Schedule of Events

11:30 – 12:20 pm  Lunch and Registration  
                    SEC Atrium

12:30 – 2:30 pm  Oral Presentations, Session #1  
                    Eaton and Miner Halls

2:30 – 4:00 pm  Poster Presentations  
                    Alumnae Lounge

4:00 – 6:00 pm  Oral Presentations, Session #2  
                    Olin Hall

6:00 pm  Reception and Dinner  
                    SEC Atrium
## Oral Session 1: (12:30-2:30 pm)

### Data, Data, and more Data – Eaton 203

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<th>Author/Co-authors</th>
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<tr>
<td>Akari Miki</td>
<td>Fruit and Vegetable Consumption Patterns Among Followers of Popular Diets</td>
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<td>Spencer Perry, Emerson Wenzel</td>
<td>Mining Transportation Patterns for the Boston Region through Big Data</td>
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<tr>
<td>Sean Murphy &amp; Uku-Kaspar Uustalu</td>
<td>Big Data in Practice: An Exploratory Analysis of New York City Parks Usership</td>
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### Very Specific Scientific Stuff You Have Always Wanted to Know – Eaton 204

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<tr>
<td>Husain Adamji</td>
<td>Density Functional Theory Analysis on the Effect of Structural Configurations on the Stability of GaAsBi Compounds</td>
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<td>Eriko Koide</td>
<td>Phosphotyrosine Mimicking Inhibitors of the Src Homology Phosphatase 2</td>
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<td>Anna Kapral, Hannah Vigran</td>
<td>Effect of Time Manipulation on the Physiological Response to Apnea</td>
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<td>Isabel Smokelin</td>
<td>Changes in Macrophage Metabolism in Response to Pro-Inflammatory and Anti-Inflammatory Stimuli</td>
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### Cycle of People, Money, and Information – Eaton 207

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<tr>
<th>Author/Co-authors</th>
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<tr>
<td>Connor Doyle</td>
<td>The Impact of Migration on Morocco's Economy</td>
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<tr>
<td>Noah Weinflash</td>
<td>Political Betting Markets: Inefficiencies and Information Integration</td>
</tr>
<tr>
<td>Joshua Clarkson</td>
<td>Migration and Morocco: Treading a Thin Line</td>
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### Minds and Brains – Eaton 208

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<tr>
<td>Katelyn Mullikin</td>
<td>Examining Massachusetts Teachers' Knowledge and Beliefs about Dyslexia</td>
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<td>Audrey Evers</td>
<td>Mindfulness for Student Athlete Mental Health</td>
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<tr>
<td>McKinzey Torrance</td>
<td>Warning eyewitnesses about the threat of misleading information influences memory strategies</td>
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<tr>
<td>Michelle Chen</td>
<td>Investigation into a novel, clinically relevant murine electroconvulsive therapy model in altering chronic-stress-induced behaviors</td>
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### The World We Live In – Eaton 209

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<th>Author/Co-authors</th>
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<td>Brandon Levenstein</td>
<td>Geothermometry of Acadian Metamorphic Rocks in Massachusetts: Re-examining the Established Geothermal Gradients in Southern MA</td>
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<td>Nathaniel Cresswell-Clay</td>
<td>A Mathematical Model for Hadley Circulation and its Response to Projected Heating</td>
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<td>Grace van Deelen</td>
<td>Coffee Eco-Certification and Farmer Livelihoods in Costa Rica</td>
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<td>Annie Nguyen</td>
<td>Kestrels on the Decline; Analyzing Landscape Correlates with Nest Box Occupancy in American Kestrels</td>
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<td>Libby Langsner</td>
<td>How do we handle Nazi Art? Contemporary theories on how to display Nazi Art and Iconography</td>
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<td>Eran Sabaner</td>
<td>Morocco as an Orientalist Setting in Western Modern Art</td>
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<td>Alessandra Moreno</td>
<td>Cultural production in Morocco</td>
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<tr>
<td>Sara Torres</td>
<td>Coloniality of Migration</td>
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<td>Arjun Padalkar</td>
<td>Politicization of Migration in Morocco</td>
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<td>Lionel Oh</td>
<td>Exploring Policy Conditions for Cyber Deterrence: A Case Study of Estonia</td>
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<td>Atrey Bhargava</td>
<td>Morocco: &quot;Labor Protests and the Left&quot;</td>
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## Oral Session 2: (4:00-6:00 pm)

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<th>Discover New England – Olin 001</th>
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<td><strong>Justin Hudson</strong></td>
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<tr>
<td>Is Winter Weather Worse? A Frequency Analysis of Extreme Snowfall in the Northeastern United States</td>
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<td><strong>James Michielini</strong></td>
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<td>The relationship between abundance and phenology in Massachusetts Butterflies</td>
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<td><strong>Paulina Jedrzejowski</strong></td>
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<td>Ethnic Identification and Political Mobilization among Brazilians in Boston</td>
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<th>African Society and Politics – Olin 005</th>
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<td><strong>Jade Nantwi</strong></td>
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<tr>
<td>What is a Ghanaian gallery?: Art spaces in Accra and The Potential of the museum space for decoloniality</td>
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<td><strong>Yuze Sui</strong></td>
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<td>China's Role and Strategy in Africa in the 1970s: A Case Study on the TAZARA Railway Project</td>
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<td><strong>Daniel Ndirangu</strong></td>
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<td>Why did Morocco rejoin the African Union? Why does it matter?</td>
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<td><strong>Taylor Lewis</strong></td>
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<td>Education Inequality in Morocco</td>
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<th>Dynamics of Identity and Power – Olin 006</th>
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<td><strong>Jiaqi Yuan</strong></td>
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<td>The Dynamics of Manager Characteristics and Compliance in Cambodia Garment Factories</td>
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<td><strong>Anne Hall</strong></td>
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<td>Reclamation: Analysis of Self-Identity among Female Lakota Adolescents</td>
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<td><strong>Alara Hanci</strong></td>
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<td>Can International Law Work for Palestine? The UN’s Engagement in the Sustained Occupations of Western Sahara</td>
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<th>Disease and Community – Olin 103</th>
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<tr>
<td><strong>Megan Kuhnle</strong></td>
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<td>Psychopathology and anxiety outcomes in female anorexic exercisers and nonexercisers</td>
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<td><strong>Alina McIntyre</strong></td>
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<td>Challenges and limitations of nationally representative census and environmental health data as illustrated by two case studies to predict urogenital schistosomiasis and diarrheal disease in Ghana</td>
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<td><strong>Maia Tarnas</strong></td>
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<td>The Weaponization of Disease in the Yemeni and Syrian Civil Wars</td>
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<th>Lessons from the Past – Olin 109</th>
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<td><strong>Alexandra Claman</strong></td>
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<td>Paso a Paso: Historical Collective Memory and the Empowerment of Democratic Actors in Chile, El Salvador and Spain</td>
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<td><strong>Constantinos Angelakis</strong></td>
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<td>Byzantine Political Theory: Sovereignty, Republicanism, and Kingship</td>
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<td><strong>Reed Collins</strong></td>
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<td>The Past, Justice, and Morocco's Truth Commission</td>
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<td><strong>Brett Isaacs</strong></td>
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<td>Taking Command: A Legal-Historical Analysis of Modern Presidential Power in Domestic Security Threat Response</td>
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<td><strong>Uzair Sattar</strong></td>
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<td>Can Blood and Water Flow Together?</td>
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<td>Ethan Whitman</td>
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<td>Alexa Reilly</td>
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<td>Hawley Brown</td>
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<td>Miriam Hauptman</td>
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<td>Aava Jahan</td>
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<td>Dominique Kaempf</td>
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<td>Supriya Sanjay</td>
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<td>Albert Mousad</td>
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<td>Carolyn Burtt</td>
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<td>Lily Hayes</td>
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<td>Jonathan Berger, Nicole Carzo, Ivette Rodriguez Borja, Awele Chukwura</td>
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<td>Lucia Francese</td>
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<td>Dafni Frohman</td>
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<td>Maura Barry</td>
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<td>Uku-Kaspar Uustalu</td>
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<td>Eva Sachar</td>
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<td>Liora Silkes</td>
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<td>Sara Torres</td>
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<td>Myisha Majumder</td>
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Abstracts:

**Density Functional Theory Analysis on the Effect of Structural Configurations on the Stability of GaAsBi Compounds**
*Husain H Adamji, 2020, Chemical Engineering*
*Prashant Desplabla, Chemical and Biological Engineering Department*

GaAs, a group III-V semiconductor, has excellent electron mobility and tunable band gap allowing for operation at high frequencies and voltages. Bi added as a dopant at As sites of GaAs reduces its band gap and improves its electrical conductivity even more. However, GaAsBi compounds are fraught with Bi clustering issues which deteriorates other useful semiconductor properties of GaAs. This research applies Density Functional Theory, a quantum computational modeling technique, to study the effects of structural configurations on the stability of GaAsBi compounds. This study has demonstrated that with increasing Bi content in the GaAs lattice, Bi's preference to cluster together inside the GaAs lattice increases. Furthermore, the Bi clusters are more likely to appear as two-dimensional structures within planar sites of the GaAs lattice, especially the (001) plane, rather than as three-dimensional structures across multiple GaAs planes.

**Byzantine Political Theory: Sovereignty, Republicanism, and Kingship**
*Constantinos V Angelakis, 2019, Classics, International Relations*
*Ioannis Evrigenis, Political Science*

The Byzantine empire lasted for a millennium under almost uninterrupted monarchy. Recent scholarship has challenged the sovereignty of the imperial office to suggest that the empire was actually a continuation of the ancient Roman republic. While this view offers valuable nuance to the established idea of pure theocracy in Byzantium, its suggestion of revolt and usurpation as a mechanism of popular sovereignty goes too far. Byzantium lacked formal mechanisms for popular participation in politics, and there were a number of forces who played a role in the selection of emperors, including the military and elites. Focusing on the history of the early and middle Byzantine periods, and using evidence from the emperor Constantine VII’s text De Ceremoniis, one can see that the Byzantine emperor was fully sovereign, although the people were able to challenge him based on certain ethical criteria passed down through the Greco-Roman and Christian traditions. These ethical criteria functioned as a shared ideology between ruler and ruled, while the actual mechanisms of politics in Byzantium often came down to dynamics of power. Additionally, although Byzantium could loosely be defined as a republic according to the ancient definition, it did not resemble post-eighteenth-century republics, and there was certainly not popular sovereignty.
Examining markers of brain tissue differentiation and cerebrospinal fluid flow in pre-metamorphic Xenopus laevis tadpoles

Maura J Barry, 2019, Biology; Spanish
Kelly McLaughlin, Biology

Craniofacial deformities are common developmental defects across all vertebrate species, which can be caused by genetic factors, environmental factors, or a combination of both. Typically, in humans, these birth defects cannot be treated or the only form of treatment is an expensive and invasive surgery. Thus, there is a critical need to study not just the causes of craniofacial defects in vertebrate model systems, but also potential resolutions and treatments for these craniofacial defects. It has been discovered that Xenopus laevis tadpoles with craniofacial deformities can remodel malformed craniofacial tissues, such as cartilage and brain tissue, prior to metamorphosis. My project has been to examine markers of self-correction in the brains of pre-metamorphic Xenopus laevis tadpoles, specifically looking at protein expression patterns and cerebrospinal fluid flow. I focused on determining whether brain tissue in pre-metamorphic tadpoles with craniofacial defects is properly differentiated prior to and after the life stages where malformed craniofacial tissues are known to correct. To do this, I tracked the expression of brain tissue differentiation using the Pax7 marker protein in the brains of Xenopus laevis tadpoles between stages 45 and 50. I performed immunohistochemistry on the brains of tadpoles that had undergone one of four exposure treatments during neurogenesis: control (no treatment), ICI 118,551 HCl, thioridazine HCl, or ethanol. For all three treatment groups, there was abnormal tissue differentiation in various brain regions at stage 45, which showed improvement by stage 49. I also performed microinjections into the tadpole brains of the same treatment groups and observed the cerebrospinal fluid flow by taking videos with a Zeiss Microscope. After analyzing the speed of the flow and the overall volume of cerebrospinal fluid within the brains, it appears that deformed brains show signs of hydrocephalus at earlier developmental stages, which some groups are able to correct over time.

Perspectives on Having Quality Measures for Nursing Homes Stratified by Race/Ethnicity

Jonathan Berger, Nicole Carzo, Ivette Rodriguez Borja, Awele Chukwura, 2019, Community Health
Andrea Acevedo, PhD, Department of Community Health

The Centers for Medicare and Medicaid Services (CMS) publicly report the quality of nursing homes across the country. This information is meant to help individuals choose a nursing home when necessary. Public reporting of quality measures stratified by race/ethnicity has been proposed as a strategy for reducing disparities in health care services, including nursing home care. This would provide information on whether quality of care varied by nursing home residents’ race/ethnicity. The goal of this study was to obtain community members’ perspectives on stratified nursing home quality measures. We first conducted 9 focus groups and 25 interviews with Black, White, and Latino community-dwelling adults living in the Greater Boston area to assess interest in seeing stratified measures. Focus groups were conducted separately by age group (40-64, and 65+) and race/ethnicity. We also created a mock website with stratified measures and conducted an additional 5 focus groups to obtain participants reactions to that information. Overall, we found that participants would like to see quality measures separately by race/ethnicity when choosing a nursing home. Those who disagreed believed that the quality of care would not vary by race/ethnicity or that
the information would be unimportant when choosing a nursing home. It is also important to note that a few participants expressed confusion on the idea of separating quality measures by race/ethnicity and how measures were calculated. The results of our study indicate that there is a general interest in having stratified measures available, and CMS should consider further investigation of interest at a larger scale.

Morocco: "Labor Protests and the Left"
Atrey Bhargava, 2021, IR; Economics
Heather Barry, Institute of Global Leadership

This research focuses on the discrepancy between the disenchantment with the political left and the labor protests on the street. It focuses on the historical evolution of the political left and the growth of the far-left in recent elections. It also delves into the cross-linkages between different protests, be it the teachers or the doctors' movement, and their connections with NGO's and independent journalists in the area.

Targeting Autophagy with Peptide Inhibitors of GABARAP
Hawley F Brown, 2020, Biochemistry
Joshua Kritzer, Chemistry

Autophagy is a cellular recycling process that is necessary for normal cell function. This process involves a vesicle called an autophagosome forming around cell cargo marked for this recycling. The autophagosome then fuses to the lysosome, which degrades the contents. However, dysregulated autophagy is implicated in a variety of diseases, including cancer. While several autophagy inhibitors currently exist, their lack of specificity limits their usefulness. Atg8 is a ubiquitin-like protein found in yeast. In humans, there are six orthologs of Atg8, including GABA Type A Receptor-Associated Protein (GABARAP) and LC3B. GABARAP and LC3B are especially involved in lysosome-autophagosome fusion, and thus, are necessary for autophagy to occur. These proteins bind a variety of proteins through a common binding site, called the GABARAP Interaction Motif (GIM) and LC3 Interaction Region (LIR) respectively. In this project, I will design a peptide to bind to the GIM and LIR domains. I will then optimize these peptides to be specific, bind strongly, and be cell-penetrant. A peptide with these properties would be a highly useful research tool and a potential therapeutic.

Effects of Bumblebee Domestication on Pollen Collection
Carolyn Burtt, 2019, Biology
Dr. Elizabeth Crone, Biology

Bumblebees, along with other pollinators, aid the reproduction of 30% global crops and 90% wild plants. With the global decreases of pollinator populations and increased agricultural development, bumblebee domestication has become commercialized. Bumblebees raised in the wild and those grown in greenhouses have been largely assumed to have identical pollen-collecting behavior, but there have been no studies directly examining if this is true.
Investigation into a novel, clinically relevant murine electroconvulsive therapy model in altering chronic-stress-induced behaviors

Michelle X. Chen, 2019, Biopsychology  
Dr. Stephanie A. Maddox, McLean Hospital, Division of Depression and Anxiety Disorders

Electroconvulsive therapy (ECT) is a robust treatment for patients with schizophrenia, major depressive disorder, and bipolar disorder. Although fast acting and effective, the mechanisms underlying the therapeutic effects of ECT largely remain unknown. While previous preclinical studies have noted a role for neurotropic signaling, neurogenesis, and alterations in monoamine neurotransmitter systems, these models were largely conducted using procedures that contrast with current human clinical parameters. Therefore, we sought to develop a clinically relevant murine model of electroconvulsive seizures (ECS), a model of ECT, which more closely approximates current clinical practice and then employ this model to begin exploring the mechanisms that accompany ECS. Using the well-established chronic social defeat stress (CSDS) paradigm, known to result in altered reward, motivational, and anxiety-related behaviors, and in line with our observed induction of plasticity-related genes in the ventral tegmental area, nucleus accumbens, and amygdala, we explore the behavioral alterations that follow CSDS and their potential reversal following courses of ECS. Thus, utilizing our novel and clinically relevant model of ECS, we have begun to elucidate the mechanisms that may contribute to ECT’s therapeutic outcomes by examining behaviorally-relevant and pathway-specific behaviors associated with stress, anxiety, and depression.

Paso a Paso: Historical Collective Memory and the Empowerment of Democratic Actors in Chile, El Salvador and Spain

Alexandra M. Claman, 2019, International Relations, Spanish, Peace and Justice Studies  
Nina Gerassi-Navarro, Spanish, Latin American Studies

Within the cases of Chile, El Salvador, and Spain, this thesis sought to investigate a possible correlation between the presence of collective memory efforts with the improvement of human rights conditions and the empowerment of democratic actors during the democratization process. The collective memory efforts that I analyzed included Truth and Reconciliation Commissions, monuments, museums, memorials, days of remembrance, and other forms of memory. I hypothesized that collective memory efforts positively correlate with human rights conditions, and that such efforts empower democratic actors, making the reconciliation process more inclusive and legitimizing the democratization efforts. I identified four factors that qualify a legitimate democracy based on the work of Tilly, Linz, Levine, Molina, and other political scientists: free and fair elections, political rights, government accountability, and pluralistic information. I analyzed the presence of these factors in the democratic structure of each nation in this case study. Ultimately, Chile was the only case in which extensive, institutionalized collective memory efforts and a legitimate democratization process could be proven by the criterion established in my research question. El Salvador and Spain are complicated cases, and perhaps other criterion should be used to assess their collective memory efforts and the involvement of democratic actors in each nation’s peace process. Regardless, I remained convinced of the importance of collective memory in a nation’s history and how citizens conceptualize the past.
Migration and Morocco: Treading a Thin Line
Joshua Clarkson, 2021, International Relations; Quantitative Economics
Institute for Global Leadership

In the last decade, Morocco has experienced a large increase in immigration, particularly from Sub-Saharan countries to its south and southeast. Traditionally a country of emigration, primarily to Europe, Morocco has transitioned to become a major country of transit for African migrants to Europe, especially those who seek irregular entry to the European Union. At the same time, Europe has been dealing with the so-called "Immigration Crisis," which has greatly impacted the continent's public opinion and policy on a number of fronts, regardless of the true effects of the "crisis." This research seeks to understand Morocco's current immigration and emigration policies, while also offering prescriptive policy suggestions. This research includes a review of the literature on the topic, as well as field research conducted this March in Rabat, Tangiers, Marrakech, and Casablanca. After compiling this research, the primary finding was that, despite reports of large aid packages from Europe to securitize Moroccan migration, Morocco maintains fairly open borders, while "crackdowns" have been wildly overemphasized in the media. Additionally, Morocco is in a difficult situation going forward, seeking to please European allies, especially France and Spain, while also preserving strengthened ties with a number of Sub-Saharan countries, in which Morocco has vested economic interests. Meanwhile, despite its shortcomings, Morocco has initiated fairly progressive reforms to assist the migrants who arrive in the country, a fact which is often overlooked amid hyper-securitization rhetoric emanating from the West.

The Past, Justice, and Morocco’s Truth Commission
Reed S Collins, 2019, International Relations
Institute for Global Leadership

Protracted violence, years of oppression, exclusion, and inequality traumatizes people, making it hard, if not impossible, to live alongside the perpetrators of those acts. In order to coexist, mechanisms must be put in place to heal and confront the collective trauma a society faced, with the goal to achieve a positive and sustainable relationship. At the core of this idea is a question societies who have suffered from divisive violence in the form of oppressive regimes or civil war must contend with the question: how does a society move from a divided history to a shared future? In 2003, King Mohammed VI established the Commission for Equity and Reconciliation (IER) by royal decree, marking the first internationally recognized truth commission in the Arab world. It’s mandate was to investigate the period of King Hassan II’s time as monarch, known as the ‘years of lead’. After establishing the importance of addressing the past and pursuing a balanced form of justice, this paper explores the effectiveness of the truth commission, the reasons behind its establishment, and how it can inform future truth commissions in the Arab world. Analyzing the commission’s findings, effects, and origins reveals that King Mohammed VI motivations a pathway for future truth commissions in the Arab world.
A Mathematical Model for Hadley Circulation and its Response to Projected Heating

Nathaniel A Cresswell-Clay, 2019, Mathematics
James Adler, Mathematics

Hadley Circulation refers to a tropical atmospheric overturning. It is, in part, defined by rising warm air at the equator and descending cold air in the subtropics. These overturning loops occur on either side of the equator and are referred to as Hadley Cells. Hadley Circulation is an important feature of our atmospheric system. On land it plays a key role in defining the world's largest deserts and at sea its range encompasses the world's most productive fisheries. The critical role Hadley Circulation plays in modulating our environment has made it a point of fascination for many climate and atmospheric scientists. In 1979, Isaac Held and Arthur Hou introduced an analytic model of Hadley Cells using first order atmospheric approximations. The model became popular for its ability to accurately describe Hadley Circulation using a purely conceptual formulation. More recently, scientists have used large numerical General Circulation Models to study how Hadley Circulation responds to a warming atmosphere; many of these studies have reported a widening of Hadley Cells over the 20th Century. To understand how climate change effects our conceptual understanding of Hadley Circulation, I recreate the Held-Hou model and observe its sensitivity to warming air temperatures. To gauge the distribution and intensity of projected warming I analyze General Circulation Model Output from the CESM1-CAM5 atmospheric model. I use model output from historical runs as well two carbon emission futures. As part of this process, I analyze atmospheric parameters relevant to the Held-Hou model and observe how they are projected to change throughout the 21st Century. Finally I force the Held-Hou model with these projected temperature changes. This analysis offers insight into how first order atmospheric processes that govern Hadley Circulation react to a changing climate.

The Impact of Migration on Morocco's Economy

Connor H Doyle, 2021, International Relations

Economists are split on the impact that migration has on economies of different countries. Many argue immigration fills job vacancies, and creates a larger consumer base for goods and services. Others worry emigration of highly educated workers reduces the ability of a developing country to have a high level of growth. Since the turn of the century, output per person in Morocco has more than doubled from approximately $1,300 to around $3,000 according to the World Bank. In that time, Morocco has transitioned from a historically sending country to a sending and receiving country. I am inclined to study how immigration has impacted the Moroccan economy and standard of living in the country, if at all. I dove into the complexities of how immigrant communities within Moroccan cities such as Tangier, Rabat, Marrakech, and Casablanca impact the economy. Furthermore, I looked at the impressive amount of remittances sent to Morocco from nationals living abroad, while trying to assess the negative impacts of the highly skilled and educated flight from Morocco. I will be presenting research combining economic data, scholarly works, and insights from interviews conducted during NIMEP's research trip.
Mindfulness for Student Athlete Mental Health
Audrey G. Evers, 2019, Psychology; Community Health
Dr. Adolfo Cuevas, Community Health

The purpose of my study was to examine the impact of a four session mindfulness based training program on mental health and stress in student athletes at Tufts University. According to national surveys, student athletes experience more stress, anxiety, and depression than their non-athlete counterparts and mindfulness has been shown to be effective in this population. This mindfulness training program was adapted from a program at the University of Southern California; adaptations to the program were made with the guidance of trained mindfulness teachers. The program, led by Audrey Evers and Jessi Somogie, helped participants build a mindfulness practice to cope with stress and other challenges in sports and in life. Participants (n=29) completed surveys before and after the four week intervention. Mindfulness ability was assessed with the Cognitive and Affective Mindfulness Scale - Revised (CAMs-R), mental health was assessed with an adapted Short Form Health Survey (SF-12), and perceived stress was assessed using the Perceived Stress Scale (PSS).

After the program, participants reported a significant improvement in mindfulness ability (t(28) = -2.61, p=.014), mental health (t(28) = -2.87, p=.008), and a marginally significant improvement in perceived stress (t(28) = 1.86, p=.073). Over half of participants (55%) reported an improved ability to fall and stay asleep along with improvements in acceptance, awareness, stress, self-control, and more. Mindfulness programs may be an effective way to improve mental health in collegiate student athletes and future research should consider integrating mindfulness programs with structural change for best results.

Representing Disease: How Hepatitis C and HIV/AIDS acquired a political identity
Lucia Francese, 2019, Sociology
Rosemary Taylor, Sociology Department

How do governments address the threats that communicable diseases pose to the health of their societies? This project will examine a critical historical case, namely, how British policy-makers dealt with the threats to the blood supply posed by two viruses, HIV and Hepatitis C (HCV) over a forty year period from the 1970s. Emphasizing how these diseases and those suffering from them acquired different political identities in the course of policy-making, it will draw on conceptual tools associated with identity formation to reveal new dimensions in the processes whereby governments cope with risk and affected persons cope with a newfound health status. Newspaper archives, government documents, and voluntary organizations’ documents paint the story of how the viruses were first discovered, how the perceptions of the severity of the diseases changed as time progressed, and the many ways those affected by the diseases responded to the diseases themselves and government (in)action regarding said diseases. Though not initially perceived as a serious disease, Hepatitis C is arguably as serious as HIV/AIDS and affects more people than HIV/AIDS in the UK. Though both those affected with Hepatitis C and HIV/AIDS had to fight to get the care and compensation they felt were merited, Hepatitis C has still not been addressed by the government to the satisfaction of those affected, as seen by the current infected blood inquiry regarding the infection of UK citizens with HCV through blood and blood products.
How Advances in Genetics / Genomics are Leading to Novel Treatments for Rare Diseases
Dafni Frohman, 2019, Biology

Children and adolescents with suspected sensory abnormalities receive only limited information from clinical diagnoses about the pathophysiological mechanisms underlying their symptoms that could help to guide treatment choice. Neuropathic pain is not generated by a single mechanism, but rather by multiple mechanisms operating together, resulting in a phenotypic heterogeneity. As pain mechanisms are multifaceted, and symptoms may be experienced to differing degrees, one approach to obtaining more information on neuropathic pain is to study the extremes of hyper- and hyposensitivity. While there are many pain conditions that may be classified as hypersensitivity, this study has focused on erythromelalgia. Quantitative sensory testing (QST), a group of non-invasive procedures that assess the sensory responses to systematically-applied and quantifiable sensory stimuli, could better phenotype these patients, resulting in more effective diagnosis and therapeutic outcome. The aim of this exploratory investigation was to use QST to phenotype patients with suspected hyposensitivity or erythromelalgia to expand our knowledge and better categorize different sensory profiles. Specifically, the study involved determining sensory profiles within the subject population and correlating the sensory profiles of subjects with those of their immediate family and normal ranges. Such correlations will provide the basis for a more detailed diagnosis of the sensory abnormalities and allow for a more precise treatment regimen.

Reclamation: Analysis of Self-Identity among Female Lakota Adolescents
Anne E Hall, 2019, Biology and Interdisciplinary Studies (Culture, Spirituality, and Female Adolescent Health)
Dr. Jayanthi Mistry, Eliot-Pearson Department of Child Study and Human Development

This thesis explores identity development among female Lakota youth through an integrative narrative-based approach. By examining how Lakota adolescents make sense of their ancestral history, cultural/environmental contexts, life experiences, and multidimensional identity, this study aims to better understand the reconstruction process female Lakota adolescents undergo as they formulate their self-identity. The ten participants for this study were recruited from the Pine Ridge Indian Reservation. Narrative-based interviews were conducted with the participants and their responses were transcribed and analyzed. Each narrative-based interview included salient experiences of abuse, dissociation, and fragmentation as well as healing, support and reconstruction. From this observed phenomenon, I generated the following narrative themes to better illustrate the identity process among female Lakota adolescents. They include: History, Naming the Wound, Piecing Together, Identity and Looking Ahead. I incorporate a mix of both Indigenous psychology and narrative inquiry in my analysis to contribute to the discussion of decolonizing identity development among historically oppressed groups, namely Native individuals. Ultimately, through this decolonizing approach, this thesis not only aims to re-imagine identity development, but also to address unequal relations of power in order to use utilize research as a way to lead to emancipation and justice for Native communities.
Can International Law Work for Palestine? The UN’s Engagement in the Sustained Occupations of Western Sahara
Alara Hancı, 2019, International Relations; Civic Studies, Malik Mufti, Poli-Sci

Since the Six-Day War in 1967, Israel has maintained its hold of East Jerusalem, the West Bank, and Gaza, which are recognized under international law as occupied Palestinian Territories. While the UN has maintained the conflict as a central focal point throughout the occupation, its enforcement of international law and attempts to drive a peaceful resolution to the conflict have been spotty. This phenomenon leads to the question, “why has the UN as the world’s preeminent international legal and conflict resolution mechanism failed to facilitate a successful end to Israel’s unlawful occupation of Palestinian territories?” This question become timelier and more significant with the waning 2-state solution alongside an occupation that has in the recent decades transformed into a settler colonial act. The extent to which the political economies of Israel and Palestine have intertwined in the last half-a-decade and the settlements have led scholars to advocate for a switch in the UN’s occupations law platform to one of decolonization, which will theoretically help revive the UN’s legitimacy and finally lead to peace. To test this claim, this research conducted a comparative study of the law of belligerent occupation in Palestine and the decolonization framework in Western Sahara. It analyzed the UN Security Council and UN General Assembly resolutions to compare the UN’s deliberative capability as reflected in its international law enforcement. It also studied the UN-led diplomatic initiatives and peace frameworks to compare the UN’s operative capability as reflected in its mediation of the two conflicts. The research has found that rather than the legal mandates in the implementation process has been the determining factor behind the UN’s (in)ability to resolve the crises.

The neural basis of non-literal language processing: A meta-analysis of functional magnetic resonance imaging studies
Miriam Hauptman, 2019, Cognitive & Brain Sciences; German Language & Literature
Ariel Goldberg, Psychology

Researchers of non-literal language (e.g., humor, metaphor, indirect speech) have traditionally sought to establish whether different cognitive mechanisms support non-literal vs. literal language processing. Previous approaches treated processing time and hemispheric lateralization as indicators of the recruitment of different cognitive mechanisms in non-literal language processing. In the present meta-analysis, we attempted to overcome methodological challenges of these paradigms by exploring the extent to which non-literal language processing is associated with neural activation in three distinct functional networks. Specifically, we analyzed whether activation peaks from 71 fMRI experiments (770 total peaks) reported in non-literal vs. literal language contrasts fell into the language, multiple demand (MD), and theory of mind (ToM) networks. These networks become robustly and selectively activated when individuals perform tasks that engage cognitive processes presumably involved in non-literal language processing. Our analysis indicated that 1) peaks from non-literal vs. literal language contrasts fell into the language and ToM networks at above-chance levels, 2) a high number of the peaks are located in the right hemisphere, and 3) different types of
non-literal language phenomena can be separated into three groupings based on their relationships to the functional networks of interest. Together, our findings suggest that different combinations of cognitive mechanisms may indeed support non-literal vs. literal language processing, though more work is needed to clarify the exact nature of these differences. Future investigations on the neural basis of non-literal language processing should continue to incorporate functional network-based analyses in order to further explore the relationships between linguistic processing, executive function, and mentalizing and non-literal language processing.

**Investigating the role of innervation in triple-negative breast cancer metastasis**

*Lily A Hayes, 2019, biology; architectural studies*

*Madeleine Oudin, biomedical engineering*

One in eight women will receive a breast cancer diagnosis at some point in their life. Thanks to medical advances enabling earlier detection and improving treatment, the five year survival rate has risen to 90%. However, when you consider the most invasive, Stage Four, type of breast cancer, the five-year survival rate drops to 22%. When diagnosed, breast cancers are tested for three receptors: estrogen, progesterone, and HER2. If none of these three receptors are present, the cancer is classified as triple-negative. Triple-negative breast cancer accounts for less than 20% of breast cancer diagnoses, but is an especially aggressive form of the disease. Triple-negative breast cancer tends to grow quickly and metastasize, or migrate throughout the body, at a higher rate than other types of breast cancer, which makes it particularly lethal and challenging to treat. Nerves are present in the extracellular matrix of cells and a higher percentage of nerve fibers is associated with poor outcomes in breast cancer. Nerves may play a structural or chemical role, or both, in cancer metastasis, and understanding the mechanism of innervation’s role in triple-negative breast cancer metastasis is an important step toward developing treatments.

**Is Winter Weather Worse? A Frequency Analysis of Extreme Snowfall in the Northeastern United States**

*Justin R Hudson, 2019, Astrophysics; Environmental Geology*

*Andrew Kemp, Earth and Ocean Sciences*

Many residents of the Northeastern United States believe that in recent years winter weather has gotten worse, research regarding winter storms and snowfall is few and far between and typically presents mixed results. Despite high spatial variability, the majority of studies regarding snowfall and precipitation have a very large regional and focus and present little to no results for individual locations. As human driven climate change modifies long existing weather patterns and intensifies weather, understanding changes in extreme winter weather which can threaten human lives and infrastructure increases in importance especially at the city and state scale where resilience and mitigation planning occur. This study utilizes a Poisson rate frequency analysis method combined with multi-decadal snowfall data to test the validity to detect and quantify statistically significant changes in snowfall at the weather station scale. The analysis I performed revealed that in Boston, MA what was a once in a century storm now occurs every four to five years. Through spatiotemporal analysis a similar intensification in extreme snowfall is found across the
Northeastern United States stretching from Portland, ME to Philadelphia, PA with Boston at its center.

**Taking Command: A Legal-Historical Analysis of Modern Presidential Power in Domestic Security Threat Response**

*Brett S. Isaacs, 2019, Political Science*

*David Ekbladh, History*

This thesis examines how the domestic power of the American executive has expanded over the course of the modern presidency, with a focus on domestic crisis and threat response. The conventional interpretation of the U.S. Constitution argues that the President is meant to be a managerial leader but that the true power of American democracy is bequeathed to the Congress. Despite this assessment, the influence of the President in domestic policy has grown substantially, to the point where the President is the central figure of government. The Constitution grants the power of the Commander in Chief to the President, and it is through this military-based authority that the executive has accrued influence and power in civil governance. This thesis will examine, in particular, enlarged executive power in domestic crisis/threat response and in the development presidential military authority in the U.S. Different case studies demonstrate how government reorganization and the construction of a vast American domestic security machine has molded a Unitary Executive in the White House today. Through this legal-historical analysis and using a combination of qualitative and quantitative data, I will explore the expansion of executive power over the course of the modern presidency. Through an examination of court cases, declassified White House records, and executive responses to different crises in American history, the power of the presidency clearly did not grow by accident. Furthermore, this thesis will demonstrate that presidential power has been deliberatively expanded in domestic security threat response. Through a mixture of legal and extralegal means, the President has become the most powerful figure in American politics, defying checks and balances to reach the power of a unitary executive.

**Neural Correlates of Comorbid Affective Disorders**

*Aava B Jahan, 2019, Biopsychology*

*Lisa Shin, Department of Psychology*

The Multi-Source Interference Task (MSIT) is widely employed to investigate the neurocognitive mechanisms underlying conflict resolution. This paradigm is informative about the neural correlates of interference inhibition. However, there is limited knowledge regarding the overlap in specific symptoms and neural activity, across comorbid psychiatric conditions. Hence, our current goal is to investigate the group dynamics of a comorbid psychiatric cohort, on the basis of specific symptomatology. We will initially employ the MSIT, in conjunction with functional magnetic resonance imaging (fMRI), to determine the neural correlates of cognitive interference. For this analysis, we identify the dorsal anterior cingulate cortex (dACC), dorsolateral prefrontal cortex (dlPFC), and the posterior parietal cortex (PPC) as our regions of interest (ROIs). Given the diagnostic heterogeneity, we will perform subsequent correlations between fMRI data and the self-report scores from the Anxiety Sensitivity Index (ASI), and Quick Inventory of Depressive Symptomatology (QIDS). This will enable us to examine relationships between brain activation
during cognitive interference and cross-diagnostic psychometric measures. We hypothesize that the correlates of interference will differ for the psychiatric compared to the healthy group, resulting in distinct patterns of neural activity in the predefined substrates.

**Ethnic Identification and Political Mobilization among Brazilians in Boston**

*Paulina Jedrzejowski, 2019, International Relations, Economics, Portuguese (minor)*

*Cristiane Soares, Romance Languages Department*

This study analyzes the possible relationship between the lack of political mobilization among Brazilians living in the United States and the difference in how American, Brazilian, and Hispanic organizations ethnically classify Brazilians. Some authors propose that Americans and Hispanics classify Brazilians as Hispanics. Others have shown that Brazilians do not always agree with the ethnic categorization with which American society classifies them. Furthermore, most studies associate the absence of political mobilization among Brazilians with aspects of the Brazilian culture, history, and politics. None of them, however, consider the issue of ethnic classification as a possible contributor to the lack of political mobilization among Brazilians. This study builds on the existing research by addressing two research questions: Is there a difference in how American, Brazilian, and Hispanic organizations ethnically classify Brazilians? If so, how can this difference in ethnic classification affect the political mobilization of Brazilians? Nine organizations located in the Boston area participated in this research. Participants from three American, three Brazilian, and three Hispanic organizations that provide services to these specific populations were interviewed. Results suggested that there is, in fact, a difference in how American, Brazilian, and Hispanic organizations ethnically classify Brazilians and that this difference affects the political mobilization of Brazilians. These findings may have significant implications for the Brazilian community. Acknowledging this relationship may lead Brazilians to view their ethnic identity in a more informed way. This research also adds value to the existing research on the Brazilian diaspora, immigrant political mobilization, and racial issues in Boston.

**Attitudes Towards Vaping and Marijuana Among Latinx Youth**

*Dominique A Kaempf, 2019, Biochemistry; Spanish*

*Nancy Levy-Konesky, Department of Romance Studies*

There have been many changes in the realm of substance use in recent years. The use of e-cigarettes, also known as vaping, was nearly unheard of just a decade ago but has become prominent in today’s society. This device was originally marketed towards current smokers but has become quite pervasive in young adult populations. In addition, more states, including Massachusetts, have begun to legalize the use of marijuana for both medicinal and recreational use. The extent to which this impacts perceptions about marijuana is not yet fully understood. This study aims at investigating attitudes towards marijuana and vaping among Latinx youth. Participants’ engagement in these behaviors as well as their general understanding of marijuana and vaping were examined. We sought to determine if they had favorable perceptions of these behaviors, as well as what factors influence those perceptions. We compared the responses of Latinx youth to their non-Hispanic peers to explore the role culture may play in substance use and substance use perceptions. In addition, analysis was performed to discern the similarities and differences among immigrant and non-
immigrant Latinx youth. This research focused specifically on middle and high school aged youth in the East Boston community. The research was performed in collaboration with the East Boston Alliance for Substance Use Treatment, Intervention and Education Coalition (EASTIE) of the East Boston Neighborhood Health Center.

**Effect of Time Manipulation on the Physiological Response to Apnea**

*Anna G. Kapral, 2019, Biology; Community Health*

*Hannah J. Vigran, 2020, Biology*

*Eric Tytell, Mimi Kao, Biology*

In this study, we examined the relationship between time manipulation and the physiological response to prolonged breath holding or apnea by having participants (n=33) hold their breath while watching to a skewed timer which made it appear as though time was moving either faster or slower than normal. It was hypothesized that the onset of the physiological breaking point would correlate with perceived time and not with actual time. The physiological breaking point refers to onset of involuntary breathing movements triggered by elevated CO2 levels. The results of this study demonstrate that time perception can be successfully manipulated using a skewed timekeeper. From a more physiological perspective, results demonstrate that maximum apnea duration, the onset of the physiological struggle phase, and duration of the physiological struggle phase correlate with perceived time and not with actual time. From a macroscopic perspective, this study may lead to new lines of thinking about impact of psychological factors on physiological processes that were once thought to be solely under biological control.

**Phosphotyrosine Mimicking Inhibitors of the Src Homology Phosphatase 2**

*Eriko Koide, 2019, Biochemistry*

*Joshua Kritzer, Chemistry*

Phosphotyrosine recognition domains are found in a large number of proteins that participate in a diverse range of signaling networks in the human body. Therefore, these domains are attractive targets for development of inhibitors to serve as therapeutic and investigative probes. However, phosphotyrosine is poorly cell permeable due to its multiple negative charges, and it is prone to dephosphorylation when introduced to cells in a foreign molecule. To address these issues, it is necessary to use minimally charged and stable phosphotyrosine mimetics. In order to develop such a mimetic, we decided to study the Src Homology Phosphatase 2 (SHP2) protein; SHP2 is a protein tyrosine phosphatase (PTP) that has an autoinhibited form with a loop binding its catalytic domain. Its crystal structure indicates the loop is binding the catalytic domain by mimicking phosphotyrosine; this suggests the loop sequence could be harnessed as an independent peptide to inhibit SHP2. This would be the first report of the use of a naturally occurring autoinhibitory loop sequence to inhibit a protein tyrosine phosphatase. In order to test this hypothesis, SHP2 will be expressed and purified to develop an inhibition assay using 6,8-difluoro-4-methylumbelliferyl phosphate (DIFMUP) substrate. Following assay development, a peptide derivative of the autoinhibitory loop will be tested for SHP2 inhibition. If inhibition is observed, the critical residues in the loop sequence will be determined via alanine scan. Finally, rationally designed peptides derived from the loop will be tested for increased potency of inhibition of SHP2.
Psychopathology and anxiety outcomes in female anorexic exercisers and nonexercisers
Megan C Kuhnle, 2019, Community Health: Spanish
Jennifer D. Allen, Community Health

Anorexia nervosa (AN) is a serious eating disorder that causes extreme weight loss and has severe physical and psychological ramifications. It is more prevalent among females than males and 1.2% of females in the United States will be diagnosed with AN at some point in their lifetime. AN is often seen with depression and anxiety as comorbidities and has the highest mortality of any psychological disorder. Excessive exercise is frequently implicated as part of an AN diagnosis and understanding the role exercise plays in the psychopathology and anxiety outcomes of AN patients is essential in order to optimize treatment strategies and understand the best way to incorporate exercise as part of recovery. Data were analyzed from four studies conducted in the Neuroendocrine Unit at Massachusetts General Hospital to better understand the relationship between exercise and eating disorder psychopathology and anxiety outcomes among anorexic exercisers and nonexercisers. We found no significant difference between eating disorder psychopathology as measured by the EDE-Q between exercisers and nonexercisers. Exercisers were found to have significantly lower anxiety levels as measured by the STAI-Trait compared to nonexercisers. Among exercisers, the number of hours per week exercised was significantly positively related to an increase in eating disorder psychopathology (EDE-Q). Statistically significant results were found with p<0.05. The results of this study indicate that exercise is an important factor to consider when evaluating the mental health of patients with AN and should be further examined to determine appropriate recommendations for exercise regimens during treatment for AN.

How do we handle Nazi Art? Contemporary theories on how to display Nazi Art and Iconography
Libby Langsner, 2019, Art History
Eva Hoffman, Tufts Art History

My work discusses the different methods contemporary artists and architects alike have grappled with as related to Nazi art and imagery. I will also discuss the iconoclastic aspects of these works and theories such as "counter-preservation," and how they are repurposed by artists from all over the world. Some of these appropriations are simply inflammatory, while others can result in a meaningful dialogue. Some of the questions I’m trying to answer are: what do we do with this art and imagery? How does this art help us form new ways of understanding the past? We have the option to never engage with these images -- what are the implications of concealing them? Who has the authority to be iconoclastic and who does not? Through my research, I look at art created and displayed by Germany during the Second World War and how it has been displayed after the war, as well as contemporary artists who engage with Nazi imagery. I also look at various theories about monuments and different approaches as to how we should commemorate the victims of the Holocaust. I will also posit my own conclusions on how Nazi art should or shouldn't be displayed, and how art can combat the reincarnation of this virulent ideology.
Understanding Italian-American Identity through Intergenerational Interactions in an Ethnic Core
Christiana Lano, 2020, Sociology
Helen Marrow, Sociology

I studied how two groups of Italian-Americans within and surrounding New Haven, Connecticut, one of the remaining "cores" (Alba and Nee 2003) of Italian immigrant settlement, relate to their ethnic identity. Grounded in classic and new assimilation theory, we know from existing literature that Italian Americans assimilated structurally into the American mainstream over the course of three to four generations (Alba 1990; Alba and Nee 2003; Lieberson 1980), but did not lose their ethnic identity along the way. Rather, because of successful assimilation, that ethnic identity transitioned, over time, from "thick" and substantive to "thin" and symbolic (Gans 1979; Waters 1990). I conducted ten semi-structured interviews with Italian-Americans who live in the New Haven area over the summer of 2018. Their ages spanned from 18 to 94 and their generational status spanned first-generation to fourth-generation. I started a preliminary literature review and began to transcribe and analyze my interviews for themes. My preliminary findings reveal differences and similarities between how the older generational cohort (first- and second-generations) versus the younger generational cohort (third- and fourth-generation) interact with their ethnic identity in ways that are both similar and different. The older generational cohort prioritized their Italian identity over their American identity and had grown up in predominantly Italian neighborhoods, while the younger generational cohort expressed interest in their Italian identity in reaction to exposure to other ethnic identities. Members of the older generations expressed anxiety that aspects of their lived Italian ethnic identity such as child-rearing practices, cooking, and language and dialect would dissipate through subsequent generations. Members of the younger generations, however, expressed a strong desire to learn these cultural traditions and wished to cultivate a strong sense of ethnic identity in their families as well.

Geothermometry of Acadian Metamorphic Rocks in Massachusetts: Re-examining the Established Geothermal Gradients in Southern MA
Brandon M Levenstein, 2019, Geological Sciences
Jennifer Axler, Department of Earth and Ocean Sciences

New geothermometry of Acadian metapelites in south-central Massachusetts shows that peak metamorphic conditions reached significantly higher temperatures than previously reported. Prior geothermometry in the region used the Fe-Mg exchange thermometers to establish peak temperatures. Retrograde re-equilibration of Fe and Mg in minerals makes it difficult to preserve peak temperatures as high as the ones reported in this study. By using thermometers that are more robust at high temperatures, more accurate peak temperature measurements can be made. This study used ternary feldspar thermometry as it has shown to preserve higher grade conditions. Ternary feldspar reintegration using the activity models of Benisek et al. (2004; 2010) of antiperthite from the Southbridge and Wales quadrangles shows that peak temperatures ranged from 750-1000 °C over a ~9 km transect across the NE-SW striking units. Multiphase inclusions in garnet were also found in the study area, which have only been reported in two localities worldwide. This study extends a previously found ultrahigh temperature (UHT) metamorphic zone found in northeastern
Connecticut into southern Massachusetts. This expands the only regional UHT metamorphic zone in the United States.

**Technical and political assessment of rooftop solar on multi-unit residential buildings in the United States**

*Myisha S. Majumder, 2021, Civil Engineering Quantitative Economics*
*Deborah Sunter, Department of Mechanical Engineering*

Despite rapidly falling prices of photovoltaics (PV) [1] and dramatic growth in the rooftop PV industry [2], the opportunity for rooftop PV on multi-family residential buildings has been largely unrealized in the US. Multi-family housing poses particular challenges, such as the split incentive scenario between building owners and tenants. In this study, we examine the disparities in rooftop PV adoption between single-unit housing and multi-unit housing to better assess the lost opportunity. Aerial images from over 60 million buildings in the US from Google Project Sunroof [3] detect both the potential and existence of rooftop PV. This data is combined with data on the number of single-unit and multi-unit residential buildings in each census tract from the American Community Survey [4]. We apply the LOWESS (locally-weighted scatterplot smoothing) method [5] to fit local linear relationships between the fraction of multi-family buildings in the census tract and both the rooftop PV potential and adoption. We use the bootstrap method [6] with a 1,000 replicas to compute the 90\% confident interval. To explore rooftop PV potential, we compare the fraction of buildings that could support rooftop solar (roofs with sufficient space, without excessive shading or slope) [7] to all buildings in the census tract. As a result of data analysis, we see negligible difference in potential for rooftop PV regardless of how many multi-unit buildings are in the census tract. However, when the relative, state-normalized deployment is analyzed, we find a dramatic reduction in rooftop solar deployment with an increased presence of multi-unit buildings. Census tracts dominated by multi-family units install less than half as much rooftop PV than single-unit dominated census tracts. To address this missed opportunity, we review several solar policies and incentive programs that have been created to encourage rooftop PV deployment in multi-unit buildings.

**Challenges and limitations of nationally representative census and environmental health data as illustrated by two case studies to predict urogenital schistosomiasis and diarrheal disease in Ghana**

*Alina McIntyre, 2019, Community Health; Spanish*
*Karen Kosinski, Community Health*

Multiple studies in high-income countries have used health data in combination with nationally-representative data to assess relationships between health, environmental, and sociodemographic variables. However, similar studies for low-income countries are limited, and a systematic analysis of associated data limitations has not been conducted. We explored data-related challenges by conducting two main case studies in Ghana. Census data extracted from the 2010 Population and Housing Census, urogenital and diarrheal disease data secured from the District Health Information Management System (DHIMS), and spatial data were acquired at the district level. Data were merged to generate summary statistics, maps, and conduct regression analysis. We found various patterns in
the census and disease data: open dumping of solid waste and open defecation were common practices (46.2±18.8%; 31.2±29.9%, respectively). The most commonly used drinking and domestic water sources are boreholes / pumps / tubewells (32.5±20.8%; 31.9±19.5). Energy fuel sources such as kerosene and wood were common and highest in rural, northern parts of Ghana. Both diarrheal disease and UGS counts are somewhat high and scattered throughout Ghana. Major limitations are to the accessibility, quality, and interpretability of the data. Key issues include a lack of publicly available raw data, the absence of contextual metadata information, and inconsistent district name standards. Regression models remain to be run. These data limitations are not unique to Ghana; future research should focus on efforts to make data freely downloadable and higher quality in terms of both raw metadata and contextual documentation. Increasing local technological capacity in low-income countries can enable researchers to draw significant conclusions in environmental health at both a national and international scale.

The relationship between abundance and phenology in Massachusetts Butterflies
James Michielini, 2019, Biology; Environmental Studies
Elizabeth Crane, Biology

Global Climate change is known to have various behavioral effects on different species. Animals have been observed expanding ranges northward and upward in altitude. As insects with annual life cycles that are regulated by temperature, butterflies are an excellent species to study the effects of climate change. Here we use data from The Massachusetts Butterfly Club from 1991 to 2017 to investigate how butterflies in Massachusetts are changing their phenology, the annual timing of life stage changes (e.g. emergence in spring and entering diapause for winter etc.). We also examine how these changes in phenology relate to population changes over time. Understanding how species are responding to climatic changes over time and how those changes affect the population of communities is critical to identifying which species are threatened by climate change. Our study of 84 butterfly species suggest that species are responding differently to changes in climate and those changes have implications on the abundance of species. Species that are extending their flight period (i.e. emerging earlier in the spring and continuing flight into the fall) appear to be increasing in abundance relative to species that are not responding to climate change. Butterfly species which are extending their flight period have several advantages over others; they may have access to more plant resources over the extended growing season and might even be able to have another generation of offspring within the year. Our results support this reasoning as the butterflies which appear to be significantly increasing their flight period are multivoltine species, those which have multiple generations per year. These results suggest the mechanism by which some species are more adaptable to climate change than others and can therefore inform future research and conservation for both butterflies and other insects.
Fruit and Vegetable Consumption Patterns Among Followers of Popular Diets

*Akari Miki, 2019, Biochemistry*

*Nicola McKeown, Nutritional Epidemiology Program*

Co-authors: Micaela C. Karlsen¹,², Kara A. Livingston², Gail Rogers², Nicola M. McKeown¹,²
¹Friedman School of Nutrition Science and Policy, Tufts University
²Jean Mayer USDA Human Nutrition Research Center on Aging, Tufts University

Interest in popular diets, such as Paleo, Mediterranean, vegetarian and whole food plant-based (WFPB), continues to grow. These diets vary in macronutrient intake and food composition; however, a commonality among them is that they are all rich in fruits and vegetables. The degree to which overall diet quality varies across these different diets is unknown. The factors that motivate popular diet followers to initially select a diet and, ultimately, adhere to the diet long term are also unknown. In 2015, the Adhering to Dietary Approaches for Personal Taste (ADAPT) Feasibility Survey recruited 13,787 self-identified followers of popular diets via social media. From this cohort, we recruited approximately 2,100 participants to complete 17 online questionnaires (demographics, lifestyle, behavior, and health) over a 6-month period in 2017. This presentation (1) examines the contribution of fruits and vegetables to overall diet quality across popular diets and (2) identifies common factors that motivate adherence to these diets. Individuals adhering to WFPB had the highest mean Healthy Eating Index 2015 score (77), followed by those adhering to vegan (76), Mediterranean (74), vegetarian/pescatarian (72), “Try to Eat Healthy or no diet” (67), or Paleo (62) diets. Individuals adhering to WFPB also had the highest daily mean vegetable and fruit intakes in cup-equivalents (7.0 CE and 3.1 CE, respectively), followed by those adhering to vegan (6.1 CE, 2.8 CE), Mediterranean (4.2 CE, 2.3 CE), vegetarian/pescatarian (4.5 CE, 2.1 CE), Paleo (5.3 CE, 1.5 CE), or “Try to Eat Healthy or no diet” (3.2 CE, 1.7 CE). Although people identify as trying to eat healthy, fruit and vegetable intake is lower compared to other diet patterns.

Cultural production in Morocco

*Alessandra G Moreno, 2021, Political Science; Middle Eastern Studies*

*Heather Barry, Institute for Global Leadership*

Over Spring Break, funded by the Institute for Global Leadership, I traveled to five cities in Morocco to study the relationship between the government and the production of culture in Morocco with a focus on visual art. Through conducting interviews with professors, curators, and artists and visiting a multitude of galleries and museums, I learned that, contrary to popular belief, there is a real lack of dialogue and funding going towards the arts in Morocco. In an effort to combat the decline of artistic production encouraged by public institutions, privately funded organizations have appeared to try to salvage the art scene.
Molecular Design of Peptides to Address Growth Deficiency in Children

Albert Mousad, 2020, Biochemistry; Psychology
Krishna Kumar, Department of Chemistry

The prevalence of growth hormone deficiency (GHD) has been estimated to be approximately 1:4000 in children, with clinical presentations of GHD often manifesting as slowed growth, lowered muscle mass, and in some cases pituitary dwarfism. The prevailing current standard for treatment of GHD is the use of expensive daily injections of recombinant growth hormone, however a superior treatment would feature less frequent administration with restoration of endogenous production and pulsatile secretion. A potential route to such a treatment is by the stabilization of the human growth hormone-releasing hormone (hGHRH) peptide. hGHRH is a 44-amino acid hormone produced in the arcuate nucleus of the hypothalamus, whose main role is to stimulate the pituitary gland to produce and release GH into the bloodstream. hGHRH appears to be a viable candidate for stable peptide therapeutics for GHD, however the peptide is rapidly cleaved by the protease DPP-4, which leaves the peptide completely inactive of its receptor (half-life of approx. 6-8 minutes). To produce a longer-acting hGHRH derivative, I have synthesized analogues of hGHRH with N-terminal modifications in an effort to promote resistance to DPP-4 degradation, while still activating its receptor with comparable potency. These hGHRH analogues were produced through a reductive amination procedure using aldehydes carefully selected to assess aspects of the peptide-receptor interaction not concretely tested before. Creating two peptides, one to test for steric influence, synthesized using adamantane-1-carbaldehyde, and the other to test for the influence of charge, synthesized using (2S) 2-aminopropanal (L-alanine aldehyde), allows for further investigation into the peptide-receptor interaction and perhaps even provide a more potent analogue that can lead to the hopeful deliverable of this project: a stabilized peptide that can then be then taken to undergo animal and human clinical trials as possible hormone therapy treatment for growth hormone deficiency and pituitary dwarfism.

Examining Massachusetts Teachers' Knowledge and Beliefs about Dyslexia

Katelyn Mullikin, 2019, Community Health; Child Development
Karen Kosinski, Department of Community Health

Dyslexia is a learning disability that affects children’s ability to acquire fluent and accurate reading, spelling, and decoding skills. Children are not typically diagnosed with dyslexia until the third grade after they have had a few years of formal reading instruction; however, at this point, children may already be falling behind or failing. Despite the often late diagnosis age, signs and predictors of dyslexia can be seen as early as preschool and kindergarten. Early intervention is critical in effectively improving dyslexic students’ reading skills and helping them achieve a reading level closer to that of their peers. It is necessary to understand what teachers of young children know and believe about dyslexia, and what misconceptions they may hold about the condition or about working with students with dyslexia. This study addressed this need by surveying the knowledge and beliefs of pre-kindergarten, kindergarten, and first grade teachers from public school districts in Massachusetts. Teachers completed a knowledge-based survey about dyslexia and answered questions about perceptions of their own knowledge and ability to support students with dyslexia. Results show that teachers hold misconceptions about causes, characteristics, and diagnostic criteria
for dyslexia, but many have a good understanding of appropriate teaching and classroom management strategies. Linear regression models show that teachers’ confidence and preparedness in their ability to work with dyslexic students is significantly associated with their demonstrated knowledge of dyslexia. This thesis raises awareness about the needs of dyslexic students and the teachers who work with them, and it demonstrates the need for better teacher preparedness and training, along with improved professional development targeted specifically at dyslexia.

**Big Data in Practice: An Exploratory Analysis of New York City Parks Usership**

*Sean M Murphy, 2020, Civil Engineering*

*Uku-Kaspar Uustalu, 2019, Computer Science; Environmental Studies*

*Shan Jiang, Urban and Environmental Policy and Planning*

The data revolution is underway and has the potential to revolutionize the field of urban planning. Novel sources of big data allow researchers to better understand how people interact with the urban environment and help design more human-centric public spaces. Smartphone geolocation records can be aggregated to reveal population movement patterns and visitation rates, social media feeds can be incorporated with machine learning techniques to assess how urban spaces make people feel, and data on public transportation usage indicates how city dwellers prefer to get around. This project, in partnership with the New York City Department of Parks and Recreation, attempts to utilize some of these new sources of big data to better understand, and be able to predict the usage patterns of New York City Parks. The exploratory analysis investigates the temporal and geospatial patterns of park usership and attempts to explain the underlying driving factors. A spatiotemporal analysis of visitation data is conducted and incorporated with various big datasets like demographic census data, weather and public event logs, park maintenance records, information on park amenities, public transportation usage data, and the urban metrics of the immediate surroundings of the parks to isolate the causes of variance in usership. A sentiment analysis is performed on geotagged social media posts to determine how parks affect the happiness levels or urban residents and a visual dashboard is developed to allow for better exploration of the available data. The findings provide crucial insight into the usership patterns of New York City parks, help determine areas in need of further research, and can be used to model park usage to better allocate available resources and aid the design and development of public spaces.

**What is a Ghanaian gallery?: Art spaces in Accra and The Potential of the museum space for decoloniality**

*Jade Yaa Addae Nantwi, 2019, International Literary and Visual Studies*

How does the way Art is displayed influence who can engage with it? In this thesis, I follow the trajectory of museum and exhibition culture in Ghana. I investigate how exhibition architecture can resist museums’ colonial and exclusive history, through the history of the accra art scene, topography and the present day art landscape.
Kestrels on the Decline; Analyzing Landscape Correlates with Nest Box Occupancy in American Kestrels
Annie Nguyen, 2019, Biology; Environmental Studies
Dr. Michael Reed, Tufts Biology

The American Kestrel (Falco sparverius) weighs in at about 80-160 grams and is roughly the size of a mourning dove or a blue jay, registering it as one of the smallest raptors in North America (Smallwood et al. 2002, Birds of North America). They are known to be common and widespread in their range, spanning over the entire North American continent—unfortunately, these birds face a declining population, with reports showing as much as a 12 percent decline in some regions over a ten year period (USGS Breeding Bird Survey). The causes for these declines are currently unknown, although there is some speculation on causes like habitat loss, pesticide use, predation, and competition from other species like European starlings (Sturnus vulgaris). This study aims to investigate features in the landscape that may correlate with numbers of nesting American kestrel breeding pairs, using nest box data obtained from conservation programs in 4 different states and different land coverage maps using GIS (Geographic Information Systems). By understanding the rates in nest box occupancy in American Kestrels and how features in the landscape can impact their success, we may be able to make better informed decisions about the placement of these nest boxes to better aide their population.

Exploring Policy Conditions for Cyber Deterrence: A Case Study of Estonia
Lionel Oh, 2020, International Relations; Computer Science
Michael Beckley, Political Science

This paper seeks to study the policy conditions for successful application of deterrence in cyberspace. The traditional concepts of deterrence are difficult to apply to cyberspace, yet as cyber becomes an increasingly more prominent domain of conflict, an understanding of the applicability of these concepts is crucial. Classical deterrence has always been closely associated with a Cold War-era nuclear context, and its translation to cyberspace will require a broader approach to account for changes in the nature of the domain. With its experience of a large-scale cyberattack in 2007, Estonia provides an insightful case study that demonstrates the necessity for such a holistic conception of deterrence, at both the international and domestic levels. I analyze how Estonia has managed to implement a deterrence framework by denial, multilateral cooperation and promotion of international norms, and an increase in societal strength and resilience among its population.

Politicization of Migration in Morocco
Arjun U Padalkar, 2021, Quantitative Economics; International Relations
Emilio Spadola, Department of Anthropology

Morocco’s colonial history as a Franco-Spanish protectorate till 1956, coupled with Morocco’s geographical position in Northern Africa, has made migration of Moroccans to Europe a continuous phenomenon. However, since the turn of the century, the rising number of Sub-Saharan migrants seeking economic opportunities or refuge in Morocco has risen. A majority of these migrants have used Morocco as a transit hub before being smuggled into Europe across the Strait of Gibraltar.
Europe’s perceived threat of rising illegal immigration and refugee applications since 2015 has been exacerbated by Spain’s fear of a migrant crisis brewing at its borders. Morocco has thus evolved as an intermediary between Sub-Saharan migrants and their final port of arrival in Europe. My research explores the possibilities of Morocco benefitting from being a transit country and using migration as a tool to gain political and economic advantages. Since the end of the protectorate, Europe has maintained strong diplomatic ties with Morocco due to their close proximity, competition for industries such as fishing and agriculture, movement of skilled and unskilled labor, and the presence of the Spanish autonomous enclaves of Ceuta and Melilla in Northern Morocco. The European Union (EU) invests heavily in Moroccan education and industries. In exchange, the EU expects Morocco to tighten their emigration laws and prevent Sub-Saharan migrants from arriving in Europe. Politically, Morocco coerces Europe to support their right to the disputed Western Sahara and their reunification with the African Union with the threat of rising immigration in Europe. As an African country, Morocco benefits from the steady supply of economically motivated migrants who are employed in service sectors. Thus, my research concludes that migration of Sub-Saharan migrants to Morocco has benefitted Morocco economically and politically.

**Mining Transportation Patterns for the Boston Region through Big Data**

*Spencer Perry 2019, Computer Science*

*Emerson Wenzel, 2018, Computer Science*

*Shan Jiang, Department of Urban and Environmental Policy and Planning*

Modern urban mobility models rely on painstakingly obtained travel surveys for their calibration. While highly detailed, these surveys have small sample sizes, and due to costs, can only be collected every five to ten years. These drawbacks and more make it difficult to create accurate models that can inform policymakers or analyze recently made policy decisions. Boston was recently ranked in 2018 by the research firm INRIX as having the worst rush hour traffic of any U.S. city, with an average of 164 hours spent in the rush-hour per driver. From this reality, a need arises for new models that incorporate alternative data sources to better inform planners and engineers about transportation system planning decisions. The current state of the art research in the field utilizes location-based (LB) data (e.g., GPS, or triangulated mobile phone data), which holds several advantages over travel surveys. LB mobility records operate on the magnitude of millions of devices and contain travel trajectories at high fidelity, offering the opportunity to gather a more powerful image of traffic patterns and can answer questions related to traffic analysis and congestion irregularities. In this research, we utilize big data sets from various technology companies, including location-based mobile app data as well as GPS-based navigation data, to estimate traffic patterns in the Boston metropolitan area for multiple months. The research findings shed lights on insights that can be directly applied to inform transportation policy in the metropolitan region and mitigate congestions to support future sustainable transportation planning.
Indigenous-Led Anti-Extraction Movements in the Ecuadorian Amazon

Alexa Reilly, 2019, Biology; International Relations
Paul Joseph, Sociology

This paper looks at factors affecting the outcomes of indigenous social movements against the extraction of subsurface resources in the Ecuadorian Amazon. Since the late 1960s, oil extraction has been an important part of the Ecuadorian economy and the land of indigenous peoples of the Amazon region continues to be sold to corporations which plan to extract oil and other resources. In response, there is a widespread movement against extraction in the region. I asked what the goals of people participating in the movements are, what factors affect whether the goals are met, and what outcomes participants experience beyond "success" and "failure." To answer these questions, I analyzed the anti-extraction movement in both the northern and the central-south Ecuadorian Amazon from 1980-2007 and compared these findings to an analysis of the movement in the central-south region today. I conducted interviews and used news sources, secondary literature, social media, and documentaries to address my questions. I found that in addition to the central goal of removing extractive corporations from indigenous land, participants also wanted fairer sharing of oil profits, safer extraction techniques, and more transparent information from corporations and the government. Factors analyzed included framing strategies, alliances, general tactics, and external factors. Results suggest that external factors like government leadership and company contract terms have the largest effect on degree of success within this movements. In terms of non-demand related outcomes, participants in the movement reported gaining an understanding of and unity with other indigenous peoples in the movement and gaining valuable skills that could be transferred to use outside of the movement. However, participants in recent years have also been at increased physical danger as a result of their participation. I hope these results can play a role in informing people who are participating in the Ecuadorian anti-extraction movement or those who may want to participate in the future.

Understanding the Experiences of Immigrant Families within Somerville Public Schools

Emily E Riseberg, 2020, Community Health; Mathematics
Joel Alves, 2019, Community Health major, Portuguese minor
Madeleine Beirne, 2021, Peace & Justice Studies and Community Health, Urban & Environmental Policy and Planning minor
Ashley Benitez, 2020, Community Health major, Italian minor
Nicole Carzo, 2020, Biology and Community Health
Stacy Chen, 2021, Community Health and Economics
Brendan Corwen, 2019, Community Health major, Food Systems & Nutrition minor
Raul Gomez, 2020, Community Health and Latino Studies
Travis Gordon, 2019, Community Health
Alexa Griffiths, 2020, Community Health and Biology
Nicole A. Masozera, 2019, Community Health and French
Justin Mills, 2020, Community Health and Economics
Ben Rutberg, 2019, Community Health
Jenna Troccoli, 2020, Community Health major, Entrepreneurship minor
Hannah Truslow, 2020, Community Health and Economics major, Entrepreneurship minor
Massachusetts is consistently ranked best in K-12 education in the United States by the National Assessment of Educational Progress; however, immigrant students experience disparities in educational outcomes. Data from Somerville, an urban community in Massachusetts, shows an average four-year graduation rate of 54% amongst English-language learners, significantly lower than 84% in native speakers. To understand factors contributing to disparities, The Welcome Project (TWP), a Somerville-based nonprofit focused on building the collective power of immigrants, initiated a research collaboration with undergraduates and their instructor in the Department of Community Health at Tufts University. Using a community-based participatory research (CBPR) approach, we collected qualitative data to understand the experiences of immigrant families with children in Somerville public schools. This was achieved by interviewing parents in immigrant families with children in the Somerville school system as well as stakeholders in the community. While interviewees highlighted many positive aspects of living in Somerville, they also identified a need for better communication between parents and teachers in the school system and greater cultural understanding of immigrant families. The research team will share key themes from these interviews in this presentation as well as methods in which this information is being distributed more widely in the community in order to support immigrant families in navigating the school system in Somerville.

Morocco as an Orientalist Setting in Western Modern Art
Eran Sabaner, 2019, Art history; film and media studies
Emilio Spadola, Anthropology

Since the dawn of modern art, Morocco has been depicted as an “exotic” place by European artists, most notably the post-impressionist artist Henri Matisse. In close proximity to Europe yet regarded as “primitive” and “mysterious” by imperial powers, Morocco inspired many to break free from the traditions of Western art and to redefine its conventions. Yet by doing so, it defined the East as the “other,” or in complete opposition to the West. European art’s relationship with the West is best explained by Edward Said’s description of imaginative Orientalism, in which the binary of the East and West serves as a model for the creation of Western literature, poetry and the arts. In his book Orientalism, Said elaborates on the “imagined Orient” by examining the literature of French romantics, yet the tradition of exploiting the East for Western artistic production has been continuing for a long time. Long after the French Orientalists, renowned photographer Irving Penn produced “ethnographic portraits” of the Moroccan people. In Penn’s photography, Moroccan culture is stripped away from its Moroccan subjects and presented in a way that supports the “imagined” Orient. Today, Morocco continues to capture the interest of Westerners. In fact, Morocco has become a top tourist destination and Marrakesh has become one of the top art hubs of the African continent. Although such phenomenon benefits the Moroccan economy, it also regenerates the Orientalist tradition of depicting the East as the “other.” This is in contrast with the contemporary Moroccan artists’ efforts to portray their culture in a more authentic light. The pop artist and photographer Hassan Hajjaj’s portraits of contemporary Moroccans resist Orientalist
tropes by displaying its subjects in colorful ways. Similarly, artist Lalla Essaydi counter Orientalist
depictions of Moroccans by giving agency to her photograph’s subjects (usually herself) and
explicitly parodies Orientalist tropes. Her work actively re-expropriates Moroccan culture from the
West.

An Unsupervised Approach to Identifying Gentrification in Providence, RI
Eva Sachar, 2019, Applied Mathematics; Computational Economics
Jeffrey Zabel, Economics

The recent resurgence of gentrification has led to debate between economists, urban developers,
public policy players, data scientists, journalists and residents with various perceptions of
gentrification as they unravel its relationship with both revitalization and
displacement. Gentrification is a type of multi-dimensional neighborhood change composed of
events related to socio-economic and demographic changes, displacement, and reinvestment. While
variables such as rent, household income, race, and education level are commonly accepted as
gentrification markers, I hope to broaden the analysis of gentrification by demonstrating that there
are more metrics that are significant in the identification and analysis of gentrification. In particular,
understanding what factors give rise to gentrification in weak market cities can shed light on what
makes these cities attractive and to whom. And thus, we can make more informed inferences on
how gentrification will occur in and influence these cities, preparing both residents and policy for
subsequent changes. I choose to analyze Providence, RI because of its unique position in terms of
demographic and socioeconomic distributions, housing market, and revitalization efforts. I apply
Latent Profile Analysis, a machine learning algorithm, and incorporate temporal and spatial
components to Census data from Providence to demonstrate the complexity of gentrification so that
we can begin to understand the nuances of this phenomena. Current techniques for the analysis and
prediction of gentrification are trained on systematic facts about the evolution of neighborhood
change; broadening our approach to measuring gentrification will strengthen how we identify and
analyze it as well.

Examining Stereotype Threat Internationally
Supriya Sanjay, 2019, Cognitive Brain Sciences; Computer Science
Keith B. Maddox, Tufts University Psychology Department

Stereotype threat has been shown to decrease math performance in women and has been proposed
as a potential explanation for the gender gap in mathematics achievement that exists internationally.
We hypothesized that stereotype threat would cause performance impairments in female students in
the Spanish Baccalaureate program and that their levels of stereotype endorsement would not affect
their performance. Based off data from (n=90) participants in Catalonia, Spain, we were not able to
confirm that stereotype threat impaired girls’ performance and instead found that, in a subset of the
data, boys’ performance was impaired. The data also suggest that stereotype endorsement did not
have an affect on performance. This study serves as an initial foray into the international
investigation of stereotype threat and suggests that while stereotypes do seem to affect cognition,
more international research needs to be done to better understand these mechanisms.
Pakistan is one of the most water stressed countries in the world. It is predicted that the nation will be water scarce by 2025. A critical element of many Pakistani's understanding of the water crisis is that it is ostensibly caused by India, their upstream neighbor who "stop" the flow of water into Pakistan. We wanted to understand the validity of this claim, the legal mechanisms of transboundary water sharing, and what Pakistan's water crisis truly was. Over the course of the research, we analyzed the effects of the 1947 Partition of the Indian subcontinent on the Indus Basin, Pakistan's need for protection as the lower riparian of the Indus River through the 1960 Indus Waters Treaty, technical issues related to Indian dam design, as well as the securitization and politicization of water. We also wanted to understand the nature of Pakistan's domestic water crisis. We did this by understanding the post-colonial effects of the 1873 British Canal Act on contemporary Pakistan, unpacking the term “water scarcity,” analyzing the role of agriculture in water resources, understanding the pricing of water, and evaluating the effectiveness of Pakistan’s push for the construction of dams. The project is best described as being “larger than the sum of its parts.” It was incredible that we, as an Indian and a Pakistani, got to conduct field-research in Pakistan together on a topic that affected both of our countries. For many Pakistanis, Atrey was the first Indian they had ever interacted with due to restrictive travel mobility stemming from sour relations between the two countries. We had hoped that on top of having an incredible learning experience, we could play whatever small part we could in deepening people-to-people relations between our two countries.

This study explores the intersection of three previously separate research topics — the relationships between environmental knowledge, identity, and behavior; the role economic status on environmentalism; and the benefits of green multifamily housing. The interaction of these concepts is important because of current trends in both the market-rate and affordable housing sectors toward sustainable building practices, and little is known about whether environmentalists seek out green housing and/or if green housing increases residents’ environmentalism. Through a survey of 120 residents of green-certified multifamily housing in the Boston area, this study found residents show similar relationships between environmental knowledge, identity, and behavior as previously studied general populations, and that income is positively correlated with environmental identity but not behavior. As for housing, residents are not extremely knowledgeable of but still identify with the green features of their buildings, especially residents of market-rate buildings. Such features are not the most prevalent factor in residents’ decision to live in their current apartment, though. These findings suggest that the market-driven and government-incentivized trends in green building are beneficial as a way of making sustainability the status quo for housing and indirectly encouraging environmental behavior for all.
Changes in Macrophage Metabolism in Response to Pro- Inflammatory and Anti-Inflammatory Stimuli

Isabel S Smokelin, 2019, Biomedical Engineering
Dr. Irene Georgakoudi, Biomedical Engineering

A cell’s metabolic state is usually related to the rate at which it produces and consumes energy and biomolecules. This is important because changing metabolic states are known to occur during disease progression. More specifically, macrophages—a cell type in nearly every tissue—play a key role in the manifestation of diseases related to chronic inflammation (i.e. Parkinson’s Disease, Type 1 Diabetes, and rheumatoid arthritis). Thus, the goal of this project is to use non-invasive optical methods such as two-photon excited fluorescence (TPEF) to examine metabolic changes in macrophages in response to pro-inflammatory and anti-inflammatory stimuli. In the long-term, we anticipate that this information will contribute to a deeper understanding of macrophage-mediated contributions in a variety of diseases.

In the absence of a stimulus, macrophages exist in an “resting” state (M0), but can be induced to enter a pro- or anti-inflammatory phenotype through the addition of exogenous stimuli such as lipopolysaccharide (LPS; a component of the bacterial cell wall) or interleukin-4 (IL-4; a cytokine secreted in large amounts by the arm of the immune system which suppresses inflammation). Macrophages stimulated with LPS (M(LPS)) mirror the phenotype of macrophages during infections assessed in vitro by the release of large quantities of pro-inflammatory cytokines. In contrast, macrophages stimulated with IL-4 (M(IL-4)) more closely resemble macrophage phenotypes assessed in vitro by a generally anti-inflammatory cytokine profile and improved regenerative responses. Changes in macrophage metabolism linked to inflammation may be detected using label-free TPEF measurements. TPEF imaging collects signal from two endogenous fluorophores, NAD(P)H and FAD—coenzymes involved in key cellular metabolic pathways—and can used to determine the cellular ratio of FAD to FAD + NAD(P)H, also called the redox ratio. Results suggest that distinct redox ratio changes occur in macrophages in response to pro- and anti-inflammatory stimuli.

China’s Role and Strategy in Africa in the 1970s: A Case Study on the TAZARA Railway Project

Yuze Sui, 2019, International Relations; Mathematics
Christopher Conz, History Department

The TAZARA Railway is a railway in East Africa linking Tanzania with Zambia. The project was built from 1970 to 1975 and was financed and executed by Chinese government. The railway only experienced a brief surging period in terms of cargo volumes and values on the railway. It has been diminished by its own decay and by the roads and air routes that have developed around it. The reasons for the decay of the railway can be complicated and several scholars have explored the effects of management chaos and the change of political environment after 1975 to the decay of the railway. However, fewer scholars have attempted to analyze the various potential incentives for the governments of China, Tanzania and Zambia to build such a project by looking into the planning and the construction stage of the TAZARA Railway. The incentives behind this large development project can influence the outcome and the performance of the project. Therefore, this paper aims to provide a new perspective to understand the TAZARA Railway and the development discourse in
Africa by putting it back to the historical context and analyzing the various incentives behind the TAZARA Railway project. This paper project tries to answer three questions: 1. What is the incentive for China to build such a large railway project given the chaotic domestic situation? 2. Besides economic incentive, do the governments of Tanzania and Zambia have other incentives and how important are these non-economic incentives? 3. What is the characteristics of the planning and the construction of the TAZARA railway, especially comparing to those development projects supervised by British government in the colonial era. The research method is analyzing the historical evidence related to the planning and construction stage of the TAZARA project, particularly those primary sources kept by governmental agencies.

The Weaponization of Disease in the Yemeni and Syrian Civil Wars
Maia Tarnas, 2019, Community Health; Middle Eastern Studies; Arabic (minor)
Professor Thomas Abowd, Middle Eastern Studies

Recent trends in the Yemeni and Syrian Civil Wars indicate that an important shift has occurred in conventional warfare as disease itself has become a tactic of war. This thesis proposes the notion of the weaponization of disease, which can indirectly or directly spread disease throughout a country and has an entrenched role as structural violence. The existence of the cholera epidemic in Yemen shows indirect weaponization of disease. Intentional and non-discriminatory bombing campaigns on critical sectors capitalizes on cholera’s endemic nature in Yemen and creates an ideal environment in which the disease can spread. Other actions including the bombing of humanitarian medical facilities, coalition attacks on farms and fisheries, and coalition blockades, remove the population’s ability to seek treatment, clean water and necessary food resources, which therefore allows the disease to spread more throughout the population. On the other hand, the weaponization of disease in the Syrian Civil War is direct because the disease of chemical poisoning is actively inserted into the Syrian population where it otherwise would not exist. The use of chemicals that settle in low-lying areas capitalizes on Syrians’ need to shelter from air raids in these same areas. Indirect actions, such as attacks on health care facilities, personnel, and convoys carrying medical supplies and medicines, allow the acute effects of the chemical poisoning to become chronic. The conflicts in Yemen and Syria create a tragic reality of human rights infractions, suffering, and death. This thesis provides a basic framework to analyze the scale and scope of disease in both these situations to show that effects on health are no longer just collateral damage in the war effort.

Warning eyewitnesses about the threat of misleading information influences memory strategies
McKinsey G Torrance, 2019, Cognitive Brain Science
Elizabeth Race, Psychology

Research has demonstrated that eyewitnesses can incorporate information that they encounter after a crime, including misleading information, into their memory for that crime. This is called the “misinformation effect.” However, such memory errors can be reduced when eyewitnesses are alerted to the fact that some of the information that they’ve previously encountered may be unreliable. This is called a “post-warning.” These findings were drawn from research that used a paradigm with a single memory test after post-event information. Yet, recent research has shown
that eyewitness memory accuracy further worsens when there is an additional test of memory before participants hear post-event information. This is called Retrieval Enhanced Suggestibility (RES) effect. Similar to a single memory test paradigm, the two-test paradigm has demonstrated that post-warnings also diminish the RES effect. Importantly, regardless of the paradigm, there has been little research into how warning affects the ways in which participants interact with experiment information. In the present study, we sought to assess whether warning mock eyewitnesses about potentially misleading information before (pre-warning) exposure to that information diminishes the misinformation effect, in addition to whether the two types of warnings influence participants’ memory strategies in different ways. Findings suggest that both pre-warning and post-warning diminish the misinformation effect. Furthermore, both warning types similarly modulate the degree that eye-witnesses source monitor, in addition to modulating the same period of information interaction, the retrieval period.
Democracy in the Arab Region
Sara Torres, 2020, International Relations; Latin American Studies
Nimah Mazaheri, Political Science/ International Relations

Scholars have traditionally argued that working class people in the Middle East tend to be either apolitical or generally opposed to democratic ideals compared with other people. I argue that these attitudes about democracy turned more positive after the Arab Spring upheavals that took place in the early 2010s. This is because the Arab Spring highlighted many of the negative economic and political effects of embedded autocracy. The protests and strikes associated with the Arab Spring were viewed by many in the working class as a window of opportunity to remove stale autocrats from power and forge a nation and economy that would offer a sense of social and political stability as well as greater economic opportunities for working class people in particular. Although many of these hopes were dashed, the promise of democratic change during these years altered the way that working class people in the region perceived and valued democracy. During the semester, I undertook a more comprehensive study of labor and the working class under the guidance of Professor Mazaheri. I read a number of important texts on the political and economic role of labor that he assigned. These texts informed my understanding of the working class; I integrated the findings and insights of these studies into a new draft of my project on the working class in the Middle East. In addition, I devoted considerable time to revisiting the quantitative dataset I worked on during the summer and expanded on my quantitative analysis per the direction of Professor Mazaheri. The final product for this course will be a polished draft of a research paper on the working class’ political attitudes in the Middle East that can be submitted for publication in a scholarly journal.

Coloniality of Migration
Sara Torres, 2020, International Relations; Latin American Studies
Heather Barry, Institute of Global Leadership

The relationship between the Spanish enclaves of Ceuta and Melilla and Morocco not only highlight the transcendence of colonialism in North Africa, but also the role of borders, both physical and symbolic, in informing national identities, that consequently inform attitudes toward migrants. In my research, I explored the history of the enclaves describing the historical context of the colonial presence of France and Spain and the significance of Ceuta and Melilla as Spanish enclaves in North Africa. In addition, I described the history and role of borders and fences Morocco dividing Spain and Morocco, or more importantly, Europe and Morocco. These borders not only act as physical boundaries, but also as symbolic cleavages that form identities and opinions. While delving into the history of the enclaves and the borders separating them from Morocco, I unpacked the geopolitical importance of these for both Morocco and Spain using both the literature on the subject and also face to face interviews. By contextualizing the enclaves in relation to Morocco, I set the stage for the bulk of my research: attitudes toward migration. I interviewed experts, officials, and professors during my time in Morocco in order to understand how attitudes and approaches toward migration relate or differ between Moroccans and Spaniards from Ceuta. I wanted to unpack this question in order to understand if coloniality has an effect on peoples' perceptions towards migrants, these being manifested in both micro and macro levels from policy to border control down to individual
interactions. My objective and goal for this research is to contribute to the available literature on migration by contributing with a new insight on the role of coloniality, especially in the unique case of Ceuta.

**Biking & Breathing: A Dangerous Combination? Assessing Bicycle Commuters’ Exposure to Air Pollution in Downtown and West Oakland, California**

*Uku-Kaspar Uustalu, 2019, Computer Science; Environmental Studies*
*Kyle Monahan, Academic Data Services, Research Technology, Tufts Technology Services*

Over the past 30 years, numerous studies have attempted to assess the air pollution exposure associated with urban cycling. For the lack of a better alternative, most researchers have relied on an extremely small sample of air pollution data collected over few select routes throughout a limited time period. Others have attempted to model air pollution and bicycle traffic volume via land-use-based models that far too often do not compare well with real-life data. Research in this field has been long hindered by the lack of widely-available large-scale datasets, but recent advances in technology are in the process of changing that. Various bike share programs in metropolitan areas all over the United States collect detailed data on every single trip taken with their share bicycles, providing crucial insight into the movement patterns of urban cyclists. And sensor-equipped air monitoring vehicles have the ability to create detailed street-level datasets on air pollutant concentrations. This project takes advantage of these technological advances and uses novel data sources to assess the exposure to air pollution of urban cyclists in Oakland, California. Bicycle traffic volume levels for all street segments in the Oakland area were estimated using local bike share data and routing algorithms. The concentrations of three select air pollutants were interpolated for all road segments in Downtown and West Oakland from a detailed street-level dataset collected by sensor-equipped Google Street View vehicles. The relationship between bicycle traffic volume and air pollutant concentrations was analyzed for all road segments in the study area and the exposure to air pollution of local cyclists was assessed. The feasibility and potential health benefit of an air-quality-conscious bicycle routing algorithm was explored. The results revealed most bicycle traffic to take place on highly polluted road segments and revealed low-traffic low-pollution areas where bicycle usage should be encouraged.

**Political Betting Markets: Inefficiencies and Information Integration**

*Noah W Weinflass, 2019, Quantitative Economics; Cognitive & Brain Sciences*
*Thomas Downes, Tufts*

Political betting markets, markets where one can put money on predicting outcomes of a future election or political event, have been used since at least the first US Presidential Election both for profit and as a way to better predict election outcomes. While touted as better predictors of elections than polling by giving a financial incentive to bettors to make good predictions, in the 2016 election, newly founded political betting sites like PredictIt.com were almost as surprised by Trump’s success as the polls. Further, if systematic biases observed in other informational betting markets, e.g. sports betting, occur in these markets, they could cause prediction markets to be biased, making them less effective election predictors. This analysis examined 30 betting markets from PredictIt.com regarding election outcomes for the 2016 election and examined 1) how reactive and dependent the
markets are on polls, over time using vector autoregression analysis, and 2) Individual candidate level factors that bettors systematically over- or under-valued in the markets’ final prices. No significant predictive influence were found by the polls on the prices, implying the market integrates many sources of information to assess prices. Democratic candidates were systematically overvalued by bettors, while candidates with higher percentages of money raised in the race were systematically undervalued. In other words, bettors were predicting a better performance for Democrats than occurred, and also did not account for higher-spending candidates’ better performance completely. This analysis seems to show that betting markets are also susceptible to partisan error much in the way polls sometimes are, but go beyond simply integrating polling information to make a prediction. Further analyses systematize certain candidate level factors including social media engagement, attractiveness, or likeability, and better reveal whether the markets are overly susceptible to certain candidate traits.

Amygdala and behavioral responses to ambiguous emotional stimuli in posttraumatic stress disorder
Ethan T. Whitman, 2019, Clinical Psychology; Spanish
Lisa Shin, Psychology

The amygdala, a brain region associated with the detection of potential environmental threats, has been identified as an integral part of the neurocircuitry of posttraumatic stress disorder (PTSD). Previous research has found heightened amygdala activation in those with PTSD in response to signs of potential threat in the environment, such as fearful facial expressions. However, little research has been conducted regarding ambiguous stimuli, such as surprised facial expressions, which can be interpreted either positively or negatively. To better elucidate the neurological mechanisms that underlie the response to surprised facial expressions in PTSD, 12 combat veterans with PTSD and 16 combat veterans without PTSD underwent functional magnetic resonance imaging (fMRI) while passively viewing surprised and neutral facial expressions. After scanning, participants categorized each facial expression by emotion and rated each facial expression for valence and arousal. There was no significant amygdala activation in the PTSD group compared to the Control group when participants viewed surprised facial versus neutral facial expressions. There was heightened activation in the right amygdala (p < 0.001, x = 18, y = 2, z = -24) and left amygdala (p < 0.001, x = -16, y = 4, z = -22) in the PTSD group compared to the Control group when participants viewed surprised faces versus a fixation cross. There was also heightened activation in the left amygdala (p < .001, x = -18, y = 4, z = -20) in the PTSD group compared to Controls when participants viewed neutral faces compared to a fixation cross. Mixed-model analyses of variance revealed no significant difference between PTSD and Control groups in categorization of surprised faces (F(1) = 0.895, p = 0.353), and no significant difference between groups for valence rating (F(1) = 0.517, p = 0.479), or arousal rating (F(1) = 0.106, p = 0.747), of surprised and neutral faces. These results suggest brain activation differences but not behavioral differences in the evaluation of surprised facial expressions in PTSD. This altered neurological processing of ambiguous faces with no behavioral correlates could suggest compensatory brain activity that corrects for abnormalities in ambiguous facial expression processing in PTSD.
The Dynamics of Manager Characteristics and Compliance in Cambodia Garment Factories  
Jiaqi Yuan, 2019, Quantitative Economics; Psychology  
Drusilla Brown, Economics

Does humanization improve compliance? Does compliances improves humanization? In this study, I am trying to explore how certain manager characteristics interact with compliances with ILO’s Standards. The measures of manager characteristics include cognitive load, fixed mindset, manager beliefs, social norms and organizational tolerance, and the measures of compliances include Discrimination, Freedom of Association and Collective Bargaining, Compensation, Contracts and Human Resources, Occupational Safety and Health and Working Time.

Coffee Eco-Certification and Farmer Livelihoods in Costa Rica  
Grace C. van Deelen, 2021, Biology; Anthropology  
Colin Orians, Biology

In past decades, coffee farming in Costa Rica has experienced intensification and increased prevalence of full-sun monoculture coffee farms, which has had adverse effects on the surrounding ecosystem. As part of an effort to maintain structural diversity in these intensified regions, eco-certification of coffee promises to protect environmental health and wildlife, as well as farmer livelihood. The goal of this research was first to construct an analysis of different eco-certification programs used on coffee farms in Costa Rica, the practices that they require, and the impact of those practices on farmer yield and livelihood, so as to better understand farmer perceptions of certification and factors that influence adopting such certification. Results suggest that while the shade requirements set by eco-certification are likely very beneficial to regional environmental health, the effects of these requirements, in addition to the price premiums and incentives offered by certifications, do little to ameliorate income effects caused by increased financial inputs necessary for the entrance into and continuation of certification on smallholder coffee farms in Costa Rica. However, the specific shade requirements of these certifications may have multiple benefits for farmers, including the protection of yield and quality. Further research was performed on manipulated plots in Costa Rica to determine the effects of shade management on another coffee phenomenon that is adversely affecting farmers: that of alternate bearing. Results show that shade management may possibly be able to mitigate the effects of alternate bearing, helping farmers resist a changing climate.