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2022-2023

September 16, 2022 – Matt Carter, Associate Professor of Biology
"Strategies for designing and delivering a scientific presentation"
It takes time, effort and skill to design and deliver an engaging scientific talk that audiences understand and remember. In this one-hour presentation, we will discuss three aspects of designing an outstanding scientific talk: (1) organizing complex scientific information into a clear narrative; (2) using PowerPoint or Keynote software to visually communicate scientific concepts; and (3) improving verbal and nonverbal delivery during a presentation. This seminar is open to anyone and is especially applicable to senior thesis students.

September 30, 2022: Professor Pam Templer, Boston University
"Imagining Future Forests Through Climate Change Experiments"
Carbon dioxide uptake by terrestrial ecosystems around the globe offsets approximately one third of emissions of this greenhouse gas from human activities like burning of fossil fuels and deforestation, yet this carbon sink may be threatened by climate change. Mean annual air temperatures are projected to increase, while the winter snowpack is expected to shrink in depth and duration for many mid-and high-latitude temperate forest ecosystems over the next several decades. Together, these changes will lead to warmer growing season soil temperatures and an increased frequency of soil freeze-thaw cycles in winter. We utilized our Climate Change Across Seasons Experiment (CCASE) at the Hubbard Brook Experimental Forest in the White Mountains of New Hampshire, USA to determine how these changes in soil temperature affect multiple biological processes in the northern hardwood forest. We found that warmer growing season temperatures increase rates of tree growth and carbon sequestration, primarily due to greater soil nutrient availability and uptake by trees leading to greater rates of photosynthesis. However, we found that these gains are offset significantly by soil freeze thaw cycles in winter, which damage tree roots, decrease nutrient uptake, and reduce C sequestration in the aboveground biomass of trees. Together, these results demonstrate that utilizing nature-based solutions to mitigate climate change requires an understanding of how forests may change in the future.

October 7, 14, 21: Honors Talks

November 4, 2022: Dr. Shannon LaDeau, Cary Institute of Ecosystem Studies
Biology Class of 1960 Scholars
"Legacies of Disinvestment Shape Vector-borne Disease Risk in Temperate Cities"
Vector-borne disease (VBD) is a growing concern in urban communities across the globe. In recent decades, the emergence and spread of mosquito-borne viruses in temperate cities has highlighted critical gaps in capacity to identify and manage arthropod vectors and associated risk in complex urban landscapes. While predictions are generally at regional scales, variation in mosquito density and human disease often reflects neighborhood boundaries and most control/management tactics are inherently retrospective. Our team employs ecological and environmental justice tools to evaluate mechanisms of mosquito ecology and human exposure in Baltimore City, MD. Our work demonstrates that legacies of race-based investment policies continue to influence variability in mosquito population growth and a suite of phenotypic traits that inform vector competence, as well as specific human behaviors and risk perceptions that influence exposure. We further evaluate how ongoing urban greening processes further refine the heterogeneous riskscape of VBD in temperate cities.

November 18, 2022: Professor Rebecca Dutch, University of Kentucky
BIMO Class of 1960 Scholars
"Human Metapneumovirus: Lessons From the Virus You Haven't Heard Of"
Human metapneumovirus (HMPV) is a non-segmented, negative strand RNA virus that is a major cause of respiratory tract infections in infants, the elderly, and the immunocompromised. Though HMPV was identified in 2001, there are currently no FDA approved antivirals or vaccines available, and many questions remain about its infection processes. A key feature in the replication cycle of HMPV is the formation of replication and transcription centers termed inclusion bodies (IBs). Our recent characterization of these compartments has yielded important new insights on their formation, characteristics and role in infection. We have shown that the actin cytoskeleton is important for their formation, and that they change in size and position over the course of infection. Recently published work from our laboratory shows that IBs represent a class of phase-separated regions, which is a newer concept in cellular organization. In addition, our unpublished work shows that IBs can be directly moved from one cell to another, identifying a new means of viral infection.

February 24, 2023: Professor Justin Touchon of Vassar College (New York)
Biology Class of 1960 Scholars
"Three phenotypes, one genotype: How variable gene expression leads to predator-induced phenotypic plasticity in a Neotropical tadpole"
Phenotypic plasticity is a nearly ubiquitous phenomenon in nature. Organisms often show adaptive changes in behavior, life-history, and morphology in response to environmental variation. Amazingly, these changes stem from an organisms single genotype. I will describe how Hourglass treefrog (Dendropsophus ebraccatus) tadpoles alter their phenotypes in response to predation risk and detail our efforts to understand the genetic basis of these adaptive changes.

March 10, 2023: Professor Matthias Stadtfeld, Department of Medicine at Weill Cornell Medicine (New York)
BIMO Class of 1960 Scholars
"Using pluripotent stem cells to model developmental and pathological epigenetic remodeling in mammals"
Dynamic cell fate specification during mammalian development requires controlled changes in gene expression, which in turn is driven by complex remodeling of chromatin modifications such as DNA and histone methylation. Incomplete or misdirected epigenetic remodeling is a common cause of developmental disorders and other diseases, but the inaccessibility and small size of the mammalian embryo complicates elucidating underlying mechanisms and risk factors. Pluripotent cell lines – which can be established either from early stage embryos or from adult cell types via reprogramming – can be readily expanded in vitro while in principle maintaining the ability to differentiate into all cell lineages, making these cells versatile tools to dissect the molecular underpinnings of developmental processes. After introducing the concepts of pluripotency and epigenetic remodeling, my talk will focus on the efforts of my group to use pluripotent cells to study the stability of genomic imprinting, a paradigmatic epigenetic mechanism in mammals, and the specification of specific cell lineages.

April 14, 2023: Amber Alhadeff, Monell Chemical Senses Center and University of Pennsylvania
"How do we regulate what we eat? Sensing of gut nutrients by the brain"
Hunger and food intake are tightly regulated by complex and coordinated gut-brain interactions. While we know some mechanisms through which the gut communicates with the brain, our understanding of how nutrients impact in vivo neural activity to regulate food intake is in its infancy. Our previous work demonstrated the ability of nutrients in the gut to rapidly modulate neural activity in a small population of hunger-sensitive, hypothalamic neurons expressing agouti-related protein (AgRP). Fats, sugars, or proteins alone are each capable of inhibiting AgRP neuron activity. How are these nutrients in the gut signaled to the brain to update nutritional status in real time to regulate what we eat? Because individual macronutrients engage specific receptors in the gut to communicate with the brain, we reasoned that macronutrients may utilize different pathways to reduce activity in AgRP neurons to reduce food intake. In this talk, I will show how different gut-brain mechanisms mediate the effects of glucose and fat on hypothalamic neuron activity to influence feeding. I will also describe emerging data describing how different sugars can differentially impact activity in the brain. Overall, since AgRP neurons drive food intake, understanding how nutrients modulate hunger circuits may inform new and effective weight loss strategies.

April 21, 2023: Emily Hatch '03, Assistant Professor, Fred Hutchinson Cancer Research Center (Seattle, WA)
Biology Class of 1960 Scholars
"The unexpected instability of the nuclear membrane"
Changes in the shape of the cell nucleus have long been used to diagnose cancer from biopsies and are associated with a large group of human genetic diseases, called laminopathies. However, the reasons for these changes and how they contribute to disease have remained mysterious. Recently, our lab and others discovered that these morphology changes can be correlated with an even more extreme phenomenon: nucleus rupture. During nucleus rupture, critical functions are impaired, and the DNA is exposed to a damaging cellular environment. Amazingly, nuclei can repair after these events and the cells continue to proliferate. However, our work demonstrated that when small nuclei, called micronuclei, form after DNA damage or defective cell division, they rupture at a high frequency and cannot repair. This leads to massive changes in the structure of the DNA that are frequent in many types of cancer. In addition, rupture in micronuclei and nuclei can induce inflammation and increase cell invasion. My lab is focused on understanding why nuclear rupture occurs, why these ruptures can only sometimes be repaired, and how nucleus rupture affects gene expression and cell behavior in cancer. In this talk, I will focus on recent work from the lab identifying a new mechanism by which histone modifications regulate the structure and stability of the micronuclear envelope through regulation of the nuclear lamina meshwork.

April 28, 2023: Eric Hoopfer, Assistant Professor of Neuroscience, Carleton College
"Using fruit flies to understand the neural basis of social behaviors"
Fighting and mating are closely linked social behaviors that are critical for the survival and reproduction of most animals. These behaviors involve complex social interactions that are influenced by external cues, experience, and the internal state of the animals. My talk will focus on our work using the fruit fly, Drosophila melanogaster, to identify the neural circuits that mediate aggression and courtship, and what these studies tell us about the basic neural mechanisms that influence the decision to fight or mate.

May 5, 2023: Data Blitz and Thesis Poster Presentations
Thesis students will present a poster on their research project, starting with a short, one-minute presentation about their work to a general audience 1:00pm. The purpose of this presentation is to succinctly summarize their thesis projects so that they can be understood by all faculty, students and friends in attendance. This will be followed immediately by a poster session on the 2nd floor of the Hopper where students will talk about their research and findings.