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<http://www.dartmouth.edu/~provost/postdoc/index.htm>

Dartmouth College Postdoctoral Association (DCPDA)

First Dartmouth College Postdoctoral
Award and Recognition Ceremony
2009



November 3rd 2009
TOP of HOP
5.30-7.30pm

What is a Postdoc?

A postdoctoral scholar ("postdoc") is an individual holding a doctoral degree who is engaged in a temporary period of mentored research and/or scholarly training for the purpose of acquiring the professional skills needed to pursue a career path of his or her choosing.

The National Postdoctoral Association (NPA)

DCPDA is a sustaining member of the NPA, giving Dartmouth postdocs free affiliate membership:
<http://www.nationalpostdoc.org/home>

Postdocs Wanted

The continued success of DCPDA depends on its members willingness to take an active role in its future.

DCPDA membership is free and open to all postdocs at Dartmouth, who are eligible to vote and run for office. If you have any questions, suggestion, or would like to become involved in the running of the DCPDA please blitz DCPDA or contact one of its officers.

First Monday

Each month, join us at Salt Hill Pub in Lebanon from 6:30pm on the first Monday of the month for cheap pints and good company.



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Schedule

**Wine and Cheese Reception
Hanover Inn**

- 5.30-6.30pm **Poster Presentations:
Finalists for the DCPDA Travel Award**
- 6.30 pm Opening Remarks
Elizabeth Bankert, Assistant Provost
- 7.00 pm **Jay C. Dunlap, Ph.D.**, Professor and Chair
of Genetics, Dartmouth Medical School
- 7.30pm **Award Presentations**



Acknowledgements

With much gratitude we would like the following DCPDA Travel Award Judges:

Matthew Ayres (Professor of Biological Sciences), Elizabeth Bankert (Assistant Provost), Ann Clark (Professor of Psychological and Brain Sciences), Sue Knapp (Public Affairs Officer and Science Writer, Dartmouth College Office of Public Affairs), Guido Memmi (Research Assistant Professor of Microbiology), Mary Pavone (Manager, NASA Space Grant Programs for Women), Nancy Serrell (Director of Outreach), Roger Sloboda (Professor of Biology), Cynthia Tobery (DCAL Associate Director), John Winn (Professor of Chemistry).

We would also like to give tremendous thanks to the following departments and funds for contributing to the travel award funding:

MCB Program; Department of Physiology; Department of Biochemistry; Howard Hughes Fellowship; Department of Biological sciences; Department of Pharmacology/ Toxicology; Department of Microbiology/Immunology; Wolford, George Filene Endowed Chair.

This event, and the DCPDA would not have been possible without the hard work and dedication of its officers:

Melanie Rutkowski, Guido Memmi, Kristine Hill, Maroun Beyrouthy, Joshua Gamsby, Danica Hickey, Louise Hughes, Sandeep Tamber, Dhana Nair, Hao Xu, Ian Street, Jennifer Bomberger, and Dawoon Jung.

Many thanks to Randy Brown, Dartmouth College Events Coordinator, for all his assistance.

Hao Xu

Biochemistry

Mentor, William Wickner

Research Abstract

SNARE dependent membrane fusion in eukaryotic cells requires the disassembly of the cis-SNARE complex (formed by individual SNAREs from the same membrane) followed by the assembly of the trans-SNARE complex (by SNAREs from apposing membranes). The dynamics of the trans-SNARE complex, which is critical for fusion, is not clear. We now show that trans-SNARE complex formed during the course of vacuole fusion is largely associated with Sec17p. Using a reconstituted proteoliposome fusion system, we show that the trans-SNARE complex, like the cis-SNARE complex, is sensitive to Sec17p/Sec18p action. Importantly, HOPS inhibits the Sec17p/Sec18p dependent disassembly of the SNARE complex in the trans-, but not in the cis- configuration. We proposed that the coordinated actions of the HOPS and Sec17p/Sec18p chaperone system maximize functional trans-SNARE complex to promote membrane fusion.

DCPDA \$1000 Travel Award

The Dartmouth College Postdoctoral Association Travel Award is a competitive monetary award sponsoring a Dartmouth postdoc to present their research at a professional conference of their choosing.

This year three \$1000 awards have been made possible by generous donations from the following departments:

MCB Program
Department of Physiology
Department of Biochemistry
Howard Hughes Fellowship
Department of Biological Sciences
Department of Pharmacology/Toxicology
Microbiology/Immunology Department
Wolford, George Filene Endowed Chair

DCPDA Travel Award Judges:

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Roger Sloboda (Professor of Biology)
Cynthia Tobery (DCAL Associate Director)
John Winn (Professor of Chemistry).

DCPDA

Mission statement

"For and governed by postdoctoral scholars, the Dartmouth College Postdoctoral Association aims to aid in the professional development of its members, foster a sense of community and identity among them, and enhance their overall experience at Dartmouth College."

Elected Officers

Council Officers (2008-2010)

Melanie Rutkowski	President	Microbiology
Kristine Hill	Vice President	Biological Sciences
Maroun Beyrouthy	Secretary	Pharmacology
Josh Gamsby	Treasurer	Genetics
Guido Memmi	Faculty Advisor	Microbiology

Social Chair Heads

Danica Hickey	(2008-2010)	Physiology
Louise Hughes	(2008-2009)	Chemistry

Career Development Heads

Sandeep Tamber	(2008-2009)	Microbiology
Dhana Nair	(2008-2009)	Biological Science
Jennifer Bomberger	(2009-2010)	Physiology
Dawoon Jung	(2009-2010)	Physiology

Community Service Heads

Hao Xu	(2008-2009)	Biochemistry
Ian Street	(2008-2010)	Biological Sciences

Qiguang Xie

Biological Sciences

Mentor, C. Robertson McClung

Natural Allelic Variation In Circadian Clock Function In *Brassica rapa*

The endogenous circadian clock confers an internal periodicity that, synchronizes an organism, with the environmental period imposed by Earth's rotation; when internal and external periods, diverge, performance measures such as net photosynthesis decline dramatically. Crop species encounter widely differing environmental conditions, including variable daylength and temperature. Thus, variation in circadian clock function has implications for agricultural productivity, especially among crops grown across wide latitudinal ranges. To date, studies of the plant circadian clock have emphasized *Arabidopsis thaliana*. We have extended this study to the crop plant, *Brassica rapa*. There is considerable variation in clock function among cultivated *Brassica rapa* accessions. To identify genes responsible for this natural variation we have analyzed a set of Recombinant Inbred Lines to identify Quantitative Trait Loci (QTL) for period, amplitude and temperature compensation of the circadian rhythm in leaf movement and for flowering time, as well as for a number of morphometric parameters, including, size of floral organs, and hypocotyl length. We are generating Heterogeneous Inbred Families to identify the genes responsible for these QTL. We also are testing candidate loci in transgenic *Arabidopsis* and *B. rapa*. We have developed a transgenic *B. rapa* hypocotyl system that expresses a light- and temperature-entrained circadian clock, as measured with clock-regulated reporter gene fusions. Our results suggest that there is considerable potential for the modification of circadian clock function as well as floral traits in *B. rapa* crops grown under agroecologically relevant daylength and temperature settings.

Jerome Whittington

Anthropology

Mentor, Michael K Dorsey

Climate Justice Analysis Methodology

New carbon emissions finance instruments are an essential component of most regulatory proposals for coping with climate change. These proposals have highly variable range of potential impacts on how climate change and climate change mitigation and adaptation will affect disadvantaged people around the world in the coming decades. This research explores methodologies for applying the insights of climate justice analysis to carbon trading and carbon finance proposals and instruments. We consider a range of factors including (1.) historical responsibility for atmospheric carbon; (2.) wealth disparities associated with colonial legacies and structural disadvantage within the global economy; (3.) incorporation of institutional mechanisms for marginalized groups to negotiate climate rights and risk; (4.) potential for evaluating accumulated unknown risk within financial markets; (5.) discrepancies in expected cultural and behavior changes in groups linked by carbon trading mechanisms; (6.) potential effectiveness in reducing carbon emissions, including subsidiary issues such as enforcement/accountability procedures and potential for corruption, profiteering and elite capture; (7.) institutional ability of carbon reduction and offset projects to be weighed against their social and environmental impacts (e.g. hydropower, biofuels, or potentially toxic industrial processes); and (8.) broad-based, employment-centered investment in marginalized communities and in developing countries. It is hoped that an available approach to analyzing the environmental justice implications of climate change policy proposals will encourage not only the application of the methodology but also the development of proposals that better meet the range of challenges associated with mitigation and adaptation of climate change.

History of DCPDA

Before 2008, aside from the resources provided by DCAL and the work that Cindy Tobery had done with postdocs, the College still lacked a centralized resource specifically intended to meet the needs of postdocs. Melanie Rutkowski, the group's founder, set out to establish an institutionally recognized society where postdocs could network, share professional experiences, and receive professional training and counseling for academic and non-academic career options. With the assistance of Elizabeth Bankert, from the Provost Office, and Cindy Tobery, from DCAL, the DCPDA was created.

The newly established association held its kick-off reception in October of 2008, with nearly 1/3 of the total postdocs at Dartmouth College in attendance. On November 14th 2008, approximately 40 postdocs met from various departments and elected officers to represent the DCPDA (President, Melanie Rutkowski; President Elect, Guido Memmi; Vice President, Kristine Hill; Secretary, Maroun Beyrouthy; Treasurer, Joshua Gamsby; Social Chair Heads, Danica Hickey and Louise Hughes; Career Development Heads, Sandeep Tamber and Dhana Nair; Community Service Heads, Hao Xu and Ian Street).

The elected officers pledged to work hard, increasing the College's awareness of postdocs and their individual needs. The DCPDA aims to aid in the professional development of its members, foster a sense of community and identity among them, and enhance their overall experience at Dartmouth College. With a main focus on career and professional development workshops, the DCPDA hopes to equip postdocs with the tools needed to find and obtain satisfying and fulfilling careers within or outside of academia.



Past Workshops

Industry Networking Panel

(January 22nd 2009)

Goals: To educate attendees about what it takes to find fulfilling careers outside of academia. A Panelist led discussion.

Conflict Resolution Workshop

(February 18th 2009)

Goals: To help postdocs realize various communication techniques to deal with conflict in the workplace

Peer Teaching:

Job Negotiation Skills Movie Night

(March 20th 2009)

Goals: To educate attendees about various strategies to utilize when negotiating job offers. Peer discussion of recorded presentation, followed by pizza, beer, and the movie "Office Space".

Faculty Panel

(April 14th 2009)

Goals: To provide a "no holds barred" conversation with younger faculty at Dartmouth about what it takes to succeed within academia.

Myers Briggs Personality Profile

(May 11th 2009)

Goals: An intensive and interactive workshop designed to provide postdocs with an in-depth look at their personality types, followed by discussion of adapting their innate skills to current and future job situations.

Transformation of an Academic CV into a Resume

(June 10th 2009)

Goals: Workshop detailing how postdocs can convert their academic CV into resumes that result in a job offer.

New Workshops

Communicating Research

(October 9th – 14th 2009)

Goals

A 3-part hands-on workshop in which postdocs are required to bring a writing sample to the workshop followed by instruction, peer review of writing samples, providing feedback, rewriting and presentation of research description.

Beyond the Bench: Science Careers Outside of Academia

(October 16th 2009)

Goals

Lessons about succeeding in industry, with a focus on effective networking. Nicole Hobbs, the Senior Operations Manager at Novartis Institutes for Biomedical Research (NIBR), Inc. discussed the path to her current position.

Mock Chalk Talk

(11/19/09 12-1pm Vail 202)

Goals

Educational session about the ins and outs of chalk-talk presentation for faculty interviewing for tenure-track academic positions.

More to come

Grant Writing Workshops
Industry Networking Events
Career development for academia
Speed Science Networking

WE WANT TO HEAR FROM
YOU....SUGGESTIONS?

Ronald White

Chemistry

Mentor, Jane E. G. Lipson

Research Abstract

My work is concerned with the modeling and prediction of thermodynamic properties of various types of liquids, solutions, and other mixtures. To give a rough sense for what I do, a few examples of some questions that I might typically aim to answer could be the following. If two liquids are combined, will they mix, or will they separate like oil and water? If the latter, at what temperature will this phase separation occur? Does heating or pressurizing cause the system's miscibility to increase or decrease, and why? Further questions might lead to probing the origins of the observed behavior at the microscopic level, perhaps using (or in other cases, elucidating) information about molecular size, packing, and energetic interactions to aid in our understanding. In fact, in our work we aim to build up our models starting from this microscopic viewpoint. Here we attempt first to mimic the structure and behavior of the molecules, and then we ultimately calculate the combined effect of a large sample of these molecules to give the bulk material properties observed at the macroscopic level. One specific area of focus in my group is in the modeling of properties associated with polymeric materials, wherein, due to their industrial significance, it is of very strong interest to be able to answer questions such as those posed above. One important characteristic of polymer molecules is that they are "chain-like" (being composed of a long succession of smaller subunits), and in our work, we try to design microscopic "chain molecule" theories to capture the most fundamental aspects of the real molecular behavior. In testing this, it can be particularly insightful to examine our models as they apply to some of the most simple and fundamental examples of real chain molecules, e.g., simple hydrocarbon fluids. Also called alkanes, they are smaller than polymers, but otherwise quite similar in terms of the nature of the interactions, and their elongated chain-like architecture. Given the wealth of experimental data available, and the relative ease in modeling smaller systems, it is possible to test and compare chain molecule theories in a very thorough and systematic fashion by comparing the modeled thermodynamic properties with the actual experimental properties of these systems. In this way much can be learned about how to construct a model theory that is accurate and at the same time leads to a tractable solution that is relatively easy to apply. Here one can explore the connection between the simplifying approximations used and the results obtained. For instance, can a satisfactory representation of the system be obtained by restricting the model to a simplified lattice structure, or, is a more realistic continuum environment required?

Sueyoung Song

Psychiatry

Mentor, Margit Berman

Research Abstract

The aim of this research project was to examine the role of developmental and culture-specific factors in eating disorder symptoms among two samples of Korean adopted adolescent girls. First, I sought to replicate past research that suggested early pubertal timing was associated with eating disordered outcomes. The second aim was to examine the association between racial, ethnic, and adoption factors and eating disordered outcomes. Third, the purpose of this research was to test whether these latter associations were moderated by pubertal timing. The relation between early menarche and body dissatisfaction was only replicated in the second study. In the first study there were significant main effects of both birth preoccupation and racial discomfort on two of the eating disorder outcomes – binge eating and weight preoccupation. The first study also revealed a significant main effect between cultural socialization and compensatory behaviors. In the second study, there were significant main effects of birth preoccupation on body satisfaction and eating disordered symptom outcomes. There also were significant main effects of both adoptive identity and ethnic identity on satisfaction with Asian appearances. Across both studies, there was no support for the hypothesis that age of menarche would moderate the association between culture-specific factors and eating disordered outcomes. The study findings provide a cultural framework to help uncover the process and mechanisms by which cultural differences in body image and eating disordered symptoms may exist. My research also provides clinical implications in treating body image concerns and eating disordered problems among a sub-group of Asian American girls and women.

Shalini Ayyagari

Music

Mentor, Theodore Levin

Visualizing Music: A Discussion on the Role of Audio-Visuals in Ethnomusicology

This roundtable focuses on various facets of the value, use, perspectives, and ethics of audio-visual media in ethnomusicology. As technology, especially video, becomes more and more prevalent and user-friendly (recording devices, internet streaming, etc.), its uses are questioned less; it is as if the video camera has become invisible in much ethnographic research. However, the complex relationships that arise in the use of video are often extraordinarily powerful in shaping ethnography and need to be examined with more discerning attention. In this roundtable we will work outwards from diverse case studies and explorations of the changing role of video in ethnomusicology to address a constellation of concerns -- from children's music of South Africa, to musical performances in Liberia, from artistry in Afro-Brazilian samba-reggae, to a hereditary caste of professional musicians in Rajasthan, India -- What is our role as ethnomusicologists to our subjects in terms of audio-visual representation and how can we use such media in greater purposes of social intervention and ethical responsibility? What are the collaborative and reflexive processes that can be used in the production of ethnographic knowledge? What are the ethics of video work in terms of access, ownership, and responsibility? Following the case study presentations there will be a roundtable discussion between the panelists and audience on the use of video in field research: the benefits of using video in the field; the rights and responsibilities of video researchers; and the historical role of video in ethnomusicology as a field.

LINK TO CONFERENCE WEBSITE:

<http://www.indiana.edu/~semhome/2009/index.shtml>

Hassina Benchabane

Genetics

Mentor, Yashi Ahmed

Jerky/Earthbound, novel regulators of Wnt/Wingless signaling, promote β -catenin/TCF complex formation

The Wnt/Wingless signal transduction pathway directs cell proliferation, differentiation, and death during metazoan development and is misregulated in several developmental diseases and types of cancer. The cellular responses to Wnt stimulation are tissue- and stage-specific and considerably diverse; however, the mechanisms that translate cell context into Wnt signaling outcome remain obscure. Using a genetic screen in *Drosophila* for context-specific Wingless pathway components, we identified Earthbound 1 (Ebd1), a novel member in a protein family containing Centromere Binding Protein B (CENPB)-type DNA binding domains. Ebd1 is required for tissue- and stage-specific transduction of the Wingless signal, and interacts with discrete chromatin sites, as well as with the Wingless pathway transcriptional co-activators Armadillo/ β -catenin, TCF, and Pygopus. We find that the human CENPB domain protein Jerky (JRK/JH8), previously implicated in development of juvenile myoclonic epilepsy, is a functional homolog of Ebd1. Jerky replaces Ebd function when expressed in *Drosophila*, facilitates Wnt signaling in colon carcinoma cells, and not only interacts with β -catenin and Lef1, but also acts as a bridge between these two proteins to promote their transcriptional activity. Our findings provide in vivo evidence that evolutionarily conserved co-activators such as Jerky/Ebd1 confer contextual regulation to Wnt/Wingless responses by promoting assembly of the β -catenin/TCF transcription complex.

Nicole C Smits

Medicine

Mentor, Nicholas W. Shworak

HSAT⁺-deficient mice exhibit a pro-inflammatory phenotype.

Antithrombin (AT) therapy reduces morbidity/mortality in systemic inflammatory response syndromes, such as septic shock. These effects stem from the ability of AT to directly initiate cell signaling (AT inhibits activation of NF- κ B, a potent pro-inflammatory transcription factor). It is presently unclear whether or how anticoagulant heparan sulfate (HSAT⁺) is involved in AT anti-inflammatory signaling. If HSAT⁺ regulates anti-inflammatory signaling then Hs3st1^{-/-} mice, which have reduced HSAT⁺, should exhibit a pro-inflammatory state. We tested this presumption using a mouse model of septic shock; female mice were administered LPS (50 mg/kg) and hemodynamics were monitored with a cardiac pressure-volume catheter. LPS induced death in 66.7% of Hs3st1^{-/-} vs. 16.7% of Hs3st1^{+/+} mice (P = 0.24). Moreover, 3 h after LPS the end systolic pressure (ESP) of Hs3st1^{-/-} mice fell by 26.2% (P = 0.07), but was unaltered in Hs3st1^{+/+} mice. Loss of blood pressure was not due to vasodilatation because vascular resistance did not decrease and levels of plasma NO products (a potent vasodilator) were comparable between genotypes. Instead, Hs3st1^{-/-} mice showed loss of left ventricular function as indicated by decreases in ejection fraction, dP/dt max, and preload adjusted maximal power. Thus, Hs3st1^{-/-} mice exhibit a pro-inflammatory phenotype characterized by selective sensitivity to LPS induced septic shock (featuring cardiogenic shock). We are now examining whether this pro-inflammatory phenotype stems from a loss of HSAT⁺ mediated anti-inflammatory signaling of endogenous AT. Our results provide an initial step towards elucidating the potential role of HSAT⁺ and AT in a natural anti-inflammatory pathway of the blood vessel wall.

Michelle Sama

Physiology

Mentor, Hermes Yeh

Research Abstract

A key challenge in Alzheimer's disease (AD) research is identifying reliable diagnostic markers for early stages of AD or high risk in developing AD. Using AD (3xTg-AD) transgenic mice, we tested the hypothesis that a decrement in learning and memory is an early indicator of AD that becomes manifest prior to amyloid- β plaques and neurofibrillary tangles. This project focuses on the medial septum/diagonal band of Broca (MS/DB), which is strongly implicated in cognitive functions and contributes to cholinergic innervation and hippocampal rhythmic neuronal activity. Here we show that (1) a decrement in spatial learning and memory is evident before frank AD pathologies, and (2) behavioral deficits correlate with altered nerve growth factor (NGF), cholinergic, and/or GABAergic signaling in the MS/DB.

Two to six-month old 3xTg-AD and wild-type mice were tested for spatial learning and memory using a modified Barnes maze. At these ages, AD pathology in cortex and hippocampus is limited to sparse intracellular amyloid- β and tau protein. Behaviorally tested mice were sacrificed and MS/DB and hippocampus microdissected for NGF-ELISA or for immunohistochemistry. Behaviorally, the 6-month old wild-type mice improved with training, showing incremental decrease in time required to complete the task, lower failure rates and more errors during reversal. The 3xTg-AD cohorts were deficient in these spatial learning and memory parameters, indicating deficits in "learning/encoding" new tasks, precluding an accurate assessment of "memory/retrieval" of that task. ELISA revealed a significant decline in NGF levels in the septum but not hippocampus. In contrast, 2-month old 3xTg-AD mice did not display any of the behavioral deficits and NGF levels were normal. These results indicate that spatial learning deficits occur prior to 6 months of age in the 3xTg-AD mice. Ongoing neuroanatomical and electrophysiological studies are investigating the neural mechanisms underlying the relatively early onset of spatial learning deficit.

William Breen

Psychiatry

Mentor, Janette Seville

Research Abstract

Most work on positive psychological states in psychopathological conditions has not considered life domains (Brown, Chorpita, & Barlow, 1998; Kashdan & Steger, 2006). We sought to extend this research by examining sexual activity and rewards derived from these events in people with varying levels of dispositional social anxiety. The relative neglect of sexual activity among socially anxious people is unfortunate given robust associations between healthy sexuality and quality of life (Frisch, 1998). Moreover, there is growing evidence that meaningful social interactions and relationships serve a central role in psychological and physical well-being (e.g., Diener & Seligman, 2002). Socially anxious people report a range of sexual problems including fewer sexual partners, greater performance anxiety, and more frequent premature ejaculation (e.g., Bodinger et al., 2002; Figueira et al., 2001; Fontenelle et al., 2007). Unfortunately, this small body of work is limited by global questionnaires about sexual history. We present a 21-day experience-sampling study of college students ($n = 150$). Respondents recorded daily sexual episodes including sexual activities, partners, emotions experienced, emotion regulation strategies employed, and social anxiety.

We conducted a hierarchical linear modeling analysis (HLM 6.0; Bryk, Raudenbush, & Congdon, 2000). Results suggest that social anxiety decreased the likelihood of orgasms during sex ($p = .04$). For women, greater social anxiety was associated with decreased sexual activity ($p = .002$), and less enjoyment from kissing ($p = .006$), oral ($p < .001$) and vaginal sex ($p = .002$). Other results indicate that social anxiety on a given day and attempts to conceal these feelings moderates the influence of social anxiety on daily sexual activity and reward responsiveness. Overall, these findings suggest that healthy sexual activity is compromised by elevated social anxiety, particularly in women. We discuss the importance of these findings for future research.

Andrew Connolly

PBS

Mentor, James V Haxby

Highdimensional representations of the animal kingdom family tree in human ventral temporal cortex

Evidence indicates that the human ventral temporal cortex (VT) is specialized for representing living things – especially animate objects, like animals and humans. However, the bulk of this evidence – primarily from neuroimaging and lesion studies – reflects coarse distinctions, such as selectivity for living vs. non-living things or faces vs. body parts. We present a more detailed depiction of the structure of information in VT, using a recently developed analysis technique for fMRI called similarity-based pattern analysis. During fMRI scanning, subjects ($n=9$) viewed photographs of six animal species – two species each of primates, birds, and insects. The recorded patterns of brain activity for each animal species were then treated as high-dimensional vectors or points in a high dimensional space, where each dimension corresponds to a particular voxel of the brain image. The pair-wise distances between vectors were used to construct a 15-dimensional neural similarity space, where each dimension corresponds to the distance between a species pair. The result is a highly stable and replicable similarity space in VT with an average between-subject correlation of $r=.93$, which is higher than that for regions earlier in the visual processing stream: lateral occipital cortex (LO), $r=.75$; calcarine cortex (CC), $r=.59$. Thus low-level visual features cannot account for the high cross-subject agreement in VT. Hierarchical clustering reveals a categorical structure in VT that mirrors intuitions about animal species and recapitulates the Linnaean order: two species each from primates, birds, and insects respectively patterned with each other, and birds and primates formed a cluster separate from insects. Such structure was less evident in LO and not evident in CC reflecting the functional formation of categories along the visual pathway. We discuss implications of this research in terms of increased sensitivity for revealing the structure of neural

Ernesto Ruleas

Biology

Mentor, Matthew P. Ayres

Phenological Plasticity In Hawk Migration

The timing of life history traits such as plant flowering and foliage development has received considerable attention in recent years for its responsiveness to changes in global climate. To understand how the phenology of bird migration changes over time and how it relates to extrinsic (environmental) and intrinsic (phenotypic) variables, I studied the migration of 11 species of raptors during a period of 17 years from a fixed monitoring locality in Mexico. I used multiple metrics to quantify interannual change under two different views: (1) a single-species approach, primarily examining variation in curve shape parameters and (2) a species-assemblage approach, measuring the pattern of temporal succession of species, the dominance and species turnover, and deviations in the sequential position of species from those of the “typical” migration. The two seasons produce contrasting results: in spring, more species show bimodal distributions with a trend of increasing “peakedness” across most species and the complete assemblage shows a temporally aggregated pattern with unclear single-species dominance over the length of the season. During the autumn, more species have normal distributions and species turnover has “clumped” patterns that denote clear dominance of individual species during a migration. In both seasons, the timing of individual species is highly plastic and directional; variation from the peak season ranges from -3.1 to -11.8 days (earlier) in spring and 2.3 to 8.5 days (later) in the autumn. Species with smaller body weight and invertebrate and bird diets show the highest degree of change; species with the longest migrations and larger body weights show the least amount of variation. The influence of extrinsic variables has been shown to advance/delay events such as the timing of migration in birds; the study of phenotypic correlates contributes to our understanding of the mechanisms that govern these seasonal events.

Rachel Obbard

Thayer

Mentor, Ian Baker

Combining Analysis Techniques to Understand Brine Channel Morphology and Chemistry in Sea Ice

Sea ice forms a permeable barrier between the ocean and the atmosphere, and the physical and chemical processes in sea ice and their accurate representation in models are important to glaciologists, oceanographers, climatologists, and biologists. The complexity of sea ice arises from the fact that it is a multiphase material containing liquid brine, salt hydrates and gas, is generally found around the eutectic temperatures of several of these components, and is strongly anisotropic. These factors affect bulk properties including permeability, albedo, electrical resistivity. In addition, the brine channels provide an environment for microbial communities.

We have developed a set of mutually informative methods to study the type and location of impurities in sea ice and its brine pockets and the effects of temperature change on its structure. These include energy dispersive spectroscopy (EDS) on the scanning electron microscope (SEM), Raman spectroscopy on a confocal optical microscope, and micro computed tomography (micro CT).

We use an FEI XL-30 field emission gun environmental SEM to locate and identify the primary ionic constituents of sea salt in the lattice and frozen brine pockets. A WITEC CRM 200 Confocal Raman microscope allows us to identify the chemical groups, and, thus, compounds present in liquid brine channels at in situ temperatures. Finally, analysis with a Skyscan 1172 micro CT produces three dimensional models of the brine network and pore space, separately, in the sea ice matrix and is used to measure changes in these with temperature. We demonstrate the capabilities of these methods on ice collected from the Amundsen Sea in February 2009.

Aurelie Deveau

Micro/Immuno

Mentor, D. A. Hogan

Research Abstract

C. albicans is an opportunistic fungal pathogen capable of causing a wide range of diseases, from mild mucosal diseases to life-threatening systemic infections. *C. albicans* frequently encounters high levels of oxygen reactive species (ROS) during interactions with other microorganisms and during infection of human tissues, and needs to reliably respond to these assaults to survive. Farnesol, a cell-cell signaling molecule produced by *C. albicans*, which has been first described to inhibit hyphal growth, has a dual effect by protecting against oxidative stress and generating ROS. The mechanism under these two processes remains to be determined. Here, we demonstrated that farnesol protects against oxidative stress by inhibiting the Ras1-adenylate cyclase-PKA signaling pathway as strains lacking this pathway no longer exhibit increased protection against ROS upon incubation with farnesol. To determine if there were connections between the generation of ROS in the presence of farnesol and its ability to protect against oxidative stress, we show that incubation with antioxidants that reduce ROS generated by farnesol do not reduce its protective effect. In addition, while we confirm previously published reports that the Hog1 signal transduction cascade is activated by farnesol, we show that HOG1 is not necessary for the farnesol-mediated protection against oxidative stress. All together our results demonstrate that the Ras-adenylate cyclase-PKA pathway is a keystone for the activity of farnesol in *C. albicans* and its inhibition is responsible for a significant part of the pleiotropic effects of farnesol.

Jennifer Erickson

Dickey Center

Mentor, Daryl Press

Stopping the Legal Flow of Weapons: Compliance with Arms Embargoes, 1981-2004

Since the 1990s especially, economic sanctions have become a common tool of foreign policy, often invoked by states and the international community in an attempt to deny human rights violators and conflict participants tools of repression and violence. However, the ability of sanctions to achieve these goals is a matter of much debate among scholars and policymakers. While proponents defend the utility of sanctions as an effective alternative to force, skeptics question their efficacy, blaming in part the allegedly frequent noncompliance of sending states. Yet studies of sanctions compliance have typically been limited to selected cases, rather than more comprehensive assessments. This article uses a large-N quantitative analysis to examine states' compliance with one of the most frequently used types of sanctions, arms embargoes, from 1981 to 2004. Using a newly coded arms embargo variable, it explores the relationship between arms embargoes and small and major conventional arms exports by ten top supplier states. It finds that, contrary to the expectations of some sanctions skeptics, arms embargoes do appear to have a dampening effect on conventional arms transfers. This suggests that an inability of sanctions to alter target state behavior may rest with reasons other than the noncompliance of sending states. It also suggests that efforts to control not only the legal arms market, but also illicit arms flows are of paramount importance in reducing the adverse effects of conventional arms transfers to repressive regimes and conflict zones.

Ping Lou

Biology

Mentor, C. Robertson McClung

Research Abstract

The endogenous circadian clock confers an internal periodicity that synchronizes an organism with the environmental period imposed by Earth's rotation; when internal and external periods diverge, performance measures such as net photosynthesis decline dramatically. Crop species encounter widely differing environmental conditions, including variable day length and temperature. Thus, variation in circadian clock function has implications for agricultural productivity, especially among crops grown across wide latitudinal ranges. To date, studies of the plant circadian clock have emphasized *Arabidopsis thaliana*.

We have extended this study to the crop plant, *Brassica rapa*. There is considerable variation in clock function among cultivated *Brassica rapa* accessions. To identify genes responsible for this natural variation we have analyzed a set of Recombinant Inbred Lines to identify Quantitative Trait Loci (QTL) for period, amplitude and temperature compensation of the circadian rhythm in leaf movement and for flowering time, as well as for a number of morphometric parameters, including, size of floral organs, and hypocotyls length. We are generating Heterogeneous Inbred Families and Near Isogenetic Lines (NILs) to identify the genes responsible for these QTL, also testing candidate loci in transgenic *Arabidopsis* and *B. rapa*. We have developed a transgenic *B. rapa* hypocotyl system that expresses a light- and temperature-entrained circadian clock, as measured with clock-regulated reporter gene fusions. Our results suggest that there is considerable potential for the modification of circadian clock function as well as floral traits in *B. rapa* crops grown under agro-ecologically relevant day length and temperature settings.

Bryan Kolaczkowski

Biology

Mentor, Andrew Kern

Research Abstract

Understanding the genomic changes responsible for environment-specific adaptation is one of the major current challenges in population genetics. The unprecedented recent availability of fully-sequenced genomes from multiple individuals in the same species—coupled with growing comparative-genomic data—provides an opportunity to examine the genomic targets of selection in the model organism *Drosophila melanogaster*. Here I use a robust statistical procedure to identify which of the substitutions along the *D. melanogaster* lineage were fixed due to positive selection vs. neutral processes. I characterize the distribution of these adaptive changes across the genome as well as across different functional categories—coding vs. noncoding changes, etc. I use the same approach to examine substitutions arising in a North American population of *D. melanogaster* relative to the ancestral African population. The results of these analyses provide important information about the extent and targets of natural selection within *D. melanogaster* as a species as well as the specific evolutionary pressures driving adaptation to the temperate North American climate.

Jeffery Evans

Biology

Mentor, Rebecca Irwin

Invasive plant species as drivers of community disassembly

Invasive plant species constitute a significant threat to the integrity of native plant communities. Weedy invaders are known to affect soil nutrient composition and can radically alter soil microbial communities through allelopathic interactions. These impacts can cascade through invaded plant communities and force changes in native plant species composition and patterns of species aggregation. Natural communities frequently exhibit significant spatial structuring, resulting in the formation of distinct species assemblages. The introduction of non-native invasive plant species which alter both abiotic conditions and biotic interactions have the potential to cause disassembly of naturally structured native communities. This disassembly has been observed in ant species, where the introduction of an exotic, invasive ant species led native ant species to become more highly aggregated and co-occur more frequently than in uninvaded communities. Using county-level presence-absence data on the distribution of native and exotic plant species, we evaluated the role of invasive plant species as potential drivers of plant community disassembly in North America. We calculated Stone and Roberts' checkerboard scores (C-scores) to quantify the degree of spatial aggregation and cooccurrence in species assemblages for both native and exotic plant species within bootstrapped, randomly selected clusters of adjoining counties. Spearman rank correlations between native and exotic C-scores within clusters indicated whether increased dissimilarity in exotic species composition between adjoining counties was correlated with disassembly of native plant community composition. Taken together, results from this research point to the importance of community disassembly theory in the study of species invasions.

David J Graber

Pathology

Mentor, Brent T. Harris

Synthetic triterpenoids attenuate nitric oxide synthesis in microglia and induce NADPH:quinone oxidoreductase activity in astrocytes

Oxidative stress and overactive immunological events are involved in the pathology of several neurodegenerative diseases including amyotrophic lateral sclerosis (ALS). The loss of the upper and lower motor neurons in ALS results in skeletal muscle atrophy and ultimately lethal paralysis. Survival is typically within five years of diagnosis and there is no treatment to halt the clinical progression. The mechanism for the neuron loss remains unclear, but recent evidence suggests that the nearby supporting cells, microglia and astrocytes, are intimately involved creating a complex pathogenic environment that has proven difficult to treat clinically. Triterpenoids belong to the group of saponin compounds and are naturally produced in some plants. They have a structure similar to cholesterol and steroids, and are bioactive in mammals. Synthetic triterpenoids generated as derivatives of oleanolic acid have enhanced action on several cellular pathways including attenuating the synthesis of harmful oxidative/nitrosative products and stimulating the production of cytoprotective enzymes. Since oxidation/nitrosation and localized inflammation are evidenced in motor regions of the central nervous system in ALS, these synthetic triterpenoids may prove to be an effective treatment. We examined the effects of several synthetic triterpenoids as derivatives of 2-Cyano-3,12 dioxooleana-1,9 diene-28- imidazolide (CDDO) on microglia and astrocytes in cell culture. The CDDO compounds attenuated endotoxin-stimulated nitric oxide production in microglia and increased NADPH:quinone oxidoreductase activity in astrocytes. The observed effects occurred with nanomolar concentrations. We propose synthetic triterpenoids should be tested in animal models of neurodegenerative diseases including the mutant human superoxide dismutase-1 transgenic model of ALS for their ability to delay onset and prolong survival.

Jingang Gui

Pharm/Tox

Mentor, Ruth W Craig

The Effects of the Viability-promoting MCL1 Transgene are Modulated by Host Factors (e.g., Age/Sex) and by Antigen/Cytokine Stimulation.

Our studies utilize a transgenic mouse model expressing MCL1, a viability-promoting BCL2 family member, to better understand the role of this gene in controlling cell survival in the lymphoid lineage. Our goal is to be able to use this knowledge to expand particular lymphocyte populations as needed (e.g., in response to antigen stimulation) or to contract populations that are not needed or are overabundant (e.g., in inflammation or cancer). Our present work focuses on the effects of MCL1 in the T-cell lineage, and has followed cells ranging from early T-cell progenitors (ETPs) through the mature cells subject to antigen stimulation. We initially examined developing cells in the thymus, as a follow-up to previous studies demonstrating splenic enlargement in the presence of the transgene. Unexpectedly, we observed thymic enlargement in transgenic females (versus age-matched controls), but this did not occur in males. An expansion of the rare ETP subpopulation was found to underlie this enlargement. Despite the enlargement, the transgene did not prevent thymic involution with age, nor did it change the proliferation and apoptosis rate of the thymocytes. The MCL1 transgene also had effects in mature T-cells (explanted into primary culture from the spleen of males or females), extended viability being seen in both naïve and T-cell receptor (TCR)-stimulated cells. Exogenous Interleukin 2 slowed down the decline of MCL1 in naïve T cells. TCR engagement increased transgene expression and interleukin 2 secretion; blocking the latter using neutralizing antibody annulled the increase in MCL1 expression. These findings show that the effects of increased MCL1 expression are dependent on cell developmental stage, and can be overcome by homeostatic factors, including factors related to age, sex, and antigen/cytokine stimulation. Understanding these factors will suggest means of targeting MCL1 to aid in regulating lymphocyte homeostasis.