

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. Deborah Martin, Dean of Research

Grace Conference Room

1:00 Surface Strain and Multiple Charge Density Wave States in TbTe₃

Presenter: Ling Fu

Department: Physics

Adviser: Michael Boyer

We present our near-room temperature scanning tunneling microscopy (STM) measurements on TbTe₃. 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 from ne (or) ime

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.

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 ecologi-

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

Presenter: Padini Nirmal

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.

1:30 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 BiS₂-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_{1-x}F_xBiS₂. LaO_{1-x}F_xBiS₂ is a member of the recently discovered BiS₂-based superconductors. These compounds are layered with BiS₂ conducting layers separated by insulating LaO block layers. While the parent compound LaOBiS₂ 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_Cmax ~ 10 K for an optimal doping of x = 0.5. In addition, charge density wave (CDW) instabilities have been theoretically predicted for BiS₂-based materials. Low-temperature STM measurements on NdO_{0.7}F_{0.3}BiS₂ 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_{1-x}F_xBiS₂. We present our room-temperature topographic and spectroscopic characterizations of LaO_{1-x}F_xBiS₂ for x = 0.23 and x = 0.46.

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; (4-64(6c 134.06 T12 792 reW1.064 Tf1 0 0 1 109.34 388.63 Tm912 0

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-

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

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.

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-

POSTER PRESENTATIONS

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.

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

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

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.

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*⁺ and one *sec*⁻. We performed a cross between the monokaryons and generated progeny that we pooled by genotype (*sec*⁻

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

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.

SPECIAL THANKS TO

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