



PREDOCTORAL  
FELLOWSHIP AWARDS  
2017

MONDAY, APRIL 10, 2017  
RACKHAM GRADUATE SCHOOL

**T**he Rackham Predoctoral Fellowship is one of the most prestigious awards given to graduate students by the Rackham Graduate School. Those selected for this twelve-month fellowship have advanced to candidacy and are anticipating finishing their Ph.D. within six years of beginning their studies. The award takes into consideration professional papers and presentations, publications, honors, as well as academic standing. This booklet contains the dissertation abstracts of all the 2017-18 Predoctoral Fellows.

The Rackham Predoctoral Fellowships are supported by the Horace Rackham Endowment which was created in 1935 by a gift to the University of Michigan from the Horace and Mary Rackham Fund. More than 2,200 doctoral students have received this fellowship since it was established.

**Elizabeth Agee**

Civil and Environmental Engineering

*Contributions of root system functional response to forest drought resilience in the Amazon rainforest*

It is well established that the Amazon Basin region is critical to global energy, water, and carbon cycles. The increased frequency and severity of drought events in the region highlight the vulnerability of tropical forests to heat- and drought-induced stress. Despite several previous and ongoing studies, the full effects of drought and the essential factors controlling rainforest response to water-limitation are not resolved and thus remain a significant source of uncertainty for projections of forest fate under changing climate. Combining advances in three-dimensional representation of root water uptake and collected hydrological and ecophysiological data from our field site in a seasonal Amazonian rainforest, this doctoral research examines the contributions of root functional diversity to individual and forest drought resilience under the extreme 2015-2016 El Nino drought event.

**Ahlam Armaly**

Chemistry

*Development of Novel Synthetic Technologies to Enable Access to Complex Polycyclic Structures for the Development of New Therapeutic Agents*

Compounds isolated from natural sources serve as an inspiration for current drug design and development due to their diverse and important biological activities. Many biologically active natural products incorporate multiple ring systems, which are often fused, resulting in intricate, highly functionalized core structures. Despite recent advances in synthetic methods and the historical importance of natural product synthesis in the development of new medicines, the selective synthesis of these complex, densely functionalized structures remains challenging, offering new opportunities for the development of new methods and strategies for their synthesis. I am developing new synthetic methods for the rapid construction of complex polycyclic molecules that possess interesting biological properties in order to aid in the development of novel therapeutic agents.

**Sara Aronowitz**

Philosophy

*Rational Structures in Learning and Memory*

My dissertation is about the ways in which our route to knowledge changes over time. I aim to disrupt an increasingly ubiquitous view which claims that we can study rationality by considering a single belief at a single time. I target three areas where diachronic (i.e., temporal) factors make a difference in the three chapters: (1) memory, a system of tremendous importance in our cognitive lives yet which is often reduced to a one-sided question of whether to trust what one's memory says, (2) learning, where I argue that we should sometimes believe in a way that's not warranted or reasonable in light of our current evidence, but which puts us in a better position to acquire evidence in the future, and (3) the connection between memory and learning, as exemplified in the case of remembering anomalous events.

**Stefan Aune**

American Culture

*Indian Wars Everywhere: Resonances of Colonial Violence in the U.S. Military*

This interdisciplinary project reconstructs the U.S. military's approach to conflict with Native people during the period of continental expansion. I argue that a set of strategic practices, developed for the "Indian Wars" and influenced by ideas about racial difference, have had an important influence on military tactics, particularly in conflicts defined as "small wars" or counterinsurgencies. Further, my project demonstrates that cultural representations of Indian people have influenced the way that U.S. soldiers have imagined both their enemies and themselves. These resonances have moved through time and space, with "Indian Country" showing up in The Philippines, Vietnam, Iraq and Afghanistan. As worldwide counterinsurgency becomes an increasing preoccupation of the U.S. armed forces, it is important to analyze the ways in which America's colonial past influences the global present.

**Zicheng Bi**

Resource Policy and Behavior

*Assessing and Enhancing the Sustainability of Electrified Vehicles by Wireless Charging - A Life Cycle Framework to Assess and Optimize the Sustainability Performance of Wireless Charging Electric Vehicle Systems*

Wireless charging technology can serve as a solution to the challenges of charging station accessibility and high cost of purchasing electric vehicles by downsizing the onboard battery and improving fuel economy, and therefore enhance the environmental, energy, and economic performance of electrified transportation. This research aims to characterize the trade-offs of large-scale wireless charging infrastructure deployment using a life cycle analysis framework. This framework will be applied to three transportation systems: 1) transit buses; 2) passenger cars on highway and urban roadway; and 3) a shared autonomous vehicle fleet. My doctoral research will develop new integrated life cycle assessment (LCA) and life cycle cost (LCC) models, and strategies based on life cycle optimization (LCO) to guide research, development, and deployment of wireless charging technologies.

**Noah Blan**

History

*"To See the Lion Dominating All Creatures and Beasts": Sovereignty and the Environment in Charlemagne's Empire*

This dissertation demonstrates that the nascent Carolingian empire laid political and moral claim to the natural resources of Western Europe by developing a vision of ecological authority. To reveal links between ideology, power, and nature it interrogates Carolingian texts written between 780-814 CE and contextualizes them with paleoclimatic and archaeobotanical data. This thesis uncovers the diversity of environmental perspectives that flourished under Charlemagne, the first Carolingian emperor, which he adopted to bolster his authority. Such ecocritical analysis moves among discussions of plants, animals, and humans, proving that ideas about a malleable nature fundamentally shaped Carolingian politics, social relations, and ecosystems. In particular, new notions of hierarchies among creatures and in creation—developed by a close group of intellectuals near Charlemagne—informed his attempts to "renovate" European society. This dissertation complements social and political narratives by showing that in court circles difficult debates about ecological issues shaped imperial policy.

**Rebecca Bloom**

Asian Languages and Cultures

*Pictures to Live By: Uncovering an Iconography of the Tibetan Buddhist Monastic Code*

My dissertation contributes to a growing body of scholarship within Tibetan Studies that bridges disciplinary divisions, thus enabling the examination of figures, texts, and objects that challenge traditional categories. The focus of my project is a heretofore unexamined book and its related murals, which integrate text and images in ways unseen elsewhere, complicating traditional Buddhist literary and artistic genres. Words and illustrations together construct a visual commentary that utilizes images as annotations, creating an iconographic transmission of a canonical text. Composed by the Thirteenth Dalai Lama (1876-1933), this text records his commentary on the Buddhist monastic code. It is a conventional work, yet employs an innovative commentarial apparatus: illustrations. In my dissertation, I will examine the genesis of this remarkable text and the elements of its composition, arguing that the book and its murals established a new iconographic system for portraying monastic life and transmitting monastic rules in modern Tibet.

**Kimberly Brink**

Psychology

*Children's attributions of mind to robots: Implications for human-robot interaction, education, and theory of mind*

Children perceive robots as able to think, have feelings, and be their friends; they expect robots to have minds. There is little research, however, exploring how these attributions of mind develop over early childhood or, moreover, how these attributions impact interactions with robots. My dissertation will investigate this gap in the literature through three separate studies. I will investigate (1) how children's attributions of mind impact their feelings toward robots, (2) how children's attributions of mind impact learning from robots, and (3) the factors that elicit children's attribution of mind to robots. Preliminary findings from two studies indicate that attributions of mind increase children's affinity for robots and their willingness to learn from them. Robots provide a novel means to study how children develop the ability to attribute mental states to others and interactions with these increasingly prevalent technologies, thus informing research on human-robot interaction, education, and theory of mind.

**Allison Caine**

Anthropology

*Restless Ecologies: Socioenvironmental Transformations in the High Andean Grasslands*

This dissertation examines how alpaca herders evaluate environmental changes and forge adaptive strategies in the daily interactive spaces or entanglements of humans, herd animals, and landscapes of the southern Cordillera Vilcanota in south-central Peru. At the broadest level, this research project explores how herders gather knowledge about their ecosystems, evaluate their vulnerability, and forge strategies in relation to transformative environmental changes. It takes seriously ontological premises of socionatural relatedness in the Andes, and the processes of identification and objectification through which individuals locate themselves in relational ecologies that confound a dichotomy of nature and culture. As such, this project is grounded in the modes of identification and methods of analysis of the herders themselves, using that framework as the starting point from which to understand how they pinpoint the emergence of incongruity, tension, and danger in their daily lives.

**Lacey Carpenter**

Anthropology

*Households and Political Transformation: Daily Life During State Formation at Tilcajete, Oaxaca, Mexico*

My dissertation research addresses questions about how people participate in political transformations and subsequently react to this systemic change. I investigate this topic archaeologically through excavations of houses, the centers of daily activities and family life. My focus is on Oaxaca, Mexico, where the earliest states in the Americas emerged. Through my research, I explore how people from different backgrounds were able to influence their political system and how the consequences of systemic change affected their daily lives, privileging some and marginalizing others. Archaeology provides a uniquely long-term perspective. I am able to study the causes and effects of sociopolitical transformation over five centuries and provide a more comprehensive understanding of the relationship between families, daily life, and political systems.

**Charlotte Chan**

Mathematics

*Towards a  $p$ -adic Deligne--Lusztig theory*

I work in geometric representation theory in the context of the Langlands program, which combines three major branches of mathematics: representation theory (the study of symmetries via linear algebra), algebraic geometry (the study of geometries via polynomials), and number theory (the study of prime numbers). My dissertation establishes the beginnings of a “ $p$ -adic Deligne--Lusztig theory,” wherein I use algebraic geometry to construct representations that arise in correspondences compatible with the Langlands program. My research forwards a program initiated by George Lusztig in 1979 that was stagnant until the 2012 work of Mitya Boyarchenko. More specifically, my results affirm two conjectures of Boyarchenko in full generality as well as a special case of Lusztig’s original 1979 conjecture.

**Anthony Charles**

Physics

*Universal Properties of Black Holes in Supergravity*

One of the longest-standing goals in modern physics is to discover a consistent theory of quantum gravity that can reconcile our current understanding of gravity and quantum mechanics. There have been some steps taken towards solving this puzzle, but these results are heavily rooted in string theory and require the existence of a new symmetry (known as “supersymmetry”). It is not known how to generalize these results to more realistic cases. In order to shed light on this mystery, we study features of black holes, both with and without supersymmetry. In particular, we detail how non-supersymmetric black holes can be embedded into supergravity theories. We then go on to show how many features of these black holes are universal, in the sense that they do not require supersymmetry. This gives surprising (and previously unknown) insights into general features of quantum gravity without supersymmetry.

**Po-Ju Chen**

Molecular, Cellular, and Developmental Biology

*The stability of acetylcholine receptor and the associated scaffolding proteins at neuromuscular junctions*

The maintenance of acetylcholine receptor (AChR) clusters at high density in the postsynaptic membrane is critical for the efficiency of the synaptic transmission and therefore muscle contraction. In this thesis, I investigated the cellular and molecular mechanisms involved in the stability of AChRs at postsynaptic sites. First, I demonstrated in living mice that AChR is required for the insertion of rapsyn (a scaffolding protein clusters AChRs) to synapses via its coiled-coil domain. Second, I found that the stabilizing effect of  $\alpha$ kap (a non-kinase CamK splicing protein) on AChRs at synaptic sites is mediated by the  $\alpha$ -dystrobrevin/USP9x complex. Finally, I generated the double mutant mice of  $\alpha$ -dystrobrevin and  $\alpha$ -syntrophin (two components of dystrophin glycoprotein complex that sustain AChRs at NMJs) to investigate the crosstalk signaling pathways between  $\alpha$ -dystrobrevin and  $\alpha$ -syntrophin involved in the stability of AChRs. Together, this work provides new insights of mechanistic interactions at neuromuscular junctions.

**Qi Chen**

Computer Science and Engineering

*Addressing Security Challenges in Smart Systems Through Systematic Problem Analysis and Mitigation*

Smart systems such as smart home and smart transportation systems introduce more ubiquitous network-based access, more intuitive user interaction, and more functionality rich operating systems, which largely improve the quality of life but also introduce new security challenges. This thesis is dedicated to developing defense solutions that can fundamentally address security challenges in existing and future smart systems. Three general approaches guide the research: 1) vulnerability discovery from inherent security weakness in smart systems, 2) systematic vulnerability detection and analysis using formal techniques, and 3) mitigation proposals and their evaluation in practice. By applying these steps, new vulnerabilities in smart systems are systematically uncovered, analyzed and mitigated. For instance, my previous work discovered new vulnerabilities in the network stack, a basic smart system component, that causes password theft and man-in-the-middle attack. We subsequently applied rigorous techniques such as program analysis to perform systematic detection and analysis, and develop practical solutions.

**Peter Chockley**

Immunology

*Differential Immune surveillance of primary and metastatic tumor cells by Natural Killer cells*

It is now well known that the immune system plays a pivotal role in the control of primary tumor progression, a process termed tumor immunosurveillance. What is less well studied, though gaining evidence rapidly, is the immunological control of tumor spreading during metastasis. Metastatic disease is a critical concern with most solid cancers; as it is typically the metastases that invariably kill the patient. The direction of my thesis is to study the variant immunological responses to primary and metastatic cancer cells.

I have been focusing on the role of Natural Killer cells in preventing metastatic spread of lung cancer. This has been confirmed in two murine models and one human model via immunodepletion strategies. The hypothesis that NK cells preferentially target “metastasizing” cells has been recapitulated in vitro as well. These studies will inform novel and unexplored therapeutic strategies for patients suffering from metastatic disease.

**Byungjoo Choi**  
Civil Engineering

*The Role of Socio-Cognitive Process of Construction Workers' Safety Behavior*

Improving workers' safety behavior has enormous potential to reduce accidents at construction sites. Although many studies have investigated determinants of safety behavior, little is known about the socio-cognitive mechanism of safety behavior. To fill the knowledge gap, this study aims to identify how workers' safety behavior can be better aligned with management's desired standard by enhancing our understanding of the socio-cognitive mechanism. To this end, I have developed a research framework that incorporates empirical study, computer simulation, and analysis of the physiological responses from wearable sensors. The empirical study presents the impacts of social norms and social identities on safety behavior. An agent-based model explains how the cognitive process interacts with the environment. Also, physiological responses are used to investigate the cognitive process of safety behavior. The integration of organizational psychology, computational modeling, and physiological sensing will contribute to advancing our knowledge on the socio-cognitive mechanism of occupational behaviors.

**Leah Claiborne**  
Piano Pedagogy and Performance

*Pedagogical Anthology of African American Piano Literature*

There are currently few resources made available to teachers, students, or performers on the significant contribution that African American composers have made in the field of classical piano music. In order to remedy this lack of inclusion in the field of classical music, I will be compiling, editing, and recording three volumes of selected piano works by African American composers. The musical compositions presented in this anthology will be ordered based on skill level by addressing the musical and technical challenges of each piece. This anthology will help diversify the demographic of performers and audience members who are not normally represented in the classical music field. The Pedagogical Anthology of African American Piano Literature will be a vital stepping stone in allowing the piano music of African American composers to take its rightful place in schools of music, piano studios, and the public concert stage.

**Lauren Eriks Cline**  
English Language and Literature

*Spectator Stories: Reading Performance Narratives in Theater History*

My dissertation solves an urgent methodological problem in theater history by developing a new method for reading first-person accounts written by theatrical spectators. Historically, self-authored narratives have posed difficulties for theater historians, in part because they interpose layers of literary style between contemporary researchers and the "real experience" of past performances. I offer a fresh path forward by embracing these accounts as representations of performance rather than failed documentations of it. Specifically, I develop a method for reading what I call the "performance narrative": an account of a theatrical performance that employs narrative strategies. In order to understand the representational techniques used in historical performance narratives, I analyze them in conversation with fictional narratives of performance in contemporaneous novels. Spanning the late eighteenth through the early twentieth century, my dissertation produces new readings of theatrical reviews, diaries, and letters by treating narrative as a part of the process of performance.

**Dori Cross**

Health Services Organization and Policy

*Electronic Information Sharing to Improve Care Transitions Between Hospitals and Post-Acute Care Providers*

Hospitals frequently transfer sick patients to skilled nursing facilities (SNFs) to receive ongoing post-acute care; information sharing between these settings is critical to ensure safe and effective care during and after this transition. Hospitals and SNFs are increasingly using electronic means of health information exchange (HIE), which has shown benefits to patient care in different contexts. But, the effect of HIE on transitional care quality in the unique context of hospitals to SNFs has not yet been evaluated. Using sociotechnical theory, mixed methods and novel data sources, my dissertation analyzes how SNFs are utilizing new HIE capabilities and whether HIE use between hospitals and SNFs affects likelihood of patient re-hospitalization, a critical marker of transitional care quality. These findings will help facilitate targeted organizational strategies and policy efforts to help hospitals and SNFs pursue HIE in ways that are most likely to result in improved care quality and patient outcomes.

**Haydar Darici**

Anthropology and History

*A Youth Now Gone: Revolutionary Politics in Turkey's Kurdistan*

My dissertation examines the youth politics in Turkey's Kurdistan and its transformation from street protests to urban warfare since 2013. I aim to re-conceptualize the concepts of "the political" and "youth" in the context of the Middle East, a region driven by a constant state of war. I show how certain spatial practices of Kurdish youth generate certain political forms and vice versa. Moreover, I argue that the category of youth is constructed in relation to temporally and spatially specific dynamics within a given polity. If youth in Kurdistan is constructed and defined by a specific form of politics, accounting for the transformations of that construction can lead to a redefinition of the concept of the political itself. In this sense, my aim in my dissertation is not only to understand construction of youth through politics, but the very construction of politics through youth.

**Cheyney Dobson**

Sociology

*Reconstituting Social Welfare in the Era of Mass Incarceration: Criminal Justice Service Provision in Mental Health Courts*

This research is motivated by the expansion of the criminal justice system into the hitherto separate domain of social welfare. This project focuses on a burgeoning intervention that exemplifies this trend: mental health courts. Mental health courts are organizations situated within the court system tasked with serving the dual mandates of helping "clients" through service provision and punishing "offenders." Operating under both mandates, court staff and "client-offenders" confront significant contradictions that must be resolved in practice. Drawing on comprehensive qualitative methods, this study examines the processes by which these individuals negotiate competing mandates and overcome contradictions, enacting this new form of policy—criminal justice service provision—on the ground. In so doing, this research joins a growing number of scholars carrying out an essential task in the era of mass incarceration: explicating how the criminal justice system is reorganizing social life for many at the bottom of the class structure.

**John Doering-White**

Social Work and Anthropology

*Violence and Care in Transit: Infrastructures of Undocumented Migration Through Mexico*

Paralleling the network of freight railways commonly known as La Bestia (The Beast), this dissertation project examines relations of solidarity and security along the Central American migrant trail through Mexico in an era of intensified immigration enforcement and militarized policing of organized crime. Drawing on extensive fieldwork between 2014 and 2016, it follows a group of migrants as they receive Mexico's 'humanitarian visa' and negotiate what comes next, paying close attention to how objects that migrants carry with them become implicated in sustaining various spaces of hospitality. Moving between participant observation in migrant shelters and workplace ethnography in working-class communities throughout Mexico, this dissertation traces shifting moral economies of humanitarianism and human smuggling to examine how intersecting politics of violence and care in spaces of transit inform understandings of humanitarianism, illegality, and policing in an era of unparalleled human displacement across national borders.

**Chrisy Xiyu Du**

Physics

*Solid—solid Phase Transition in Colloidal Matter*

Phase transitions are ubiquitous in nature, and observed throughout everyday life from the melting of ice to the magnetization of iron. In particular, solid–solid phase transitions are important in many areas such as metallurgy, geosciences, and the design of reconfigurable materials. Following the recent initiative of using nano building blocks to design next generation materials, we answer fundamental questions about solid–solid phase transitions in colloidal matter and guide the design of materials that can change phase. We construct a minimal model of solid–solid phase transitions that are induced by altering particle shape. Using the minimal model, we are able to determine the thermodynamic order of several phase transitions. We also study the kinetic transition pathway between solid phases. Our results show viable candidate particles for reconfigurable materials. Moreover, our results give insight into the fundamental of the most common, but most poorly understood phase transitions in nature.

**Kate Duchowny**

Epidemiological Science

*Muscle Weakness in Older Americans*

My overall goal is to understand the social determinants of muscle weakness across the diverse older adult population, and to examine its consequences for longevity and independence in later life. Specifically, I seek to (1) establish race- and sex-specific grip-strength cutpoints and estimate the prevalence of clinical muscle weakness in a nationally representative, racially-diverse sample of older Americans, (2) examine the consequences of muscle weakness for functional disability and mortality in older Americans, and; (3) identify the socioeconomic determinants of muscle weakness in older Americans by examining multiple intersecting components of ones' identity and life course history.

**James Erbaugh**

Resource Policy and Behavior

*The impact of forest landscapes on Indonesian villages: Studying socio-ecological outcomes and forest landscape change*

This dissertation analyzes and evaluates interactions between production and conservation forests in Indonesia to understand their impact and association with forest cover change and rural livelihoods. Though research often considers conservation and production forests separately, they can be investigated in tandem across forest landscapes to promote economic and ecological sustainability of forest management. This research contributes extended forest-related policy content analysis, longitudinal data analysis of development and forest cover change across over 60,000 villages from 2000 to 2014, and site-specific survey analysis of over 1,300 forest proximate households in Kerinci, Sumatra. Using this mixed-methods approach to examine the rules, outcomes, and processes that unite multi-purpose forest landscapes and the communities that rely on them, this dissertation advances the study of socio-ecological forest systems in Indonesia and provides a framework for future research that investigates longitudinal, multi-faceted environmental issues.

**Yuchen Fan**

Pharmaceutical Sciences

*Exploiting Immunogenic Cell Death for Cancer Immunotherapy*

Whole-cell cancer vaccines may induce anti-tumor immune responses; however, they are subjected to suboptimal efficacy and cumbersome ex vivo manipulations. Certain anthracyclines have been shown to promote immunogenic cell death (ICD) of tumor cells, thereby inducing anti-tumor immune responses. I hypothesize that tumor cells induced to undergo ICD and engineered for release of immunostimulatory agents, such as Toll-like receptor (TLR) agonists, will elicit potent anti-tumor immunity as a new form of cancer immunotherapy. Using the murine B16 melanoma model, I have shown that mitoxantrone-treated tumor cells underwent ICD and recruited dendritic cells. Co-delivery of immunogenically dying tumor cells with CpG-loaded hybrid nanoparticles further improved antigen presentation in vitro and elicited potent CD8<sup>+</sup> T-cell immune responses in vivo. I propose to perform more detailed immunological analyses in vivo and evaluate the therapeutic potential of my strategy as a new form of immunotherapy against tumor metastasis and relapse.

**Jared Ferguson**

Applied Physics

*Bridging scales in weather and climate modeling with adaptive mesh refinement*

Complex multi-scale atmospheric phenomena like tropical cyclones challenge conventional weather and climate models, which use relatively coarse uniform-grid resolutions to cope with computational costs. Adaptive Mesh Refinement (AMR) techniques mitigate these challenges. They dynamically place high-resolution grids over salient features, thus providing sufficient local resolution while limiting the computational burden. This thesis explores the development of AMR within a new nonhydrostatic, finite-volume dynamical core and demonstrates its effectiveness in improving model accuracy and its ability to resolve multi-scale features. The AMR dynamical core is implemented in a hierarchy of models of increasing complexity, from an idealized 2D shallow-water configuration to the nonhydrostatic 3D equation set with subgrid-scale parameterizations schemes. The research explores effective refinement practices and assesses the benefits achieved with increased dynamic refinement. It is shown that AMR is a powerful modeling approach that bridges the resolution gap for extreme weather events.

**Ludmila Ferrari**

Romance Languages and Literatures

*The Architectonics of “De-Grounding”: The Violent Foundations of Modern Dwelling in Latin America*

Through analysis of the rise and demise of foundational projects in Latin America, my dissertation explores conditions and limits of dwelling within the historical materiality of violence. In order to analyze these dynamics, my research develops the notion of degrounding, a principle for comprehending the intimate correlation between ground (simultaneously: land, reason, and foundation), violence and dwelling.

Throughout its four chapters, my dissertation integrates art, architecture, urban studies and philosophy to offer an interdisciplinary analysis of the problems of degrounding and dwelling in three foundational projects: the institution and destruction of the Jesuit “reductions” in colonial Paraguay (1607-1767); the hyper-modern construction of Brasilia in 1956; and La Escombrera (2001-2015), a urban mass grave in a rubble heap in Medellin, Colombia. Finally, the conclusion reexamines my twofold question in the realm of art, considering Gordon Matta-Clark’s architectonic perforations as sites where the aesthetic experience of a groundless dwelling is possible.

**Romain Fiévet**

Aerospace Engineering

*The Physics of Supersonic Aircraft Engines*

In the aerospace world, supersonic aircrafts have a special place in research due to their transformative potential: The ability to travel at speeds greater than that of sound will vastly alter the global movement of people and goods, significantly impacting the scope of civilization. A typical example is to be able to travel from Beijing to New York in less than a few hours, or cross North America in under an hour. At the heart of such supersonic aircrafts is the dual-mode scramjet engine - supersonic combustion ramjet engine - which processes fuel and air to generate propulsive thrust required for such high speed flight. The purpose of this dissertation is to decipher certain fundamental physics inside such scramjets that can lead to instabilities and catastrophic failure, so that future engines are made operationally robust. In particular, the sensitivity of shock turbulent boundary layer interactions and supersonic combustion are investigated.

**Christopher Fitzpatrick**

Neuroscience

*Neural and epigenetic mechanisms of individual variation in contextual fear learning*

The vast majority of the United States population experiences traumatic events during their lifetime, yet only a small minority develop enduring fear responses typical of posttraumatic stress disorder (PTSD). This suggests that individual differences in emotional learning play an important role in the development of PTSD. My dissertation research utilizes a Pavlovian conditioned approach (PCA) procedure to investigate individual variation in contextual fear, a potent modulator of PTSD symptoms. I have demonstrated that some rats identified using a PCA procedure (goal-trackers) display excessive fear while other rats (sign-trackers) show virtually no contextual fear learning following conditioning, which can be restored by pharmacologically increasing histone acetylation. Ongoing experiments are investigating what brain regions, genes, and histone acetylation marks underlie these differences. These results will provide a better understanding of PTSD neurobiology and may inform novel treatment strategies.

**Christopher Fort**

Slavic Languages and Literatures

*Imperial Literary Dialogue: The Transnational Dynamic in the Russian Empire and the Soviet Union (1905-1996)*

Examining the period from 1905 to 1996, this dissertation argues that Russian and non-Russian national literary canons of the Romanov Empire/Soviet Union provide opportunities to be read together as a single multinational body of literature. Taking Russian literature and Uzbek literature as its two cases, the dissertation demonstrates how common subjection to imperial, colonial, and socialist power resulted in similar aesthetics, forms, and politics in literature. Through the investigation of these similarities, the dissertation reveals how literary exchange or dialogue between national communities took place in the empires. Through its four chapters, the dissertation analyzes four historical moments: one in the Russian Empire and three in the Soviet Union. To provide a theoretical basis for reading this supranational literature, the dissertation modifies and adapts concepts from postcolonial theory to the unique circumstances of the Russian and Soviet empires.

**Leanna Foster**

Macromolecular Science and Engineering

*Combatting Bacterial Infections: Synthetic Cationic Polymers for Biofilm Prevention and Treatment*

Biofilms account for 65-80% of bacterial infections, which are often persistent with high recurrence rate. Due to the insulation of the bacteria in a matrix, traditional antibiotics are ineffective treatments, and engineered surfaces that prevent biofilm formation have short lifetimes under physiological conditions. To address the unmet need for an innovative anti-biofilm treatment, my dissertation focuses on the development of new polymeric materials that can prevent or treat bacterial biofilms. One approach utilizes cationic polymers to prevent initial bacteria attachment to surfaces by sequestering bacteria in solution. This approach can be improved by including hydrophilic, charge-neutral segments in the polymer to create a barrier surrounding planktonic bacteria for adhesion prevention. In an effort to develop new anti-biofilm agents, antimicrobial polymer-nanoparticles have been synthesized to treat both planktonic and biofilm bacteria without contributing to antibiotic-resistance. These approaches will significantly contribute to the future prevention and treatment of biofilm related bacteria infections.

**David Giles**

Immunology

*Distinct myeloid cell subsets with divergent pathogenic or protective functions in the central nervous system in an animal model of multiple sclerosis*

Multiple sclerosis (MS) is a debilitating disorder of the central nervous system (CNS) caused by inflammation and subsequent demyelination and axonopathy in the brain, spinal cord, and optic nerves. Many current therapies function by limiting inflammatory cell access to the CNS; however, there is growing evidence that immune cells may not only be pathogenic but may also play regulatory and pro-regenerative roles. It is critical, therefore, to distinguish these pathogenic and protective subsets in the development of safer, more effective therapies for MS. Myeloid cells, such as macrophages and dendritic cells, are a major component of the immune cell infiltrate in the CNS during MS and in the animal model experimental autoimmune encephalomyelitis (EAE). Using this model, we define pathogenic and protective myeloid cell subsets with distinct expression phenotypes and divergent functions in disease.

**Heather Goetsch**

Environmental Engineering

*Assessing microbial risks through production of urine-derived fertilizers*

Urine diversion and the development of urine-derived fertilizers can provide several environmental benefits. Before these benefits can be realized, risks of contaminants found in urine to be used as fertilizer must be evaluated. Polyomavirus, a virus found in urine at high gene copy levels, loses infectivity quickly, yet its DNA lasts much longer in stored urine. The risk of additional genomic material found in urine, including antibiotic resistance genes (ARGs), is also evaluated in production of urine-derived fertilizers. Finally the presence and infective state of polyomavirus and ARGs in urine-derived fertilizers are compared to other wastewater treatment byproducts such as biosolids. This comparison is necessary for communication of risks of a novel sustainable nutrient product to aid in its adoption and public acceptance.

**Sharon Grim**

Earth and Environmental Sciences

*Genomic and ecological investigations of modern anoxygenic photosynthetic cyanobacteria, and implications for Earth's oxygenation*

For billions of years, cyanobacteria have transformed Earth through oxygenic photosynthesis. However, cyanobacteria can also perform photosynthesis without producing oxygen; this form of photosynthesis (“anoxygenic”) was critical to Earth’s chemical and biological evolution but is understudied in modern ecosystems. This dissertation used molecular and ecological techniques to investigate modern anoxygenic cyanobacteria. Genomic analysis of *Geitlerinema* sp. PCC 9228, an anoxygenic cyanobacterium, revealed numerous adaptations to low-oxygen and sulfidic conditions, which were prevalent for much of Earth’s history. An ecological study of Middle Island Sinkhole microbial mats, a modern analog of ancient ecosystems, revealed (i) light-dependent seasonality in abundances of two cyanobacterial groups and (ii) variation in abundance of light harvesting proteins. These results suggest that shifts in cyanobacterial community structure and light availability influence oxygen production. This research provides insights into the genetics and ecology of anoxygenic cyanobacteria, and a foundation for understanding their role in ancient ecosystems.

**Yaakov Herskovitz**

Near Eastern Studies

*Linguistic Limbo – Writing and Rewriting in Hebrew and Yiddish*

My dissertation offers a new way of understanding Jewish bilingualism, namely Hebrew-Yiddish literary bilingualism. Focusing on four writers who wrote prose extensively, in both Yiddish and Hebrew, my project explores one of the most significant yet understudied phenomenon in Jewish literature. These writers wrote bilingual literature in a time where there was a demand for monolingualization of Jewish culture; The first half of the 20th century was wrought with dramatic change, with the rise of Zionism and World War I being key factors in a changing cultural environment. The writers I discuss worked against cultural trends to offer a complex vision for literature which was translanguagual, self-translated and innovative. The four refused to choose one Jewish language or another, but rather fluctuated and oscillated between the two, using their bilingual production as a springboard for creativity and poetic innovation.

**David Hietala**

Chemical Engineering

*The effects of reaction conditions and feedstock characteristics on the hydrothermal liquefaction of microalgae: Experimental observations and quantitative kinetic model*

This dissertation elucidates and models the reaction kinetics for biocrude (a biofuel precursor) and co-product formation from the hydrothermal liquefaction (HTL) of microalgae. Algal polycultures demonstrated trade-offs between biocrude production and quality compared to the most productive monoculture. Temperature profile measurements enabled experimentally observing and modeling short reaction times, clearly highlighting the region of product formation kinetics. A meticulous follow-up study expanded the kinetic dataset to include different algal species, varying biochemical compositions, and additional initial concentrations. This dataset informed the development of a quantitative kinetic model for product formation and composition evolution encompassing a broad range of temperatures, times, concentrations, and biochemical compositions. This model will provide direction beyond empirically testing individual reaction conditions and facilitate the design of large-scale biorefineries.

**Trever Hines**

Earth and Environmental Sciences

*Transient ground deformation in tectonically active regions and implications for the mechanical behavior of the crust and upper mantle*

Transient ground deformation is any geodetically observable deviation from the steady rate of deformation associated with plate tectonics. The physical mechanisms driving transient deformation are not always easily discernible, and potential mechanisms include slow slip on a fault, viscous flow in the lower crust or upper mantle, volcanism, as well as seasonal and anthropogenic effects. When mechanism can be ruled out through careful and methodical analysis, we can begin to glean insight into the mechanical behavior of the lithosphere. This information has direct relevance for assessing seismic hazard. In this dissertation I present novel techniques for identifying transient ground deformation from geodetic data, and I present a method for inferring its driving mechanisms. I focus on transient deformation in southern California following the 2010 El Mayor-Cucapah earthquake and transient deformation associated with slow slip events in the Pacific Northwest.

**Tiffany Jantz**

Psychology

*Valuing a memory: Individual difference and task effects on value directed remembering*

Given the daily barrage of information, how do we determine what to remember versus what to forget? Presumably we prioritize important information; however, when and how we use such strategies remain unknown. My dissertation investigates these questions under simulated conditions where importance is determined by point values of studied items. My experimental tasks examine how item value affects memory and whether these effects are influenced by differences in working memory capacity (WMC). One line of experiments tests the hypothesis that people rely more on value when conditions are uncertain. For example, even in lists of only three words high value items are prioritized if list length is unpredictable. Another line tests the hypothesis that people with poorer memory rely more on value. Accordingly, people with lower WMC should show stronger value-directed memory than those with higher capacity. This research can advance learning strategies, personalized study skills, and age-specific memory interventions.

**Zoe Johnson King**

Philosophy

*Trying to Act Rightly*

My research focuses on the moral evaluation of people's motivations; I am interested in the question of what kinds of motivations make someone a good person. A popular view in Philosophy is that good people are motivated by the things that make actions morally right. For example, this view entails that a Black Lives Matter protester can be a good person if she is motivated to engage in protest by the thought that it will bring about equality, or justice, since these are the things that make it morally right to engage in protest. But this popular view entails that the protester cannot be a good person if she engages in protest because it is morally right. I think that this is a serious mistake. I develop the view that it is good to be explicitly committed to acting rightly and motivated by the moral rightness of one's actions.

**Evgeny Kagan**

Business Administration

*Behavioral aspects of managing innovation*

Innovation and product development have been studied extensively in operations management and economics, focusing mainly on firm behavior and aggregate market outcomes. In this thesis I argue that studying individual behavior and inter-team dynamics is equally important and that behavioral factors may affect the appropriateness of managerial and policy recommendations in innovation contexts. I examine three questions central to many collaborative innovation efforts: how to divide scarce time between innovation activities, how to align incentives of team members working on a highly uncertain project and how to find a market for a technological invention. The analysis presented shows that externally imposed product development schedules work better than the internal ones and demonstrates how different personality types are signaled in startup ownership negotiations. These findings call into question several standard assumptions in the theoretical and empirical literatures and help derive actionable recommendations for policy and firm decision-making.

**Takuya Kaneko**

Cell and Developmental Biology

*Neuronal Activity-Dependent Development of the Nociceptive Circuit in Drosophila*

The development of the nervous system is not just hard-wired by the genome, but depends on sensory experiences and neuronal activities. My dissertation research aims to address how sensory inputs and neuronal activity contribute to the formation of functional neural networks. I have contributed to the finding that the spatial arrangement of sensory axons in the *Drosophila* nociceptive circuit depends on the activity levels of the neurons. Furthermore, I discovered that experience of noxious stimulation during *Drosophila* development adjusts the function of the nociceptive circuit without affecting other sensory modalities. My studies elucidate the mechanism that underlies this sensory-pathway-specificity. In the last part of my thesis research, I will determine whether spatially separated sensory axons connect with different types of target neurons and elucidate the role of neuronal activity in this process. This study contributes to our understanding of how nature and nurture interact to sculpt the nervous system.

**Joss Kiely**  
Architecture

*The Infrastructure of Itinerancy: Politics and Image in the Late Modern Architecture of Minoru Yamasaki, 1951-86*

Conceptually situated in the tension between the stability inherent in buildings and bodies newly set in motion by air travel, this project focuses on Detroit-based architect Minoru Yamasaki's contributions to late modern architecture resulting from the new spatial and organizational demands of foreign commerce, global diplomacy, and international travel. The project examines well-known buildings such as the World Trade Center (1971), as well as lesser-known projects such as the Dhahran Civil Air Terminal (1962). Looking beyond the infamous Pruitt-Igoe Public Housing Project, I reframe Yamasaki's contributions to the discipline, revealing how they constructed post-war America and worked to exert its national interests in a globalizing world. Combining formal analysis of buildings with an accounting of the complex interactions between the architect, private corporations, and governing bodies, this project theorizes the architectural response to the changing mandates of air travel and global capital as an infrastructure of itinerancy.

**Ramya Kumar**  
Chemical Engineering

*Directing Interfacial Events in Stem Cell Culture & Glycocalyx Engineering using Biomimetic Polymer Brushes*

The success of biomaterials in medicine is determined by events that transpire at the interfaces between biological entities and synthetic materials. Multifunctional polymer brushes were developed to control interfacial outcomes in two applications. Some synthetic substrates can maintain human embryonic stem cell (hESC) pluripotency in fully defined culture conditions, circumventing the need for animal-derived products in regenerative medicine. With the goal of maximizing hESC self-renewal rates, a property-prediction tool was developed to identify optimal poly(zwitterionic) brush attributes. The glycocalyx is a brushy carbohydrate-rich biointerface that functions as a gatekeeper, defending our cells from viral attachment and eventual infection. Bioactive carbohydrate brushes were engineered to mimic the glycocalyx's chemical composition and sieve-like functionality. By varying brush architecture and composition, viral and biomolecular adsorption could be tuned. Using this model surface, physicochemical parameters that shape viral binding were identified, allowing us to formulate design guidelines for virus-resistant coatings.

**Ozan Kuru**  
Communication Studies

*Communicating Public Opinion in Post-Fact Politics: Perceptions of Public Opinion Reports, Political Polarization, and Implications for the Public-Media Relationship*

People rely on polls and other representations of public opinion in the media to update their political cognitions and behaviors. However, individuals' preexisting beliefs can color how they perceive opinion reports, and lead them to cherry-pick evidence that is congenial when presented with multiple options. Such biases result in distorted perceptions of public opinion, declining trust in journalism, and political-polarization. Moreover, in today's unprecedentedly-polarized and contentious information environment, individuals often encounter contradictory messages from digital data-journalism and numerical evidence is regularly critiqued, fact-checked, or debunked on reasonable or unreasonable grounds. In such a cacophonous context, motivational biases might amplify. Through national survey-experiments and a media content-analysis in the U.S., this dissertation examines how news-consumers' attributes, the content of opinion reports, and patterns of media coverage can trigger or mitigate biases in public perceptions. I discuss implications for trust in journalism and polarization, offer tangible journalistic remedies, and test their effectiveness.

**Christina LaRose**

English and Women's Studies

*Arab American Women's Poetry: Violence and Boundaries in the Levantine Diaspora*

What can poetry, as an artistic resource through which we try to understand humanity, tell us about the problem of violence in the Arab region? This dissertation seeks to answer this question by analyzing the poetry of women who were displaced from the Levantine region (Syria, Lebanon, Jordan, Palestine, Egypt, and Iraq) and who live in the United States. I focus on poets from the Levant because this is the location from which Arab emigration began and the place from which most Arab Americans trace their ancestry. Through poetry, women of Arab descent illuminate the causes of violence in this region and proffer solutions. I explore how these poets address several upheavals in the Levantine region: the collapse of the Ottoman Empire after WWI, French and British colonial interventions, the Israeli-Palestinian conflict, the Lebanese Civil War, the Gulf War (1990-91), and the 2003 U.S.-led war in Iraq following the September 11, 2001 terrorist attacks.

**Tina Le**

History of Art

*Spoiling the Senses: Philippine Conceptualism Under Marcos Martial Law*

Following Ferdinand Marcos' declaration of martial law in 1972 to the end of his regime in 1986, over half of presidential issuances had immediate bearing on the relationship between the arts and the state in the Philippines. My dissertation explores how 1970s conceptual art challenged the Marcoses' authoritarianism with acts of visual, aural, and tactile disruption. While works by these artists were dismissed as complicit with the regime and too abstract or illegible to a local audience, I counter that visible symbols and images of dissent were often employed by authoritarian regimes to justify the need for consolidated power. Through analysis of art and performances by Jose Maceda, Roberto Chabet, the artist collective Shop 6, and Luis "Junyee" Yee, Jr., the dissertation reveals how these seemingly politically innocuous artworks demonstrate the importance of resistance as an unstable category that manifests in elastic and uncertain forms.

**Sang Won Lee**

Computer Science and Engineering

*Facilitating Collaborative Creation of Complex Artifacts*

Collaborative systems and crowdsourcing provide a scalable solution to the problems that cannot be easily automated with artificial intelligence. However, its applications are limited to the well-defined problems that can be decomposed into a set of microtasks. For such complex tasks, the collaborative problem-solving process is essential to make the process agile and iterative. My dissertation seeks to understand how we can coordinate collaboration among users and crowd workers, especially for complex tasks that require creativity and involve a continuous, open-ended process. The contribution of this work will be methods and tools that facilitate real-time collaboration in computational systems. Also, we aim to involve non-expert crowd workers in the collaborative process coordinated by the system to engage a more general audience for various purposes. We validate our study by developing a number of interactive systems in various domains; performing arts, programming, writing, and design, supporting creative collaboration at scale.

**Jihang Lee**

Materials Science and Engineering

*Materials and Device Optimization of Transition Metal Oxides-based Memristors*

Memristive devices (memristors) showing resistive switching have been the subject of intense research due to their enormous potential for next-generation nonvolatile memory, logic, and neuromorphic computing applications. This thesis presents a comprehensive study on the fundamental understanding on physical mechanism and the optimization of materials and device structures with theoretical calculations and experimental engineering. First, I investigate the formation and interaction of oxygen vacancies in amorphous Ta<sub>2</sub>O<sub>5</sub>, an important resistive switching material, using first-principles calculations. The results uncover the charge-transition processes involved in during resistive switching in oxide-based memristors. Next, I develop novel structure including engineered nanoporous graphene to control the internal ionic transport and redox reaction processes at the atomic level, leading to improved device performance. Last, I employ new high-entropy oxides as switching layers to achieve desirable characteristics of resistive switching behavior with additional degrees of controllability.

**Erin Lynch**

Earth and Environmental Science

*Geofluids and mountain building: Integrated isotopic studies of deformed, clay-rich rocks*

Hypotheses on the origins of geofluids in Earth's crust are numerous and conflicting, ranging from the release of volatiles from magmatic and metamorphic bodies to the infiltration of surface waters. By looking at the isotopic signatures preserved in secondary clay minerals, this dissertation explores the origin of fluids in mountain belts. Hydrogen, oxygen, and mercury isotopes are used to examine the provenance of deformational fluids; <sup>40</sup>Ar/<sup>39</sup>Ar-dating is used to constrain the timing of deformation. Chapter 1 shows that ancient meteoric fluids dominate Basin and Range crust. Chapter 2 shows that fault rock fluids of the Argentine Precordillera preserve Miocene climate in Central South America. Chapters 3 and 4 combine isotopic methods to examine fluid involvement in the Sevier and Appalachian fold-and-thrust belts of North America. Chapter 5 develops the novel application of mercury isotopes to crustal deformation studies.

**Meera Mahadevan**

Economics

*Essays on Public Infrastructure Provisioning and Economic Decision Making in Developing Economies*

My dissertation is focused on two crucial issues that face developing economies – how consumers and firms respond to the provision and quality of energy infrastructure such as electricity; and how major life transitions affect decision-making and behavior amongst the poor and unemployed. Specifically, I study how electricity sector reforms in India, geared towards greater efficiency, affected the manufacturing sector. I find surprising results indicating that the final structure of the distribution network in a state – whether a single entity or multiple distribution companies – is significant in determining whether these reforms are beneficial. I am currently working on another paper that examines how consumers perceive and respond to electricity prices, and what this implies about how electricity tariffs should be designed to elicit certain behaviors. My other work, with Catalina Franco, studies how transitioning from student life at a large public university in Colombia, to working can affect economic decision making.

**Bharadwaj Mantha**

Civil and Environmental Engineering

*Enabling Data-Driven Online Simulation Through Real-Time Multi-Sensory Robotic Data Collection and Fusion*

Buildings account for about 40% of the total energy consumption in U.S. Building managers need to routinely retrofit or retro-commission the existing buildings to improve their energy performance. For making informed decisions, scientific investigation of the data at floor and room level granularity is required. Such data is typically gathered with the help of wired and/or wireless sensors already installed in new buildings or by instrumenting such sensors networks in existing buildings. This is time-consuming, infeasible, cost-prohibitive, and may often result in lack of critical actionable information. Therefore, my research will primarily focus on 1) Using autonomous mobile indoor robots for gathering critical actionable building information in real-time, 2) Developing agent based models for modelling, designing, and simulating the interaction of the autonomous ‘agents’ (robots), 3) Formulating different data fusion techniques in order to utilize the asynchronous sensory data (gathered by several robots) for further simulation analysis and subsequent decision-making

**John McCrone**

Microbiology and Immunology

*The dynamics of intrahost influenza evolution*

Influenza diversity has been well characterized at the global scale. However, the factors that influence evolution within and between hosts are poorly understood. We have addressed this knowledge gap by investigating the diversity in patient-derived samples from two vaccinated cohorts. In the first, we compared influenza diversity from vaccinated and unvaccinated individuals enrolled in the FLUVACS study, the last randomized, placebo controlled trial of influenza vaccine efficacy. Surprisingly, we found that vaccination does not impact intrahost influenza diversity. In the second, we quantified the shared diversity in longitudinal samples and transmission pairs from a household cohort (HIVE) of over 250 families of 4 or more. Our data show that the intrahost populations of influenza are characterized by rapid turnover and that rare variants are rarely transmitted to new hosts. Together these findings suggest that at the local scale influenza evolution is driven by random drift and not natural selection.

**Selin Merdan**

Industrial and Operations Engineering

*Optimization and Statistical Learning Methods for Design of Diagnostic Test Protocols for Early Detection of Chronic Diseases*

Early detection can lower the burden of the disease on the patient, prolong the survival, as well as reduce the economic burden of chronic diseases --- the leading cause of mortality in the United States. Molecular biomarkers and radiologic imaging tests offer the potential for early diagnosis of chronic diseases. These advances have resulted in multiple types of information that can be used to make clinical decisions, but how best to use these multiple sources of information is a challenging engineering problem. The questions that need to be addressed are which biomarker screening tests to choose and how best to combine them into a composite test that trades off the benefits of early disease detection with the harms from side effects of testing and cost to the health care system. In this dissertation, new optimization-based models and data-driven methods are proposed, which combine several diagnostic tests into an optimal composite test. The utility of these approaches is demonstrated in the context of prostate cancer.

**Chad Milando**

Environmental Health Sciences

*Exposure apportionment of ambient air pollutants among vulnerable urban residents*

Current methods for assessing and reducing exposures to ambient air pollution may not protect the health of vulnerable individuals. Exposure to emissions from large point sources, which have been successfully regulated, differs from exposure to vehicle emissions, which are increasing with global urbanization. To identify new targets for exposure reduction, the proposed research quantifies contributions from various sources to individual exposures at high spatial and temporal resolution, so called “exposure apportionment.” Through exposure apportionment, source-activity pairs contributing the majority of air pollution burden among individuals can be targeted for interventions that reduce exposure. Exposure apportionment is demonstrated through a case study of vulnerable individuals in Detroit, MI. In addition, this work addresses gaps in the modeling of local pollutant sources, evaluates dispersion model predictions resulting from mobile sources, and evaluates the representativeness of national time-activity databases for individuals in selected vulnerable subpopulations.

**Inah Min**

Education and Psychology

*Nurturing cultures – A cross-cultural perspective on the intersection of parenting and teaching*

Every society invests enormous resources to ensure that children grow up with the skills, knowledge, and values that will enable them to be successful. Yet cultures vary in their beliefs about what effective parenting and teaching require. This dissertation consists of three studies that use different methods to reveal cultural beliefs about teaching and learning. Study 1 uses PISA parent survey and achievement data to examine whether there are cultural differences in the kinds of parental involvement in schooling that predict children’s success. Study 2 uses data-mining methods to identify cultural differences in beliefs about effective teaching and parenting as depicted in popular media. Study 3 uses an experimental approach to evaluate how students in different societies experience aspects of teaching and how those differences are reflected in their learning. Taken together, the three studies examine the broader cultural context in which these different cultural models influence student learning.

**David Morphey**

Classical Studies

*Passionate Platonism: Plutarch on the Positive Role of Non-Rational Affects in the Good Life*

Plutarch develops a distinctive form of passionate, practical Platonism. Contrary to philosophical rivals within and outside his tradition, he argues for the centrality of emotions in ethical development and the good life. First, Plutarch sees himself as part of a unified Platonic tradition committed to critical philosophical reflection. He criticizes the Stoics, the main philosophical rival of his day, arguing that their foundational ethical theory of “appropriation” (oikeiōsis) is a form of “alienation” from our passionate nature and from others, which Plutarch considers important aspects of our moral life. Passions are ineradicable aspects of our nature and positive forces in moral development according to Plutarch. He also surprisingly defends poetry’s usefulness for ethical and philosophical development against the criticisms of Plato. Finally, he acknowledges the rationality of non-human animals and the respect we owe them, while arguing that virtues require uniquely human rational capacities to be practical, moral agents.

**Roberto Mosciatti**

Romance Languages and Literatures

*Cynicism, Christianity and Post-Human Italian Thought*

My project, Cynicism, Christianity and Post-Human Italian Thought, unearths significant changes that have characterized Italian culture starting in the 1970s and which seem to anticipate the birth of a new Christian spirituality, one divested of metaphysical overtones. The relevance of such a new religious demeanor rests in how it would reconcile faith and reason and undermine materialistic values, while mitigating religious conflicts that have exploded after 9/11. Why would several contemporary Italian thinkers attempt to sanction lay philosophical views by engaging with sacred texts? Why should they develop secular arguments from religious postulates? I would like to answer these questions by considering the hypothesis that, due to historical and philosophical factors, contemporary Italian thought converts theological assumptions into non-religious discourses by recovering a strand of Greek Cynic thought from within the Catholic tradition.

**Jessica Muir**

Physics

*Unbiasing cosmology on the largest observable scales*

One of the most exciting areas of research in cosmology is the effort to extract information about fundamental physics from observations of the universe on large scales. With the advent of increasingly large cosmological datasets (and correspondingly small statistical uncertainties), future progress in the field will fundamentally be determined by our ability to understand and account for systematic errors. In this thesis, we explore the challenges posed by systematics in two areas of active research: the separation of primordial and late-time contributions to large-angle features of the the Cosmic Microwave Background (CMB), and the use of galaxy clustering measured by the Dark Energy Survey (DES) to constrain and perform consistency checks on the properties of dark energy. In both cases, we discuss dominant systematics and present methods for controlling their impact, with an eye towards how such techniques can be extended to the analysis of data from next-generation surveys.

**Gopal Nataraj**

Electrical Engineering - Systems

*Advances in Quantitative MRI: Acquisition, Estimation, and Applications*

Magnetic resonance imaging (MRI) is a non-invasive, safe, and versatile tool that has earned widespread clinical adoption; however, MRI examinations are expensive relative to other imaging modalities. Quantitative MRI (QMRI) seeks to increase the value of MRI examinations by building targeted MRI biomarkers that measurably describe physical processes linked to the onset and progression of specific disorders. QMRI poses several challenges beyond those of anatomical MRI, including long acquisitions and challenging estimation problems. This thesis seeks to build a systematic framework towards QMRI. We borrow tools from optimization, statistics, and machine learning to design time-efficient workflows for quantifiably characterizing physical processes of interest. We apply this framework to challenging QMRI problems that are motivated by pathological studies. Our goal is to introduce tools that aid in identifying clinical tasks for which QMRI should (or should not) be part of a targeted, high-value MRI examination.

**Alaina Neal**

Educational Studies: Foundations and Policy

*Beyond Resilience: Exploring the school experiences of Black girls*

Drawing upon sociocultural theory, this year long ethnographic study of one predominately Black high school asks, how do schools and school officials construct and position the identities of Black girls in their school as evidenced through organization policies, practices and micro-interactions and discourses that constitute their culture. Scholarly inquiry on Black girls' experiences has been limited to examining the feminine identities that they bring into schools with them, as shaped by familial and community forces, and the institutional response to these identities. This focus has led to an under study of how schools actively construct Black feminine identities and what these constructions may mean for the young women's academic opportunities, present and future. Consequently, this dissertation will provide empirical and analytical insight into the particular mechanisms embedded within the organization and culture of schools that determine how they structure academic opportunities for Black female students via that identities they construct.

**Kathryn O'Connor**

Kinesiology

*Concussion incidence, risk factors, and effects on mental health among United States service academy cadets*

There is growing concern regarding the consequences of concussions. However, much of the current literature has been cross sectional, limiting the ability to draw a causal link between concussions and future health deficits. Furthermore, studies have focused on males and only sport-related concussions. The current series of projects aims to address the natural history of concussion, recovery, and the effects of any concussion on health outcomes among male and female United States service cadets. Each participating cadet at the four service academies will complete a baseline assessment followed by post-injury assessments in the event of a diagnosed concussion. From an estimated sample of 10,000 baseline assessments and 1,000 concussions, three aims have been constructed: 1) Define concussion incidence among Service Academy Cadets; 2) Examine recovery trajectories to determine the rate of recovery relative to published literature on athletes; and 3) Prospectively examine the effects of concussion on mental health.

**David Ogden**

Linguistics

*Positive Attitudes Through Better Comprehension: The Role of Perceptual Adaptation in Accent-Based Discrimination*

Discrimination based on language and accent, which has negative consequences in housing, employment, education, and more, serves as a "back door" to discrimination based on nationality and ethnicity (Lippi-Green, 2012). This dissertation examines cognitive forces, beyond stereotypes of social groups, that perpetuate negative attitudes towards speakers with accents that are difficult to understand. Integrating theories of social cognition and speech perception, the project builds on evidence that (1) processing effort and disfluency lead to negative speaker evaluation (Dragojevic & Giles, 2016), and (2) listeners can, over time, typically adapt to and more accurately comprehend accented speech (e.g., Baese-Berk et al., 2013). Bridging these bodies of research, two experiments test the central hypothesis that adaptation to non-native speech leads to more fluent (less effortful) processing and, in consequence, improved attitudes. A long-range broader impact of this research is to inform potential interventions against accent discrimination.

**James Roach**

Neuroscience

*Cholinergic neuromodulation optimizes information representation, encoding, and retrieval in neural networks*

Acetylcholine (ACh) is an important neurotransmitter responsible for regulation of arousal and attention. At the cellular level, ACh regulates two critical biophysical properties of neuron by reducing the magnitude of the M-current. Reduction of the magnitude of this current recreates the reduction in spike frequency adaptation and in a shift from a type 2 to a type 1 phase-response curve observed experimentally in the presence of ACh. Using a biophysical model of a cortical network, which includes cholinergic modulation, I show that dynamic regulation of ACh is responsible for moving neural networks through three behaviorally relevant functional states. These three states correspond to periods of high attention and REM sleep (high ACh), resting state waking (moderate ACh), and NREM sleep (lowest ACh). The results of these numerical simulations show the importance of dynamic changes in neuromodulatory tone to the proper function of the brain.

**Tay Rosenthal**

Chemistry

*Chiral Phosphoric Acids: Innovations and Application to Selective Glycosylation of Macrolides*

The research of my dissertation focuses on the development of a new method to selectively append saccharide onto biologically relevant natural products. This new method may provide an efficient route for chemists and biologists to synthesize unique analogues of sugar-appended natural products, that are otherwise difficult to access by conventional chemistry. I became particularly interested in studying the glycosylation of 6-deoxyerythronolide B (6-dEB), which is the biogenic precursor to erythromycin, a macrolide antibiotic. Previous studies with enzymatic reaction and transition metal catalysis have shown that differentiation of the hydroxyl groups on 6-dEB for selective glycosylation poses significant challenges. I applied organocatalysis using chiral phosphoric acid (CPA) as a promoter to study the glycosylation of 6-dEB. Through a rational design of CPA catalyst, I am able to achieve unprecedented regio-selectivity, where in each of the three hydroxyl groups on 6-dEB may be selectively glycosylated based on the choice of catalysts and reaction conditions.

**Michael Rozier**

Health Services Organization and Policy

*When Populations Become the Patient: Mapping the New Ethics of U.S. Health Care*

Even if the Affordable Care Act (Obamacare) is amended or replaced, our health care delivery system is moving from a sick care system, focused on treating individual illness, to a health care system that emphasizes disease prevention for entire communities and values the social context of patients. Although the operational elements of reform are being studied, we must also anticipate the ethical concerns that will arise when health care organizations aim to balance treatment with prevention, and balance patients with populations. This project maps the ethics of population health by studying the \$4 billion that nonprofit hospitals spend each year on community health improvement and does so through 38 interviews, 10 focus groups, and a discrete choice experiment and survey with over 400 respondents. Patient autonomy is the dominant value in clinical medicine. This project is the first to articulate which values are shaping our new system of community-level care.

**Jennifer Rubin**

Psychology and Women's Studies

*#fragilemasculinity: The Role of Masculinity Threat, Gender Discrepancy Stress, and Anonymity in Men's Harassment of Women in Social Media*

Although scholarship examines women's experiences with online harassment, there is less attention to men's motivations for perpetrating digital hostility. This research considers whether men's endorsement of gender harassment in social media may be motivated by attempts to (re)affirm their masculinity following gender threats. Accordingly, the goals of this dissertation are threefold: 1) to extend prior work assessing the effects of gender-threatening feedback on men's reparative responses; 2) to examine the impact of masculinity threats via perceptions of women in new media contexts and; 3) to explore the role of online affordances (i.e., anonymity) in men's likelihood to harass following masculinity threats. Taken together, this dissertation aims to provide empirical evidence that technology enables harassment to thrive in social media, yet men's motivations are grounded in performances of masculinity and maintaining hierarchical gender relationships.

**Jingchunzi Shi**

Biostatistics

*Statistical Methods for Detecting Heterogeneous Association Signals Through Meta-analysis*

Genome-wide association studies, which examine millions of genetic variants in thousands of individuals, have identified many complex trait associated loci. Most studies make their summary level data publicly available. Meta-analysis of the data available can lead to discovery of novel signals as the sample size increases. However, conventional meta-analysis approaches do not properly account for the expected heterogeneity among different ancestry groups and thus have low statistical power in identify association signals. The objective of this dissertation is to propose innovative statistical methods to account for heterogeneous genetic effects from different ethnicities in order to utilize summary statistics to gain further insight into the genetics of various diseases. We demonstrate through extensive simulations and real data applications that our proposed methods can efficiently model the expected heterogeneity and further improve power comparing to existing meta-analysis approaches.

**Meredith Skiba**

Biological Chemistry

*Structural and Biochemical Characterization of Methyltransferases in Polyketide Biosynthesis*

Polyketide natural products constitute a broad range of chemically diverse compounds with important pharmaceutical properties and complex chemical structures, making them challenging targets for chemical synthesis. Nature has evolved efficient routes for polyketide biosynthesis using polyketide synthase (PKS) enzyme pathways composed of six main classes of enzymes. Among these classes, the methyltransferases (MTs) are unstudied. This thesis reports the structural and biochemical characterization of MT enzymes in polyketide biosynthesis. PKS pathways contain distinctly different oxygen (O)-MTs and carbon (C)-MTs. O-MTs were shown to stereospecifically methylate substrates, the timing of methylation by C-MTs in the PKS enzyme cycle was identified, and the study of two C-MTs in the initiation of the biosynthesis of apratoxin, a polyketide with anti-cancer properties, revealed unprecedented biochemical activities for MT enzymes. Their remarkable chemistry and exquisite chemical control make PKS MTs ideal reagents for combinatorial biosynthesis of pharmaceuticals and other high value molecules.

**Hung-An Ting**

Molecular and Cellular Pathology

*The role of Delta-like ligand 4 and its epigenetic mechanism in regulatory T cells differentiation during respiratory infection*

Respiratory Syncytial Virus (RSV) induces airway immunopathology to be the number one leading cause of infant hospitalization and childhood asthma risk factor. Regulatory T cells (Treg) prevent RSV-induced immunopathology. Understanding how Treg are regulated provides new target to alleviate RSV-induced immunopathology. Since RSV infection specifically up-regulated Delta-like ligand 4 (DII4), we investigated the role of Delta-like ligand 4 (DII4) and its downstream mechanism in Treg regulation. Using neutralizing antibody and genetically-modified mouse model, we found that DII4 stabilized Treg identity to prevent RSV immunopathology. DII4-mediated Treg stability was maintained by an epigenetic enzyme—SET and MYND domain containing protein 3 (Smyd3). Depletion of Smyd3 decreased Treg stability and exacerbated immunopathology in vivo. This dissertation provides a new insight into DII4 as a ‘GO’ signal in Treg, and uncovered a novel epigenetic mechanism of DII4 to be a potential target in the future

**Pascal Title**

Ecology and Evolutionary Biology

*Diversity controls in Australian squamate reptiles*

Some of the most significant ecological patterns involve striking differences in numbers of species between climatic regions (e.g., tropics and temperate zone), yet there is no consensus as to the evolutionary and ecological mechanisms that underlie these patterns. Australia is home to 12 separate radiations of lizards and snakes, each of which occupies the continent’s climatic space in different ways. As this provides 12 independent replicates of diversification that have happened alongside dramatic climatic change, Australia is an excellent system to study the spatial distribution of species accumulation over evolutionary time. By generating climatic and phylogenetic datasets, and developing empirical methods, I investigate the geographic, climatic and evolutionary factors that have contributed to shaping the assemblages of species found at regional scales. The datasets and methods that I have developed over the course of my dissertation can be broadly applied to ecological patterns of diversity at a global scale.

**Priyamvada Trivedi**

Political Science

*Negotiating Order: An Empirical Investigation into the Micro-Dynamics of Social Change in Gujarat, India*

What happens when an order premised on the belief that some people are inherently more privileged than others confronts another that believes all people are equal? Specifically, how does the Indian caste system, a hierarchical social order, interface with a democratic political order? Do privileged castes accede to the democratic system or do they resist and subvert the democratic process? This dissertation attempts to explain the behavior of the privileged by focusing on the caste system as manifested in untouchability. Untouchability is the religiously sanctioned but constitutionally outlawed discrimination against lower castes by higher castes. I argue that privileged groups disengage from discrimination when they are able to secure their interests via the democratic system and create new forms of privilege. Several observable implications are tested using both quantitative and qualitative methods.

**Christina Vallianatos**

Human Genetics

*Interplay of writer and eraser enzymes for histone H3K4 methylation in neurodevelopment*

Dysregulation of histone methylation has emerged as a major contributor of neurodevelopmental disorders (NDDs) such as autism spectrum disorder (ASD). These early onset cognitive disorders affect 1-8% of the general population and pose the largest health care cost in the developed world. Understanding how mutations in specific genes contribute to NDDs will provide an important foundation for developing therapeutics for individuals with these lifelong disorders.

My thesis research investigates histone H3 lysine 4 methylation (H3K4me) balance in neurodevelopment. Mutations in H3K4 demethylase KDM5C are frequently associated with an ASD syndrome. My central hypothesis is that one or more writer enzymes mediates abnormal brain development of Kdm5c-knockout mice at behavioral, molecular, and cellular levels. My work has expanded our understanding of the H3K4me dynamic in normal and pathological brain functions, and may provide a drug target to alleviate ASD-like symptoms in individuals with mutations in KDM5C and other related genes.

**Naomi Vaughan**

Germanic Languages and Literatures

*The Space of Power: Berlin's Architecture of Sovereignty After National Socialism*

This interdisciplinary project analyzes representations of the destroyed national socialist chancellery in diverse media vis-à-vis the material history of its site in Berlin. Investigating the physical and symbolic construction of the iconic but provisional center of Hitler's sovereignty, I examine the representation of the chancellery as the visible manifestation of state power and guarantor of a new political order, manifested in architectural reconstruction. I then explore how these representational strategies are critically re-appropriated in the immediate postwar to the present in film, narrative, architecture, and exhibitions. Structured around the constitution and collapse of Hitler's sovereignty and the reconstitution of democratic sovereignty in Berlin, I argue that the continual reappearance of the chancellery in representation offers a site for negotiating both Germany's relationship to the past and challenging and complicating the aesthetic possibilities for representing sovereignty in architecture.

**Andrew Walker**

History

*Strains of Unity: Property, Antislavery, and Sovereignty in Haitian Santo Domingo, 1822-1844*

In February 1822, Haitian president Jean-Pierre Boyer proclaimed unification and emancipation in neighboring Santo Domingo, bringing the entire island of Hispaniola under the laws of the post-revolutionary Republic of Haiti. My dissertation explores the relationship between property ownership, the transition to free labor, and the formation of the Haitian state in Santo Domingo. I argue that former slaves, rural inhabitants, and large-scale landowners together forged an uneasy consensus in favor of Haitian rule that sustained the unification for more than two decades. First, I examine property transfers in the capital of Santo Domingo in order to highlight the growing social networks among citizens of both sides of the island and to gauge the limits of Haitian land and labor reforms. Next, I show how the arrival of foreign runaways from enslavement and successive diplomatic crises forced the Haitian state to uphold antislavery as a cornerstone of the unification project.

**Joseph Walker**

Ecology and Evolutionary Biology

*Investigating the potential of phylogenomic analyses for addressing evolutionary questions*

DNA provides the most abundant source of information for inferring evolutionary relationships and is one of the few characteristics universal to life. Developments in next-generation sequencing have resulted in an exponential increase in the amount of DNA data being generated. This data generation has outpaced the development of computational tools and methods for processing and analyzing it. My thesis addresses this problem through the creation of novel tools and methods that facilitate the investigation of many outstanding evolutionary questions that may only be approached using large datasets. Using datasets comprising thousands of genes, I have found that conflicting gene histories surround debated species relationships. I have inferred in the carnivorous Caryophyllales the highest level of whole genome duplication in flowering plants. I have also shown that gene retention after genome duplication plays a role in evolution and that, with spatial genome data, researchers may make more biologically informed species relationships.

**Guihua Wang**

Business Administration

*Empirical Studies of Health Care Outcomes and Cost Effectiveness*

This dissertation is based on three essays on health care outcomes and quality information. In essay 1, we show that patients of different demographics and levels of acuity benefit differently from elite surgeons. We estimate that the total societal benefits from using our proposed patient-centric information are comparable to those achievable with 10%-60% increase in surgeon capacity. In essay 2, we use a machine learning approach to identify patient types that exhibit significant differences in outcome quality. We quantify the differences in patient outcomes between providers in a (patient-centric) manner that is useful to individual patients, providers and payers. In essay 3, we examine the role of state-sponsored public reporting programs of hospital quality on patient choice of providers. We compare the effectiveness of different information formats in guiding patients to providers that benefit them the most.

**Carly Wayne**

Political Science

*The Strategic Psychology of Terrorism*

Terrorism presents a fundamental paradox – terrorists are vastly weaker in their capacity to inflict harm than the government they oppose, yet they often receive tremendous attention from the state. What explains this disconnect between the costliness of government responses to terrorism and terrorists' objective capacity to harm? This research argues that the target selection of terrorists is central to triggering expansive vs. limited reactions from states. I contend that terrorists use their target selection as a strategic signal directly to the mass public regarding the group's micro-level willingness and capacity to inflict personal harm. These attacks thus capitalize on biases in risk perception, moral outrage and the divergent preferences of citizens and their governments to constrain elected officials' policy options. I test this argument using a mixed-methods approach that includes survey experiments, qualitative analysis of declassified terrorist communications and a large-N empirical analysis of state policies in the wake of terrorist violence.

**Sang Joon Won**  
Chemical Biology

*Structure, Function, and Inhibition of Protein De-palmitoylases*

Proteins are often regulated through the addition of chemical modifications to modulate localization, activity, and interactions. Protein S-palmitoylation describes the attachment of long-chain fatty acids to cysteine residues in proteins to promote membrane association. Altered S-palmitoylation contributes to the pathogenesis of neurological disorders, cancer, and many other diseases. Overall, S-palmitoylation contributes to the regulation of essentially all cellular processes, yet the enzymes that catalyze lipid attachment and removal are poorly characterized. My dissertation addresses this gap by focusing on the structure, function, and inhibition of the de-palmitoylating enzymes APT1 and APT2. First, I applied isoform-selective APT inhibitors to understand the substrate engagement and inhibitor selectivity. Second, I validated the selectivity of the APT inhibitors using affinity enrichment and proteomics. Finally, I plan to profile the dynamic rate of palmitoylation regulated by APT enzymes in cells. Overall, my research has clarified the mechanism and function of protein de-palmitoylation in cell regulation.

**Sara Wong**  
Cellular and Molecular Biology

*Mechanisms for the termination of vacuole transport*

Eukaryotic cells contain several types of organelles – subcellular compartments that perform specific functions. In order for cells to function, molecular motors must transport organelles to designated locations. The mislocalization of organelles has been linked to diseases of the skin, gut, and nervous system. Organelle transport is partially regulated by cargo-specific adaptor proteins, which physically connect organelles and molecular motors. Attachment to motors is critical for organelle transport. An emerging view from our lab is that the release of organelles from the motor is equally critical. The overall goal of my thesis is to determine mechanisms that regulate the release of cargoes. I discovered that the modification of adaptor proteins signal that organelles have arrived at their destination, which in turn regulates the release of organelles from molecular motors. These studies may ultimately provide greater insight into diseases caused by impaired cargo transport.

**Bowei Wu**  
Applied and Interdisciplinary Mathematics

*Simulation of particulate flow based on integral equation method*

The simulation of particulate flow is important in a great number of biological and engineering applications. In this paper, simulation schemes based on the integral equation method are developed and analyzed. Critical issues of the integral equation method, including accuracy, stability, and boundary conditions, are addressed. Applications to simulate electrohydrodynamics, microfluidics, and other phenomena are presented. Software is also developed for particulate flow simulation, which includes fast algorithms and high performance computing techniques to greatly enhance the efficiency of the simulation.

**Biming Wu**

Biomedical Engineering

*Design of synthetic gene circuits in mammalian stem cells and its therapeutic application in cartilage repair*

Synthetic gene circuit marries the strengths of biology and engineering, and it can re-engineer cells for specific functions or desirable behaviors. However, most of these applications are practiced in microbes, but many human health challenges are problems with the mammalian system. Therefore, advancing mammalian synthetic biology is critical to developing novel therapeutic solutions based on cell-based and gene therapies. This dissertation focuses on the therapeutic application of synthetic biology in cartilage repair. Specifically, this project is to develop a synthetic gene circuit that reprograms mouse and human stem cells to improve their ability to regenerate articular cartilage. The implementation of this project involves optimizing in vitro test platforms, designing synthetic mammalian promoters, validating in mouse and human genomes, and verifying the gene circuit in vivo. The design and system developed in this study not only contributes to cartilage biology but also demonstrates the feasible therapeutic application of synthetic gene circuits.

**Chia-Chen Wu**

Civil and Environmental Engineering

*Bacterial colonization in point-of-use (PoU) drinking water filters and the risk associated with opportunistic pathogens and antibiotic resistance*

When Point-of-Use (PoU) drinking water filters are used to remove hazardous chemicals from tap water, they cannot remove but increase the bacterial abundance and alter the bacterial community composition in the effluent. How bacteria colonize and are selected for in the PoU filter is unknown, yet genus of concerns, such as Mycobacterium, are predominant in the biofilm formed on the PoU filter and the filter effluent. To study the microbial ecology of PoU filter, I will conduct a lab-scale PoU filter manifold system spiked with green fluorescent protein tagged bacteria to identify the mechanism of bacterial colonization and proliferation in PoU filter. The risk of utilizing PoU filter will be evaluated by analyzing the opportunistic pathogens and antibiotic resistance determinants in PoU filter using high-throughput sequencing method and bioinformatics tools.

**Zhiyuan Yao**

Molecular, Cellular and Developmental Biology

*Molecular mechanism, transcriptional and post-translational regulation of Autophagy*

Macroautophagy, hereafter autophagy, is one of the major degradation systems in eukaryotic cells. During autophagy process, cells generate a double-membrane vesicle called autophagosome to deliver cargos to vacuole/lysosome for degradation and recycling. Malfunction of autophagy results in numerous diseases including Alzheimer's disease and cancer. My thesis research, which consists of three major parts, investigates molecular mechanism and the regulation of autophagy. In the first part, I focus on the role of novel protein Atg41/Icy2 in autophagosome formation and how this regulation affects autophagy. In the second part, I focus on the transcriptional regulation of autophagy. The role of SAGA (Spt-Ada-Gcn5 Acetyltransferase) complex in regulating autophagy related genes is studied. In the third part, the post-translational regulation of autophagy is investigated. The role of Na<sup>+</sup>-acetyltransferases C (NatC) complex in mitophagy, the selective type of autophagy that specifically degrades mitochondria, is studied.

**Mike Zabek**

Economics

*Essays on places and economic inequality*

I examine changes across space and use this variation to understand economic inequality. Chapter one examines people's ties to places. If people are tied to places by family and experiences, then welfare will be less equal across space. I show evidence that this is the case, and derive formula that show how this makes local policies less wasteful in declining areas. Chapter two uses changes in housing prices and rents to study inequality in standards of living. It suggests that changes in income inequality since 1930 have caused similar changes in standards of living. Local externalities are an important, understudied contributor. Chapter three investigates the impact of technological changes on the wages of unskilled workers using an administrative dataset. It provides causal empirical estimates of the impact of technology on demand for these workers in the labor market.

**Yunqi Zhang**

Computer Science and Engineering

*Architecting Data Centers for High Efficiency and Low Latency*

My dissertation investigates data center architecture designs that reconcile high system efficiency and low response latency. To increase the efficiency, I propose techniques that understand both microarchitectural-level resource sharing and system-level resource usage dynamics to enable highly efficient co-locations of latency-critical services and low-priority batch workloads. Moreover, I introduce methodologies to better manage the response latency by automatically attributing the source of tail latency to low-level architectural and system configurations in both offline load testing environment and online production environment. Several systems I built have already been deployed in production onto thousands of servers at Facebook and Microsoft.

**Wei Zhou**

Bioinformatics

*Computational and statistical approaches for large-scale genome-wide association studies for cardiovascular diseases*

Cardiovascular diseases (CVDs), the leading cause of death worldwide, encompass a wide spectrum of conditions that affect the structure and function of the heart and blood vessels. Over the past decade, genome-wide association studies (GWAS) have proven successful at shedding light on the underlying genetic variations that affect the CVDs risks. In my dissertation research, I perform GWAS to identify novel genetic risk factors for CVDs, as exemplified by a birth defect of the heart called bicuspid aortic valve (BAV). Two novel independent genetic variants near gene GATA4 have been identified to affect the BAV risk. I also develop computational and statistical approaches to improve the power and accuracy of GWAS. Not only will my work provide valuable insight into the biological mechanisms of CVDs to improve the prevention and treatment, but the methods and pipelines I develop will benefit researchers using GWAS to study other complex traits and diseases.



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