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September 18, 2015 - "Strategies for designing and delivering a scientific presentation" (by Matt Carter, Assistant Professor of Biology and Author of "Designing Science Presentations: A Visual Guide to Figures, Papers, Slides, Posters, and More")

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 25, 2015 (BIOL 60s Scholar) - Jack Bateman, Bowdoin College
"Interchromosomal interactions and nuclear organization in *Drosophila melanogaster*"

Studies from diverse systems have shown that distinct interchromosomal interactions are a central component of nuclear organization in eukaryotes. In fact, in some cases, genetic regulatory elements encoded on separate chromosomes can interact and influence gene expression. This phenomenon greatly complicates a long-standing question in genetic research: in the crowded three-dimensional space of the interphase nucleus, how do regulatory elements choose their correct target genes, and avoid acting on the "wrong" genes? My lab explores this question using *Drosophila melanogaster* as a model system.

October 2, 9, 16, 2015 - Thesis talks (on two of these dates depending on Mt. Day)

October 23, 2015 - Yaowu Yuan, University of CT
"Developmental Genetics of Pollinator-associated Floral Traits"

Most flowering plants rely on animal pollination for reproductive success. However, the genes and developmental networks regulating many of the pollinator-associated floral traits remain poorly understood, largely because the conventional genetic model system, *Arabidopsis*, is not particularly suitable to study these traits. We have developed a wealth of genomic and genetic resources and functional tools in a classical ecological and evolutionary model system, monkeyflowers (*Mimulus*), to dissect the genetic bases and developmental mechanisms of floral

trait evolution. The bulk of this talk will be composed of two stories: the first involves identification of a causal gene underlying natural flower color variation that contributes to pollinator preference between bumblebee-pollinated *Mimulus lewisii* and hummingbird-pollinated *M. cardinalis*; the second story concerns the utilization of chemically induced mutants of *M. lewisii* to discover the first transcription factor that regulates carotenoid pigmentation during flower development. I will finish the talk by briefly mentioning our ongoing efforts in studying the developmental genetics of other pollinator-associated floral traits (e.g., pigment patterning, corolla tube formation and elaboration, stamen and pistil length).

October 30, 2015 (co-sponsored with Neuroscience, Psychology and Cognitive Sciences)
- Michael Goldstein, Cornell University
"Emergence of Complex Communication from Simple Interactions: Lessons from Songbirds and Human Infants"

Despite the immense variety of sounds we associate with the animal world, the ability to learn a vocal repertoire is a rare phenomenon, emerging in only a handful of groups. To gain a better understanding of the development and evolution of vocal learning, we will examine the processes by which birds learn to sing and human infants learn to talk. A key parallel in the vocal development of birds and babies is the social function of immature vocalizations. The responses of adults to the plastic song of birds and the babbling of babies create social feedback that guides the young towards mature vocalizations. The difficulty of measuring rapid social interchanges organized by immature vocalizing has led many to overlook their importance and assume that young songbirds and human infants learn by passive exposure followed by motor practice. My research indicates that vocal learning is an active, socially-embedded process. By creating feedback that is both inherently informative and socially relevant, structured social interaction boosts the salience of acoustic patterns in the input, activates reward circuitry, and facilitates learning of speech and song.

November 6, 2015 - Roman Yukilevich, Union College
"Zooming in on rapid speciation in *Drosophila*: What drives inter-fertile, sympatric taxa to speciate?"

A ubiquitous pattern of speciation is the observation that sympatry often accelerates the evolution of sexual isolation in nature. While many have suggested that Reinforcement, natural selection to avoid maladaptive hybridization, is the main explanation for this pattern, it is not clear how it can explain rapid speciation between inter-fertile sister species. These inter-fertile taxa typically show rapid divergence in mating preferences and sexual cues that cause them to be strongly or completely sexually isolated. In this talk I will focus on such a case in the *Drosophila athabasca* species complex, which is composed of three behavioral races that have speciated only in the last 15,000-5,000 years. My primary focus is to decipher the causal target traits of speciation and to determine how mating preferences for such traits have genetically diverged across these races. I will also present data on the fitness consequences of hybridization between these races in order to test why mating preferences and sexual cue traits have diverged so rapidly. In total this system highlights the advantages of studying recently, but yet strongly reproductively isolated taxa to reveal the true targets and mechanisms of speciation.

November 13, 2015 (Co-sponsored by Neuroscience) - David Weinshenker, Emory University
"Norepinephrine-Dopamine Interactions Underlying Addiction and Arousal"

Drug addiction and Parkinson's disease are classically considered to be disorders of the dopamine system; all known drugs of abuse increase mesocorticolimbic dopamine transmission, and the motor symptoms of Parkinson's disease are caused by the death of dopamine neurons in the substantia nigra pars compacta. However, psychostimulant drugs also increase dopamine's lesser known catecholamine cousin, norepinephrine in the brain, and degeneration of the noradrenergic locus coeruleus actually precedes the degeneration of substantia nigra dopamine neurons and motor impairment in Parkinson's disease. Our work has focused on how modulation of dopamine systems by norepinephrine contributes to neuropsychiatric and neurological disorders.

November 20, 2015 (BIMO 60s Scholar) - Rachel O'Neill, University of CT
"The dark matter of genomes: understanding the forces and conflicts that drive genome change"

While genome sequencing has become more mainstream thanks to advances in modern sequencing technologies, most reference genome sequences (including human) are incomplete. For example, the centromeres of most multicellular eukarya consist of highly repetitive DNA composed of large arrays of simple satellites and transposable elements, rendering them intractable to traditional sequencing technologies and assembly algorithms. Paradoxically, the demonstrated lack of conservation of centromeric sequences, even among closely related species, suggests that the genomic component of eukaryotic centromeres is relatively rapidly evolving, while function is preserved by conserved epigenetic components. By using nontraditional models, genome sequencing and novel functional genomics approaches, my lab studies how selfish elements are an important component of chromosome function and may underlie the genetic conflict that drives genome evolution.

February 12, 2016 (BIMO 60s Scholar) - Russell Debose-Boyd, UT Southwestern Medical Center
"Mechanisms controlling degradation of HMG CoA reductase, the rate-limiting enzyme in cholesterol synthesis"

February 26, 2016 (Class of 60s Scholarss) - Biology Alumni Research Reunion with Carrie Tribble '13, Theresa Ong '09 and Erin Troy '01. Panel Discussion about science careers/grad school at 2:00pm followed by a poster session at 3:00pm in the TBL Lobby.

March 4, 2016 (Co-sponsored by Neuroscience) - Michael Krashes, NIH
"Hunger-drive motivational state competition"

Behavioral choice is ubiquitous in the animal kingdom and is central to goal-oriented behavior. Animals in nature are constantly bombarded by multiple sensory stimuli, and yet typically perform one behavior at a time. Agouti-related peptide (AgRP) neurons localized in the arcuate nucleus of the hypothalamus (ARC) are critical regulators of appetite. Utilizing ARC^{AgRP} neurons as an entry point into the brain modulating satiety state, we analyzed the hierarchical position of hunger in its ability to suppress or mask competing motivational systems including exploration/foraging, thirst, anxiety, fear and social interactions.

March 11, 2016 - Sigma Xi Lecture Eliabeth Kolbert, Author and journalist, Writer-In-Residence

April 8, 2016 - Michael Levy, University of Pennsylvania
"Socio-spatial studies of Chagas Disease in Peru"

Chagas disease, caused by the protozoan parasite *Trypanosoma cruzi*, has become an urban problem in the city of Arequipa, Peru. At every scale the factors that have led to the emergence of *T. cruzi* in Southern Peru are linked to larger political, social and economic phenomena in the region. On the scale of the city the distribution of the insect vector of the parasite (known locally as the 'Chirimacha') is constrained by the process of formalization of property; on finer scales fluctuations in domestic animal (mainly guinea pig) populations, ultimately driven by the price of feed and seasonal rains, can propel the parasite through vector colonies. The dense urban environment also complicates the control of the insect, and social pressures and systematic limitations of the health system threaten the success of an ongoing vector elimination campaign. Recently my group confirmed that the common bed bug (*Cimex lectularius*) can transmit *T. cruzi*—similar social, economic and political forces affect the spread of these insects and ultimately may determine whether they become important in the epidemiology of Chagas disease in the US and abroad.

April 15, 2016 - Alison Brody, University of Vermont
"Putting the below-ground above-ground in plant-animal interactions"

Plants interact with mutualists and antagonists and do so simultaneously. One of the most conspicuous and well-studied mutualism is that between plants and pollinators. From these, it's easy to assume that reciprocal interactions between plants and pollinators drive the evolution of floral traits. Yet, antagonists such as pre-dispersal pollinators, nectar robbers and pollen thieves often use the same cues in locating hosts and exert significant selection that opposes that of pollinators. I will first set the stage by providing data on complimentary and conflicting selection pressures exerted by pollinators, pre-dispersal seed predators, and pollen thieves on the floral trait evolution and the maintenance of females in a gynodioecious plant, *Polemonium foliosissimum* ("sticky Polemonium"). I will then link these above-ground interactions to those occurring below-ground by exploring how, arguably the oldest mutualism—that between plants and mycorrhizal fungi— affects plant-pollinator interactions in sticky Polemonium and in highbush blueberry, *Vaccinium corymbosum*.

April 22, 2016 (Co-sponsored by Neuroscience) - Kai Zinn (Class of 60s Scholar), California Institute of Technology
"Control of synaptic connectivity by an interacting network of cell surface proteins"

We have defined a network of interacting *Drosophila* cell surface proteins in which a 21-member IgSF subfamily, the Dprs, binds to a 9-member subfamily, the DIPs. The structural basis of the Dpr-DIP interaction code appears to be dictated by shape complementarity within the Dpr-DIP binding interface. Each *dpr* and *DIP* gene is expressed by a unique subset of larval and pupal neurons. In the neuromuscular system, interactions between Dpr11 and DIP-gamma affect presynaptic terminal development, trophic factor responses, and neurotransmission. Interactions between Dpr10 and DIP-alpha control motor axon branching. In the visual system, *dpr11* is

selectively expressed by R7 photoreceptors that use Rh4 opsin (yR7s). Their primary synaptic targets, Dm8 amacrine neurons, express *DIP-gamma*. In *dpr11* or *DIP-gamma* mutants, yR7 terminals extend beyond their normal termination zones in layer M6 of the medulla. DIP-gamma is also required for Dm8 survival or differentiation. Our findings suggest that Dpr-DIP interactions are important determinants of synaptic connectivity.

May 6, 2016 - Thesis Poster Presentations