for a commodious life."³ Thus, it is the government's foremost duty to secure these basic liberties for all of its peoples, regardless of their position or status. And, although unfortunately subject to varying implementation, these essentials are enshrined in the Pakistani Constitution.

The second and more notable tenet of Rawls's thesis is the principle of having social and economic inequalities "arranged so they are both (a) reasonably expected to be everyone's advantage, and (b) attached to positions and offices open to all."¹ This principle is where equity is incorporated as a form of justice, because it calls for social institutions to divide benefits appropriately to uplift the disadvantaged and ensure that they have the opportunity, skills, and resources to succeed. This idea is important to help us make the distinction between equality and equity, because it demonstrates how simply declaring all people equal under the law is insufficient; there will always be people who are worse off due to this "equal" distribution, since they were disadvantaged to begin with. Thus, relying on equality without considering equity is akin to turning a blind eye to both the excessiveness of the haves and the plights of the have-nots. Equality is the bare minimum; it should not define the institutions that the constitution establishes. Instead, I aim to elevate my aspirations above the basic and urgent provision of equality, ideally reaching a point where it provides the backdrop for the pursuit of justice and equity.

Rawls's principle of justice as fairness is based on an intriguing thought experiment that he engages in throughout the book. Although this scenario is purely hypothetical, it helps one truly understand the benefits of an equitable society, particularly equitable social institutions. He creates a fair choice situation by asking readers to assume that all individuals must cooperate to define the principles based on which their society will function. However, these people are behind a "veil of ignorance" – they are unaware of what their status in society will be once the veil is lifted.¹ In this scenario, not knowing whether they will be better or worse off after an

equal distribution of benefits, the natural principle, or what Hobbes would call the “law of nature,”³ is that they will collectively decide to adhere to an equitable system that benefits even the worse off, leaving no one behind. Therefore, equity is what he defines as the “original position,” i.e. the elimination of conflicts of interest, resulting in cooperation within social, political, and economic institutions, providing everyone with the chance to truly succeed. This eliminates the injustice and arbitrariness of what Rawls calls “accidents of natural endowment and the contingencies of social circumstances,”¹ ensuring a division of advantages that makes for a level playing field and equal life chances for all.

Despite this idea of equity being the “natural” and “original” inclination—an innate preference, of sorts—Rawls does not deny that humans are “rational beings,” looking to further “their own ends.”¹ Rather, he argues that this system will be agreed upon by all reasonable individuals, as it will further each party’s interests without compromising any one group, providing a comprehensive framework for equitable ends. Similarly, May in *Limiting Leviathan* argues that Hobbes’s discussion of the binding power of equity is “grounded in prudence,” because violating the principle would undermine the safety of the people, what Rawls would consider a basic liberty and the state’s primary responsibility. This would result in unrest and therefore jeopardize the regime.³ Thus, both Hobbes’s and Rawls’s theories of justice and equity go beyond the theoretical “original position” to illustrate the motivating reasons behind choosing justice as fairness as the foundation of society as well as the viability of furthering the principle in political institutions: the practicality of equity, and the tangible effects of a lack thereof. Both scenarios culminate in what Rawls and Hobbes define as the “social contract,” and although their interpretations of this concept vary, both have demonstrated that equity is the most practical as well as the most moral foundation for any constitution.

Furthermore, Rawls draws stark contrasts between justice as fairness and the utilitarian view of justice, which is typically used to define democracies, illustrating how the latter promotes inequity by trying to make the most number of people happy. Because utilitarianism aims for the maximization of the net satisfaction in society, it has no qualms about neglecting a disadvantaged minority, or violating the liberty of a few to promote the greater good. Not only is this an unjust distribution of benefits because it fails to make distinctions between people of varying statuses and their different needs, but it also makes maximizing good the topmost priority, even if it only benefits a particular sector of the population. Within Rawls’s interpretation of justice as fairness, however, good is not necessarily the end goal. Instead, social institutions should be striving for the right and the fair. To aim for what is right does not always mean maximizing satisfaction, although this might be a by-product of being equitable.¹ Hobbes has a similar perspective on the issue, stating that just and efficient legislators and judges must have a “right understanding of...equity.”³ His view supports Rawls’s claims because he believes that equity provides the standards to

judge laws and their applications as wrong or right. As Rawls puts it, “the concept of right is prior to that of the good.”¹ This is what makes institutions stable and ensures that the violation of justice does not occur. This distinction between what is right and what is good effectively dismantles the perception that governments must prioritize the greater good in a democracy and makes for a compelling argument in favor of equity over utilitarianism.

This interpretation of justice as a means to promote equity also acts as a check on individuals’ desires, if these inclinations violate the principles of justice. Thus, this system helps individuals strive for ends that bring them satisfaction while working within a “framework of rights and opportunities,” making sure their ends are “equitably pursued.”¹ Similarly, Curran also analyzes May’s examination of *Leviathan*, outlining the “notion of equity” that Hobbes wrote about as both a “moral law” and as a “requirement of a sovereign’s lawmaking authority.”³ This brings attention to the role of equity in all aspects of a democracy, especially in the limitations and restrictions in a sovereign’s power, which by extension can be considered limitations on the desires and demands of the principles in a democracy. Although Hobbes’ views on the preferred form of government are questionable, May argues that he agrees that agents should be restricted via moral principles. These principles—equity in particular—are considered “laws of nature” and act to “bind the sovereign,” May notes.³ Thus, Hobbes sees equity as both a way to regulate government policies and to further “civil amity,” establishing a “long-term stability” originating from “a general human capacity to treat others fairly.”² Rawls, further on in his book, explores this intersection of personal and government morality. He goes a step further by examining the specifics of how the “choice of a political constitution” and the “main elements of the economic and social system” can be defined and regulated within the frameworks of equity, focusing on how rights, freedoms, duties, and opportunities are assigned in “various sectors of society.”¹

It is this “broadened and rich version of equity,” going “beyond a mere procedural rule of equal treatment to encompass fairness itself”³ that will define my hypothetical constitution. Although Rawls disagrees with many of Hobbes’s philosophies, both writers base their notions of social justice on the principle of equity. In their own distinct ways, they have introduced a social contract that all individuals voluntarily ascribe to, using equity as the basis of whichever social institutions they each prefer. Rawls’s book, Curran’s commentary on Hobbes’s work, and May’s interpretation have all demonstrated to us that equity is the most practical method to secure one’s own interests without infringing upon the rights of any other groups. It also helps establish social, economic, and political institutions that prioritize the well-being of each distinct sector of society.

Therefore, through an examination of Hobbes’s and Rawls’s political philosophies and their respective interpretations of justice, I establish that equity is the foundation that must un-

derpin any democracy. This will result in a stable state that transcends the simplistic and one-dimensional notion of equality under the law, instead championing equity as the guiding principle for its institutions and its social ideology and striking an ideal balance between a socialist welfare state and the capitalistic machine driven by self-interest.

National Ideology

According to Lerner, the constitution of any nation-state must express “the underlying common vision of the polity”⁵ because it acts as an ideological charter for the state’s very identity. This national identity must represent a “we:” a unified, if not homogenous, group. The whole of the Pakistani Constitution defines this “we” as the diverse ethnic, linguistic, cultural, and religious groups within the Pakistani population. However, the country itself, and much of its constitution, is characterized by an Islamic identity; therefore, it is an incontestable fact that any version of its constitution will be derived from Islamic values. Although a political and economic system that prioritizes equity may take on any number of forms, for the purposes of this paper, what I am most interested in exploring is the idea of an Islamic socialist state—an ideology that both founder Muhammad Ali Jinnah and first Prime Minister Liaquat Ali Khan endorsed.^{6,7} Islamic socialism is strikingly similar (with some notable religious variations) to the democratic socialism that is supported by Rawls,⁸ and it is perhaps the most equitable form of government for the country. However, I will be discussing the institutional choices that the constitution will make, and so state ideology, albeit intriguing, is beyond the scope of this paper. Nevertheless, it is my hope that these institutional choices will eventually culminate in the establishment of Islamic socialism, for they certainly further the values of equity and social justice that the ideology embodies.⁹

Federal versus Unitary Government

For my first institutional choice, I will be advocating for a federal system of government. Federalism is my system of choice for a number of reasons—the pursuit of justice as equity underpinning them all. To understand the need for federalism in Pakistan, I must briefly take a step back to examine the historical basis of the country. Here, I will begin lifting Rawls’s veil of ignorance by moving past the original position. Rawls states that this veil-lifting will continue until “everyone has complete access to all the facts,” allowing people to frame the most just constitution possible considering the society under discussion’s “natural circumstances and resources,” “beliefs and interests,” “political culture,” and “level of economic advance.”¹⁰ This sort of information is essential to ensure that the constitution is equitable in the specific context of the nation-state in question.

Pakistan was formed as a remedy to many Indian Muslims’ fear that “majority rule” in India, after the country gained independence from the British, would simply mean Hindu domination over the Muslims.⁵ According to Jinnah, “talk of

Indian unity...[was] simply a myth,” since he saw India’s “geographical unity” as “entirely the creation of the British who [held] it as one administrative unit by...the sword and not the will or the sanction of the people.”⁵ He saw India as comprising a multitude of nations, the most distinct being the Hindus and the Muslims, the latter of which he foresaw would be overpowered and marginalized by the former. Other writers have explored the complexity of Hindu-Muslim relations in the subcontinent before, but the point of importance here is that Pakistan was conceived as a Muslim-majority nation-state, meant to provide adherents of the religion the constitutional protection that India, under the rule of the Indian National Congress, seemed unlikely to deliver.

However, this statement leads one to presuppose that for this seemingly homogeneous population, the most logical dynamic between the central government and its subunits would be a unitary state. This is false, owing to the ethnic, linguistic, and until 1971, geographic diversity within the polity, which is the primary reason Pakistan adopted federalism. Still, the country has, in the past, leaned towards a regressive centralization of power, first introduced in the 1962 Constitution as the “One Unit Scheme.” This policy stemmed from a refusal to provide equity for the people and politicians of East Pakistan, and resulted in the dismemberment of the east wing (now Bangladesh).¹¹

A return to federalism in 1973, however, aimed to reinstate the autonomy of the provinces. Federalism is indeed the most suitable and equitable way forward for the current ethnic and linguistic diversity in the country. The decentralization of power ensures that all provinces can retain their autonomy and preserve identities that transcend the federation’s collective Muslim identity. These groups make up nations of their own: Punjabis, Pashtuns, Balochis, Sindhis, and Saraikis, among others. They each have their distinct languages, cultures, histories, and practices, and are limited for the most part to definitive geographic territories, known as provinces. Therefore, theoretically, a federation allows for Pakistan to ensure unity between these peoples without erasing their separate cultures and needs.

That being said, the East-West Pakistan conflict is not the only time Pakistan has alienated groups of people on account of their differences. Although the “preservation of language, script and culture” is mentioned in the Constitution (Article 28), the forceful imposition of Urdu as the national language has oftentimes been seen as a misstep, and has been said to result in the erasure of regional languages in the federation. The Eighteenth Amendment in the 1973 Constitution also addressed the provincial ownership of natural resources, dividing it equally between “that Province and the Federal Government.”¹¹ Although this was an improvement from the complete control the federal government previously claimed over provincial resources, Ahmed and Faiz argue that in order to promote “vibrant federalism,” the state must resolve the resentment that provinces harbor regarding the issue of

resource ownership so that underdeveloped provinces such as Balochistan can tap into their primary sources of economic gain.¹¹ This is an issue of equity, because not all provinces are equal in their resources and their representation, and so there is a need to ensure that within the federation, each province gets its due as per their respective needs. This should be done through providing them the autonomy that they require. "Accepting and accommodating their diversity" is crucial, instead of imposing a mythological national identity that fails to resonate with a country that considers itself beyond a common religion and a national language.

Supporting this thesis, Lerner also reaffirms that federalism is the most effective solution for states where "various ethnic, national or linguistic groups are territorially concentrated," as is the case in Pakistan. However, it is also important to remember federalism alone cannot ensure equity and justice in a society as deeply divided as Pakistan's. As Lerner puts it, creative provisions are required to prevent a "rigid and supreme" constitution that will create "competing systems of norms and identities" between distinct peoples.⁵ Ahmed and Faiz also observe that there is a need to honor "unity in diversity" to make for a "sustainable and long-lasting" federation, one where each province is given their basic liberties as well as equitable treatment under the constitution, providing for social, cultural and economic prosperity.¹¹

Electoral System

As ethno-linguistic, sectarian and provincial strife continues to exist, it must be understood that federalism (even well-executed federalism, of which there is a deficit in the country) cannot alone promote justice. Thus, the next institutional choice in question, to encourage equitable representation, is that of the election system. For my hypothetical Pakistani constitution, drafted with the purpose of furthering justice, I believe that proportional representation (PR) should be preferred over the majoritarian electoral system that currently exists in the country. As I shall explore presently, PR goes hand in hand with other institutional choices that make up what Lijphart dubs "the consensus cluster," which is characterized by PR, a multiparty system, coalition governments, and a strong legislature.¹² Although the arrangement is not perfect, I believe it is the most viable method of achieving systemic equity in the constitution, establishing a foundation for further equity throughout society.

One of the most important reasons for the adoption of PR is one that I have already discussed: the ethno-linguistic, religious and cultural diversity within the country. Due to this, many countries in Europe have opted for PR to ensure that ethnic groups within their heterogeneous populations are provided adequate representation. A second consideration whilst choosing PR is the "rising working class [wanting] to lower the thresholds of representation...to gain access to the legislatures," paired with "the most threatened of the old-established parties [demanding] PR to protest against the new waves of mobilized voters."¹² And so, in accordance with Rawls's natural principle (whereby decisions were made to

benefit all parties involved), proportional representation reconciles both groups—it allows more political participation while pacifying traditionally powerful parties, such as the Pakistan Muslim League and the Pakistan People's Party. This creates a more competitive democracy, protects the interests of minorities and disadvantaged groups, and maximizes representation.

Many in favor of plurality argue that while PR does work to expand representation and participation, this does not always result in a more effective democracy. It is claimed that majoritarian systems provide accountability for government policy, also resulting in "firm leadership" and a greater "capacity to govern."¹² This is a myth, because divided societies require coexistence, conciliation, and compromise, all of which can only be achieved through the "greatest possible inclusion of representations of [differing] groups in the decision making process."¹² The PR system is uniquely positioned to provide just that, and thus is best suited for effective and efficient policymaking in the long term, as decisions being made will reflect the interests of the entire country and not just the majoritarian party's singular ideological objectives. This links back to Hobbes's support for enduring "civil amity,"² which can best be achieved through equitable representation.

Turnout is also maximized in countries with parliamentary-PR systems, according to empirical data provided by Lijphart, which shows a 90% turnout being realistically attainable when voting is made compulsory in countries within a PR system, and a much lower turnout in countries with either presidentialism or plurality systems. Other statistics suggest that economic inequalities and the unequal distribution of income is the lowest in countries with parliamentary-PR systems, as opposed to parliamentary-plurality systems or any variation of the presidential system. Lijphart also provides compelling evidence to suggest that parliamentary-PR systems have the best records in representation, minority protection, and low unemployment.¹²

Now that I have established the clear reasoning behind adopting proportional representation over plurality voting, I must discuss further institutional choices that need to be made regarding PR. I believe that the most equitable method of casting votes within a Pakistani democracy is an open-list PR system, whereby people vote for both a political party via a party list and individual candidates within the party list. Seats are then allocated to each party in proportion to the total votes it received, and each party's seats are given to the candidates with the most individual votes.

Traditionally, Pakistani politics has been gate-kept by the rural and urban elite, including industrialists, businesspersons, and real estate tycoons, who have developed "dynastic holds" and exploited patron-client power dynamics in their local constituencies.¹³ Known as "electables," they have dominated politics due to their financial strength, regardless of their true intentions or political alignments. PR, however, would allow for the country's democracy to break loose of

the far-reaching influence of these incompetent electables, allowing new candidates and smaller parties (such as the Awami Workers Party) to get their foot in the door in both local and national elections. Thus, PR ensures that elections are not undermined through the power of patron-client relationships by guaranteeing some degree of minority faction representation, while continuing to encourage competition between candidates.¹⁴

Another method to further discourage patron-client relationships that result in disproportionate political dependency within local elections is the option for either approval voting or the Single Transferable Vote within the open-list PR system. In the former, voters express approval for as many candidates as they would like. Parties' seats are then allocated to candidates who have the highest approval votes, limiting the scope for the unjust monopolizing of power. In the latter, voters rank the candidates, and a predetermined quota of votes is used to decide the threshold to guarantee a seat. If a candidate reaches or crosses the threshold, the individual's vote is transferred to their second preference, ensuring that no vote is wasted. This option is already utilized within the Senate, but since the Senate is an indirectly elected body, it does not represent the people equitably—especially since the Parliamentarians who vote for Senators are elected via the plurality system.

Within national and provincial elections, a simple plurality (the "first-past-the-post" system) is used in most cases, with the exception of seventy seats for women and minorities in the National Assembly allocated by PR. This creates a multitude of issues, including immense barriers against the entry of new political players, voting for whom is often seen as a waste regardless of their election platform, as they are unlikely to win a seat in the National Assembly due to the winner-takes-all nature of plurality voting. According to Media for Transparency, one in two voters in Pakistan was never represented in the federal legislature in the 2013 National Assembly elections.¹³ This is only one of many instances of discrepancies between the vote percentages and the percentage of seats that parties are eventually assigned. This dissonance grows more pronounced when the provincial breakdown of seats is examined. Abbas demonstrates how the severity of the issue increases since in 2013, only 50 percent of eligible voters cast a vote, meaning only about a quarter of the Pakistani population was represented in the National Assembly. Thus, PR will remedy these issues in multiple ways: increasing the turnout, expanding representation, encouraging competition, protecting minority rights, creating long-term stability, and ultimately, promoting equity.

Political Parties and Interest Groups

For the third institutional option, namely political parties and interest groups, I have delineated some of the constitutional choices I would like to make in order to encourage multipartism and strengthen interest groups, promoting equity and fairness. As mentioned in Taylor et al., political

parties and interest groups are "less a feature of a constitutional/legal order as they are a result."¹⁵ This applies to my other institutional choices, such as PR (as discussed) and a parliamentary system, which foster a culture of political pluralism. Interest groups are also a vital element of a just and healthy democracy, and must be encouraged and protected through the provision of constitutional rights such as the right to free speech, the right to organize and assemble, and the ability to petition to the government.

The decision to encourage a multiparty system is an easy one, especially if it is in conjunction with my other institutional decisions. As seen in ethnically diverse countries such as Belgium, PR lowers the barriers for smaller parties, allowing ethnic political parties to gain "virtually perfect proportional representation,"¹² making it a mechanism that Pakistani democracy requires urgently. Multiparty systems where national parties nominate candidates in local elections can, in particular, promote equity in a democracy, providing a "primary route for thousands of local leaders" who would ordinarily not be able to participate.¹⁴

Some might argue that if a multiparty system in the country was to be paired with PR, stability in the government might become impossible to achieve with the vote being fragmented and more parties than ever forming a coalition. If this kind of instability ever arises, a minimum threshold would prevent it, such as that in Germany where there is a five percent vote threshold that parties must obtain in order to gain representation. However, it is unlikely for the presence of more representation of the people to result in instability; instead, I would argue that it would lead to "maximum popular support" and the "harnessing [of] best talents."¹³ Lijphart mentions that the notion that coalitions are "messy, quarrelsome and inefficient" is a myth because two-party systems are just as, if not more, prone to "paralysis and deadlock."¹² While on the surface two-party systems might be more capable of forming policies with "greater ease and speed," well-thought-out policies formed through broad consensus and the good of every stakeholder in mind truly characterize a strong government in the long term, and are what maximizes justice.

Regarding interest groups, a vital issue in the formation and promotion of interest groups in Pakistan is the lack of rights that they are given – arbitrary arrests, censorship, and outright bans are not unheard of. For example, student unions were outlawed in 1984 under the flawed pretext of preventing violence, and student solidarity movements across the country have resulted in arrests and widespread silencing tactics. Movements such as the Haqooq-e-Khalq (Human Rights) Movement, and campaigns by health workers, lawyers and laborers, have also been subjected to intense marginalization by the state. Furthermore, activists and dissenters' rights are frequently violated through fines and arrests at best and forced disappearances at worst. The suppression of interest groups, therefore, must be explicitly outlawed in the constitution in order to make for an equitable system and a robust

democracy that, as mentioned in the Haqooq-e-Khalq Movement's manifesto, "addresses the needs and concerns of a majority of Pakistanis, not just the political one-percent."¹⁶

Legislative Branch

As the central policy-making institution, the legislature is the backbone of the government. The major institutional choice that political engineers are required to make in this regard is whether the legislature should have a bicameral or unicameral structure. For Pakistan, as for many federations, the most obviously equitable choice is a bicameral legislative branch. This is because Pakistan has previously experimented with unicameralism, which directly culminated in the conflict between West and East Pakistan and the eventual independence of the latter. To remedy the grievances of the subunits of the federation and prevent yet another future crisis, the 1973 Constitution established a lower and an upper house, the National Assembly and the Senate, thus "[providing] a platform at [the] highest level to characterize and honor regional, linguistic, cultural and religious and community representation."¹⁷ The primary purpose of introducing a Senate was to provide equitable representation for all provinces, with the intention of strengthening the federation. This provides provincial autonomy (in theory, at least) and creates a balance with the National Assembly, where the province of Punjab continues to dominate due to its population density.

The Senate also ensures that all legislative decisions be reviewed for a second time, a measure which prevents the tyranny of the lower house. I believe that this degree of medium symmetry is equitable, but only if the lower house is elected through proportional representation, as discussed; because, the National Assembly will already consist of a number of veto players within its diverse multiparty system. Making the relationship between the Senate and National Assembly fully symmetrical would make the legislative process unnecessarily complicated. According to Mushtaq, the Senate of Pakistan employs its oversight capacity "seriously and frequently," often utilizing a committee system, adjournment motions, attention notices, resolutions, and questions in the process.¹⁸ Therefore, its power of scrutiny, revision, and the ability to suspend what are often time-sensitive bills is a sufficiently equitable arrangement, making for an efficient relationship of checks and balances between the two chambers.

However, a major flaw in the Senate's powers is that it cannot revise economic and other money-related bills.^{17, 19} This is an issue that undermines the equity of the institution because, as mentioned, the distribution of economic resources is one of the main issues of contention between the provinces, and to not give the Senate—which serves to protect these subunits' rights—any say over fiscal federalism is a glaring injustice and a major "setback to the legitimacy of bicameralism."¹⁹ Therefore in my hypothetical Pakistani constitution, I would choose to give the Senate the additional authority to deliberate on financial bills and the federal budget.

Yet another flaw in the structure of the Senate is that although it sufficiently addresses the issue of provincial representation, this representation is not completely equitable due to the diversity of ethno-regions within each province, and their distinct interests. Once again, this calls for further diversification in the Senate's seat allocations, providing various subgroups within the provinces with their own representation.¹⁹

An additional weakness in the Pakistani bicameral system is the lack of youth representation. Although 64 percent of Pakistan's population is younger than thirty, and this percentage is slated to further increase in the coming years,²⁰ there is almost no representation for young people in the legislature. Furthermore, it is virtually impossible for young people to run a successful election campaign, due to the deep-rooted political hierarchies of the country. Although many of the solutions that I have presented might help increase the youth's political participation, there is also the need for direct affirmative action, which would provide a surefire, equitable remedy to this malady. Political activist Shaheera Jalil Albasit has recently petitioned for the government to establish a thirty percent youth quota: allocating "thirty percent election tickets to candidates under 35," applying this thirty percent youth composition across all legislative bodies, providing "financial support to [young candidates'] election campaigns," and empowering "underrepresented sections of society" via the quota.²¹ I believe that although the exact percentage is open for discussion, quotas of the sort, some of which are already established in the constitution, can provide an opening for more political participation from disadvantaged groups.

Executive Branch

For my penultimate institutional choice, a parliamentary system over presidentialism will come as no surprise since I have previously discussed the viability of the parliamentary-PR combination. The reasons behind this decision are manifold, some of which I have already examined during my exploration of electoral systems; the attractiveness of the consensus model is apparent and consistent with my commitment to promoting equity. Presidentialism, on the other hand, is usually associated with a two-party system and plurality elections, thus treating the executive position as a "prize to be won" by the majoritarian party.¹² Presidential cabinets also tend to consist solely of members of the governing party, which is a further blow to democratic fairness. Furthermore, presidentialism is the ideal method to ensure the concentration of power not just in one party, but in one person. This individual rarely represents disadvantaged groups, making the system by far the least equitable institutional choice possible, as it is "inimical" to power-sharing¹² and based on the assumption that a single popularly-elected executive can "create a government by his personal mandate."¹⁴ On the other hand, a parliamentary government allows for more checks and balances, such as the head of state and the legislature's prerogative to enact a motion of no confidence,

and the executive branch's ability to dissolve the National Assembly.

In addition, Lijphart debunks the notion that a powerful executive results in the most efficient leadership and decision-making. In fact, Latin-American countries, where the presidential-PR model is most common, are no strangers to "executive-legislative deadlock and inefficient leadership," with the exception of Costa Rica, and perhaps Venezuela and Colombia.¹² One could argue that one solution to this deadlock could be to trade the PR system with a majoritarian system; however, because PR is the cornerstone of my pursuit for constitutional equity, this is not an option, and thus, the parliamentary system is the most viable way to prevent the gridlock that combining PR with presidentialism would cause.

Lijphart also disproves the idea that a more inclusive executive branch is less effective at economic policymaking, citing both historical examples and political scientists' observations. Finer, for example, has stated that economic development is not directly related to the rapid decision-making that is associated with presidentialism, because development requires "greater stability and continuity," "moderation," "bargaining and conciliation," and a "steady hand," not just a strong one.¹² This sort of consensus-based decision-making is both wise and equitable, because it is done with many parties' interests in mind – especially since the disadvantaged will have multiple seats at the table.

Furthermore, according to Dahl's ranking of democracies based on ten indicators (including freedom of press and association, strong parties and interest groups, effective legislatures etc.), most parliamentary-PR systems are ranked much higher than almost all parliamentary-plurality systems, presidential-PR systems, and presidential-plurality systems.¹² This is a clear judgment on the feasibility of both the parliamentary model and proportional representation voting.

However in Pakistan, the doctrine of separation of powers that underpins the very purpose of having a tripartite government—avoiding the tyranny of the majority or the most powerful—has often been thwarted.²² The country has a history of failing to separate the executive branch from the legislature, with the former often aiming to wield absolute power. This is also complicated by the fact that the Prime Minister is the head of the majoritarian party—a problem which would be resolved through PR. This penchant for exerting unconstitutional power reflects a shortcoming in the constitution and a lack of accountability mechanisms outside of it, thus undermining the principle of equity. Therefore, further constitutional amendments are required to ensure that the executive branch does not abuse or overstep its authority, limiting it to the functions prescribed in the constitution.

Judicial Branch

A lack of separation of powers is also pervasive in the judiciary, becoming a catalyst for unfairness in the institution that is the very bedrock of justice. To remedy and prevent

such injustice, I will be making institutional choices that work to strengthen democracy in Pakistan, in conjunction with the aforementioned systemic changes.

First, I would favor a common law system, similar to the current legal doctrine in Pakistan, which follows the principle of judicial precedent and makes for a "creative and assertive" court.²³ This balances out performance deficits within the executive and legislative branches by protecting the fundamental rights of the populace, whilst also recognizing that no two cases are the same and should be interpreted considering both past court decisions and the distinctive features of the current case – thus ensuring equity. Civil law, on the other hand, features strictly codified laws that leave no space for interpretation, often resulting in unjust rulings that erase important differences between distinct circumstances.

Furthermore, I would enforce the concept of equity jurisdiction within the common law. This practice is common in countries such as the United States, Scotland, India, and Australia, and it embeds the principles of equity within the codified law. For example, the Indian legal system allows courts to "devise a new principle in a situation where the statute of codified law [has] no answer to a given situation."²⁴ Similarly within the Pakistani Constitution, equity is prioritized over the codified law if the two clash, reflecting the legal maxim of *ubi jus ibi remedium* (where there is a right there is a remedy). The maxim, implied in Articles 184(3), 187, and 199 of the 1973 Constitution, allows courts, through their writ jurisdiction, to give fundamental rights precedence when the law is inadequate in order to have complete justice or remedy an injustice.²⁵ Therefore, combining equity jurisdiction with common law in the constitution enhances the dispensation of justice.

Common law and parliamentarianism go hand in hand with the practice of judicial review, which acts as a check and balance on "the functioning of elected governments" in both "constitutional matters" and other "domains of public life."²³ This mechanism allows the judicial branch—a neutral third party and the "chief protectors of individual rights"²⁵—to hold other branches responsible by declaring administrative actions unlawful or unconstitutional. Although Rawls argues that the issue of judicial review is largely dependent on a country's "historical circumstances and conditions of political culture,"²⁴ he mentions that some might argue against it because to allow an unelected institution to make decisions regarding the pursuit of fairness seems undemocratic. However, in certain cases, "independent judiciaries" are the most suitable actors to pass "apt and credible resolutions" that uphold "fair equality of opportunity" as well as constitutional essentials such as basic freedoms.⁴ The latter case is certainly applicable in Pakistan, where judicial review is one of the most vital checks and balances on legislation that might restrict constitutional freedoms.

However, Rawls notes that the consequent pressure on the judiciary to guarantee constitutional essentials may result in the "over-extension of the judicial role."⁴ This has manifested

in the Pakistani judiciary through a number of instances where the judiciary has overreached, citing its duty to protect the citizens as justification for the unconstitutionality of its acts. This has recently been seen in the Supreme Court's judicial activism, whereby it has utilized its ability to conduct judicial review to interfere with what it considers matters of "public importance" under the Constitution.²⁶ This provision in the Constitution allows for any petitioner or the Supreme Court, suo motu, to move against any party in the event of a violation of law. However, the apex court has fallen victim to the urge to act as a "social reformer,"²⁶ overusing its suo motu jurisdiction to undermine democracy and the principle of equity in more ways than one. It has done this by taking direct action against private parties that were indeed acting inequitably but were not breaking the law (such as private schools charging exorbitant tuition).

Although the intention behind such actions has always been honorable, it is undeniably unconstitutional, and sets a dangerous precedent for future judicial actions, especially considering Pakistan's history with interruptions in its fragile democracy. The superior judiciary should have the power to strike down unconstitutional laws or actions, and can direct the legislature to pass certain laws to protect the polity, but cannot be a legislative body in itself—it lacks both the expertise to draft laws and the democratic principal-agent relationship that legitimizes policies. Such actions also usurp other citizens' rights in a multitude of ways, producing further inequity – the implicated private parties are disadvantaged and lack the fundamental right to petition against unjust laws in the apex court, since the Supreme Court is in fact the party that formulated the law.²⁷ There is a fine line between promoting justice and compromising democracy, and the latter must never occur in pursuit of the former. Therefore, my constitution would include the necessary safeguards to ensure that the superior judiciary exercises restraint in its decision-making and does not violate the separation of powers between itself, the legislature, and the executive.

Beyond amending the constitution to include restrictions in the process of judicial review, another way to guarantee the separation of powers is by ensuring that the judiciary is both politically and financially independent. The current constitution has no provisions for the latter. However in 1996, the Supreme Court and provincial High Courts requested that superior courts be given funds to re-appropriate "without the approval of the Finance Ministry," supported by Article 175(3) of the Constitution, which states that the judiciary must be separate from the executive branch.²⁸ Nevertheless, it is unclear whether such provisions have been made in the budget: as of 2012, the judiciary was still calling for financial independence.²⁹ Thus, I would amend the constitution to make room for fiscal autonomy, freeing the judiciary of its dependence on the executive branch, and thus enabling independent and unbiased rulings.

Furthermore, the judiciary requires political insulation to ensure that it dispenses justice impartially, uninfluenced by

political actors. This comes down to factors such as how judges are appointed and whether their tenure is secure. Pakistan has a history of "arbitrary appointment, transfer, promotion, and suspension of judges,"²³ which damages the independence of the judiciary considerably. Currently, Pakistan follows a career judiciary model whereby Supreme Court justices have a permanent tenure of 65 years, which I believe is reasonable. However, they are appointed by the Judicial Commission, headed by the chief justice, and composed of four other senior judges: a retired Supreme Court judge, the federal minister for law and justice, the attorney general, and a representative of the Pakistan Bar Council.³⁰ This commission nominates judges proposed by the chief justice and approved by the other members.³¹ The nominees are then forwarded to the Parliamentary Committee, which includes parliamentarians from both houses. The role of the Parliamentary Committee, however, is almost redundant—it must provide reasons for its disapproval of any appointments, and any dissent may be overruled by the Judicial Commission in its review of the Parliamentary Committee's comments. This model of "aggressive judicial independence" is an inversion of the historical power of the executive over judicial appointments, and is just as damaging, because it gives the chief justice a "monopoly" over judiciary appointments.³¹

To preserve both the independence of the judiciary and dilute the overwhelming power that the chief justice holds, I would alter the constitution to create an independent judicial council for the nomination of new judges, among other functions (such as court administration, training, performance evaluation, overseeing ethics, etc.). This calls for both judicial representation to ensure independence and broad membership, as a check-and-balance. Therefore, the council would not include any political actors—only senior judges and members of the independent legal profession, civil society, academia, and other nonpracticing jurists.³² Members of the council must be competent and diverse in terms of ethnicity, religion, profession, and gender.³³ In addition, all members must have an equal say in the nominations, which should also meet a set of equitable criteria (such as that of New Zealand's). Provisions for both a diverse, independent committee and a diverse bench will prevent the overrepresentation of a dominant or privileged group in the judiciary, which might otherwise compromise "the neutrality of the judiciary" in matters concerning the less privileged.³³

The judicial council's nominees may then be forwarded to the president for approval. Allowing a neutral head of state to make the final appointments would act as a sufficient check and balance on the power of the committee and strengthen the democratic legitimacy of the judiciary.³³ To further this end, I would also suggest televised interviews of the candidates, which should be one of the many constitutional provisions that ensure the transparency of the process. Furthermore, the judicial council's activities and decisions, its future projects, and any obstacles encountered would also be documented online. Currently minutes of the Judicial

Commission's meetings are not published, and the appointment process is "shrouded in mystery."³⁰ To establish a fair process, however, Baig argues correctly that the judiciary should maintain the same "standards of transparency and objectivity that it holds every other institution accountable to,"³⁰ which would only strengthen the institution and allow for more equitable decisions to take place.

Conclusion

Justice has a widespread reach, as it must be the driving force behind every branch of government. However, a sense of justice must also be reflected in each citizen in order for a state to reach its full potential. The provisions made in my redesign of the Pakistani constitution's basic institutional choices aim to fulfill both Rawls's first and second principles of justice—the equality of constitutional essentials and the arrangement of inequalities – so everyone is at an advantage and has the opportunity to succeed. When these principles are reflected in the basic institutional structures of the state, one might expect that they will be mirrored throughout politics, economics, and the wider society.

References

1. Rawls, John. *A Theory of Justice*. Original ed. Cambridge, Mass: Belknap Press, 2005.
2. Abosch, Yishaiya. "An Exceptional Power: Equity in Thomas Hobbes's Dialogue on the Common Law." *Political Research Quarterly* 66, no. 1 (March 2013): 18–31. <https://doi.org/10.1177/1065912911434160>.
3. Curran, Eleanor. "Comments on Larry May's Limiting Leviathan, Hobbes on Law and International Affairs." *Hobbes Studies* 27, no. 2 (September 8, 2014): 178–84. <https://doi.org/10.1163/18750257-02702003>.
4. Michelman, Frank I. "Justice as Fairness, Legitimacy, and the Question of Judicial Review: A Comment." *Fordham Law Review* 72, no. 5 (2004).
5. Lerner, Hanna. *Making Constitutions in Deeply Divided Societies*. Cambridge University Press, 2013.
6. Ispahani, Mirza Abul Hassan. *Qaid-E-Azam Jinnah As I Knew Him*. Royal Book Co. , 1976. https://www.cambridge.org/core/product/identifier/S0021911800146777/type/journal_article.
7. Kazimi, Muhammad Reza. *Liaquat Ali Khan: His Life and Work*. Karachi: Oxford University Press, 2003.
8. Wenar, Leif. "John Rawls." In *Stanford Encyclopedia of Philosophy*, edited by Edward N. Zalta. Stanford University, 2007. <https://plato.stanford.edu/archives/spr2017/entries/rawls/>.
9. Azam, Ikram. *Islam and Socialism*. London Book Co., 1971.
10. Moore, Ronald. "Rawls on Constitution Making." *Nomos* 20 (1979): 238–68.

11. Ahmed, Manzoor, and Jalal Faiz. "The Experiment of Federalism in Pakistan: An Analytical Study." *Pakistan Journal of History and Culture* XXXVII, no. 1 (2016).
12. Lijphart, Arend. "Constitutional Choices for New Democracies." *Journal of Democracy* 2, no. 1 (1991): 72–84. <https://doi.org/10.1353/jod.1991.0011>.
13. Abbas, Hassan. "Proportional Representation: Is Pakistan Ready for a New Electoral System?" *Media for Transparency* (blog), September 29, 2018. <http://pakrtidata.org/2018/09/29/proportional-representation-pakistan/>.
14. Myerson, Roger. "Constitutional Structures for a Strong Democracy: Considerations on the Government of Pakistan." *World Development* 53 (January 2014): 46–54. <https://doi.org/10.1016/j.worlddev.2013.01.005>.
15. Taylor, Steven L., Matthew Soberg Shugart, Arend Lijphart, and Bernard Grofman. *A Different Democracy: American Government in a Thirty-One-Country Perspective*. New Haven: Yale University Press, 2014.
16. "Haqooq e Khalq Movement - HKM." Accessed December 22, 2020. <https://www.facebook.com/haqooqekhalq/posts/457136048057734>.
17. Javaid, Umbreen, and Zainab Ahmed. "Role and Significance of Senate in the Federation of Pakistan: An Analysis Before and After 18th Amendment to the Constitution." *Margalla Papers* 2017, July 2018.
18. Mushtaq, Muhammad. "Empowering Ethnoregional Minorities and the Federal Bicameralism: Examining the Role of Senate in Pakistan." *FWU Journal of Social Sciences* Winter 17, no. 4 (n.d.): 1–11.
19. Khan, Kishwer. "Bicameralism in a Federation: An Historical Analysis of Role of Senate in Promoting Federalism in Pakistan." *Pakistan Perspectives* 22, no. 1 (June 2017).
20. Ahmad, Shakeel. "Unleashing the Potential of a Young Pakistan." *United Nations Development Programme: Human Development Reports*, July 24, 2018. <http://hdr.undp.org/en/content/unleashing-potential-young-pakistan>.
21. Albasit, Shaheera Jalil. "30% Youth Quota," n.d. https://docs.google.com/document/d/1doOm0yc-VqfMfgC5h3PLN1RikQtMXh7yTrKn4XANrFA/edit?fbclid=IwAR111GRS5rF1zPo16abnMWeN4Zjsbo-CWYJPGtgLAN4_lxNB5H51rVpJicQ.
22. Sultana, Tasneem. "Montesquieu's Doctrine of Separation of Powers: A Case Study of Pakistan." *Journal of European Studies*, n.d.
23. Waseem, Mohammad. "Judging Democracy in Pakistan: Conflict between the Executive and Judiciary." *Contemporary South Asia* 20, no. 1 (March 2012): 19–31. <https://doi.org/10.1080/09584935.2011.646077>.
24. Upadhyaya, M. L. "Review of T.R. Desai's Equity, Trusts and Specific Relief (9th Ed.)." *Journal of the Indian Law Institute* 38, no. 4 (1996): 549.
25. "Maxims of Equity." *University of Peshawar*, n.d. <http://www.uop.edu.pk/ocontents/where%20there%20is%20right%20there%20is%20remedy.pdf>
26. Omer, Reema. "Suo Motu Action." *DAWN.COM*, May 27, 2018. <https://www.dawn.com/news/1410267>.

27. Rahman, Zaki. "Saqib Nisar: Between Protecting Fundamental Rights and Unwarranted Interventions." DAWN.COM, January 30, 2019. <https://www.dawn.com/news/1460569>.
28. Hussain, Faqir. "The Judicial System of Pakistan." Supreme Court of Pakistan, 2011.
29. "Judiciary Striving for Financial Autonomy: CJ," DAWN.COM, September 5, 2012. <https://www.dawn.com/2012/09/05/judiciary-striving-for-financial-autonomy-cj/>.
30. Baig, Mirza Moiz. "Judicial Appointment." DAWN.COM, April 21, 2019. <https://www.dawn.com/news/1477480>.
31. Ijaz, Saroop. "Judicial Appointments in Pakistan: Coming Full Circle." LUMS Law Journal 1, no. 1 (2014). <https://sahsol.lums.edu.pk/law-journal/judicial-appointments-pakistan-coming-full-circle>.
32. Autheman, Violaine, and Sandra Elena. "Global Best Practices: JUDICIAL COUNCILS - Lessons Learned from Europe and Latin America." Edited by Keith Henderson. FES Rule of Law White Paper Series, April 2004. <https://www.csm.org.pt/wp-content/uploads/2017/12/authemaandelena2004judicialcouncilslessonslearnedeuropelatinaamerica.pdf>.
33. "Judicial Appointments." International IDEA: Constitution Building Primers, August 2014. https://constitutionnet.org/sites/default/files/judicial_appointments_0.pdf.

Reflection and Correction: Guaman Poma's Precolonial Critique of Spanish Dominance in the Andes

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Introduction

Felipe Guaman Poma de Ayala wrote *El primer nueva coronica y buen gobierno* during the early years of seventeenth-century Spanish colonial rule in what is now Peru. He writes to his Spanish audience and King as an "umilde bazallo," humble vassal, seeming to embrace Spanish political structure.¹ Guaman Poma distances himself from his indigenous identity and the "yndios"--Indians--he describes by identifying himself as a Christian chronicler, going so far as to address his work to the pope in addition to the King. His text is reminiscent of a colonized subject, but when interrogated through a postcolonial lens, I question whether his subjective representation of indigenous history, Inkan² rule, and colonial history reflect the "dominant values and oppressive belief systems" of Spanish colonial society.³

The text contributes to a mythic view of an indigenous-American "Other" by producing a chronicle for consumption by a Spanish audience. Like other scholars, I view Guaman Poma's Christian identity as a key influence on the text. I suggest that this identity allows him to write a subaltern history of colonization as it is happening. However, applying postcolonial theory to works created in the midst of the colonization process is not anachronistic. As Lois Tyson explains, "because colonialist and anti-colonialist ideologies can be present in any literary text, a work doesn't have to be categorized as postcolonial for us to be able to use postcolonial criticism to analyze it."⁴ When used as a tool for distilling "colonialist and anticolonialist ideologies," postcolonial theory helps approach the text as a repository for the dynamic context in which it was written.

The most basic scholarly position towards the text is that it is *not* pro-colonial, but there is no consensus on the extent Guaman Poma presents an *anti*-colonial perspective. Was he opportunistic--seeking power in the new colonial world order? Anti-Spanish? Pro-Inka? The scholarly debate approaches a question of degree: just how radical was Guaman Poma's critique?

An application of postcolonial theory helps answer this question. Like other writers of postcolonial works that resist continuing imperial influences, Guaman Poma resists the nascent imposition of colonial Spanish rule. Both postcolonial authors and Guaman Poma write of the colonized--of marginalized voices, of their histories, of their struggles--but Guaman Poma differs because postcolonial authors react to their past while Poma reacts to his present. In light of this disjunction, I distinguish my postcolonial analysis from Guaman Poma's "precolo-

nialist" critique. Guaman Poma's text provides evidence that he did not succumb to the dominating influence of colonial Spanish rule in Peru. Rather, his appropriation of Spanish form and customs allows him to exercise agency and resistance in the face of invading cultural and political Spanish forces, going so far as to hint at Andean superiority.

Background, Theory & Author

In the liminal space between the indigenous Andean subaltern, and educated colonial elite, Guaman Poma writes *The First New Chronicle and Good Government*. Postcolonial theory's emphasis on themes of identity, resistance, and heritage deepen my analysis of the text, its author, and its context to better understand the complex pre-colonial critique Guaman Poma presents.

As an artifact, the chronicle is a manuscript housed at the Royal Danish Library in Copenhagen. According to Rolena Adorno, the nearly 1200-page document "differed from the usual requests for recompense and royal recognition written to the Spanish monarch by *conquistadores*⁵ and *caciques*⁶" with nearly 400 illustrations that "pictured Andeans as they had lived under Inca rule and as they were currently conforming to the demands of Spanish colonialism."⁷ After a period of unnoticed disappearance, the manuscript was rediscovered in 1908 and is now a canonical text for those studying Latin American history and literature.

The Inkan customs described in the document reflect the ethnic heritage of Guaman Poma since he was a fully indigenous man himself. His pre-colonial critique of Spanish dominance is grounded in this ethnic identity and the experience of living in an increasingly culturally-hybrid environment. I use "subaltern" to describe his marginalized position as an indigenous man, a term that Gayatri Spivak says is "defined as a difference from the elite."⁸ For Guaman Poma, the elite were the powerful Spanish colonists that were asserting control across Latin America.

Though I use "subaltern" as an apt description of the author's position, I question Spivak's final conclusion to her essay "Can the Subaltern Speak?" -- that the subaltern *cannot* speak.⁹ Guaman Poma indeed spoke. The paradox of a speaking subaltern raises some interesting questions about Guaman Poma's identity. Perhaps "subaltern" is *not* an apt way to describe his position. The text is written in Spanish, it follows a standard pattern for European books, and Guaman Poma presents himself wearing Spanish dress in his self-portrait.¹⁰ According to Tyson's description of colonials, "individuals tried to imitate

their colonizers, as much as possible in dress, speech, behavior and lifestyle,¹¹ suggesting that Guaman Poma was an acculturated colonial subject. Applied to the cursory summary above, this description displays remarkable congruency: with his appropriation of Spanish sumptuary custom, Spanish language, and even Spanish book formats, Guaman Poma seems like a colonial subject, someone who tries as hard as possible to be similar, not different, to the colonizer.

That Guaman Poma was educated by a mestizo priest, used his colonizers' language, and appropriated Spanish dress does not negate or otherwise marginalize his ethnic identity, however. Labeling him as a colonial subject presumes that simultaneous education in the indigenous tradition did not take place or was overshadowed by Spanish influence. Yet, he recalls Andean history and iconography, details Inkan societal custom, and writes 1,189 pages to correct and add to the histories that had already been created by Spanish chroniclers. His heritage and the content he describes place Guaman Poma squarely within the designation of indigenous subaltern.

Colonial influence on Guaman Poma's identity is normal and does not indicate that he betrays subaltern interests in his text. The expectation that a subaltern subject will remain unchanged in the face of social, political, and cultural upheaval is unrealistic. Spivak's famous claim that the subaltern cannot speak implies that appropriating the dominant power's method of communication distances them from their marginal identity; thus, when they speak, their voice no longer reflects that of a subaltern. I reject this expectation as impossible and would even go so far as to say that the idea that a "true" member of the subaltern cannot speak contributes to essentializing discourse. Appropriating the dominant power's method of communication does not result in losing a subaltern identity. To argue this suggests the subaltern is an essential group that is predicated upon their unchanged difference in the face of a dynamic power context. This is not accurate. For Guaman Poma, becoming literate in both the custom and the language of his oppressors allowed him to write a critique that would be intelligible to his Spanish audience and express resistance without drawing unwanted colonial punishment to himself as an indigenous person expressing dissent to Spanish dominance.

One could argue that without the Spanish invasion of Latin America, this text would never have been written. Put this way, the logic suggests that a profound Spanish influence completely permeates an indigenous man's scholastic production, making its entire existence the result of colonial imposition. At the same time, this text would not have been written if Guaman Poma had not felt the need to resist. The impetus for this chronicle was not acceptance of Spanish imperialism, but rather, a rejection of how Andean history was narrated by Spanish chroniclers.

The corrective aspects of Guaman Poma's text confront a constructed image of the "savage Indian that needs saving." To better understand this aspect of resistance, I turn to Edward Said's analysis of the notion of the "Orient" - it applies equally well to

the "Occident." Speaking of how the construction of the Orient is justified, Said argues, "The exteriority of the representation is always governed by some version of the truism that if the Orient could represent itself, it would; since it cannot, the representation does the job, for the West...and for the poor Orient."¹² Guaman Poma rejects the Hispano-centric, Spanish-authored history of the Americas that "does the job." The "poor *Occident*" is nowhere to be found in his powerfully voiced text.

Said posits "the Oriental" as a creation that "in a sense obliterate[s] him as a human being."¹³ In Peru, a stereotyped view obliterated complex Andean history and a diversity of Andean experience across time and within generations. The entirety of the tenth chapter, "El capítulo de la visita general o censo,"¹⁴ details divisions in age and gender in pre-colonial Inkan society. Guaman Poma's loquacious elaboration on Inkan society--in this chapter and elsewhere--brings the flattened category of an all-encompassing "yndio" back into relief, humanizing his people and their society.

He describes that "Dies calles de yndios para ocupar en traujos por que no fuesen ociosos y holgasanes en este rreyno, porque de otra manera no pudiera sustentarse ellos ni los demás prencipales y señores y la magestad del *Ynga* y su gouierno."¹⁵ All these "yndios" worked in the service of the Sapa Inka, but their responsibilities and expectations were diverse, as he describes and illustrates in the following 40 pages. His chronicle populates the "New World" with complex indigenous peoples that were not barbarians, but part of a flourishing indigenous tradition.

Identity of Guaman Poma

In postcolonial analysis, the identity of the author makes a significant difference when interpreting the text. This "precolonial" critique comes from a place where colonial identity is emerging, making the discussion of Guaman Poma's identity even more relevant. The name "Felipe Guaman Poma de Ayala" suggests mixed heritage. The compound last name conjures Spanish ancestry while "Guaman Poma" presents the Castilian reader with an exotic "New World" name. In reality, "Guaman Poma was a full-blooded native, not a mestizo."¹⁶ His ethnic identity proved to be challenging during the author's lifetime, causing "una gran frustración frente a la ingratitud de las autoridades coloniales que no reconocen '[t]reinta años estando sirviendo a su Magestad."¹⁷ The frustration that Rubec brings up expresses how Guaman Poma was limited by his identity, which solidifies his place within a subaltern that is different from the elite.¹⁸

Despite not being ethnically mestizo, Guaman Poma's actions suggest a *cultural* mestizaje. He repeatedly insists on his devout Christian identity, suggesting he knew "the suspicion with which ethnic Andeans' conversion to Christianity was held."¹⁹ This explanation implicitly suggests that he knew how his ethnic identity was perceived and countered that with the better-received Christian one. Yet the author's Christian faith does not necessarily imply acceptance, or even closeness, with

Spanish culture. Adorno describes him as "vehemently anti-clerical in his general criticism."²⁰ Adorno's comments point out the implicit difference between faith and institution: Guaman Poma was Christian but rejected the Spanish-imposed clerical system.

Performative belief in the religion for his own advancement within the colonial system may have shown Guaman Poma to be an opportunistic colonial subject, but his actions as a translator suggest that his faith was genuine. He "refers with pride to his work as interpreter for the church inspector" which allowed him to help the religion reach others.²¹ Had he wanted to limit its intrusion into the Andean region, he could have refused to translate. Instead, he makes the faith accessible to other indigenous people in their own language. This act helps separate Christianity from its Spanish-colonial introduction.

In work and politics, Guaman Poma's actions contest the absolute domination of the Spanish. He pursues power by seeking work within the colonial structure, "reflect[ing] the attitudes and actions of the Andean provincial elite" who "responded eagerly to the chance to seek offices and privileges in the colonial system."²² To do so, he readily appropriated the Spanish language. This put him in the category of "ladino, es decir que ha aprendido la lengua castellana y que se ha servido del bilingüismo durante su vida para asistir a las autoridades coloniales."²³ Even his service as a translator was not enough to give him social mobility; "no significa que haya ganado el respeto de los colonizadores."²⁴ Even though he tried to integrate himself into the Spanish colonial structure, his ethnic indigeneity--not his cultural practice of Spanish and Catholicism--defined him in the eyes of Spanish colonizers.

In "La deconstrucción de las culturas originales en una sociedad colonial híbrida," Rubec argues that when Spanish and indigenous cultures confronted each other in the Andean region, it resulted in the mutual destruction of both original cultures and the construction of a hybrid colonial society.²⁵ Rubec's stance would explain Guaman Poma's opportunism as an example of the hybrid colonial culture. Yet Guaman Poma's work with the Spanish colonial government is not evidence of his loss of ethnic indigenous roots; he is simply working under the conditions he is faced with and addressing his text to the colonial powers that had control. Guaman Poma's text may reflect hybridity, but it cannot be used to posit as Rubec does, since that hybridity fundamentally changes the original cultures.

Perhaps Spanish language and culture was an imposition at first, but Guaman Poma adopted and used it for his own purposes. In a text as complex as the author's own identity, the author presents a subtle and incisive critique of the colonial context that formed him. His colonially influenced education makes his resistance intelligible to the Spanish audience he addresses, but his complex lived experience as an indigenous colonial subject means the text is far more than a reflection of indoctrinated Spanish values.

Reflection or Rejection?

A text as complex as Guaman Poma's shows that strict separation between subaltern and dominant power oversimplifies the identity and lived experience of the subaltern. The text certainly reflects Spanish influence, starting from its most fundamental form as a Spanish-language book. Postcolonial analysis reveals that some of these reflections of Spanish colonial imposition can be understood as rejections of colonial control because they allow Guaman Poma's indigenous voice to enter and correct the narrative of Andean history.

The Manuscript: Form, Language, and Audience

The manuscript itself "followed the practices of typeset books in every detail."²⁶ Guaman Poma's knowledge of this form suggests that he was "an avid reader and consumer of all forms of colonial discourse,"²⁷ which extends to literary tropes as well. There was no indigenous equivalent form he could have used for the creation of this book. At the time, indigenous traditions were oral, or at most mnemonic, using quipus. The text reflects Spanish literature because *textual* indigenous influences would have been uncommon at best. For the critique to be intelligible, this had to be the form.

Spanish colonial influence in Guaman Poma's narrative cannot be overstated when one considers that Spanish is not Guaman Poma's native language. However, this Spanish colonial imposition is what allowed him to speak out. To the modern reader, there is some irregularity in punctuation, accentuation, and spelling in the narration. For example, even the title, "El primer nueva corónica," diverges from Spanish grammatical convention. To conform to gender agreement and standardized spelling, the title would be corrected as "La primera nueva crónica." These errors, however, are not evidence of incompetence; rather, they reflect the irregularity of spelling and calligraphy during the era in which the text was written.

Guaman Poma's fluency in Spanish allowed him to serve the colonial government. What he wrote after this service was, perhaps, a response to the injustices he saw. Rubec's discussion of the implications of writing the document in Spanish is worth quoting in full:

"Guaman Poma se da cuenta de que para que su queja sea legítima ante el rey debe ser comunicada mediante la escritura. Es importante notar que ello no significa que el sujeto no reconozca también el valor de las tradiciones orales andinas y de sus códigos simbólicos que incluyen quipus y tocapus. El hecho de que los contiene en su crónica, paralelamente y yuxtapuestos a la escritura, implica que los considera muy importantes y relevantes a su cultura peruana."²⁸

Her point that using the Spanish language legitimized Guaman Poma's complaint in the eyes of the king reflects my own argument: by appropriating Spanish culture, Guaman Poma made his critique intelligible to his Spanish audience. Rubec is

right to anticipate the accusation that Guaman Poma sidelines Andean oral tradition by using the written word to express himself. However, Andean oral tradition would not have sufficed as a medium to express resistance to colonization. As a pre-colonial criticism, Guaman Poma focussed on ensuring that the colonial forces he was reacting to could understand his criticism, so he wrote in Spanish.

Nevertheless, a reader could never forget that Guaman Poma is an indigenous author. From the very beginning of the text, he recognizes “relaciones de muchas lenguaxes ajuntando con la lengua de la castellana y quichiua ynga, aymara, poquina colla, canche, cana, charca, chinchaysuyo, andesuyo, collasuyo, condesuyo, todos los bocablos de yndios”²⁹ as his sources, and continues to use words in Quechua throughout the text. Tyson explains that postcolonial literature in an author’s local language emerges “in order to reject colonialist ideology and embrace... precolonial cultures.”³⁰ In Guaman Poma’s text, resisting the dominance of Spanish takes the form of including words in these languages, something he does at least as often as he references the Catholic faith. Yet, when the majority of the text is written in Spanish, can it be a text of resistance? Tyson explains further: “English, as a world language, facilitates the emergence of those nations into global politics and economics.”³¹ In a similar way, by writing in Spanish, Guaman Poma ensured that his narration--and more importantly, his critique--had a chance of coming to prominence in colonial politics.

The text’s audience, explicitly the Spanish king and Catholic pope, reflects the power of Spanish influence. Guaman Poma’s emphasis on his “service to the colonial administration” supports his claim to “the right to address the king.”³² He does so by identifying himself as an “umilde bazallo”³³ --of both the king and pope.³⁴ His text “works *within* the imperial context” by acknowledging “the intimate correlation between historiographic poetics and imperial politics...to insert his chronicle into an ongoing debate about these issues.”³⁵

These observations could be twisted to describe the text as indoctrinated into the power structure of Spain. However, the author’s self-identification as a humble vassal presents himself to Spanish readers as non-threatening. By presenting his critique to the king and pope as a subservient vassal, Guaman Poma avoids accusations of fomenting rebellion while still presenting a fairly radical critique of colonial impositions on the Andean people.

Christian-Andean Mythology

Beyond just using the Spanish language, Guaman Poma uses biblical Christian references to ensure his text is culturally intelligible to his audience. He demonstrates his religious literacy as a way to legitimize his text in the discourse of its time, advance his precolonial critique, and protect himself as the author. He seeks respect by justifying the “God-given” right of indigenous people to the territory Spain is trying to conquer. The creation story he presents in the section titled “La primera edad de los indios, Vari Vira Cocha Runa”³⁶ incorporates ele-

ments of the book of Genesis within an Andean context. Other elements are used anachronistically to align with elements of Andean history. For example, the story of Noah and his ark is used to explain how people in Latin America arrived an ocean away from the Spanish.³⁷ The great flood of that story links with a great flood of indigenous memory, “*unu yacu pachacuti*.”³⁸ By using this story, he establishes the legitimacy of the indigenous people’s inhabitation of the land on a Christian basis.

Guaman Poma’s mixing of Christian and Andean myth and symbolism shows a deeper desire to see Christianity as a spiritual inheritance that is shared with, but not dominated by, the Spanish. In the seventh drawing of the manuscript,³⁹ Adam and Eve appear on a background with mountains, perhaps condors, and most importantly, with both the sun and the moon.⁴⁰ The sun and its relationship to the man below harkens to Andean ontology that connects Inti, the sun god, with masculinity. Though the image explicitly invokes Christian myth, it implicitly joins this myth to extant Andean ontology. This early reference to Christian creation myth helps Guaman Poma demonstrate his religious literacy to his Hispanic audience early on.

The early inhabitants of Guaman Poma’s homeland “se entraron en este rreyno de las Yndias *por mandado de Dios*.”⁴¹ He invokes the name and the will of God as a way to explicitly justify indigenous presence, and then recalls Genesis to describe the land of Latin America, where God had chosen to settle these people. Like the Garden of Eden, the land was already inhabited by creatures: “En esta tierra primero uiuían serpientes *amaro*; saluages, *acha runa uchuc ullco*; ticres, *otorongo*; duendes, *hapi nuno*; *poma*, león; *atoc*, sorra; hozos, *ucumari*; *luychoy*, venados.”⁴² Some creatures he lists are important symbols in Andean iconography, for example, the *otorongo*, or jaguar.⁴³ Others, like the forest men,⁴⁴ *zacha runa*, and a fountain, *uchuc ullco*, which emerged from rocks reflect Andean cosmology. The fountain, something a Western audience would view as a non-living object, is listed among the Andean Eden’s creatures because it would have been seen as an agentive being within the landscape by an indigenous person, often called a *huaca*.⁴⁵ Guaman Poma’s inclusion of this symbol, even one that could be considered “heathen,” shows that biblical elements do not appear in the narration at the cost of indigenous ones.

In *El primer nueva coronica*, Catholic myth legitimizes Andean myth, making it intelligible for a Spanish audience, and connects the heathen “other” to a shared Christian ancestry. Guaman Poma connects indigenous people with the story of Adam and Eve through his depiction of the Eden-like land they inhabited, making an implicit comparison of their shared naïveté. Like Adam and Eve, the indigenous people “fell” from faith: “Esta gente *Uari Uira Cocha Runa* perdieron la fe y esperansa de Dios y la letra y mandamiento, de todo perdieron.”⁴⁶ Yet, in the pages that follow, Guaman Poma describes how they retained faith in a creator and followed Christian morals, though they forgot the Christian names.

Guaman Poma’s suggests that the Spanish simply reintroduced Christian names for an inclination that his ancestors had retained unconsciously, implicitly – the tone even suggests *naturally*. In the “second age of the Indians,” Guaman Poma describes their implicit belief in the Christian trinity, which used Quechua names.⁴⁷ In the third age, he states indigenous law and order and the virginity of women was emphasized.⁴⁸ He suggests similarity between indigenous beliefs and Christian beliefs, highlighting that the early Andeans did not need to be taught to believe and act the way Christians should.⁴⁹ After each description of an “age of the Indians,” he addresses his “cristianos letores,”⁵⁰ encouraging them to reflect on their own behavior in light of the Andeans’ purity.⁵¹

Whether or not the parallels are an exaggeration, by using them, Guaman Poma is clearly trying to convince his Christian readers of indigenous people’s divine right to the land and of their purity. His use of Christian myth explains indigenous history to them in a way that they can understand. Rather than revealing himself as a colonial subject, Guaman Poma’s usage of Christian myth shows his attempt to culturally translate and describe indigenous history in a way that is intelligible for those of a different culture.

The self-professed Christian who includes biblical references, directly addresses the Pope, and the various “Prologues to the Christian Reader,” suggests radical acceptance of colonial imposition. Postcolonial analysis shows the opposite: Guaman Poma’s chronicle uses Christian discourse to elevate the position of Andean natives, advocating for better treatment by showing they are deserving of Christian treatment. As he delinks Christianity from Spanish dominance, Guaman Poma sets up the chronicle to criticize Spanish colonialism as an immoral influence.

Correction and Superiority

The overt Christian influence in *El primer nueva coronica* is not a clear concession to Spanish influence. Under scrutiny, the Christian rhetoric is a way for Guaman Poma to correct the depiction of a dehumanized indigenous population and to legitimize them in the eyes of a Spanish, Christian audience. Though the text does reflect Spanish influence, it is not at the cost of Guaman Poma’s critique. At its core, the chronicle is a correction to Spanish narratives.

Ralph Bauer looks to the title’s “respective qualifiers – ‘*nueva coronica*’ (new chronicle) and ‘*buen gobierno*’ (good government) – [to] indicate that Guaman Poma was acutely aware of the intimate correlation between historiographic poetics and imperial politics and that he meant to insert his chronicle into an ongoing debate about these issues.”⁵² Why was there a need for a “new” chronicle or explanation of “good” government? Bauer’s research suggests it was because Guaman Poma was dissatisfied with how indigenous people were presented.

In the chronicle, Guaman Poma does criticize indigenous Inkans, but not for being uncivilized. He valorizes the law and order of indigenous society in the text, leaving his critique for their apparent “loss” of Christian faith. Idolatry was one way

for Spanish-authored literature to belittle indigenous Andeans, but Guaman Poma claimed it was not endemic to the Inka: “el primer *Ynga, Tocay Capac*, no tubo ydolo ni serimonias; fue linpio de eso hasta que comensó a rreynar su madre y muger de *Mango Capac Ynga* y su casta.”⁵³ Andean heritage includes purity from false idols, just as it includes sinfulness. The appearance of a serpent at least once reminds a Spanish reader of the wicked snake of Genesis, insinuating a similarity between indigenous “sinfulness” and the sinful biblical heritage the Spaniards claimed.

Guaman Poma humanizes indigenous people who, for the Spanish, would have been heathen idolaters. Addressing “¡O perdido Ynga!”⁵⁴ could suggest the Inka were “lost,” as in hopeless. Read with a reminder of his earlier commentary that the Inkas’ ancestors arrived on the land “por mandado de Dios”;⁵⁵ the phrase takes on a different tone: That the Inka are misguided, led astray, lost souls – lost lambs. An address like this frees the Inka from Spanish portrayal as savage heathens. Regardless of whether the author thought the Inka should convert, the direct impact of an address like this was to change how non-Christians were perceived by a Spanish audience. As a precolonial critique, the text addresses current reality.

Later, Guaman Poma readdresses sinfulness, specifically that of Eve, once again correcting Spanish perception. After spending a whole chapter describing powerful women of Inkan heritage, he addresses the story of Eve and the apple. Implicitly, he addresses the Spanish view of women as impure and sinful. He concludes his acknowledgement of the myth by saying, “Todo ello es cosa de burla y mentira. Deja todo y tene devoción.”⁵⁶ The comment suggests that women need only pray to be given respect. The unstated follow up is that the sinfulness of one’s ancestors does not prevent a group – women or indigenous people – from being moral now. Once again, the Christian rhetoric serves as a subtle way to suggest respect for the indigenous people.

Other parts of Guaman Poma’s text are not so subtle. For example, when “he proceeds to argue that ‘no hubo conquista,’”⁵⁷ he rejects their treatment “under the law as if they had been vanquished *inimicus* of Spain.”⁵⁸ The comments Sara Castro-Klarén refers to reject the idea of indigenous inferiority without identifying them as Christian or not. By saying there was no conquest, Guaman Poma is calling for treatment as equals. The Spaniard’s treatment of indigenous Andeans as inferior is wrong because, as discussed earlier, the Andeans have a God-given right to inhabit the land.

Not only does he claim there was no conquest, Guaman Poma also suggests that Spanish invasion tarnished a morally and socially superior culture. Describing the populations of Andean society, the author writes of how “Cada uno los que podían trauajar y ayudar, los que tenían ojos seruían de mirar, los que tenían pies andauan.”⁵⁹ Unlike in Spanish society, disabled Inkans contribute to the common good. He concludes “y ancí no auía menester hospital ni limosna con esta horden santa y policia desta puede tenella por más cristiano muy buen.”⁶⁰ The implication here is that the Inka were better able

to provide for their society, as seen by how they humanely help the disadvantaged people of their communities. It includes the value judgement of “horden santa,” which, again, supports the idea of an innocent indigenous population naturally aligned with the values of the Catholic Church and, moreover, functioning more morally and efficiently than Spanish society given the same conditions.

At one point, Guaman Poma criticizes invading Spanish Christians bluntly. He claims, “Todo lo malo adulterio y otros pecados mortales trajo concigo los dichos cristianos.”⁶¹ His writing could not be clearer: it is the Spaniards who damaged Andean society by bringing adultery and sin. “*Todo lo malo*” was brought by the Spanish Christians. In a text that has such outward respect for Christianity, this insult is even more acute. Here more than ever the chronicle takes the offensive. Beyond reframing how indigenous Andeans are represented, Guaman Poma takes control over the representation of invading Spaniards as well.

Conclusion

Guaman Poma should never have been forced to use Christianity to humanize the indigenous Andean people. However, reading *El primer nueva corónica* through a postcolonial lens, reveals that the text actually subverts its apparent Spanish cultural influences. As a precolonial critique, the text had to be permissible, not rebellious, in order to avoid colonizers using it as a reason to further subjugate the indigenous population. Presenting the critique from a subaltern position within the Spanish imperial system, Guaman Poma appropriates colonial influences to avoid Spanish censure. His success in doing so is what has protected this outstanding testament of the complex lived experience of colonial Peru.

Shrewdly presenting himself as an ideal colonial subject, Guaman Poma wrote a textual document in Spanish and addressed it to the Spanish king and the pope. He then proceeds to use this learned language, form, and religion to craft a critique that undermines Spanish representation of indigenous people and of the colonists themselves. Each word that he writes is an act of resistance because he has subverted the imposition of their language onto his culture to serve as a tool for his critique.

On the surface, Guaman Poma’s chronicle is concerned with Christian salvation and subservience to the ultimate Spanish authorities. His text repeatedly uses Christian rhetoric and imagery, but these influences are what makes his critique intelligible to his Christian audience. He draws parallels between Christian and Andean myth to show that indigenous history, belief, and culture deserve the respect of Spanish colonizers. He acknowledges Spanish chronicles only to refute their narratives and correct them with his own *new* chronicle. *El primer nueva corónica* may have contributed to a mythic view of an indigenous-American “Other,” but it is not the same “Other” that the Spanish chronicles presented.

Guaman Poma’s critique worked within the bounds of his colonial environment to craft an alternate version of Andean history as it was happening. His indigenous “Other” is deserv-

ing of Christian treatment, and the Spanish invaders are not. Its indigenous myth and imagery, inclusion of local language, corrective tone, and even assertion of superiority, anticipate key features of post-colonial literature. More importantly, they serve as part of a precolonial defense. Guaman Poma’s chronicle does not recover lost indigenous culture, rather, it attempts to assure that colonization will not extinguish it.

Endnotes

1. Felipe Guaman Poma de Ayala, *El primer nueva corónica y buen gobierno* [1615] (Copenhagen: Royal Library of Denmark, 2004), 4[4]. In order to most easily reference *The First New Chronicle and Good Government*, I use the page numbering that reflects the manuscript itself rather than any published edition. The first number is the page number Guaman Poma writes; the second, in brackets, is the corrected number that accounts for mistakes and unnumbered pages. The system comes from the Guaman Poma Website run by the Digital Research Center of the Royal Library of Copenhagen, Denmark, where the original manuscript is housed. The website offers high resolution images of all of the pages of the manuscript, and direct transcriptions of the calligraphy. The transcriptions include contextual footnotes and translation to normalized Quechua, since Quechua was still primarily oral at the time Guaman Poma wrote the work.
2. Inka and Inca are both appropriate spellings, but I choose the former per Michael Malpass in *Ancient People of the Andes*, Cornell University Press, 2016, page ix.
3. Donald Hall, “Race, Ethnicity, and Post-Colonial Analysis,” in *Literary and Cultural Theory: From Basic to Advanced Applications* (Boston: Houghton Mifflin Company, 2001), 266.
4. Lois Tyson, “Postcolonial Criticism,” in *Critical Theory Today* (London: Routledge, 2015), 399.
5. Conquerors, translation mine.
6. In English, also cacique. Used to describe an indigenous leader of local government.
7. Rolena Adorno, “Waman Puma de Ayala ‘Author and Prince,’” *Latin American Literature and Arts Review* 28 (1981): 12.
8. Gayatri Spivak, “Can the Subaltern Speak?” in *Colonial Discourse and Post-Colonial Theory: A Reader*, ed. Patrick Williams and Laura Chrisman, (New York: Columbia University Press, 1994), 80.
9. Spivak, “Can the Subaltern Speak?” 104.
10. Rolena Adorno, *Guaman Poma and His Illustrated Chronicle from Colonial Peru: From a Century of Scholarship to a New Era of Reading / Guaman Poma y su crónica ilustrada del Perú colonial: un siglo de investigaciones hacia una nueva era de lectura* (Copenhagen: Museum Tusulanum Press, 2001), 19; Felipe Guaman Poma de Ayala, *El primer nueva corónica y buen gobierno* [1615] (Royal Library of Denmark, 2004), 975.
11. Tyson, “Postcolonial Criticism,” 403.

12. Edward Said, “From *Orientalism*,” in *Norton Anthology of Theory and Criticism*, ed. Vincent B. Leitch, et al. (New York: W.W. Norton & Co., 2010), 2007.
13. Said, “From *Orientalism*,” 2011.
14. “The chapter of the general inspection, or census,” translation mine.
15. Guaman Poma, *El primer nueva corónica y buen gobierno*, 193[195]; “Ten groups of Indians in this kingdom were to do work in order not to be lazy because otherwise they could not support themselves nor the high officials and lords and his Majesty the Inca and his government,” trans. Hamilton, 148. All translations of Guaman Poma’s manuscript are Roland Hamilton’s unless otherwise noted.
16. “Mestizo” describes someone of mixed Spanish and indigenous heritage. In Latin American society, being mestizo would have opened opportunities and raised one’s social status. The term refers to ethnic background, rather than cultural practice; Adorno, *Guaman Poma and His Illustrated Chronicle from Colonial Peru*, 28.
17. Emily-Jayn Rubec, “La deconstrucción de las culturas originales en una sociedad colonial híbrida,” *Crónicas urbanas* 10 (2010): 35; “great frustration toward the colonial authorities’ ingratitude, which did not recognize ‘thirty years having served His Majesty,’” translation mine.
18. Spivak, “Can the Subaltern Speak?,” 80.
19. Adorno, *Guaman Poma and His Illustrated Chronicle from Colonial Peru*, 28.
20. Rolena Adorno, “Waman Puma de Ayala ‘Author and Prince,’” *Latin American Literature and Arts Review* 28 (1981): 15.
21. Adorno, “Waman Puma de Ayala ‘Author and Prince,’” 15.
22. Adorno, 28.
23. Rubec, “La deconstrucción de las culturas originales en una sociedad colonial híbrida,” 35; “*ladino* [Spanish-speaking Indian], that is, that one has learned Castillian Spanish and that bilingualism has been useful for serving the colonial authorities during his life,” translation mine.
24. Rubec, “La deconstrucción de las culturas originales en una sociedad colonial híbrida,” 35; “it does not mean that he has won the respect of the colonizers,” translation mine.
25. Rubec, “La deconstrucción de las culturas originales en una sociedad colonial híbrida,” 32; “The Deconstruction of Original Cultures in a Hybrid Colonial Society,” translation mine.
26. Adorno, *Guaman Poma and His Illustrated Chronicle from Colonial Peru*, 19.
27. Sara Castro-Klarén, “Writing Subalterity: Guaman Poma and Garcilaso, Inca,” *Dispositio* 19, no. 46 (1994): 241.
28. Rubec, “La deconstrucción de las culturas originales en una sociedad colonial híbrida,” 36; “Guaman Poma realizes that for his complaint to be considered legitimate before the king, it must be communicated in writing. It is important to note that this does not mean that the subject did not also recognize the value of Andean oral tradition or their symbolic systems, which included quipus and tocapus. The fact that they are included in his chronicle, concurrently and juxtaposed with relation to the

- writing shows that he considers them very important and relevant to his Peruvian culture,” translation mine.
29. Guaman Poma, *El primer nueva corónica y buen gobierno*, 11[11]; “accounts in many languages besides Spanish, Quechua, Aymara, Puquina Colla, Canche, Cana, Charca, Chinchaysuyo, Antisuyo, Collasuyo, Condesuyo, all Indian languages,” trans. Hamilton, 9.
 30. Tyson, “Postcolonial Criticism,” 403-4.
 31. Tyson, “Postcolonial Criticism,” 403-4.
 32. Adorno, *Guaman Poma and His Illustrated Chronicle from Colonial Peru*, 16.
 33. “your humble vassal,” translation mine.
 34. Felipe Guaman Poma de Ayala, *El primer nueva corónica y buen gobierno*, 4[4] and 10[10].
 35. Ralph Bauer, “‘EnCountering’ Colonial Latin American Indian Chronicles: Felipe Guaman Poma de Ayala’s History of the ‘New World,’” *American Indian Quarterly* 25, no. 2 (2001): 282.
 36. “The first age of the Indians, Vari Vira Cocha Runa,” translation mine.
 37. Guaman Poma, *El primer nueva corónica y buen gobierno*, 49[49].
 38. Guaman Poma, *El primer nueva corónica y buen gobierno*, 51[51]; “water cataclysm,” trans. Hamilton, 39.
 39. All images are accessible through the Royal Library of Denmark’s website. This is the link for this image: <http://www5.kb.dk/permalink/2006/poma/22/en/text/?open=idm46287306367136>.
 40. Guaman Poma, *El primer nueva corónica y buen gobierno*, 22[22].
 41. Guaman Poma, *El primer nueva corónica y buen gobierno*, 50[50], emphasis mine; “entered this kingdom by the command of God,” trans. Hamilton, 38.
 42. Felipe Guaman Poma de Ayala, *El primer nueva corónica y buen gobierno* [1615] (Royal Library of Denmark, 2004), 50[50]; “First there lived in this land serpents, *amaros*; savages, *zacha runa-uchuc ullcos*; jaguars, *otoroncos*; goblins, *hapinunos*; mountain lions, *pomas*; foxes, *atocs*; bears, *ucumaris*; deer, *luychos*,” trans. Hamilton, 38.
 43. This symbol appears often in the iconography of Chavín de Huántar in the Ancash region of Peru, and other Andean iconography.
 44. The translation to Spanish from Quechua given by the Royal Library is “hombres del bosque,” or men of the forest, which I refer to here as forest men. I am dissatisfied with both, however, because they fail to translate culturally. The inhabitants of the forest were likely less man and more “being,” a forest somehow embodied rather than a being defined by living in a forest. I suspect that of the list Guaman Poma supplies, this item is more similar to the cosmologically important fountain which I briefly describe above.
 45. “Huaca” is a difficult word to translate, simultaneously meaning sacred place, sacred being, godlike, and otherwise. See Marisol de la Cadena’s *Earth Beings: Ecologies of Practice Across Andean Worlds* for an in-depth explanation of the difficulty of culturally translating the concept of *huaca*.
 46. Guaman Poma, *El primer nueva corónica y buen gobierno*, 50[50]; “These people called Vari Viracocha Runa lost their faith, hope of

God, writing and commandment; they lost everything,” trans. Hamilton, 38.

47. Guaman Poma, *El primer nueva corónica y buen gobierno*, 55[55]-56[56].
48. Guaman Poma, *El primer nueva corónica y buen gobierno*, 59[59].
49. Guaman Poma, *El primer nueva corónica y buen gobierno*, 62[62].
50. “Christian readers,” translation mine.
51. Guaman Poma, *El primer nueva corónica y buen gobierno*, 52[52], 56[56], 62[62].
52. Bauer, “EnCountering’ Colonial Latin American Indian Chronicles,” 282.
53. Guaman Poma *El primer nueva corónica y buen gobierno*, 80[80]; “But the first Inca, Tocay Capac, had no idols nor ceremonies. There was none of this until the reign of the mother and wife of Manco Capac Inca and his lineage,” trans. Hamilton, 57.
54. Guaman Poma, *El primer nueva corónica y buen gobierno*, 119[119]; “Oh, lost Inca!” trans. Hamilton, 91.
55. Guaman Poma, *El primer nueva corónica y buen gobierno*, 50[50]; “by the command of God,” trans. Hamilton, 38.
56. Guaman Poma, *El primer nueva corónica y buen gobierno*, 114[114]; “All of this is a mockery and a lie. Put it all aside and have faith,” trans. Hamilton, 111.
57. “There was no conquest,” translation mine.
58. Castro-Klarén, “Writing Subalterity,” 242.
59. Guaman Poma, *El primer nueva corónica y buen gobierno*, 201[203]; “Each one did what they could; those with eyes would watch; those with feet would walk...” trans. Hamilton, 154.
60. Guaman Poma, *El primer nueva corónica y buen gobierno*, 201[203]; “Thus they did not need a hospice, nor alms with the holy arrangements made in this kingdom; no Christian kingdom has ever had such a good system nor can have it, no matter how Christian, much less a pagan kingdom,” Trans. Hamilton, 154.
61. Guaman Poma, *El primer nueva corónica y buen gobierno*, 224[226]; “The Christians brought all the bad adultery and other sins,” trans. Hamilton, 171.

Bibliography

- Adorno, Rolena. “Waman Puma de Ayala ‘Author and Prince.’” *Latin American Literature and Arts Review* 28 (1981): 12-15.
- Adorno, Rolena. Guaman Poma and His Illustrated Chronicle from Colonial Peru: From a Century of Scholarship to a New Era of Reading / Guaman Poma y su crónica ilustrada del Perú colonial: un siglo de investigaciones hacia una nueva era de lectura. Copenhagen: Museum Tusculanum Press, 2001.
- Bauer, Ralph. “EnCountering’ Colonial Latin American Indian Chronicles: Felipe Guaman Poma de Ayala’s History of the ‘New World,’” *American Indian Quarterly* 25, no. 2 (2001): 274-312.
- Castro-Klarén, Sara. “Writing Subalterity: Guaman Poma and Garcilaso, Inca.” *Dispositio* 19, no. 46 (1994): 229-244.
- Guaman Poma de Ayala, Felipe. *El primer nueva corónica y buen gobierno* [1615], Royal Library of Denmark, 2004. GKS 2232 4^o, www5.kb.dk/permalink/2006/poma/titlepage/en/text/?open=idm46287306382352.
- Hall, Donald E. “Race, Ethnicity, and Post-Colonial Analysis.” In *Literary and Cultural Theory: From Basic to Advanced Applications*, 265-76. Boston: Houghton Mifflin Company, 2001.
- Hamilton, Roland, translator. *First New Chronicle and Good Government: On the History of the World and the Incas up To 1615*. By Guaman Poma de Ayala, Austin: University of Texas Press, 2009. ProQuest Ebook Central, <https://ebookcentral.proquest.com/lib/rochester/detail.action?docID=3443464>.
- Rubec, Emily-Jayn. “La deconstrucción de las culturas originales en una sociedad colonial híbrida.” *Crónicas urbanas* 10 (2010): 31-44.
- Said, Edward. “From Orientalism.” In *Norton Anthology of Theory and Criticism*, edited by Vincent B. Leitch, et al., 1986-2012. New York: W.W. Norton & Co., 2010.
- Spivak, Gayatri. “Can the Subaltern Speak?” In *Colonial Discourse and Post-Colonial Theory: A Reader*, edited by Patrick Williams and Laura Chrisman, 66-111. New York: Columbia University Press, 1994.
- Tyson, Lois. “Postcolonial Criticism.” In *Critical Theory Today*, 398-428. London: Routledge, 2015.

Beauty on Social Media and its Racial Intersections

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Abstract

Social media has become as influential as traditional mass media such as television and magazines. Traditionally, social media has championed diversity and inclusion by promoting the representation of marginalized people who are plus size, differently abled, or black. Despite this, do these platforms still perpetuate the harm of their media predecessors? While much good has been done in this realm, there are some practices based on real-life racial tensions that manifest on digital platforms. Some examples that will be discussed include the commodification of Others, the lack of representation of all black hair types, and the promotion of diverse black women on Instagram. This paper will explore beauty trends on social media and whether these changes are inclusive or harmful by examining black beauty liberationist pages through the Afrocentric and looking glass self theories.

Background

Social media has ushered in a new feminine beauty ideal that includes a curvaceous body, plump lips, long hair and nails, a flat stomach, and poreless, acne-free skin, which can include darker skin. This is known as a “slim thick” or “Instagram baddie” look. This image includes components from the “stereotypical black woman” who has been historically hypersexualized for her curves and voluptuous lips. Another component to this aesthetic is the digital aspect: perfect, pimple-free, and smooth skin, which can only truly be obtained through digital editing. The specificities of this image seem to stray from a pure European standard, but maintain it nonetheless through long hair and the host of a white body. This look only became a trend when white women came to think of it as “cool.” According to Tracey Owens Patton, a professor in African American Studies, this is an example of commodification of minority groups,

through Whites setting the beauty norms then coveting aspects of authorized beauty, while at the same time rejecting Other, we find that many White women are incorporating Black beauty standards into their regime. For example, injecting collagen into their lips to get the full effect that African American women have naturally, tanning in order to achieve the natural brown skin of African Americans, and padding of the derriere in order to have a fuller backside. (Patton 2006, 44)

The Media’s effect on Beauty Standards

In fact, celebrity sisters Kim Kardashian and Kylie Jenner popularized aspects of this aesthetic, which is indicated by

the “Kylie Jenner Lip Challenge,” where participants use various methods to plump up their lips to match the celebrity’s look. Kylie has also profited off of this appearance through the creation of a successful makeup line marketed towards women that want to imitate her look. The features that these sisters have popularized are believed to be natural to black women. Some black women have reported being made fun of for having these features, and it is also historically documented that these women have been hypersexualized for their look.

Kardashian has also been a culprit of culturally appropriating Fulani braids (a traditional hairstyle that black women wear for hair growth). Cultural appropriation is the practice of taking components of another culture, usually from a minority group, and making it “trendy.” This includes taking credit for features or hairstyles which makes the real creators—who are usually members of minority groups—invisible as they are not getting credit for what they have been cultivating. Like making a hairstyle or an article of clothing mainstream, it is now possible to make specific bodily traits that women of color have naturally trendy through plastic surgery and injections. These anatomical features are embedded in this new beauty ideal. While this new face and body seems inclusive because by incorporating pieces of multiple cultures to make the “perfect woman,” it raises problems that journalists are exploring.

This idea is explored in Jia Tolentino’s article in *The New Yorker* called “The Age of the Instagram Face.” The article is about the beauty trend on social media to strive for perfection and how it has led more people than ever before to augment themselves. Tolentino interviewed plastic surgeons who revealed that women of all races and ethnicities have requested to look like the Kardashians. Tolentino touched on the algorithmic perspective of how social media promotes these beauty ideals with filter functionality. Instagram and Snapchat both have filter features that change the way the user looks in various ways, such as erasing pores and making lips bigger or maintaining the Eurocentric standard of a slimmer nose, lighter skin, and enhanced eye color. These filters are intended to make the users “more beautiful,” which reinforces certain beauty ideals. Tolentino claims that white women are the ones that can achieve this “exotic” look. The look is described as, “an overly tan skin tone, a South Asian influence with the brows and eye shape, an African-American influence with the lips, a Caucasian influence with the nose, [and] a cheek structure that is predominantly Native American and Middle Eastern” (Tolentino 2019). Technically this is an inclusive face, in which a piece of every type of

person is mixed into the beauty standard, creating this raceless, ambiguous look.

Even though this new beauty ideal takes the “best of us” into one ideal face, it exemplifies implicit appropriation because there are only a few people that can accomplish this look. For example, it is relatively easier for lighter skin people to feign a mixed, ambiguous look. Moreover, they are able to capitalize off of the look by obtaining sponsorship deals from companies to advertise products over women that have these features naturally; this harmful practice is known as black-fishing. Furthermore, the message that is being conveyed is that there exists a “worst of us.” This means that black features that are absent from this look are not desirable, such as darker shades of brown skin, broad noses, and kinky hair. This essentially excludes the black woman that has big lips, but also has a big nose and short kinky hair, from profiting off of this new ideal because her other features are not as conventionally desirable as her lips. It is important to note that this trend follows the nature of Instagram, which is used only to post and expose the best moments, sides, and pictures of oneself. This trend maintains remnants of Eurocentricity due to the avoidance of having skin that is considered “too dark.” The tanned skin color of women who go for this look is usually seen on biracial people or light skinned black people. This look is neither purely Eurocentric or Afrocentric; instead it tries to achieve ambiguity or to look biracial. Regardless, it still is not achievable by all races of women, and white women tend to profit from and are seen as the trend-setters of this look.

Black Instagram, specifically some popular natural hair appreciation accounts that promote black women wearing their natural hair, also engages in this cherry-picking behavior. This representation is important because it was most common to see black women with relaxed hair, straight wigs, or braids in traditional media like television and magazines. Now, the masses have the ability to control their own representation through Instagram. Around the 2010s, black women started to learn about their hair and embrace it more. However, I have noticed that the least popular hair type on social media is kinky hair, especially when it is short in length. This is validated by the research Paulette Parris discusses in her paper which dissects the images under natural hair hashtags on Instagram:

However, it should be noted that the most frequent curl pattern was 3C which is generally associated with Black women who possess a lighter complexion...The data collected from Instagram revealed diverse hairstyles, where many of the images that received the most likes were for a looser curl pattern, revealing that while the OC [online community] is accepting of different hair types, it lacks representation of *all* types (Parris 2020, 59).

Due to the lack of representation, those with short kinky hair types like myself may feel unappreciated by the black community. For example, there is this Instagram account called

@haircareavenue with roughly eighty thousand followers. Though this page seems to uplift all black hair, it is clear that they value length which, according to previous descriptions, is a Eurocentric standard. In fact, in *The Impact of Colorism on African American Women*, Spike Lee stated that, “[w]hether black men admit it or not... they’d rather see long hair than a short Afro, because that’s closer to white women” (Mathews & Johnson 2015, 254). This shows that one of the possible reasons that black women pursue long hair is to be more desirable, both to men and in general. This is based on the Western standard that long hair is the most desirable. Since kinky hair is the polar opposite of this “ideal,” then it must be the least desirable according to these beauty standards. Not only is this opposition seen through the actual textures of both hair types, but it is seen in the definitions of them. In a thesaurus, the word “straight” is associated with words like “right,” “pure,” and “neat,” all of which fall in line with the messaging of white superiority (“Straight”). Kinky is analogous with terms like “deviant,” “abnormal,” “immoral,” and “unhealthy,” all of which are words that our society continues to push on black people (“Kinky”). The manipulation of kinky hair to be curly, sleek, or tamed in any way is an attempt to meet a Eurocentric standard because it is used to make kinky hair appear straight.

If these natural hair appreciation pages and communities wanted to uplift kinky hair, they would embrace how defiant kinky hair is to straight hair. It can be assumed that this is why the Afro was used in the original Black is Beautiful movement in the 1960s, which was a movement motivated to eradicate Euro-American standards of beauty (Patton 2006, 40). It is interesting to see that the only people shown with short, kinky hair on the page are males. It is only acceptable for men to have short, kinky hair in this society, which sends the message that short, kinky hair is masculine. There is also an obsession with obtaining curl definition, which is problematic because kinky hair does not have a strong curl definition. Hair with kinks either has to be altered and stretched out through bantu knots, twist outs, and braid outs to achieve an elongated curl, or tucked away, hidden from sight under a wig or weave. All in all, the natural hair community’s obsession with curl definition and long hair speaks to the undesirability of short kinky hair, which does not have these traits.

Another synonym of “kinky” is “sexy.” However, this is the only definition that is not represented for kinky hair, unlike the other hair types (“Kinky”). Other hair textures are used to create sex appeal and can be described as “sexy,” while kinky hair is not typically described in this way. For example, while many black female rappers like Nicki Minaj, Cardi B, Meg Thee Stallion, and Lil Kim maintain a sexual presence through their music and image, kinky hair is never a part of that. Perhaps wearing kinky hair would disrupt the sexual look they are going for. It is interesting to note that although many things about a black woman are hypersexualized, like her butt, breasts, and overall shape, her hair is not represented as sexy even though “kinky” is synonymous with “sexy.” For the black community to truly oppose Western

beauty ideals, it must fully love, support, and produce images of kinky hair in its natural form. Patton calls those who uphold these ideals black beauty liberationists, “which means that you are not identified with the powers that be, but rather directly challenge the White supremacist hegemony that has kept your beauty and your body invisible, marginalized, and stereotyped” (44).

The Importance of having a Safe Space on Social Media

While there is a lack of full representation of the diversity of black women on some social media accounts, it cannot be denied that many Black Instagram pages, including @haircareavenue, are black beauty liberationists since they work to define black beauty for themselves and make black women visible. Instagram is a great medium to obtain visibility because the platform relies on pictures, unlike other social media platforms that rely mostly on text. An African American Studies professor, Jayne Ifekwunigwe, discusses the differences between third wave feminism and activism on social media, like ‘Care Free Black Girl’ Feminism (CFBGF):

In other words, third-wave black feminism would argue that none of us is truly visible unless we are all visible. Meanwhile, CFBGF would argue that I am now visible because I have rendered myself visible, in spite of the fact that the white patriarchal system that has created such constraining definitions for black womanhood has not been dismantled (Ifekwunigwe 2018, 122).

The latter statement applies to all new feminisms that have been cultivated on the internet. Due to the attacks that black women have historically received about their sexuality, third-wave feminism seems to be cautious about sexuality. However, this new age of feminism embraces it completely: “sex positivity that is at the heart of the feminism that us younger folks have come to embrace, that she’d [bell hooks] consider that the joy many of us find in our bodies, in sex and yes, even in the male gaze” (Ifekwunigwe 2018, 118). There are countless accounts on Instagram that carry this attitude through their content. For example, @afroprincesses, a black beauty liberationist page, showcases the diversity of black women in predominantly Afros and other natural hairstyles. Specifically, there is an image of a slim, dark-skinned black woman with a relatively short Afro in purple lingerie contrasted against sheer white cloth (@afroprincesses). Though these pictures almost show her nipples, she does not look too sexy, in that her dark brown skin doesn’t

make her any more or any less sexy than anyone else. Another great thing about this picture is that she makes wearing an Afro sexy, as the picture does not look less sexy because of her Afro either—in fact, it compliments her well. Lastly, this display of sexuality is not the same as watching unnamed naked women being objectified in a rap music video. This woman is choosing to show off her sexuality because she wants to, and it emits the message that dark skin women with

an Afro can be sexy, which is a narrative that traditional media does not provide.

Another social media account that counters hegemonic beauty standards is @darkskinwomen, an account with over one million followers. Western beauty ideals convey that white women are the most beautiful, and the best way to combat that is with pages like this one, which showcases the beauty of dark-skinned black women. The pictures on these pages work like positive affirmations to combat the negative pictures that society paints about black women. Black beauty being corroborated through this safe space on the internet contributes to the weakening of the power that the hegemonic order has on black women (Patton 2006, 43). These black beauty liberationist pages ensure that black women are not all painted with a broad brush. They allow for black women to tell their own narrative apart from what society projects them to be. This practice of Afrocentric theory is revealed through the display of different black women that are skinny, “slim thick,” plus size, light- and dark-skinned with curly or kinky hair, braids, wigs, weaves, and more (Patton 2006, 43).

Conclusion

Both the lack of representation of “undesirable” hair types in the black community and the black beauty liberationists pages on social media enforce the theoretical framework of the Looking-glass self, as proposed by Charles Horton Cooley. This theory suggests that the way we think of ourselves, whether negative or positive, mirrors the way society thinks of us. Furthermore, he attests that, “It is in others that we come to know ourselves” (Mathews & Johnson 2015, 257). If this is the case, then that shows how detrimental poor images of anyone can be, because, according to social science, humans are more likely to accept these messages whether they benefit them or not. For example, Tayler J. Matthews and Glenn S. Johnson describe how destructive or constructive it can be for a person to take in negative or positive images. These images can impact other areas of their life, such as quality of education, career, and support networks (256). In other words, having a high self-esteem is conducive to being the best version of yourself while feeling competent enough to achieve your goals. Therefore, this shows the importance of having more representation and love for short, kinky hair, as it combats the development of low self-esteem in black women with this attribute. This also shows why it is so important for black beauty liberationist pages to continue to exist, as they uplift black women with content that counters the negative messages of the outside world.

Social media has given everyone the opportunity to be exposed to new things. This is important because a black woman, who once only had access to harmful messages about her natural hair, skin, and features in the physical realm, now has an outlet to counter those messages. Social media pages that promote a diverse range of black beauty are fighting the good fight in terms of reversing the negative images that the hegemonic forces have thrust upon minority

communities. The accessibility of social media also allows women of different races to be exposed to black culture and can take aspects from it and make them trendy. This shows that this beauty trend can be harmful to communities that face the brunt of this superficially inclusive trend. Ultimately, social media has the power to continue to perpetuate hegemonic dogmas, but because of its reliance on user produced content, users themselves can shift the narrative.

References

- @afroprincesses. N/A. 2020. Instagram. <https://www.instagram.com/afroprincesses/>.
- @darkskinwomen. N/A. 2020. Instagram. <https://www.instagram.com/darkskinwomen/>.
- @haircareavenue. N/A. 2020. Instagram. <https://www.instagram.com/haircareavenue/>.
- Ifekwunigwe, Jayne O. 2018. The Palgrave Handbook of Feminism and Sport, Leisure and Physical Education, by Louise Mansfield et al., Palgrave Macmillan. pp. 111–131.
- “Kinky: Synonyms of Kinky by Oxford Dictionary on Lexico.com Also Antonyms of Kinky.” Lexico Dictionaries | English, Lexico Dictionaries, OAD, www.lexico.com/synonyms/kinky.
- Mathews, Tayler & Johnson, Glenn. 2015. “Skin Complexion in the Twenty-First Century: The Impact of Colorism on African American Women.” *Race, Gender & Class*, vol. 22, no. 1-2, pp. 248-274.
- Parris, Paulette. 2020. “‘Glowing up Ain’t Easy’ How #BlackGirlMagic Created an Innovative Narrative for Black Beauty Through Instagram.” *Dearcadh: Graduate Journal of Gender, Globalisation and Rights*, vol. 1, pp. 50–65., doi:10.13025/crzd-tq39.
- Patton, Tracey. Summer 2006. “Hey Girl, Am I More than My Hair?: African American Women and Their”. *NWSA Journal*.
- “Straight: Synonyms of Straight by Oxford Dictionary on Lexico.com Also Antonyms of Straight.” Lexico Dictionaries | English, Lexico Dictionaries, www.lexico.com/synonyms/straight.
- Tolentino, Jia. 12 Dec. 2019. “The Age of Instagram Face.” *The New Yorker*, *The New Yorker*. www.newyorker.com/culture/decade-in-review/the-age-of-instagram-face.



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Featured in This Issue

The Direct and Indirect Effects of Calcium Dyshomeostasis on the Amyloidogenic BACE1 Enzyme in Alzheimer's Disease

Lia Calcines-Rodriguez '20, Neuroscience

Alzheimer's disease, a leading cause of death in the United States, results in the loss of hippocampal neurons and cognitive decline. Understanding the pathways leading to neuronal loss is the first step to developing therapeutic treatments. Amyloidogenesis, the aggregation of amyloid proteins in the cell, and accompanying ER stress are known characteristics of an affected neuron. In this review, the role of Ca²⁺, an important molecule in neuron function, in the regulation of amyloidogenic pathways is discussed. A primary focus is the impact on the enzyme BACE-1, the first rate limiting step in these pathways.

The Pakistani Constitution: in Pursuit of Justice

Syeda Mahnoor Raza '24, Political Science & English Literature

Pakistan is presented as a case study for "diverse, divided and developing countries" with structural issues that impact execution of democracy. Drawing on John Rawls political philosophies and Eleanor Curran's comments on Larry May's "Limiting Leviathan" to define concepts of justice and equity and the grounds of a moral constitution, Raza considerably crafts a hypothetical constitution centering around the pursuit of justice, deconstructing and reconstructing Pakistani political institutions to create a more fair and equitable system.

Reflection and Correction: Guaman Poma's Precolonial Critique of Spanish Dominance in the Andes

Anna Remus '21, Anthropology, Spanish, & Archaeology, Technology & Historical Structures (ATHS)

In *El primer nueva corónica y buen gobierno*, Felipe Guaman Poma de Ayala courageously writes the voices of indigenous people into the history of Spanish colonization as it was happening in 17th century Peru. Though he addresses his audience as a 'humble vassal,' Remus argues that this proud Andean did not succumb to dominating influences but rather used them to exercise agency and resistance toward invading cultural and political forces. His is a "precolonialist" critique: one anticipates key features of postcolonial literature, and one that goes so far as to hint at Andean superiority over Spanish invaders.

Beauty on Social Media and its Racial Intersections

Dominique Dorvil '20, Computer Science & Digital Media Studies

Social media: champion of diversity, or perpetuator of harm? In a world where social media has a considerable influence on beauty ideals, observed practices can be traced back to real-life racial tensions. Examining the effects of celebrity influence and filter functionality on the implicit appropriation of ethnic features, this paper explores beauty trends on social media and illustrates the importance of the safe space in black beauty liberationist pages through the Afrocentric and looking glass self theories.



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