



PREDOCTORAL
FELLOWSHIP AWARDS
2016

TUESDAY, APRIL 5, 2016
RACKHAM GRADUATE SCHOOL

The Rackham Predoctoral Fellowships are 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 2016-17 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.

Yubraj Acharya
Health Management and Policy

Essays in Health Economics in Developing Countries (tentative)

Current outreach efforts in many countries fail to reach the minority groups due to the difference in the ethnicity of the outreach worker and that of the client, and thus exacerbate health disparities. In my first chapter, I will use data from a field experiment in Nepal to estimate the extent to which financial incentives can reduce such barriers due to ethnicity. In doing so, I will propose and test a new method to estimate prejudice-based discrimination in a healthcare setting. The second paper will evaluate the long-term effects of Nepal's vitamin A supplementation program. Using within-household variation in exposure to the program, I will estimate its effect on adult health and education outcomes. The third paper will evaluate a community-based program designed to reduce child mortality, also in Nepal. Using a difference-in-difference framework, I will assess if the "effect" estimated from correlational studies approximates the causal estimate.

Maryam Arbabzadeh
Natural Resources and Environment

Sustainability Assessment and Principles for Green Energy Storage in Grid Applications

Grid-scale energy storage may serve as a solution to the integration challenges of high penetrations of renewable energy, reduce air pollution from the grid, and therefore yield better environmental outcomes. However, understanding the total impact of using energy storage for grid applications are challenging because each application yields different responses to the complex grid system. Therefore, comprehensive sustainability assessments are necessary to yield the best environmental outcomes for grid-scale energy storage systems. My doctoral research seeks to develop integrative sustainability models and principles to guide development and deployment of grid-connected energy storage technologies. I am applying life cycle assessment methods to evaluate environmental and economic sustainability performance of energy storage systems both in developed and developing countries.

Maria Arredondo
Psychology

A bilingual advantage? The neural interaction between linguistic competition, attentional control, and their functional organization in the developing brain

Learning a language requires attention to linguistic input (e.g., distinguishing "I" versus "eye"). In my dissertation, I test the hypothesis that doubling linguistic input alters a bilingual child's attention. Specifically, young bilinguals should show better performance and greater recruitment of left (language) prefrontal brain regions relative to monolinguals. To test this hypothesis, I will use functional Near-Infrared Spectroscopy to image brain regions in 40 English monolinguals and 40 Spanish-English bilinguals (ages 7-9), while they perform a verbal task assessing linguistic interference and a non-verbal attention task. Preliminary results revealed bilinguals show greater left hemisphere activation during a non-verbal attention task relative to monolinguals, who showed greater right hemisphere activation. These preliminary findings are consistent with my hypothesis that early bilingual exposure alters the developing brain's functionality for attention. Findings from the dissertation will inform theories of cognitive and brain development on how early life experiences such as bilingualism impact development.

Kevin Bakker

Ecology and Evolutionary Biology

Uncovering the Mechanisms Governing Childhood Disease Dynamics

To mitigate childhood infectious diseases via vaccination, quarantine, or sanitation, it is necessary to understand the mechanisms by which pathogens are spread from person-to-person. My dissertation provides the first characterization of human birth seasonality across the globe, which replenishes the pool of children susceptible to disease, investigates the role of digital epidemiology when no reported case data are available, and applies environmental, demographic, and social factors to disease transmission models to understand their role in childhood disease outbreaks, with a focus towards polio eradication. This work has the potential to drastically reduce global childhood disease burden by informing policy makers with: (1) an understanding of the global variation in birth seasonality—allowing for locally tailored immunization campaigns, (2) model-based outbreak predictions – providing opportunity for prevention, and (3) the knowledge of the mechanism that is most strongly tied to poliovirus seasonality – granting epidemiologists the knowledge of when to time immunization efforts.

Vivienne Baldassare

Astronomy and Astrophysics

Understanding the population of active black holes in dwarf galaxies

Super-massive black holes are ubiquitous in the centers of galaxies the mass of the Milky Way and larger. Furthermore, there exist tight scaling relations between the masses of these black holes and large-scale properties of their host galaxies, pointing toward co-evolution of the two. Conversely, little is known about the population of black holes at the centers of dwarf galaxies. It is unclear what fraction of dwarf galaxies host black holes, and when they do, whether the same black hole-galaxy scaling relations apply. The form of these scaling relations for dwarf galaxies can be used to place constraints on the mechanism by which black holes and galaxies co-evolve. Thus, in my thesis, I search for black holes in dwarf galaxies using observational signatures of black hole accretion. Furthermore, I carry out in-depth, multi-wavelength studies of individual systems to understand the properties of this as-yet unexplored population.

Meredith Blank

Political Science

Militias versus Militaries: Understanding how states generate military capabilities in civil conflict

How do states organize their internal security forces? What are the consequences of these actions for conflict reoccurrence and human rights abuse? My dissertation explores why states use a variety of internal armed forces in civil conflict, and how the resulting security apparatus has unintended consequences for stability. I argue that the modern state has strong incentives to mobilize militias in place of regular armed forces during civil conflict. Yet, the short-term benefits of militias undermine the state's prospects for an enduring peace, because many of these groups remain decentralized and without adequate management by the government. I test these claims using an original global dataset on internal security forces that covers 198 countries and territories from 1970 through 2011. Broadly, my findings show how internal security forces have long lasting consequences for future stability.

Kevin Boehnke

Environmental Health Sciences

Risk of infection from waterborne Helicobacter pylori in Lima, Peru: Examining sustainable solutions through an integrated assessment approach

Helicobacter pylori (HP) is a stomach bacterium that has been categorized as a class 1 carcinogen, causing gastric cancer. Over the past decades, accumulating evidence suggests that HP may be transmitted in water. I hypothesize that contaminated water acts as a reservoir for HP, and that drinking water contaminated with HP presents a quantifiable risk to human health. In Chapter 1, I quantify the extent to which citizens are exposed to HP via drinking water. In Chapter 2, I estimate the infectious dose of HP in drinking water using mice. In Chapter 3, I develop recommendations for household water treatment systems (HWTSs) based on HP reduction capacities and cost performance. In chapter Chapter 4, I estimate the annual risk of infection from waterborne HP and the costs associated with health effects from waterborne HP to evaluate whether HWTS use is a cost-effective intervention.

Pablo Cabrera Ventura

Chemistry

Selective Pd-catalyzed C–H functionalization of aliphatic amines

The conversion of carbon-hydrogen (C–H) bonds into new functional groups (FG) represents a powerful strategy for the synthesis of organic molecules. Despite tremendous progress in the field, selective C–H functionalization can still only be achieved in the context of a limited set of organic substrates and C–H sites. One class of substrates that has proven particularly challenging for selective C–H functionalization is aliphatic amines. This thesis focuses on harnessing the strongly donating properties of the sp³-nitrogen atom in cyclic amine substrates to direct metal catalysts at specific C–H bonds remote from the nitrogen. This approach leverages the energetically disfavored boat conformation of these cyclic substrates to achieve transannular C–H activation and subsequent C-FG bond formation. Much of the work is focused on the experimental and computational design of several auxiliary directing groups to enhance the metal reactivity towards the C–H bond cleavage.

Raymond Cavalcante

Bioinformatics

Beyond the transcriptome: Facilitating interpretation of epigenomics and metabolomics data

The increasing amount of data produced by high-throughput sequencing and metabolomics experiments requires new resources and methods to understand their biological contexts and to help interpret them in an automated and equally high-throughput manner. I have developed a variety of tools that improve methods and create resources to this end.

I have developed Broad-Enrich to determine biological pathways that are affected by histone modifications, which play important roles in gene regulation. I have developed the methylation integration (mint) analysis pipeline to discriminate different regions of different DNA methylation marks that play different and important biological roles. I have developed annotatr to give genomic regions structural context, which can further add to experiment interpretation. Finally, I have developed ConceptMetab, a database annotating thousands of metabolites to thousands of biological processes. Combined with statistical methods, ConceptMetab can help interpret high-throughput metabolomics experiments

Qiushu Chen

Biomedical Engineering

The optofluidic laser and its applications in ultra-sensitive biochemical analysis

The optofluidic laser is an emerging technology that integrates microfluidics with a laser cavity and gain medium in liquid. Strong light amplification in lasing processes can signify small changes in biochemical systems using specific biomolecules as the laser gain medium. To explore the potential of optofluidic lasers for biochemical analysis, thorough theoretical and experimental studies are performed in my dissertation. A theoretical model is built to illustrate the optofluidic laser performance, revealing that the optofluidic laser is able to amplify small changes in gain medium by two orders of magnitude in comparison with the traditional fluorescence technologies. Experimentally, optofluidic lasers are demonstrated using various bio-related gain media in vitro. I am also building an integrated microfluidic system for fluorescence resonant energy transfer (FRET) laser study using live cells as the gain medium, aiming for in vivo drug screening that targets G protein coupled receptors (GPCRs).

Yin-Hsiu Chen

Biostatistics

Robust Distributed Lag Models with Multiple Pollutants Using Data Adaptive Shrinkage

We consider three problems in environmental epidemiology where the overarching goal is to enhance efficiency via integrating multiple estimators from different models and finding an optimal bias-variance tradeoff. In problem 1, we consider modeling the association of a health outcome at time t with an exposure measured at times t through $t-L$. We consider a generalized ridge regression approach to shrink unconstrained maximum likelihood estimates towards distributed lag models (DLM) estimates. In problem 2, we consider the situation with two potentially interacting pollutants. We first consider extension of DLM with Tukey's type of interactions to describe the joint exposure-response surface. We then allow for departure from the assumed surface via shrinkage techniques. In problem 3, we consider the scenario with multiple pollutants. We propose an algorithm that combines group lasso and hierarchical lasso to identify a subset of important pollutants and pairwise interactions that are associated with a health outcome.

Ellen Compernelle

Sociology

A three-part investigation of male international labor migration and marriage in rural South Asia

International labor migration is a worldwide phenomenon that has skyrocketed in recent decades. Temporary migration, in particular, is increasingly common, with families living apart for significant periods of time due to fluctuating labor demands. While scholars often emphasize the financial benefits of remittances, migration's broader social effects on family dynamics remain unclear. Using unique panel data supplemented with primary mixed methods data from a random subsample, I investigate the relationship between marriage and migration in rural Nepal. I identify specific marital circumstances – marriage and fertility - that increase male migration, and test whether positive marital dynamics - criticism, disagreement, love - decrease the risk of migration among married men. Last, I estimate the effects of migration on marital dynamics. This study will contribute to larger literatures by examining key social and psychological factors driving migration and the wellbeing of those in transnational marriages - the discord of which may have serious consequences for spouses and their children.

Natalie Davis

Educational Studies

Hope in Those Places of Struggle: A Critical Exploration of Black Student Agency in One Place-Based and One African-Centered Elementary School

Critical emancipatory pedagogy (CEP) refers to curriculum and instruction that seeks to facilitate and inspire human agency. For African Americans, CEP has been concerned with the systematic production of citizens who hold intimate knowledge of history and the obstacles faced by Black people and yet, are poised to contend with and overcome these injustices. Although the theoretical literature endorsing CEP is robust, empirical analyses of non-academic outcomes in schools seeking to actualize a CEP remain limited. Consequently, we know little about how the theories translate into practice and even less about CEP's capacity to deliver on its promise of sociopolitical development and Black student empowerment. This study relies on a critical, ethnographic design to investigate the political agency of Black children across two liberatory educational contexts. I explore whether and how agency manifests and, determine if the differential emphases of these schools serve to animate student agency in distinct ways.

Jeseth Delgado Vela

Environmental Engineering

The Membrane Aerated Biofilm Reactor for Nitrogen Removal from Mainstream Anaerobic Wastewater Treatment Processes

When nitrogen is emitted to sensitive watersheds it can be toxic to aquatic life and cause oxygen depletion. Consequently, effluent nutrient discharge limits on wastewater treatment plants are becoming increasingly stringent in watersheds across the country. In parallel, mainstream anaerobic treatment is being investigated as a low-energy alternative to conventional wastewater treatment, yet anaerobic treatment does not remove nitrogen. I am therefore investigating the membrane aerated biofilm reactor (MABR) to remove nitrogen following mainstream anaerobic treatment because I hypothesize the MABR will have low energy demands and greenhouse gas emissions relative to conventional technologies. I am combining lab-scale demonstrations, bioprocess modeling, and biomolecular methods to understand the efficacy, sustainability, and nitrogen removal mechanisms of the MABR. Understanding the mechanisms for nitrogen removal and evaluating reactor efficacy can propel mainstream anaerobic treatment to regions of the country facing stringent nitrogen regulations and ultimately support widespread energy neutral or positive wastewater treatment.

Dzovinar Derderian

Near Eastern Studies

Belonging to Nation and Empire: Love, Law and Knowledge

By concentrating on Muslim Turkish and Kurdish as well as Christian Armenian communities of the Ottoman Empire this dissertation breaks away from ethno-centric narratives of the nineteenth-century history of the Ottoman Empire. "Belonging to Nation and Empire: Love, Law and Knowledge" historicizes the understandings of terms such as progress, love, knowledge, law, nation and patria. It focuses on how different ethno-religious groups utilized these terms to redefine territorial, gendered, ethno-religious boundaries in the Ottoman reform era between the 1840s and 1870s. By analyzing the discursive constructions of difference, this dissertation explains how people negotiated and imagined their belonging to both nation and empire. Using local sources from the eastern Ottoman provinces and examining the construction of the Ottoman East as a backward place, I give voice to inhabitants of a region that have remained at the margins of Ottoman historiography.

Tyler Dillstrom

Mechanical Engineering

Predicting the Formation Pathways and Morphologies of Carbonaceous Nanoparticle Precursors in High Temperature Environments

Carbonaceous nanoparticles (CNPs) are as ubiquitous as they are deleterious in modern society. They are prevalent in a wide range of manufacturing processes and necessary components in composite materials, ink pigments, and catalysts. Most importantly, 100 metric tons per day are emitted as critically hazardous by-products from combustion sources like automotive engines. Despite the vital need to establish the causes of CNP production, their formation mechanisms are poorly understood. In order to elucidate the causes, I developed a novel chemical reactivity scheme describing their formation pathways and extended a recently created multiscale software package, the Stochastic NAnoParticle Simulator (SNAPS), to predict the compositions and morphologies of CNPs. SNAPS simulations capture the macroscopic evidence of CNPs as observed in experiments while simultaneously providing a level of microscopic detail previously unknown. I present ideas and evidence which will contribute significantly to the understanding of particle formation in high temperature environments.

Daniel Drucker

Philosophy

Subjectivity in Thought and Talk

A number of issues arise where it's hard to tell our representations apart from the world we aim to represent. This dissertation is about those issues. First, it argues that we are not rationally required to have most sorts of affective attitude, no matter the empirical evidence. This allows us to define a theoretically useful notion of the subjective, and to argue against various versions of Reflection principles. Second, it shows that how we speak about subjective things, e.g., in recommendation, suggests a picture where we derive rather than posit norms of utterance production and interpretation. Finally, it argues that various semantic theories have erred in making some common sorts of utterance about us, rather than about the external world. That mistake has led to some wrong-headed theories of those utterances, despite their initial plausibility. It then sketches what a theory that didn't make this mistake could look like.

Joseph El Adli

Earth and Environmental Sciences

Lives and deaths of the last mammoths

Woolly mammoths, *Mammuthus primigenius*, went extinct on the continents at the end of the last Ice Age (ca. 10,000 years ago). However, a small population survived on Wrangel Island, off the coast of Siberia, before going extinct ca. 4,000 years ago. The exact causes of the mainland and insular extinctions have been widely debated. However, current data have not yet provided compelling evidence of the reason for the mammoth's demise. The high-resolution records of growth found within mammoth tusks allow for interpretation of life history, and thus gives insight into many aspects of mammoth biology, including calving history. More importantly, calving history has been shown to change predictably and in opposite directions under the two main hypothesized drivers of mammoth extinction, climate change and human hunting. Thus life history information extracted from tusks can be used to test the cause of extinction on both Wrangel Island and continental Siberia.

Harold Elliott

History

Tribal Liberalism: Lumbee Indians and Native Self-Government in the Age of Civil Rights

This dissertation examines the attempts of the Lumbee Indians of southeastern North Carolina to establish an administrative tribal government and to achieve full federal acknowledgment from the aftermath of World War II to the dawn of the Reagan administration. I argue that neither the widespread adoption of bureaucratized tribal councils, nor the emergence of a standardized federal procedure for recognizing Indian governments, can be understood without reference to the mass migration of American Indians from their overwhelmingly rural homelands to metropolitan areas. For Lumbees in particular, sustained contact with urban spaces and waged employment catalyzed their transition from a makeshift form of tribal government under North Carolina's Jim Crow laws to their current, liminal status just short of full federal recognition. Anomalous in their racial and indigenous status, Lumbees illuminate the broader shift from race-conscious to formally "colorblind" governance, as well as the concomitant transition from an industrial to a consumer economy.

Anthony Fiorino

Mechanical Engineering

High-efficiency, Low Bandgap Thermophotovoltaic (TPV) Devices Operating Across Nanoscale Gaps for Waste Heat Recovery Applications

Thermophotovoltaic (TPV) systems directly convert heat to electricity without producing environmentally harmful emissions. However, current TPV systems are limited in their power output and efficiency. Recent computational work suggested that dramatic enhancements in performance can be achieved if the emitter and TPV cell are separated by nanoscale gaps (i.e., are in the "near field"), but experimental verification has remained elusive due to major technical challenges. In this dissertation, I first describe how I overcame these technical challenges to demonstrate the feasibility of obtaining dramatic enhancements in radiative heat transfer (~1000 times that predicted by the Stefan-Boltzmann law) in the near field. Subsequently, I will describe my current experiments, performed with custom-fabricated planar emitters and planar, thin film TPV cells (In_{1-x}Ga_xSb) separated by nanoscale gaps. With these experiments, I seek to provide the first experimental evidence for using near field radiation to surpass longstanding power and efficiency limits in TPV systems.

Joanne Garbincius

Molecular and Integrative Physiology

Mechanical regulation of striated muscle nitric oxide signaling in muscular dystrophy

Genetic disruption of dystrophin causes Duchenne muscular dystrophy (DMD), a fatal muscle wasting disease. Impaired skeletal and cardiac muscle nitric oxide (NO) synthesis secondary to dystrophin deficiency compromises muscle function and exaggerates fatigue. This dissertation aims to understand the mechanisms whereby dystrophin regulates muscle NO production. The overall hypothesis is that dystrophin functions as a mechano-sensor to transduce mechanical cues into a biochemical signaling pathway that regulates NO synthase activity. A novel live-cell imaging assay using isolated muscle cells identified dystrophin-dependent, mechano-activation of AMP-activated protein kinase (AMPK) as a key regulator of neuronal NO synthase (nNOS) activation. Importantly, pharmacological AMPK activation bypassed defective mechano-signaling and increased NO production by nNOS in dystrophin-deficient cells. Subsequent studies now seek to determine whether restoration of AMPK-nNOS signaling improves muscle function and fatigue resistance in vivo in a mouse model of DMD.

Gail Gibson

English and Education

Efficiency, Correctness, and the Role of Technology in Postsecondary Literacy Instruction

Nearly one-third of first-year college students are required to complete remedial courses (NCES, 2013), costing public institutions an estimated \$1 billion annually (Bettinger & Long, 2009). This project examines a core tension in that much-debated policy space: whether colleges should pursue automated instructional tools to more efficiently prepare students for later coursework. Drawing upon historical inquiry and case-study analysis, this interdisciplinary work investigates how pressures to make writing instruction for underprepared students faster and less costly risk restricting student access to complex literacy skills and, in turn, full access to higher education pathways and professional roles. The project begins with a historical review of how technology and automation efforts have intersected with college literacy remediation. A contemporary case study of a developmental writing course at a regional community college then examines student and instructor beliefs about automated classroom tools and writing instruction.

Jillian Gross

Higher Education

Institutional Entrepreneurship in Action: Translating the Community College Concept in India

Since 1995, Indian educational reformers have promoted the community college concept as a tool for national development. Institutional theory would predict strong collective action among community college professionals to advance common goals and ensure coherent development. However, most practitioners operate in relative isolation leaving community college implementation highly fragmented. Because contemporary theories were developed in Western contexts, their relevance to emerging economies has yet to be tested. Therefore, I explore the translation of the community college concept in India. Data include over 100 hours of recorded interviews and field visits to 30 community colleges. Findings suggest that rather than banding together, leaders engage in coercive cooperation and recognition chasing to legitimize the community college concept locally and satisfy demands of government-controlled community college initiatives nationally. In addition to providing theoretical insights into how institutional phenomena function in an emerging economy, this research has critical policy implications for community college development.

Brady G'sell

Anthropology and History

Child Support Claims and the Making of Obligation in South Africa

My dissertation tracks the changing efforts of poor mothers in urban South Africa to secure resources for their families from mid-century to the present. Focusing on one inner-city neighborhood, I trace how women's strategies change over time and across race groups as the neighborhood demographics shift in response to political economic transition. As a space of considerable racial and cultural diversity, attention to the micro-processes by which women in the neighborhood manage networks of support reveals larger trends present throughout South Africa and the Global South. Though women were expected to translate resources into social reproduction, women themselves were not seen as deserving aid. I examine women's strategies to justify their entitlement to support and how these shaped women's broader relationships with their children, the state, non-governmental organizations, neighbors, and fathers. In doing so, I bridge the persistent analytic divide between the domestic and the political.

Ashley Hardin

Business Administration

How do we learn about colleagues personally and how does that impact our interactions?

In my dissertation, I introduce the concept of personal knowledge of colleagues, discuss how it is formed, explore how it is used, and theorize contextual factors that influence these outcomes. Though scholars have examined how bringing one's personal life into organizations impacts individual behavior, research has not uncovered how integration impacts interpersonal treatment. I argue that through blurring the work-life boundary, colleagues gain personal knowledge about one another, which changes the way they interact in both positive and negative ways. I propose testing these ideas through three studies. First, a multi-source pilot study established a positive association between personal knowledge and responsiveness. Second, I will conduct a field survey to establish mediating mechanisms and moderating factors of this main effect. Third, I will conduct a field experiment to establish causality. Finally, I discuss the theoretical implications of these findings for research on work-life, interrelating at work, and knowledge sharing.

Leslie Hempson

History

Making the Khadi Economy: Experiments in Informal Employment in Twentieth-Century India

This dissertation is a study of informal modes of employment in late-colonial and early post-colonial India. Specifically, it examines the historical development of "the khadi economy," the centerpiece of M. K. Gandhi's efforts to make rural economic life more egalitarian and self-sufficient through the introduction of new types of informal employment to the countryside. My dissertation joins the literature on political economy to that on materiality to tell the story of economic decolonization from the perspective of the rural masses. Moreover, it interrogates models of informal economy that—although they did not ultimately become ascendant—prepared the way for those that did. Broadly, it tells an alternative story of India's transition from a colonial to a post-colonial economy, while also helping us to understand the historical roots of contemporary debates over the status of the informal sector in India.

Randeep Hothi

Asian Languages and Cultures

Sikhism Will Be Televised: Recognition and Religion-Making at British-Sikh Television Networks

This project will investigate cultural production at influential community-owned television networks in order to examine the practices by which British Sikhs formulate public representations of Sikhism. Specifically, this study will examine how television employees discuss, debate, and build consensus as they address diasporic and national audiences simultaneously. These community-sponsored, non-profit television networks are sites where Sikh cultural producers come together and produce diverse programming that creatively makes sense of the world while engaging with Sikh tradition. I will conduct long-term, situated ethnographic research at two particularly influential Sikh television networks, both located in Birmingham (UK), in order to examine how British Sikh cultural producers make decisions about how Sikhism should be publicly presented. This project will uncover the living debates, interests, and aspirations that shape British Sikh cultural production and the complicated ways that the notion of religion frames discourses about Sikhism.

Amr Ibrahim

Electrical Engineering and Computer Science

Miniaturized Sub-Millimeterwave Radar Systems for Autonomous Navigation

In recent years, the increasing demand on high resolution imaging radars has pushed the research activities to the sub-millimeterwave frequency range. Important applications that can benefit from such systems include short-range autonomous navigation radars used in vehicles and aircrafts, as well as high resolution radars for standoff imaging of persons and hidden objects, including illicit drugs and explosives. These systems have the potential to approach the resolution of optical imaging while operating under adverse conditions of weather.

In this thesis, I investigate the unique advantages as well as the performance limitations of radar systems operating at 240 GHz working in typical outdoor environments. The thesis has three main objectives which are: 1) developing novel scattering models that can accurately describe the propagation and scattering of electromagnetic wave in realistic communication channels, 2) material characterization of different synthetic and artificial targets found in typical radar environments, and 3) developing novel microfabrication techniques that rely on piezoelectric micro-actuators to fabricate such radar systems in a reliable and very compact fashion.

Annemarie Iddins

Communication Studies

No Concessions: Independent Media and the Reshaping of the Moroccan Public

This dissertation examines how transformations in media and communication that followed policies of economic liberalization reshaped the Moroccan public. In an era defined by economic transitions and a marked political shift from an authoritarian Hassan II to a quasi-reformist Mohammed VI, a range of independent media have re-made the link between the cultural and political domains. Once the domain of the state and the monarchy, culture – everyday, lived experience – has been re-mediated through magazines, film, and various digital media platforms and practices. Over the course of three decades, starting with economic liberalization in the 1980s, accelerating upon Mohammed VI's ascent to the throne in 1999 and crystallizing in the 2011 Arab Spring moment, independent media have brought questions about the exclusion of youth and a progressive counterculture from politics to the public and participated in an explosion of cultural production across media and public space as a means of expression and engagement.

Donia Jarrar

Music Composition

Seamstress: a documentary song-cycle featuring the collected oral histories of Palestinian women in six movements for solo soprano, chamber ensemble, chorus, electronics, recorded audio and video projection

Seamstress is a multimedia and interdisciplinary documentary song-cycle, in six movements, for solo soprano, chamber ensemble, chorus, electronics, recorded audio and video. It is based on oral history interviews I conducted with Palestinian women from different generations and social sectors in the West Bank from the summer of 2012 through the summer of 2015. The women interviewed include my aunt, a seamstress from Nablus, former students, and current artistic collaborators and colleagues. Song texts are adapted from the interviews, weaving together their different voices, perspectives and experiences in a way that challenges current existing media stereotypes of Palestinian culture and womanhood, specifically, through the portrayal of universal themes within a larger global context. The result is a sonic and visual exploration of personal experiences with place in relation to transnational intersectional feminist perspectives on the self/denial of the self, the state, personal identity, the body, sociality and agency.

Nan Jiang

Computer Science and Engineering

A Theory of Model Selection in Reinforcement Learning

We advance the theoretical understanding of how to select good representations in Reinforcement Learning (RL). Despite the problem's fundamental importance, limited progress is made as it is generally hard to quantify model misspecification from data in RL, a challenge unfaced by other popular machine learning paradigms. We propose two novel solutions to the problem in the batch setting: in the first solution, we directly evaluate the output policy of a representation against existing data, and the variance of the estimate is near-optimal. In the second solution, we make mild assumptions on the candidate representations, and compare them via a statistical test based algorithm; the algorithm enjoys an oracle-like property, which is established in the small sample region for the first time. The extension to the online setting is also discussed, and we provide algorithms with improved guarantees over existing baselines.

Lauren Johns

Environmental Health Sciences

Environmental phthalate exposure, maternal thyroid hormone levels, and birth outcomes

Preterm birth and low birth weight are the most frequent causes of neonatal morbidity worldwide, and are associated with numerous long-term health consequences among surviving infants. Several recent studies suggest that exposure to phthalates (a group of plasticizers) during pregnancy may be associated with an increased risk of adverse birth outcomes. Maternal endocrine disruption in pregnancy may be one pathway linking these associations. The present study will focus on the effects of maternal thyroid disruption in potentially mediating the relationships between prenatal phthalate exposure and adverse birth outcomes because (1) maintaining homeostatic maternal thyroid hormone levels throughout pregnancy is crucial for normal fetal growth and development; (2) few data are available on the direct effects of subclinical thyroid hormone alterations across gestation and the risk of preterm birth; and (3) phthalate-associated thyroidal disturbances in pregnancy is a largely understudied area of environmental and reproductive epidemiology.

Anna Johnson

Asian Languages and Cultures

A History of the Vow: The Material Power of Promise in Buddhism from India to Tibet

This dissertation will consider the central concept of the vow in Tibetan Buddhism. Specifically, it will trace the development of what is known as the "three-vow" genre of literature (sdom gsum), looking especially at works composed over the twelfth to nineteenth centuries in the Geluk sect, the sect of the Dalai Lamas. The aim of three-vow theory is to resolve contradictions among three modes of practice, that of the monk (who seeks enlightenment for himself), the bodhisattva (who seeks enlightenment for all beings), and the tantric yogin (who uses sexual rites to achieve enlightenment). In Tibet, it was considered appropriate for one person to hold all three vows, despite the apparent contradictions.

Three-vow literature analyzes the ontological status and functionality of vows to determine their mode of interaction in a single practitioner. This objectification of the vow removes it from the volition of an individual and reifies the vow itself as an "agent" external to the intentional subject. My aim is to pursue the origins of three-vow theory concepts in Buddhist Sanskrit literature and analyze the stakes of the continuing debates in Tibet, addressing the anxieties that motivated its authors, foremost among them being to uphold a literal interpretation of monastic celibacy.

Alexei Kananenka

Chemistry

Self-energy embedding theory: development and application

Theoretical description of correlated electron systems is difficult since the computational time grows steeply in post-DFT methods that deliver systematically improvable description of electronic correlation. We developed the self-energy embedding theory (SEET) that is capable of describing few strongly correlated electrons embedded in the field of delocalized electrons. SEET chooses the best combination of accuracy/computational cost for different orbitals of the system. We implemented FCI-in-GF2 variant of SEET in which the self-energy for few strongly correlated orbitals is computed using FCI method and then embedded into the self-energy coming from the weakly correlated orbitals evaluated using Green's function second-order perturbation theory (GF2). We tested SEET by comparing energies for model and real molecular systems to the ones computed using most popular quantum chemistry methods. We showed that SEET is one of few methods that predicts correct energies for both weakly and strongly correlated systems.

Benjamin Katz

Education and Psychology

Moderators of improving executive function: individual differences and motivational factors

Compelling evidence suggests that certain life experiences may positively impact the development of the control and regulation mechanisms of the prefrontal cortex. However, the extent to which cognitive interventions can improve these so-called 'executive functions' is unclear. In my dissertation, I explore the plasticity of executive functions by investigating how individual and contextual factors moderate cognitive improvements following experience and direct intervention. In one set of studies, I examine the influence of motivational factors, such as monetary compensation and game-like feedback, on training. In another set of school-based studies, I consider the influence of socioeconomic-status (SES) and the extent to which high- and low-SES children benefit from cognitive training.

Kyle Ketchesin

Neuroscience

The Role of Corticotropin Releasing Hormone-Binding Protein (CRH-BP) in Binge Drinking and Alcohol Dependence

Stress is a major environmental factor in alcohol addiction. Corticotropin releasing hormone (CRH) is the key regulator of the stress response, and dysregulation of the CRH system is observed in binge drinking and alcohol dependence. CRH-binding protein (CRH-BP) is a secreted glycoprotein that binds CRH with high affinity and regulates CRH receptor activity. My dissertation examines the role and regulation of CRH-BP in mouse models of binge drinking and alcohol dependence. Using in situ hybridization, I determined that CRH-BP mRNA expression is decreased in the medial prefrontal cortex after binge drinking and the paraventricular nucleus of the thalamus after alcohol dependence. Studies with CRH-BP knockout mice suggest that the complete absence of CRH-BP may prevent increases in dependence-induced alcohol consumption. Ongoing experiments investigate the molecular mechanisms of CRH-BP action using CRH receptor signaling experiments. These results will provide a better understanding of the mechanism of CRH-BP action and the role it plays in alcohol addiction.

Dana Kornberg

Sociology

Making Markets on the Margins: Sources of Persistence for Informal Scrap Collection in Delhi, India

Why do informal markets persist in cities across the world despite the global expansion of capitalism and widespread economic growth? My dissertation addresses this broader question through an urban ethnographic study in Delhi, India, where 75 percent of workers are employed in unregistered enterprises. I analyze the particular case of household garbage collection services, where the municipal government introduced formal "solid waste" companies into neighborhoods previously served by informal collectors who earned a livelihood through recycling. Based on empirical findings that the informal workforce was displaced neither rapidly nor completely, I argue that in the face of capitalist expansion, extra-legal economies are able to persist by creating mechanisms for repeated territorial claims and transactions and by cultivating legitimacy for their activities. My chapters focus on informal collection processes, such as garbage collection and scrap selling, with activities contextualized vis-à-vis the state and formal enterprises to demonstrate how they are reproduced.

Ho Chak Law

Musicology

Cinema of Performatives: Chinese Opera, Translation, and Articulation of Chinese National Identity, 1945–1971

This dissertation investigates how Chinese opera was being translated into filmic presence in certain practices and discourses that constituted a cinema of performatives. Covering the post Second World War period until the People's Republic of China superseded the Republic of China (in Taiwan since 1949) as a permanent member of the United Nations Security Council in 1971, this investigation addresses such translation to those Chinese localities in Mainland China, Taiwan, and Hong Kong. It unfolds a cinema evolved from Chinese opera, which exceptionally possesses the latter's sonic, non-sonic, and mixed musical features and meanings. This unfolding aims to illustrate how Chinese peoples of distinct social, cultural, political, and linguistic backgrounds projected through cinema competing visions of Chinese modernity and national identity, thereby "fuel[ing] the repeated drive to (re)construct a national cinema and (re)formulate collective positioning."

Benjamin Lawson

Physics

Search for Topological Superconductivity in Doped Bi₂Se₃

Bi₂Se₃ is a known topological insulator. When doped with transition metals, this compound becomes superconducting. Doping Bi₂Se₃ has been one of the leading avenues to search for topological superconductivity. Here we present torque magnetometry studies on topological superconductor candidates, Cu-doped and Nb-doped Bi₂Se₃. We observed quantum oscillations in Cu-doped and Nb-doped Bi₂Se₃. In both compounds, the change of the oscillation period follows the prediction for an ellipsoidal Fermi surface. In the Cu-doped compound, the Fermi velocity is unchanged from Bi₂Se₃ implying it has a Dirac electronic band. In Nb-doped Bi₂Se₃, two quantum oscillations frequencies are observed indicating a multi-orbit electronic state. In the Nb-doped compound, we observed that the magnetic response is enhanced along one direction confirming the presence of nematic order. Furthermore, heat capacity measurements indicate a nodeless superconducting gap. Together with the nodeless gap, nematic order provides a strong evidence of odd-parity topological superconductivity in Nb-doped Bi₂Se₃.

Doowon Lee

Computer Science and Engineering

Low-cost comprehensive robustness for modern heterogeneous systems

The ever-growing complexity of digital systems introduces the challenge of ensuring their correct operation at runtime. For decades, engineers have investigated solutions to improve failure-tolerance, a capability to provide correct operation even in the presence of transistor faults and lack of complete design verification. However, in recent years, failures have been occurring more frequently, mainly because modern designs comprise billions of nanoscale devices, which lead to extreme challenges in manufacturing and complexity management. In turn, this trend creates a new research challenge: minimizing the cost of failure-recovery solutions. This dissertation aims at proposing a comprehensive, ultra low-cost solution to overcome runtime failures in modern heterogeneous systems, comprising hundreds of specialized processing units.

I present a two-faceted solution that combines software-based failure detection and hardware-based failure recovery to preserve high performance in recovered systems. This solution nearly eliminates area and performance overheads entailed by my solution, bringing overheads down to 5% or below

Jhansi Leslie

Microbiology and Immunology

Determining the Role of Adaptive Immunity and Bacterial Interactions in Protection from Recurrent Clostridium difficile Infection

Clostridium difficile infection (CDI) is a significant cause of morbidity and mortality in patients who receive antibiotics. While the primary therapy for CDI is antibiotics, 25% of patients fail treatment and experience recurrent disease. Alternative strategies utilizing antibodies targeting C. difficile toxins or preparations of “competitive” bacteria have been described for prevention of recurrent CDI. This suggests two mechanisms of protection, via development of adaptive immunity or through bacterial antagonism. I hypothesize that protection from CDI reflects the combination of host immunity and bacterial interaction. To test this I utilized a mouse model of CDI as well as human intestinal organoids, a system that recapitulates the physiology of the human gut. My results show that surprisingly, adaptive immunity is not necessary to protect from recurrent CDI. These results are important because they imply that targeting this immune response may not be essential when designing next-generation therapeutics for recurrent CDI.

Jake Levinson

Mathematics

One-dimensional Schubert problems with respect to osculating flags

My work is in linear algebra, the study of lines and planes. My focus, a subfield called Schubert calculus, uses tools from two branches of mathematics — combinatorics and algebraic geometry — to investigate spatial configurations of lines and planes. In my dissertation, I combine these two approaches to study a special class of configurations, involving tangent lines and tangent planes to curves. I show how to build simple combinatorial ‘models’ for these configurations, using certain well-studied combinatorial objects called ‘Young tableaux.’ The ‘model’ makes it possible to translate the existing, extensive body of combinatorial knowledge into a more detailed understanding of the geometry.

The configurations I focus on are all realizable with degrees of freedom, meaning that they can be continuously deformed or reshaped. This leads to the main challenge: translating a continuous change to the geometry into a discrete (algorithmic) change to the corresponding combinatorial model. This takes some finesse!

Shasha Li

Medicinal Chemistry

Hapalindole-type Alkaloids from cyanobacteria: characterization of biosynthetic pathway for drug discovery

Biosynthetic exploration of natural products provides a promising opportunity to produce novel bioactive molecules for drug development. Hapalindoles are a fascinating class of indole alkaloids which are valued for their pharmaceutical activities and intriguing structure features. Since the initial isolation from cyanobacteria Hapalosiphon fontinalis in 1984, this type of alkaloids has garnered immediate attention from biologists because of its wide range of activities, including antibacterial, fungicides, insecticidal and anticancer ones. Besides the attention from the biology community, its intriguing structural features of highly functionalized polycyclic ring system have also spawned many research programs directly devoted into the total syntheses. Compared with the progress in natural product isolation, bioactivity evaluation, and total synthesis, very little has been documented in the literature concerning the biogenesis of hapalindoles. Therefore, my research is intended to fill the critical gap in the biogenesis of hapalindole-type alkaloids and develop chemoenzymatic processes for leading molecules synthesis.

Wen-Chi Lin

Chemical Engineering

Multifunctional Micro-Fabricated Fluid Sensors

Water is a basic necessity for human life but a significant fraction of the world lacks access to clean water. One major challenge with improving water safety is affordably and rapidly gathering information about water quality. Determining water quality is extremely difficult because several factors have to be analyzed simultaneously to ascertain meaningful information. Additionally, existing devices required for these measurements are over-sized, expensive, and challenging to integrate because they function by different physical principles. Thus, a “water safety meter” is incredibly challenging to develop because all factors have to be analyzed simultaneously. This dissertation provides a solution for people, especially those living in poor regions of the world, to measure their water quality and secure its safety. Essential sensors for water analysis are integrated on a glass chip. The device is smaller than a rice grain and cost less than 10 cents to fabricate. The sensors include: thermo flow meter for high flow rate region, ionic conductivity sensor, an innovative platinum solid-state reference electrode (SSRE), pH sensor, oxidation-reduction-potential (ORP) sensor, and specific ion selective sensor.

Xu Liu

Molecular, Cellular, Developmental Biology

Molecular mechanism of Autophagy and Regulation of subcellular localization of autophagy-related (ATG) gene mRNAs

Macroautophagy (hereafter autophagy) is an evolutionarily conserved process in which portions of the cytoplasm are targeted for degradation in the vacuole/lysosome. Malfunction of autophagy has been shown to be associated with many human diseases. My thesis research consists of three major parts, exploring the molecular mechanism and regulation of autophagy. In the first part, the role of peroxisomal fission in regulating pexophagy, the selective type of autophagy targeting peroxisomes for degradation, is studied. The second part is about identifying a novel role of the Atg17-Atg31-Atg29 complex in regulating autophagosome-vacuole specific fusion by recruiting vacuolar SNARE Vam7 to the phagophore assembly site (PAS), where an autophagosome forms. In the third part, I investigate the regulation of subcellular localization of autophagy-related (ATG) gene mRNAs. My thesis research will provide important insights into understanding the autophagy process.

Geoffrey Lorenz

Political Science

How Interest Groups Influence Congressional Committee Agenda-Setting

Observers of the U.S. Congress frequently lament interest groups' influence on lawmaking, but there is little broad evidence of such influence. Existing research focuses on interest groups' ability to affect individual legislators' roll-call votes or issue attention. This dissertation examines lobbying's influence on the legislative agendas of congressional committees. In particular, I argue that committee chairs use interest groups' public support or opposition to legislation as a heuristic for evaluating bills for potential committee consideration. Using novel data on interest groups' public positions on over 5,000 congressional bills introduced since 2005, I examine the association between the composition of interest group coalitions and the progress those bills make through committees. I expect to find that committee chairs prefer to grant committee consideration to bills supported by coalitions of groups that are: electorally relevant to committee chair; diverse, both ideologically and substantively; and willing and able to coordinate around the bill.

Sara Meerow

Natural Resources and Environment

A Green Infrastructure Spatial Planning (GISP) Model for Building Urban Resilience

In the face of climate change and other challenges, there is a growing focus on 'urban resilience.' To foster this resilience, cities are increasingly expanding multifunctional green infrastructure. This dissertation uses green infrastructure to empirically examine questions of scale, power, justice, and trade-offs in resilience planning. A new definition and heuristic for operationalizing urban resilience is proposed, and then applied to the spatial planning of green infrastructure. The Green Infrastructure Spatial Planning (GISP) model is developed as an approach to assess spatial trade-offs in resilience benefits of green infrastructure and to identify priority areas (or 'hotspots') where green infrastructure can be strategically placed so as to maximize ecosystem service functions. The model combines GIS-based multi-criteria evaluation, case studies, and stakeholder surveys and is applied in four diverse cities: Detroit, Los Angeles, and New York (U.S.) and Manila (Philippines).

Megan Michalski

Oral Health Sciences

Contributions of Macrophage Efferocytosis of Apoptotic Bone Cells to Bone Turnover and Oral Wound Healing

Apoptosis occurs at an extraordinary rate in the human body and the effective clearance of these dead cells (efferocytosis) is necessary to maintain homeostasis and promote healing, yet the contribution of this process to bone turnover is not appreciated. This dissertation studies how macrophages clear apoptotic bone cells and how this process contributes to bone turnover and healing. To answer these questions, we will conduct cell culture experiments to study factors which enhance efferocytosis of apoptotic bone cells and the response macrophages exhibit after engulfing these dead cells. Additionally, we will utilize genetic mouse models deficient in crucial efferocytosis genes to analyze bone phenotypes and tooth extraction socket healing changes related to altered phagocytic capacity. A better understanding of the role of macrophage efferocytosis as it relates to normal and abnormal bone turnover will provide essential information for future therapeutic approaches to treat bone related diseases.

Kaitlin Moore

Applied Physics

High-precision spectroscopy using cold Rydberg atoms

Using cold Rydberg atoms, I probe energy level intervals to high spectroscopic precision. The focus of this work is an updated, highly-controlled measurement of the Rydberg constant, needed to resolve the recent conflict in proton-radius values. Toward this end, I have demonstrated a fundamentally-novel method of driving inelastic Rydberg-Rydberg transitions using ^{85}Rb atoms by amplitude-modulating a 1064-nm-wavelength optical standing wave at a transition resonance. I additionally demonstrate 'magic-wavelength' conditions and transitions driven using modulation harmonics. I present the background and design work for a microgravity-based measurement of the Rydberg constant utilizing this excitation method. Finally I present a high-precision measurement of the ionic core polarizability of the Rb atom, necessary to achieve state-of-the-art precision in our Rydberg constant measurement. With these advances, this thesis lays essential groundwork for the employment of cold Rydberg atoms in a highly-controlled precision measurement of the Rydberg constant.

Orquidea Morales

American Culture Studies

Border Horror: Violence and Death in the Borderlands after NAFTA

My dissertation examines the relationship between representations and real death along the US-Mexico border in the post-North American Free Trade Agreement (NAFTA) era. Through textual and discursive analysis as well as data derived from studying how cultural productions are received, my dissertation, *Border Horror: Violence and Death in the Borderlands after NAFTA*, examines the *From Dusk Till Dawn* (1996, 1999, and 2015-2016) films and television franchise, the film *Ahí va el Diablo* (2012) and the graphic novel *Dreamland: The Way Out of Juarez* (2010). I introduce a border horror framework to look at changing representations of border deaths complicating a singular narrative that equates border with violent death regardless of place, type of death, and time period. My dissertation highlights how the border is not by nature a space of death but instead death and horror have become stand-ins for the border in popular, governmental, and social discourses.

Alex Nett

Chemistry

Synthetic and Computational Catalyst Design Strategies for N-Heterocyclic Carbene Supported Nickel Complexes

A number of nickel-NHC-catalyzed processes have emerged as cutting edge methods for many organic transformations. Although important progress has been made in these areas, the rapid development of reactions often overshadows the relatively low number of reports concerning reactive well-defined nickel-NHC catalysts like those described herein. The progress described in this statement contributes to addressing this void, including in-depth analysis of detailed reaction profiles that include kinetic, thermodynamic, productive and unproductive reactivity. This level of analysis is enabled by the use of a synergistic approach incorporating both synthetic and computational chemistry. The reactions encompassed in this study include nickel-catalyzed reductive couplings of π -components and C-H functionalizations. The overarching goal of this work is to identify the origin of inefficiency or unproductive reactivity in nickel-catalyzed processes and to design optimal catalysts that overcome these challenges.

Yashar Niknafs

Cellular and Molecular Biology

Discovery and Investigation of Novel Non-Coding Cancer Genes

Cancers are a leading cause of morbidity and mortality worldwide, and the role of long non-coding RNAs in oncogenesis is not fully understood. Discovery and elucidation of these non-protein-coding genes and the subsequent investigation of their potential role in cancer is a necessary step in attaining a consummate understanding of the molecular processes leading to cancer. Investigation of the following aims will provide a critical layer of insight into our understanding of the molecular underpinnings of cancer: 1) discovery of novel non-coding elements of the human transcriptome by leveraging next-generation sequencing data, 2) identification of cancer-associated non-coding genes and interrogation of their clinical relevance and mechanistic function, and 3) development of an online platform to facilitate the utilization of these data by the scientific community.

Cyrus O'Brien

Anthropology and History

Faith in Imprisonment: Religion and the Development of Mass Incarceration in Florida

'Faith in Imprisonment' contributes to an emerging literature that seeks to explain how and why the United States became the world's largest jailer. Where existing scholarship about mass incarceration primarily focuses on race, 'Faith in Imprisonment' sets forth the hypothesis that religious ideas and religious organizations profoundly contributed to the development and structure of mass incarceration in the latter half of the twentieth century. Drawing on historical and ethnographic research, it also explores how, for many prisoners, religion formed a constitutive part of the experience of incarceration. Religious ideas and organizations, I argue, played powerful roles in shaping the ideologies, everyday practices, and institutional structures of mass incarceration. Finally, by emphasizing the constitutive connections between prisons and other social sites and discourses, 'Faith in Imprisonment' shows how religious ideas and religious organizations helped shape not only mass incarceration in the United States, but also broader politics and ideals of citizenship.

Lukasz Ochyl

Pharmaceutical Sciences

Tumor membrane nanoparticles for elicitation of cellular and humoral immune responses

Elicitation of tumor-specific cytotoxic T lymphocyte (CTL) responses against tumor-associated antigens is a major focus of cancer immunotherapy. Vesicles generated from tumor cell membrane possess many characteristics of optimal vaccine delivery vehicles. I hypothesize that co-delivery of antigens and adjuvants to dendritic cells (DCs) will result in effective CTL and humoral responses. Nanoparticles were generated from murine melanoma cell lysates expressing model antigen ovalbumin (OVA) by calcium-dependent aggregation of membranes, purification, and insertion of lipid-linked polyethylene glycol along with adjuvants. Vesicles contained a wide repertoire of antigens and effectively drained to lymph nodes in vivo, resulting in expansion of OVA-specific CTLs and generation of tumor-lysate-specific antibodies allowing for prolonged survival in mice after subcutaneous challenge. I expect these responses to slow down tumor growth in a therapeutic setting and decrease formation of metastases translating into clinically-relevant novel therapy.

Alan Olvera

Materials Science and Engineering

Complex Multifunctional Mixed Metal Chalcogenides for Solid-State Energy Conversion

Research on solid-state energy materials often focuses on the optimization of known technologically significant compounds, however with limited material selection available, a new frontier must be explored, where material discovery and innovation is emphasized. This dissertation investigates the design, development, and characterization of chalcogenide-based materials for applications in thermoelectric and photovoltaic devices. Recently, we demonstrated several new phases with ultra-low thermal conductivity and high figure of merit, such as Pb-4Bi7Se13 ($\kappa = 0.33 \text{ Wm}^{-1}\text{K}^{-1}$, and $ZT \sim 0.9$ at 775 K), in the (Pb,Sn) – (Bi,Sb) – (Se,S) system suggesting promising applications in thermoelectrics. Additionally, we developed a simple and energy efficient approach for stoichiometrically controlled synthesis of CuInSe_2 through the solid-state transformation of the structural template, CuSe_2 . This strategy is further implemented for the synthesis and characterization of novel single-phase and bulk nanostructured materials for potential applications in photovoltaic energy conversion technology.

Joon Ha Park

Statistics

Two Novel Statistical Methods for Computationally Challenging Inference Problems and Their Application to Infectious Disease Transmissions

Particle filter has formed the basis of most inference methods for Partially Observed Markov Processes (POMP). However, it is well known that the performance of particle filter deteriorates as the underlying state dimension increases. This so called 'curse-of-dimensionality' has been the main limiting factor in large scale inference. A novel particle filter method that performs well in high dimension is presented in the first chapter. This method is a statistically consistent algorithm with the 'plug-and-play' property, which offers key practical value from the modelling perspective. Both theory and experiment demonstrate that the method scales much better than standard methods. The second chapter showcases how this method can be used for inference of infectious disease transmission dynamics. The last chapter discusses a new simulation-based statistical inference algorithm. This algorithm extends the Hamiltonian Monte Carlo method, known for its efficiency in simulating irregular distributions, to discrete domains.

Amy Pistone

Classical Studies

When the Gods Speak: Oracular Communication and Concepts of Language in Sophocles

Oracles in Sophoclean tragedies are consistently misunderstood, not because the gods speak in out-and-out lies, but because they communicate in a decidedly non-human mode that appears to violate the unwritten rules of effective human conversation. I use pragmatic linguistic theory to examine how oracles are misunderstood, since pragmatics is concerned precisely with these unwritten rules—how context, inferences, and implications complement the basic semantic content of language. These non-semantic elements are conspicuously absent from oracular communication, which leads to misinterpretation. I examine how the liminality and strangeness of oracular speech afford Sophocles the flexibility to explore the different components of language. Oracular speech—precisely because it is not bound by the rules of "normal" speech—offers a context in which pragmatic principles can fail and artificially constructed miscommunications can "break" pragmatic rules. By exploring the limits of communication and miscommunication, Sophocles illustrates exactly those guiding principles that underlie effective communication.

William Runyan

Comparative Literature

The Space of Global Yiddish Literary Culture

Following emigrant writers from Eastern Europe to Mexico City and Buenos Aires, this dissertation examines the shifting global outlook and practice of Yiddish literary culture in the twentieth century from the perspective of the Americas. Rather than privileging one cross-regional axis, my approach aims at a careful engagement with the geographic imaginations and travel itineraries of poet Yankev Glantz (Mexico City) and journalist Yankev Botoshansky (Buenos Aires) between the 1920s and the 1980s. A descriptive-analytic account of the careers and works of these representative figures serves to illuminate the broader workings of Yiddish literary culture. My objective is not only to chart networks, movements and locations lived and imagined, but also to excavate a world of thought sustained by them and to assert its relevance for theorizing mobility and cultural form in the present.

Leigh S. Saris

Anthropology

Guests in the Homeland: Transnational Heritage Tourism in Greece and Turkey

My dissertation explores the recent efforts of Greek and Turkish descendants of the 1923 Population Exchange to reconnect with their lost homelands and ancestral neighbors despite pervasive nationalism that constructs Greeks and Turks as enemies. This transnational community draws upon shared family histories and memories of trauma and exile to work across national boundaries to preserve exchangee identity and heritage. Moreover, Greek and Turkish exchangees across the Aegean have formed a network to support heritage tourism to the homeland. On return tours, exchangees are hosted in their ancestral homes by strangers who practice a different religion, speak a different language, and belong to a different nation. They conform to particular rules of etiquette in their guest-host relationships in order to manage these differences and avoid political disputes. In doing so, they reveal everyday ways of reconnecting after national conflict and indicate a salient Aegean community of belonging for many exchangees.

Brian Segal

Biostatistics

Computationally Efficient Resampling Methods by Partitioning the Resamples, and Construct Validation as Cluster Validation

Researchers in various fields, including the physical, life, and social sciences, use resampling methods, such as permutation tests and the bootstrap, to conduct statistical inference and test hypotheses. Resampling methods are appealing from a statistical standpoint, because they rely on minimal assumptions and can be used even if the distribution of the test statistic is unknown. However, resampling methods are computationally intensive, which prevents some researchers from using them.

In this dissertation, we develop computationally efficient resampling methods by taking advantage of a property of the resamples that has not been previously studied. We have successfully developed methods for approximating small permutation p-values, and based on preliminary work, are hopeful that we will be able to adapt our approach to approximate bootstrap quantiles near zero and one. We also investigate the use of resampling methods to evaluate clusters in psychological data, particularly to validate unobserved constructs measures by questionnaires.

Wendy Sepponen

History of Art

Milanese Bronze, Spanish Stone, and Imperial Materials: Sculptural Interchange and the Leoni Workshops (1549-1608)

My dissertation investigates how objects and visual practices affected cultural cross-pollination and interchange within the Hapsburg Empire in the latter half of the sixteenth century. I focus on two sculptors, Leone Leoni (c. 1509-1590) and his son Pompeo Leoni (c. 1533-1608), who had workshops in Milan and Madrid and worked in the rare and exclusive sculptural format of life-size bronzes for Charles V and Philip II. The Leoni collaborated between multi-regional workshops — Leone from Milan and Pompeo in the workshop he established in Madrid — while trading on the cultural capital, sculptural traditions, and available materials of their unique locales. I aim to understand how these sculptors enacted, through their geographically and materially diverse sculptural practices, the processes of artistic adaptation and transformation that underpin the mutually informative relationships between historical sites of imperial cultural integration.

Apoorv Shanker

Macromolecular Science and Engineering

Designing Polymeric Materials for Engineering and Biomedical Applications

In this work, I have focused on engineering the intermolecular interactions in polymeric materials to modulate either its intrinsic property or its response to environmental changes. The first work involves designing amorphous plastics with enhanced thermal conductivity by replacing the weak inter-chain van der Waals interactions, which is the bottleneck for phonon transport, with the stronger H-bonding. H-bonded polymer blends with better inter-chain interactions and expanded chain conformation results in an order of magnitude increase in thermal conductivity. Following up, I have also shown that pH-modulated changes in chain conformation can affect thermal conductivity as well. In the second work, I have developed a thermally tunable polymer-graphene oxide (GO) nanocomposite film that was then incorporated in a microfluidic device to yield a bi-functional on demand capture/release device for isolation and enumeration of circulating tumor cells (CTC) from blood.

Yue Shao

Mechanical Engineering

Bioengineered three-dimensional human pluripotent stem cell culture for modeling peri-implantation human embryogenesis

In my dissertation, I use human pluripotent stem cells (hPSCs), which could be derived from adult tissue cells and give rise to embryonic cells, to develop culture models for recapitulating the differentiation and morphogenesis in peri-implantation human embryos. Through bioengineering three-dimensional (3D) extracellular space that mimics uterus-embryo interactions, I found hPSCs could rapidly differentiate and form 3D luminal structures, which mirrored the morphology of peri-implantation embryos. I also found such luminal structures exhibited squamous morphology and cell fate patterning mimicking amniogenesis in early embryos, suggesting developmental similarities between the 3D hPSC culture model and the peri-implantation embryo. Using this model, I further study the developmental mechanism of implantation-driven cell differentiation and morphogenesis, to better understand early human embryogenesis. My dissertation establishes the first method for generation of human amniotic cavity-like tissue and will facilitate the study of important but previously inaccessible biological aspects of early human embryonic development.

Diana Carolina Sierra Becerra

History and Women's Studies

Insurgent Butterflies: Gender and Revolution in El Salvador, 1965-2015

I rethink the history of Salvadoran feminism via an analysis of how rank-and-file women transformed the theory and practice of leftist movements in El Salvador from 1965-2015. I analyze new archival sources and conduct participatory workshops and over fifty oral histories in order to trace women's organizing across three major periods: prewar (1965-1979), Civil War (1980-1992), and postwar (1992-2015). Part One discusses women's participation within teacher and peasant organizations, the radicalization of the left, and the gendered nature of class-based demands prior to 1980. Part Two, focusing on the Civil War period, examines how peasant women and guerrilleras shaped the daily practices of armed struggle and the meaning of liberation. From these struggles, a revolutionary feminist praxis blossomed. Part Three examines the collective memories of older activist women and their efforts to transmit their political visions to a younger generation of activists.

Kyera Singleton

American Culture

Containing Black Women: Gendered Geographies of Imprisonment in the American South, 1840-1900

This dissertation is an interdisciplinary study of race, gender, sexuality, and punishment in the U.S. South. This project traces the legacies of enslavement and imprisonment for black women through a close reading of slave narratives and state archives. My dissertation illuminates how the treatment of black women in state sanctioned institutions, such as penitentiaries, jails, and workhouses, and domestic spaces of containment, such as smokehouses, closets, and dungeons on plantations, exposes how slaveholders and prison officials trafficked in racist notions of black criminality to control black women's mobility, prevent their freedom, and steal their labor. Thus, my project seeks to understand how black women responded to the development of violent carceral regimes, and how their ideas about mobility, sexuality, and freedom shaped black women's desire to find ways, sometimes illicitly, to claim autonomy over their lives and labor.

Helena Skorovsky

Romance Languages and Literatures

Rethinking Faith in Early Modern France

My dissertation explores shifting understandings of belief in sixteenth and seventeenth century France. Drawing on both fairly known historical sources (Jean Calvin, Michel de Montaigne) and fairly unfamiliar ones (Jean-Joseph Surin, Jacques Abbadie, Geoffroy Vallée) of writers from different confessions, I attempt to trace the messy historical process by which belief was reconceptualized from a willful act of trust in God and one's fellows humans into an unwillful, uncontrollable, unpredictable, mental state which came to depend on believable representations. As such, my dissertation is aimed as a contribution to historicization of belief- one of Western culture's most basic categories of thought.

Matthew Spellings

Chemical Engineering

Statistical Mechanics of Anisotropic Active Matter

Systems of active matter, which are driven far from equilibrium by some repeated input of energy to the system, have recently been a topic of great interest in simulation as well as experiment. Activity is a promising, orthogonal (to previously-understood equilibrium assembly) design parameter for assembly engineering which is inherently tunable: when the energy input to the system is removed, the system must return to its equilibrium behavior. So far, studies of active matter have been mostly limited to self-propelled isotropic particles, which can form "living crystals" for monodisperse particles or coexisting fluid phases for soft, polydisperse particles. The role of shape has begun to be explored for both translationally-driven and rotationally-driven anisotropic particles, but these studies focused on particular shapes rather than systematically probing the effect of anisotropy. In this dissertation, I use molecular dynamics simulations to systematically relate the behavior of anisotropic active particles to that found in equilibrium systems.

Ethan Sperry

Human Genetics

Roles for CHD7 and SOX11 in CHARGE Syndrome Pathogenesis

CHARGE syndrome is an autosomal dominant, multiple anomaly disorder characterized by multiple sensory impairment and other developmental malformations requiring continuing medical and surgical therapies. Mutations in CHD7, a chromatin remodeler, are found in up to 90% of individuals with CHARGE. Here, I present data showing that (1) CHD7 is crucial for craniofacial and respiratory development, (2) a chromosomal duplication including the gene encoding transcription factor SOX11 may be a rare cause of CHARGE, and (3) SOX11 has critical roles in development of the vestibular system in the inner ear, an organ often affected in individuals with CHARGE. These studies provide insights into the broad role of CHD7 in governing craniofacial morphogenesis and demonstrate that SOX11 is critical for proper inner ear development.

Andréa Thomaz

Ecology and Evolutionary Biology

Insights into the generation of the endemic freshwater fish fauna along the coast of Brazil

Multiple processes that result in similar patterns confound the underlying mechanisms promoting genetic variation in riverine fishes. For example, geographic barriers, constraints imposed by physical properties of a river, and species ecological requirements affect the dispersal of organisms and, consequently, the genetic differentiation among populations. My Ph.D. dissertation is a step towards addressing this issue by disentangling the effect of these three processes on patterns of genetic structure of freshwater fishes in a system of drainages along the Atlantic coast of Brazil. By using new sequencing technologies and hypotheses testing statistical approaches I'm able to understand the processes responsible for generating the high species diversity and strong genetic structure observed among populations of fishes in the region. This approach also provides insights into which river portions are critical to conservation efforts because of their impact in population persistence and movement patterns of organisms living in these environments.

Joshua Logan Wall

English Language and Literature

Rooted Cosmopolitans: Urban Prophecy in American Modernist Poetry

This dissertation examines the use of prophetic modes in interwar American poetry that sought to bridge local and cosmopolitan commitments. Drawing on multi-lingual archives and readings of significant though under-studied modernist poets, I expand scholarship of American “prophetic” rhetoric to include modernism, while offering an alternative to familiar dichotomies between “art” and “politics” in left-wing literature. Readings of James Weldon Johnson and Louis Zukofsky examine the intersections of a prophetic mode with modernism’s engagement with dialect and vernacular. Alternately, Lola Ridge and Charles Reznikoff revise the modernist “epic” to craft biblical counter-histories that preserve stories of history’s outcasts. All write prophetic poetry that challenges the trope of America as “Promised Land” and modernism’s tendency toward apocalypticism. By manipulating linguistic and literary forms, they claim cultural and civic agency while attempting to radically reshape society at-large. This “rooted” cosmopolitanism speaks, like biblical prophecy, through poetry that calls for reform and revolution.

Brandan Walters

Biomedical Engineering

Augmentation of Adipose-derived Mesenchymal Stem Cell Differentiation to Smooth Muscle Cells Using Biophysical and Biochemical Cues

Technology to efficiently produce large numbers of mature smooth muscle cells for regenerative medicine therapies is lacking. By engineering a fine-tuned microenvironment for stem cells, we will be able to effectively create smooth muscle cells from an abundant source. To achieve this, we will apply conditions to emulate the niche stem cells experience during endogenous development. We will 1) culture the cells in three-dimensional collagen, a major component of smooth muscle cells’ extracellular matrix, 2) we will expose the cells to growth factors suggested to enhance differentiation, and 3) we will stretch the cells within these enhanced environments in effort to simulate the forces they experience in vivo. Together these effects may produce cumulative and possibly even synergistic effects. With these environmental cues, we plan on producing smooth muscle-like cells from an abundant source so that they may be used in tissue engineering applications and possibly regenerative medicine therapies.

Amy Westmoreland

Psychology

Demystifying the Model Minority Myth: Racial Stereotypes and Workplace Outcomes Among Asian Pacific Islander Americans

Racial stereotypes shape pathways for upward mobility and workplace satisfaction among marginalized groups. With an interdisciplinary mixed-methods approach in mind, a series of three studies are used to examine how Asian Pacific Islander Americans (APIAs) navigate racial stereotypes in organizations. Study 1 examines why APIAs tend to be underrepresented in leadership. This phenomenon, known as the “Bamboo Ceiling” stems from the stereotype of APIAs as cold and non-assertive, traits that are ill-fitted for leadership. Study 2 challenges an aspect of the model minority stereotype that equates high performance with high well-being. Using a working-adult sample, this study finds that high job performance is not indicative of high job satisfaction. Drawing from the same working adult sample from Study 2, Study 3 examines mindfulness as an intervention for coping with racial discrimination. This work has clear, practical implications for how organizational members can counteract the effects of stereotypes in the workplace.

Josh Wondra

Psychology

An Appraisal Theory of Empathy and Other Vicarious Emotional Experiences

Emotions for oneself and emotions for others have been studied separately for too long. Theories of emotion say little about feeling emotions for others. Theories of empathy focus on situations where we feel the same emotion as another person but they do not explain how we feel emotions for others that they are not feeling. I introduce a theory of empathy and vicarious emotions that is based on appraisal theories of emotion. According to the theory, our emotions for others are based on how we appraise their situations. If we appraise their situations the same way they do, then we feel the same emotion; otherwise, we feel a different emotion. In my dissertation I will review existing empathy theories, outline the new appraisal theory, and test the appraisal theory in two experiments.

Amanda Wong

Immunology

Mechanisms of lysosomal membrane damage responses in macrophages

Macrophages incur damage to their endolysosomes upon internalization of pathogens and noxious particles. Whether macrophages have mechanisms for limiting such damage is not well understood. Previous work in our lab uncovered a novel macrophage activity for enhancing lysosomal membrane integrity following activation by certain stimulating factors such as bacterial lipopolysaccharide (LPS), a phenomenon we term “inducible renitence.” My thesis work is directed toward uncovering the mechanistic basis of renitence. Kinetic studies reveal that LPS stimulation confers protection by containing the damage experienced by lysosomes to a narrow time period, in part by promoting the repair of damaged organelles. As a mechanism distinct from renitence, cholesterol accumulation within macrophages restricts lysosomal damage. Examination of the immunological contexts in which renitence acts finds that classically-activated but not alternatively-activated macrophages display renitence. These studies support a model in which renitence defends macrophage endolysosomes from pathogen perforation through the rapid repair of membrane damage.

Adrienne Woods

Education and Psychology

Who Is Placed in Special Education? Assessing the Longitudinal Profiles and Academic Achievement of Students At-Risk for Special Education Identification

Large-scale demographic patterns of students could indicate systemic bias surrounding special education identification, despite the fact that special education should be delivered based on individual needs. This dissertation investigates antecedents to special education placement and consequences of receiving services. Study 1 examines how 1) timing of identification (early/late) and 2) duration of services (persistent/delayed/terminal) are influenced by disability and student demographic characteristics. Study 2 compares the educational trajectories of special education students to general education students, using propensity-score matching and multilevel modeling for change. Finally, Study 3 contextualizes the findings of the first two studies, examining individual-level characteristics (i.e., race/ethnicity, gender, SES) in conjunction with school- and community-level characteristics (i.e., average SES, available school resources). Results will help illuminate whether special education maintains, exacerbates, or equalizes academic differences occurring as a result of SES, racial/ethnic inequality, or school-level bias, which has enormous significance for educational policy, teachers, and parents.

Carrie Wenjing Xu

Information and Economics

Three Essays on Peer Effects in College STEM Education

There is extensive literature showing that peer effects matter in various economic contexts. In education literature, peer effects are, “externalities across students within peer groups” (Sacerdote, 2006), and have a profound impact on student academic achievement. Although causal estimates of peer effects are highly policy relevant, proper econometric identification is challenging (Manski, 1993). In this dissertation, I present three experimental studies on peer effects in college STEM (Science, Technology, Engineering and Math) education. In Chapter One, I study a natural experiment that randomly assigns students into study groups and estimate the effect of studying with peers with certain characteristics. In Chapter Two, I design an experiment to estimate the direct effect and the indirect peer effects of advising messages on study group attendance. Chapter Three (job market paper) examines how a study buddy network affects various outcomes, ranging from final grades to study habits formation.

Xiang Yin

Electrical Engineering: Systems

Property Enforcement for Centralized and Decentralized Partially-Observed Discrete Event Systems

Cyber-physical systems are at the core of key infrastructure in our society. Ever-increasing demands for safety, security, performance, and certification of these critical systems put stringent constraints on their design and necessitate the use of formal model-based approaches to synthesize provably-correct feedback controllers. This dissertation aims to tackle these challenges by developing a novel methodology for synthesis of control and sensing strategies for discrete event systems, an important class of cyber-physical systems. First, we develop a uniform approach for synthesizing property enforcing supervisors for a wide class of properties called information-state-based property. We then consider the enforcement of non-blockingness in addition to the information-state-based property. We develop a finite structure called the All-Enforcement Structure that enumerates all valid supervisors. Furthermore, we propose novel and general approaches to solve the sensor activation problem for partially-observed DES. Finally, we extend our results from the centralized cases to the decentralized cases.

Rachel Young

Applied Physics

Accretion Shocks in the Laboratory: Using a High-Energy Laser to Learn About Star Formation

This thesis project investigates shock waves that form during star formation through a series of experiments using the OMEGA laser, one of the highest energy lasers in the world. Accretion shocks form when supersonic material from the surrounding accretion disk slams into the surface of the young, growing star. To create a scaled version on OMEGA, we drive magnetized plasma jets into solid blocks and image the results.

The structure of these accretion shocks is not well understood and there are open questions about the structures that form and their evolution. A better understanding of this will allow more accurate mass accretion rate measurements, which are crucial to testing broader theories about star formation, including the origin of our own solar system.

Zhen Zhao

Nuclear Engineering and Radiological Sciences

Studies of Electrons and X-rays Produced During High-Intensity Laser Interactions with Metallic and Gas Targets

When a short-pulse, high-intensity laser irradiates a metallic or gas target, plasma is produced and electrons are accelerated to high energies due to the presence of high Coulombic fields. Irradiation of a low-density gas produces plasma waves capable of accelerating electrons that emit high energy X-rays. With metallic targets, an inhomogeneous, dense plasma forms near the target surface and a portion of the laser energy is coupled into energetic electrons. These electrons propagate into the target and along its surface, and generate characteristic line emission and bremsstrahlung radiation. In both scenarios, the properties of the X-rays are linked to that of the electrons and the laser pulse parameters. The X-rays typically have micron source size and femtosecond duration, making them ideal for imaging applications. This thesis describes experimental and theoretical work aimed at optimizing the electron generation process as well as the resulting X-ray emission for both targets.

Junxing Zheng

Civil Engineering

Intrinsic Engineering Properties of Soils through Image Analysis

The intrinsic properties of soil including particle gradation, sphericity, and roundness control their macroscopic engineering properties such as packing density, limit index porosities, strength, compressibility, hydraulic conductivity, erodibility and others. However, due to difficulties in reliably and expediently determining them, intrinsic properties have not received their deserved attention and usage in practice. This research has facilitated rapid and precise quantification of intrinsic properties using optical-image techniques. Extensive laboratory tests were performed on sands of various gradations, angularities, sphericities and geologic origins to develop relationships between their intrinsic properties and fundamental soil properties. The models have proven to be highly accurate. They can readily be used by engineers and scientists for estimation of soil behavior in construction, geology, soil science and geoenvironmental engineering. More importantly, the models have led to fundamental understanding of soil behavior based on first principles and thus are essential to advances in soil micromechanics.

Zhengting Zou

Bioinformatics

Molecular convergence in the context of evolutionary genomics and phylogenetics: frequency, cause, effect and utility.

Convergence evolution is the independent occurrence of the same trait in two or more evolutionary lineages. In this thesis, I conduct computational analysis using evolutionary genomics and phylogenetics methods to investigate genome-wide convergence pattern and underlying mechanism. First, I compare the inferred frequency of convergence and theoretical expectation based on various models to show neutral evolution can explain the most convergence events in genome-wide protein evolution. Then my case study on echolocating mammals confirms this conclusion by comparing convergence in echolocating mammals with that of their sister species. Next, I compare morphological traits and amino acid sequences used in phylogenetics to show that the former are more prone to convergence due to small number of curated states. In the final chapter I test whether epistasis counters the saturation effect of convergence and reserve phylogenetic signal in distantly related species.

Weizhong Zou
Chemical Engineering

Exploiting polymer theory to simulate the rheology of micellar solutions and polymer glasses

Exhibiting different rheological (viscoelastic) behaviors, micellar solutions and polymeric glasses are at the center of many applications. For micellar solutions, we have developed a fast simulation model, drawing from concepts developed for entangled polymer melts, to account for different micelle structures (linear and branched micelles), which allows, for the first time, not only quantitative prediction of rheological behaviors but also estimation of important micelle properties from rheometric measurement with much greater accuracy than ever before. For polymeric glasses, by treating the short glassy segments as “solvent” for the slow-relaxing polymeric part, a hybrid Brownian dynamics/constitutive model has been developed to successfully capture numerous behaviors of polymeric glass (yielding, strain hardening, recovery, physical aging, and flow rejuvenation) under various types of deformations as well as the effects of polymer pre-orientation, whose results appear to be consistent with observations reported in the literature.



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