

*Crossing Borders:*

Why Interdisciplinary Research

*Matters*

15TH ANNUAL

Graduate  
**Multidisciplinary  
Conference**

April 19, 2017      12 - 8 p.m.

*Higgins University Center*

*A conference to celebrate the contributions  
of Clark University graduate students to the  
broad academic community*

**CLARK**  
UNIVERSITY



# PROGRAM SCHEDULE

The Graduate Multidisciplinary Conference is a place to learn about the ideas and methods unique to each of the many fields encompassed by Clark University graduate research. The mission of the MDC is to give Clark students a broad perspective on academic research, as well as to offer the graduate community the experience of communicating their findings to a diverse academic audience.

- 12 - 1 p.m.**      **WELCOME LUNCHEON**  
*Tilton Hall*
- 12:45 p.m.**      **OPENING REMARKS**      Deborah Martin, Dean of Research
- 1 - 2 p.m.**      **ORAL SESSION A**  
*Grace and Lurie Conference Rooms*
- 2 - 3 p.m.**      **POSTER SESSION A**  
*Tilton Hall*
- 3:30 p.m.**      **KEYNOTE SPEAKER**      Dr. Esther Jones, English  
*The Half-Life of Alternative Facts: Or, The Case for Multidisciplinary Research*
- 4 - 5:45 p.m.**      **ORAL SESSION B**  
*Grace Conference Room*
- 5 - 6 p.m.**      **POSTER SESSION B**  
*Tilton Hall*
- 6 - 8 p.m.**      **EVENING RECEPTION**  
*Tilton Hall*  
Raffle, Travel Awards, and Election Results

# ORAL PRESENTATIONS

## Session AG *Grace Conference Room*

### 1:00 Surface Strain and Multiple Charge Density Wave States in TbTe<sub>3</sub>

Presenter: Ling Fu

Department: Physics

Adviser: Michael Boyer

We present our near-room temperature scanning tunneling microscopy (STM) measurements on TbTe<sub>3</sub>. Recent x-ray measurements and DFT calculations indicate that anisotropic lattice strain energy is important in the establishment of a unidirectional CDW along the c-axis over the a-axis in the bulk below 336 K. In our STM measurements, we detect spatially separated perpendicular unidirectional CDWs established along both the a- and c-crystal axes with no directional preference for the in-plane crystal axes (a or c). In addition we find regions where these two unidirectional orders coexist leading to observed bidirectional order. Our measurements indicate that the surface Te layer exposed on cleaving is only weakly coupled to the bulk and that strain variations across the surface drive the specific CDW order(s) observed. Our work suggests that similar mechanisms for CDW formation in the bulk are also involved at the surface.

### 1:15 Got the Brains, but Not the Body: Decoupling brain from nerve cord evolution in animals

Presenter: Allan Carrillo-Baltodano

Department: Biology

Adviser: Néva P. Meyer

Neural development often starts with a region of ectoderm receiving extrinsic signals instructing it to become neural. This process has been mostly studied in vertebrates and insects, and very little is known about neural specification in spiralian, the third major clade of Bilateria. Using blastomere isolations in the annelid *Capitella teleta*, a spiralian, we studied to what extent extrinsic versus intrinsic signals are involved in neural specification. We hypothesize that 1) the potential to generate brain neural ectoderm is autonomously specified by factors being asymmetrically segregated to the daughters of the first quartet micromeres (1q), and 2) the neural ectoderm of the ventral nerve cord (VNC) is conditionally specified in daughters of the 2d micromere by extrinsic signaling from surrounding blastomeres. We have successfully isolated blastomeres from 2- to 16-cell *C. teleta* embryos. Isolated blastomeres were raised for six days, and then assessed for neural fate via expression of neural genes and proteins. In agreement with our first hypothesis, daughters of isolated 1q cells express the pan-neural gene *Ct-elav1*, indicating a possible role for neural determinants in *C. teleta* brain formation. Isolated 2d blastomeres did not survive, but 2d isolated with other micromeres generated larvae with a head and an elongated trunk. Furthermore, only cells in the head expressed *Ct-elav1*. This finding supports our hypothesis that daughters of 2d require extrinsic signals to specify neural fate in the VNC, and also suggests that the signal is coming from the macromeres and not first- or second-quartet micromeres. Future experiments will examine the transcriptomic profile of isolated and recombined blastomeres to identify the putative genes involved in early neural specification in spiralian, which can provide us with a better understanding of how this specification evolved in Bilateria.

## 1:30 Couples that Sit Together Stay Together: The effects of meditation on romantic relationships

Presenter: Justin Laplante

Department: Psychology

Adviser: James Cordova

Meditation and mindfulness are associated with many positive outcomes, including reductions in stress, anxiety, and depression, increased well-being, and increases in self-regulated behavior and positive emotional states. Most relevant to the current paper, a small but growing literature has begun to investigate the effects of mindfulness on intimate relationships, over and above the beneficial outcomes associated with intimate relationships in general. However, to date most research focuses on self-reported overall mindfulness levels within the general population; there is relatively little investigation of the effects of a dedicated meditation practice on long term relationships. No research as of yet focuses on how the influence of a meditative practice on romantic relationships might change over time, both as the relationship and the meditation practice grow and develop. In order to best understand this process, Dynamic systems theory will be applied. Dynamic Systems Theory is a trans-disciplinary approach to investigate complex, non-linear systems as they change through time; as such, it is a particularly useful theory to use when investigating the influence of meditation on romantic relationships. The current presentation will discuss how applying a Dynamic Systems Theory framework to the question of how a meditation practice influences romantic relationships across the lifespan can best explain and contextualize this relationship, with a discussion of implications for the broader society.

## 1:45 Influences of Maternal Stress on Early Life Characteristics of Offspring in Threespine Stickleback Fish

Presenter: Amanda Fragata

Department: Biology

Advisers: Susan Foster and John Baker

Performance in early life is predictive of individual survival and reproductive success. Here we take advantage of the broad geographical range inhabited by the threespine stickleback, *Gasterosteus aculeatus*, to consider how ecological factors might shape early life characteristics over evolutionary time. Additionally, with the application of maternal stressors, we investigate the extent to which offspring growth and behavior are plastically influenced by maternal condition. First generation lab-reared parents were studied, representing populations in British Columbia and Alaska. Gravid females received one of four treatments: acute stressor at ovulation, chronic stressor throughout clutch production, post-ovulatory egg retention (an ecologically relevant challenge) or minimal handling time at ovulation (control). Fry were reared under identical conditions and assayed for growth and feeding performance during the first three weeks post yolk absorption. We discuss how early life traits are affected by maternal stressors, ecological conditions, parental rearing environment, and interactions among these factors.

## 2:00 Territory, Narratives and Violence: Stories of eight women who live in the presence of a large scale mine

Presenter: Chelsea Viteri

Department: IDCE - CDP

Advisers: Denise Bebbigton and Laurie Ross

Women play a substantial role in communities that are affected by mining nevertheless, their role has not been well documented and their voices and experiences have not been centered in the debates around extraction. In Ecuador, local, rural, campesina, and indigenous women bear much the cost of large scale development projects, as their bodies, families, homes, environments and economies are impacted. This paper emerged from eight semi-structured interviews with indigenous and campesina women from Tundayme, a small rural town which is in the middle of the first large scale mine in Ecuador. Using a feminist political ecology framework and storytelling, this paper seeks to elucidate the ways in which these women experience the introduction of a large-scale mine into their territories.

## Session AL *Lurie Conference Room*

### 1:00 Disembodiment and Deworlding: Taking decolonial Feminist Political Ecology to ground in Attappady

Presenter: Padini Nirmal

Department: Geography

Advisers: Dianne Rocheleau and Jody Emel

In an effort to understand the geometric rise of land conflicts and struggles in Adivasi (indigenous peoples) India in an intersectional, historical context, I undertake a decolonial feminist political ecology analysis of the nature of indigeneity and resistance in the Adivasi region of Attappady, Kerala. In doing so, I draw from my research into the Adivasis' land ontologies (including their geographies and histories), which contextualize their relations to land, in relation to those of rural settlers, land activists, government officials and other actors. In my analysis, I examine the socio-political-ecological history of Attappady using the theory of rooted networks, showing how Adivasi land ontologies reveal a) the loss of land to be a form of historical disembodiment causing various ailments to the individual and collective body of the Adivasi, which in turn result in violent disruptions in Adivasi world-making practices, or deworlding; and, b) land struggles to be decolonial resistances against such disembodiment and deworlding. In doing so, complex counter narratives of settlement, occupation, encroachment, alienation and resistance emerge challenging current understandings of indigeneity as rooted in place alone, showing the existence of rooted networks through a grounded environmental history of Attappady centered on land. Further, such a decolonial feminist political ecology analysis rejects 'dispossession' as an analytic, in favor of disembodiment and deworlding to capture the socio-political-ecological complexity of violent land losses.

### 1:15 The Climate and Land Use Alliance

Presenters: Hannah Silverfine and Kim Johnson

Department: IDCE and Geography

Adviser: Denise Bebbington

The Climate and Land Use Alliance (CLUA) is dedicated to creating a more global response to curbing the effects of climate change by: promoting low-carbon growth, protecting natural land and indigenous communities, and promoting sustainable agriculture practices. This presentation will highlight two research projects at Clark that support CLUA's work in relation to addressing the threats of deforestation: (1) the development of waterways in the Amazon region and (2) coal mining in Indonesia. Although waterways are hailed as more cost effective and environmentally sustainable forms of transport than land based options, they ultimately threaten indigenous communities and natural ecosystems. Recent priority projects within the Tapajós and Madeira River Basins in Brazil expose the movement of commodities (soy, corn, minerals) across the Amazon from international investments in a large scale, regional, multi-modal transport system. The second project investigates coal mining in Indonesia from 2000 to 2014 in relation to forest loss and protected areas. The direct impacts of coal mining on forest loss are examined in relation to those from other sectors, including logging, oil palm, wood fiber, and tree plantations. Granting concessions that overlap with protected areas is a common occurrence due to the administrative landscape in Indonesia. The forest loss in all concession types has been increasing during the study period, indicating that Indonesia can expect continuing increases in forest loss unless changes occur in the way concessions are granted. These studies contribute to the body of knowledge that informs recommendations for forest conservation efforts.

## 1:30 Keeping the Story Straight: Meeting Nepal's first "Climate Refugees"

Presenter: Dylan Harris

Department: Geography

Adviser: James McCarthy

The word 'refugee' is a particularly loaded term, especially in the context of our current national and international political climates. The word is charged with images of people fleeing their homes in the wake of violent events (i.e., war, earthquakes, etc.) However, how does the issue of slow violence – violence that is subtler and less immediate – factor into the refugee discourse? More specifically, how do the slow-burn effects of climate change factor into the refugee discourse? Furthermore, given the differential and uncanny impacts of climate change, how does the plight of climate refugees further our understanding of the lived experience of climate change? This presentation begins to answer these questions by looking at the case of Nepal's "first climate refugees." Located in the high Himalayan deserts of Upper Mustang, two communities – Dhe and Samzdong – are being resettled due to climate precarity. Or, at least that is how the 'story' is told. This presentation will draw on fieldwork in Upper Mustang to dig deep into the climate refugee discourse, highlighting the various intersections of power and politics that inform this particular case study but also provide lessons for global climate refugee discourse. The ultimate goal of this presentation is to first situate and demystify 'climate refugees' in order to think more clearly and deeply about experiences and knowledge of climate precarity.

## 1:45 Scanning Tunneling Microscopy of BiS<sub>2</sub>-based Superconductor

Presenter: Bishnu Sharma

Department: Physics

Adviser: Michael Boyer

We present our room-temperature, ultra-high vacuum scanning tunneling microscopy (STM) measurements on LaO<sub>1-x</sub>FxBiS<sub>2</sub>. LaO<sub>1-x</sub>FxBiS<sub>2</sub> is a member of the recently discovered BiS<sub>2</sub>-based superconductors. These compounds are layered with BiS<sub>2</sub> conducting layers separated by insulating LaO block layers. While the parent compound LaOBiS<sub>2</sub> is insulating, the electrical properties of the material can be altered by substituting F for O; electrons are doped into the conduction layers and a superconducting state emerges with T<sub>C</sub>max ~ 10 K for an optimal doping of x = 0.5. In addition, charge density wave (CDW) instabilities have been theoretically predicted for BiS<sub>2</sub>-based materials. Low-temperature STM measurements on NdO<sub>0.7</sub>F<sub>0.3</sub>BiS<sub>2</sub> detect a checkerboard pattern which may provide evidence for CDW ordering. High-temperature resistivity measurements showing "humps" at temperatures above 100 Celsius have been interpreted as possible evidence for the onset of CDW ordering in LaO<sub>1-x</sub>FxBiS<sub>2</sub>. We present our room-temperature topographic and spectroscopic characterizations of LaO<sub>1-x</sub>FxBiS<sub>2</sub> for x = 0.23 and x = 0.46.

## 2:00 Walled Cities and Urban Density: Evidence from Chinese

### prefectural-level cities

Presenter: Rui Du

Department: Economics

Adviser: Junfu Zhang

Throughout the imperial era, Chinese cities were surrounded by defensive walls. Although almost all of those city walls have vanished, many of the cities have survived. We analyze a sample of nearly 300 prefectural-level cities in China at present time, among which about half had city walls in history. We document the fact that cities that had walls in the late imperial China have higher population and employment density today, despite that their walls have long gone. We propose several possible explanations of this fact, including: (1) walled cities have a well-defined historical core that helps hold economic activity close to the city center today; (2) walled cities are situated in regions where the local geographies make it more difficult to build out; (3) walled cities today tend to have different industry compositions that are un conducive to decentralization; (4) walled cities are located in more populated regions where rural land is more valuable today and resists to urban sprawl; and (5) walled cities have more regular shapes that facilitate high density development. Using data from various sources, we test which explanation is more plausible. Our findings contribute to the budding literature on the persistence of urban economic activity.

## **Session B**      *Grace Conference Room*

### **4:00 Take the Stress Out of ECOSTRESS**

Presenter: Savannah Cooley

Department: Geography

Adviser: Chris Williams

This research investigates the climatological and biophysical impacts of the 2015 drought in Guanacaste, Costa Rica through quantifying the change in precipitation, evapotranspiration (ET), and vegetation cover from 2000 to 2015. First, this study quantifies the annual change in precipitation and analyzes historical rainfall patterns using the Standard Precipitation Index. The research then assesses plant stress at a regional scale by examining ET and evaporative stress index (ESI) anomalies in Guanacaste at 1km spatial resolution using the Priestley-Taylor Jet Propulsion Laboratory (PT-JPL) model. The third phase of analysis involves investigating the differences in drought resilience observed within various land stewardship scenarios including irrigated agricultural fields, non-irrigated agroforestry sites, as well as unmanaged forest. This involves analyzing 2000 - 2015 anomalies in normalized difference vegetation index (NDVI) data at 30m, 60m, 90m and 1km spatial resolution and comparing these results to the coarser 1km PT-JPL results. When launched in 2018, the ECOSystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) mission will estimate ET at 70m pixel resolution using PT-JPL. The findings of this research illustrate how ECOSTRESS can help reduce agricultural vulnerability through providing ET information at spatial and temporal resolutions high enough to improve drought estimation and monitoring of water consumption.

### **4:15 Recent CO2 Regulations and Public Transportation in European Union**

Presenter: Deniz Ozdiktas

Department: Economics

Adviser: Junfu Zhang

The European Union define its land transportation policy as “promoting mobility that is efficient, safe, secure and environmentally friendly”. Adoption of passenger cars that are clean and energy efficient, have an important role in achieving those aims. Promotion and the usage of public transportation is as important as that, if not more so. The purpose of this paper is to analyze the determinants of public transportation demand in European Union, focusing on recent CO2 emission regulations for the passenger vehicles. The data for this research sourced from several European Union organizations and covered the years from 2010 to 2014. European Union bus, train, metro, high-speed train ridership was estimated by using a panel data with an instrumental variable and seemingly unrelated regression method. Results suggested that these new regulations created a positive impact on all transportation modes, especially in bus ridership.

### **4:30 The impact of Climate Shocks on Social Networks: Understanding Sensitivity and Building Resilience among Indian communities**

Presenter: Richard Ramsawak

Department: Economics

Adviser: Wayne Gray

This paper examines the impact of long term climate change and shorter term climate shocks on measures of social capital in the case of India. In particular we leverage climate deviations during the monsoon period, as well as crop production data to analyze the impact on key social capital variables. In all estimation models we find social capital measures to be negatively affected by precipitation shocks, and based on crop production data we confirm the income channel to be the main channel through which such climate deviations affect social capital. In terms of recommendations we find that encouraging diversification in crop production and institutional strengthening to be the key strategies which can support increased resilience to climate shocks, particularly for poorer communities.

## 4:45 Granular Erosion by Shear Flow

Presenter: Benjamin Allen

Department: Physics

Adviser: Arshad Kudrolli

Using index matching techniques along with rheological methods we study erosion in a table top experiment where we can probe the dynamics of the particle movement deep inside the bed while also measuring the overall stresses in several different ways. We find that the movement of the grains deep in the bed is essentially independent of the fluid filling the interstitial regions and that the stress applied to the bed to keep up steady state erosion increases as a function of the number of suspended/saltated particles.

## 5:00 A Tanzanian Woman's Place is on Top: An exploration of women's participation in Kilimanjaro's trekking tourism industry

Presenter: Margeaux Prinster

Department: IDCE

Advisers: Jude Fernando and Cynthia Enloe

While high poverty rates persist for women in Tanzania, the growing trekking tourism industry surrounding Mount Kilimanjaro and its resulting demand for labor presents these impoverished women with a potential avenue for economic empowerment. This paper examines the national and local realities of women's work in Tanzania, analyzing culturally informed gendered patterns of employment against the colonial and sexist histories of tourism and commercial mountaineering on Mount Kilimanjaro to identify barriers to women's economic participation in Kilimanjaro's trekking tourism industry. This analysis is followed by a cross-cultural comparison with Nepal, focusing specifically on women's barriers to participation in commercial mountaineering, and a preexisting model for women's integration into the mountain guiding profession. Created by Three Sisters' Adventure Trekking, a private sector trekking tourism company, this Nepalese model provides a basis upon which a preliminary international development project design aimed at integrating impoverished women into Mount Kilimanjaro's trek guiding industry is discussed.

## 5:15 Before Sunrise or Before Midnight?: Tackling spatiotemporally uncertain contextual effects in measuring night-time urban vitality

Presenter: Young-Long Kim

Department: Geography

Adviser: Yuko Aoyama

A micro-scale analysis using big data can provide a granular and comprehensive look at spatiotemporal dynamics in cities. Although big data at small spatiotemporal scales become widely available, the spatiotemporally uncertain contextual effects significantly affect the validity of the spatiotemporal big data research. To date, big data collected on a certain spatiotemporal basis has been usually regrouped in an uncertain and arbitrary way. In order to minimize the uncertain contextual effect, this project applies functional principal component analysis (FPCA), which is an efficient non-parametric method to transform the discrete data to a continuous functional form. In this paper, FPCA extracts principal components from the 24 hour-basis data of pedestrian traffic and bank card transactions on a statistical basis.

## 5:30 Vanguard Africa: The Fight for an African Avant-Garde

Presenter: Ama Bemba Adwetewa-Badu

Department: English

Adviser: Stephen Levin

To speak about the avant-garde with an eye for accuracy means to speak about avant-gardisms; that is, to attend to an inclusive understanding of the political, cultural and aesthetic attributes that have defined and re-defined iterations of the avant-garde throughout history. Peter Bürger, in his touchstone text *The Theory of the Avant-Garde*, stresses that the rise of the avant-garde has a history that is linked to a purposeful divergence and critique of the middle class' allegiance to capitalism; that is, to have the freedom to detach oneself from the dominant ideology.

Typical avant-garde discourses are rooted in a historically European context, meaning that, rather than examining the flow of dialogue regarding aesthetics, it has been made simplified and compressed into a plane of homogeneity. Full examinations of the avant-garde in an African context are not near the forefront of these discourses. This raises the question: if Bürger asserts that the historical, and therefore European, avant-garde pushes against a homogenized center, then what does a black diasporic avant-garde do? What, then, is the Black diasporic artist pushing against? This paper argues that the answer is situated on a communal aesthetic that can be found in the poetics of 1960's post-independence Africa and the correlating Black liberation efforts in America. I argue that communally, the afro-diasporic avant-garde poet pushes against pre-conceived notions of objectified blackness and africanes.

## 5:45 How to Solve Men's Relational and Emotional Deficits

Presenter: Lucas Glenn

Department: IDCE - CDP

Adviser: Laurie Ross

Men are becoming less connected to other men and to their own hearts. I have researched the history of how men have made those connections, why they have lost them, and what are the consequence of those losses. I have also researched various solutions to the problems, experimented with those solutions on myself, and made some proposals for future actions.

# POSTER PRESENTATIONS

Posters will be hung in Tilton Hall and will be available for the duration of the conference.

Two main sessions will be held from 2 - 3 p.m. and from 5 - 6 p.m.

## 1. Asset Assessment for Women: A Case Study of Imasayi Village in Ogun State, Nigeria & NGO Development

Presenter: Olamide Adeyinka

Department: GSOM/IDCE

Advisers: Donna Gallo, Cynthia Caron, Laurie Ross, and William Fisher

This paper presents the findings of an asset assessment performed with women in a village southwest of Nigeria, Imasayi Ogun state. This paper not only provides the process and results of a qualitative study, but also presents the implementation plan for an NGO that will work with the women of Imasayi to implement community-wide development projects. The research upon which this paper is based used the framework of seven capital domains, which are then used in turn to structure findings, recommendations and NGO planning and analysis. For the purpose of this paper, the marketplace is identified as significant for Imasayi's women and is discussed in detail in relation to two other asset types, roads and community connections. The paper concludes with an in depth discussion of the proposed plan for the NGO, including the strategic direction, asset assessment and stakeholder analysis of the research, value chain and governance of the NGO. The goal for the NGO is to create a path to work with marginalized women to identify assets and maximize their capital base.

## 2. Increasing Complexity of Form-Function Relationships When Considering Multiple Modes of Locomotion

Presenter: Amy Cheu

Department: Biology

Adviser: Philip Bergmann

Natural selection acts upon an organism's ability to perform well at ecologically-relevant tasks. These tasks are affected by the organism's underlying phenotypic traits. However, one phenotypic trait does not necessarily impact the performance of a single task. Instead, one trait may affect multiple tasks or many traits may redundantly affect one task. Many-to-many mapping of form-to-function is a concept that considers how multiple phenotypic traits affect multiple performance measures within the same system. However, in previous form and function relationship work, only two measures of performance have been considered at a time. By considering greater numbers of performance measures, we are able to examine how trade-offs and facilitations can affect a given phenotypic trait simultaneously. Here, we look at five different modes of locomotion: bipedal sprinting, jumping, climbing, running on water, and swimming in brown basilisk lizards (*Basiliscus vittatus*) to examine the relationships between variation in phenotypic traits and variation in the performance of these different types of locomotion. *Basiliscus vittatus* is a highly dynamic performer that performs well at all of these modes of locomotion in nature, given it is terrestrial, arboreal, and aquatic. By relating phenotype to performance via the statistical model, the F-matrix, we are able to quantify these complex relationships. Our findings show that it is important to consider a wide array of tasks to comprehensively understand how trade-offs and facilitations impact the functional architecture of an organism. The F-matrix approach also allows us to predict which traits are most readily evolvable, given the system's functional constraints.

### 3. Running on Uneven Surfaces: The effect of substrate particle size and irregularity on performance and kinematics

Presenter: Marian Crockett

Department: Biology

Adviser: Philip Bergmann

The physical characteristics of substrates that terrestrial animals move on can affect their locomotor performance and kinematics. Uneven surfaces are ubiquitous in nature and animals must frequently move across them, yet their effects on locomotion are not thoroughly understood. We studied how particle size and surface irregularity of uneven substrates made of large particles affect the locomotor performance and kinematics of the terrestrial generalist sprinter, the Northern Curly Tailed Lizard (*Leiocephalus carinatus*). To look for differences in locomotor performance, we compared seven substrates: a flat surface, three sizes of spherical balls ranging from 43 to 113 cm in diameter, and three sizes of natural rocks matched to the ball sizes. The flat substrate provided an even surface and served as the control, spherical balls provided a regular but uneven surface, and natural rock substrates provided an irregular and uneven running surface. As the size of the particles increases, the unevenness of the surface increases, which poses a challenge to animals running upon it. We expected that as unevenness increased, sprint performance would decrease. We also expected that as irregularity increased, sprint performance would further decrease because lizards would need to constantly adjust their stride while running, compared to the regular substrates. This work helps us understand how substrate unevenness and irregularity affects locomotor performance, which will have implications on microhabitat selection in nature, and how animals compensate for such challenges during locomotion.

### 4. Achieving Carbon Neutrality in New England through Strategic Electrification

Presenter: Travis Dodge

Department: IDCE/GSOM

Advisers: Chris Van Atten and Mary-Ellen Boyle

Massachusetts is one of many states that have committed to reducing carbon emissions 80% by 2050, relative to 2001 levels. Recent ruling in favor of the plaintiff in Massachusetts Supreme Court case, *Kain vs. DEP*, found that the state has failed to adequately plan and implement measures towards achieving this goal. Massachusetts is not alone in its unpreparedness in addressing this mandated shift in socio-technical infrastructure. One policy route being explored by regional stakeholders is "Strategic Electrification"; The process of interconnecting all carbon emitting technology to the regional electrical grid, while deploying 100% renewable generation, including heating/cooling and transportation. This project serves as a feasibility study for the New England region.

### 5. Walled Cities and Urban Density: Evidence from Chinese Prefectural-level Cities

Presenter: Rui Du

Department: Economics

Adviser: Junfu Zhang

Throughout the imperial era, Chinese cities were surrounded by defensive walls. Although almost all of those city walls have vanished, many of the cities have survived. We analyze a sample of nearly 300 prefectural-level cities in China at present time, among which about half had city walls in history. We document the fact that cities that had walls in the late imperial China have higher population and employment density today, despite that their walls have long gone. We propose several possible explanations of this fact, including: (1) walled cities have a well-defined historical core that helps hold economic activity close to the city center today; (2) walled cities are situated in regions where the local geographies make it more difficult to build out; (3) walled cities today tend to have different industry compositions that are un conducive to decentralization; (4) walled cities are located in more populated regions where rural land is more valuable today and resists to urban sprawl; and (5) walled cities have more regular shapes that facilitate high density development. Using data from various sources, we test which explanation is more plausible. Our findings contribute to the budding literature on the persistence of urban economic activity.

## 6. Understanding and Addressing Governance Dysfunction and Unsustainable Development in the Illegal Gold Mining Region of Madre de Dios, Peru

Presenter: Phyllis Duff

Department: IDCE

Adviser: Timothy Downs

This paper endeavors to explore the link between dysfunction in governance systems and persistent challenges to sustainable development in the illegal gold mining region of Madre de Dios, Peru. Through the use of stakeholder narratives, field observations and literature review, four questions were examined: 1) What are the existing social and environmental conditions in the case study area? 2) What are the existing relationships amongst stakeholders, and how do these illustrate dysfunction of the existing system of governance? 3) What gaps and/or deficiencies in the existing system are revealed by stakeholder narratives, and what are their visions for an alternative system? 4) What kind of integrative, multi stakeholder, sustainable development planning is called for in this context, and what capacities need to be built to accomplish this? Using stakeholder engagement processes, transition management and co-production of knowledge, recommendations and capacities are provided for each major stakeholder. The work is a first step toward a new integrative sustainable development approach, and will add to the knowledge base not only on this case study region, but to broader sustainable development practices elsewhere as well.

## 7. How to Solve Men's Relational and Emotional Deficits

Presenter: Lucas Glenn

Department: IDCE - CDP

Adviser: Laurie Ross

Men are becoming less connected to other men and to their own hearts. I have researched the history of how men have made those connections, why they have lost them, and what are the consequence of those losses. I have also researched various solutions to the problems, experimented with those solutions on myself, and made some proposals for future actions.

## 8. Complexities at the Intersection of Antisemitism and Racism: Toward an approach of informed solidarity

Presenter: Devra Goldstein

Department: IDCE

Advisers: Eric DeMeulenaere and Laurie Ross

As discussions of intersectionality and justice deepen and expand, this project calls activists to include analyses of antisemitism in identity politics and organizing initiatives, most notably racial justice. I situate my critique of silence around antisemitism in social justice within emerging analyses of antisemitism in current contexts. I also draw on theorists' and activists' work on this issue, notably Jewish people of color, as well as those who have contributed to meaningful work and relationships across these divides in the past. I seek to illustrate some of the points of tension and opportunity at the intersection of antisemitism and racism. This discussion also addresses how antisemitism or racism can be a barrier for people to organize in order to dismantle the other system of injustice. When I explore the nuances of navigating this intersection, I find that deeper healing and understanding are necessary for transformational relationship, action, and solidarity in liberation movements.

## 9. Evolution of the Maternal Stress Axis and Plasticity of Offspring Hormonal and Behavioral Characteristics

Presenter: Melissa Graham

Department: Biology

Adviser: Susan Foster

Maternal effects can significantly impact both maternal and offspring fitness and are likely to be influenced by the evolutionary history of a population. Here we evaluate the influence of maternal hormonal state on offspring development in populations of threespine stickleback (*Gasterosteus aculeatus*) that differ naturally in the presence and intensity of cannibalistic foraging groups to understand how evolutionary history with a stressor shifts the female stress response and influences offspring phenotype. We imposed a cannibalism-related challenge (post-ovulatory egg retention) and measured subsequent maternal, egg, and fry hormone levels, as well as fry growth and behavior. While females did not show elevated cortisol with forced egg retention, egg cortisol levels were affected and correlated with differences in fry stress response at three months of age. The maternal challenge significantly reduced fry growth rate and feeding performance in the first month of life. While maternal response to a natural challenge did not differ between populations, the results here show evolved differences in the consequences for offspring in the face of such challenge.

## 10. Developmental Genetics of Fungal Monstrosity: Comparative analyses of the secotioid and agaricoid forms of *Lentinus Tigrinus*

Presenter: Alicia Knudson

Department: Biology

Adviser: David Hibbett

*Lentinus tigrinus* is a wood-decaying basidiomycete that occurs in two distinct forms: an "agaricoid" form, which has exposed gills that release spores into the air, and a "secotioid" form, which has its gills enclosed by a layer of tissue that traps the spores, much like a puffball. Prior genetic studies suggested that the secotioid form is conferred by a recessive allele at a single locus (*sec*). In an attempt to identify the genetic basis of the secotioid form, we produced draft genome sequences of two monokaryons, one *sec*<sup>+</sup> and one *sec*<sup>-</sup>. We performed a cross between the monokaryons and generated progeny that we pooled by genotype (*sec*<sup>-</sup> vs. *sec*<sup>+</sup>), and subjected to Illumina sequencing to identify regions that segregate with the secotioid phenotype. We also produced six dikaryons, three homozygous *sec*<sup>-</sup> and three homozygous *sec*<sup>+</sup>, and obtained transcriptomes from developing fruiting bodies at four developmental stages (mycelium, primordium, and young and mature fruiting bodies). Preliminary analyses identify approximately 20 SNPs that co-segregate with the secotioid phenotype, and 27 genes that have differential expression in homozygous agaricoid vs. secotioid dikaryons.

## 11. An *in vivo* Search for a Small Molecule Inhibitor of PLC $\gamma$

Presenter: Chitra Naidu

Department: Biology

Adviser: Justin Thackeray

PLC $\gamma$  is a key signaling molecule that regulates pathways required for cell proliferation, differentiation and apoptosis. Various studies have reported PLC $\gamma$  overexpression to be a key factor in transforming primary tumors to metastatic by affecting these very pathways. A PLC $\gamma$ -specific inhibitor could therefore be an invaluable tool not only for basic research but also for anti-cancer studies. Small wing (sl), the *Drosophila* homolog of PLC $\gamma$ , plays a dual role. It negatively regulates the EGFR pathway controlling photoreceptor and wing vein differentiation while positively regulating the Insulin pathway affecting growth. An sl null mutant (sl9/sl9) shows a reduced wing size, ectopic veins and rough eyes as a result of extra R7 photoreceptors in ~60% ommatidia. Our objective is to identify a novel small molecule inhibitor of PLC $\gamma$  using *Drosophila* as a model system. In a primary screen, we looked at vein differentiation patterns to identify molecules that alter EGFR signaling. Argos, an inhibitor of EGFR, when overexpressed in wings causes severe loss of venation which is significantly rescued in L3 by a partial loss of Sl function. Thus, drug fed MS1096>Aos flies were used as a sensitive model system to detect potential Sl inhibition by looking for L3 vein recovery. 37 of the 1,596 small molecules, provided by the NCI, showed significant results. In a secondary screen, we confirmed EGFR inhibition by looking at photoreceptor differentiation in the eye in an sl7 mutant. sl7 is a missense mutation that results in 5-10% ommatidia with extra R7 photoreceptors. Further inhibition of Sl or the EGFR pathway would result in a higher percentage of R7 recruitment. So far, we have identified 9 small molecules as potential inhibitors.

We are currently in the process of retesting these 9 molecules using the MS1096>Aos flies on a larger scale. Subsequent experiments will try to determine whether any of the small molecules identified do in fact inhibit Sl.

## 12. Vulnerability Profiling and Evaluation of Shallow Drinking Water Aquifers

in Holliston, MA

Presenter: Gabrielle Rigutto

Department: Environmental Science and Policy

Adviser: Timothy Downs

This research aims to contribute to the on-going Holliston Health Project, which consists of a team of Clark University researchers working with Holliston, MA residents to better understand the link between municipal drinking water, the environment and the health of the community. Town of Holliston operates its own public water supply and utilizes two local overburden groundwater aquifers as a drinking water source. The town currently utilizes seven (7) municipal supply wells to withdraw groundwater from the local aquifers: the Bogastow Brook aquifer and the Cedar Swamp aquifer in the eastern and western portions of the town respectively. The aquifer is comprised of highly permeable material and the aquifers are relatively shallow. The hydrogeological characteristics of the aquifers make the aquifers particularly vulnerable to contamination from anthropogenic sources, such as spills or underground discharge of wastes, as well as natural-occurring contaminants, such as manganese. Investigation of pollutant fate and transport behavior of manganese is imperative for understanding the mechanisms which enforce and influence the release of naturally-occurring manganese into the environment through the erosion of Manganese-containing soils. Increased understanding of manganese activity in the water column can be used to critique the currently employed monitoring regime in Holliston, especially since the aquifers exhibit increased vulnerabilities to naturally occurring and anthropogenic contaminants. Additionally, identifying the factors which create ambiguity in the degree of toxicity experienced by the exposed individual helps to better identify the weaknesses in the reasoning behind the governmental standards for manganese in drinking water.

## 13. Engaging in Effective Behavioral Health Treatment Methods

Presenter: Tracie Sullivan

Department: IDCE

Advisers: Laurie Ross and Jennifer Safford-Farquharson

Nearly 60% of youth involved in the juvenile justice system in the United States have a diagnosable mental illness. These high and proven risk youth have fallen through the cracks in the behavioral health system, with a lack of prevention, intervention, and effective treatment methods being provided to them prior to incarceration. This paper presents connections between childhood trauma, undiagnosed and untreated mental illnesses, and delinquency in adulthood for high and proven risk young men. In addition to the literature, an analysis of the behavioral health programming of the Safe and Successful Youth Initiative (SSYI) in Worcester, MA focuses on exploring the importance of clinicians using trust and relationship building techniques within their therapeutic models to produce higher rates of engagement with high and proven risk youth.

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