The 11th Annual W.M. Keck Center for Behavioral Biology Student & Postdoc Symposium

by Sarah Cash and Lauren Dembeck

The 11th Annual W.M. Keck Center for Behavioral Biology Student & Postdoc Symposium was held on Friday February 5th, 2010. There were 16 presentations from the NCSU Entomology, Biology and Genetics Departments, as well as from visiting scholars from Indiana University's Center for the Integrative Study of Animal Behavior and the Center for Behavioral Neuroscience in Atlanta. Undergraduate students were also given the opportunity to present posters on their research.

The first session offered a variety of topics. Shanshan Zhou showed that there is high plasticity in the expression of chemosensory genes in Drosophila *melanogaster*. Expression changes with various environmental and physiological conditions and throughout development.

Adrienn Uzsak is investigating "grouping effect" in cockroaches. Oocytes of grouped adult females develop more quickly than those from isolated females. Adrienn seeks to understand the mechanisms that cause this social interaction to lead to physiological effects. Preliminary evidence suggests it may be tactile signals.

Visiting from Georgia State University, Laura Been described her work on the neural regulation of reproductive behaviors in male Syrian hamsters, also referred to as "big, fuzzy Drosophila." Males typically show an opposite-sex odor preference, thus being highly attracted to females. Both the bed nucleus of the stria terminalis (BNST) and the medial preoptic area (MPOA) are critical for appetitive behavior. However, the MPOA appears to be more important for consummatory behavior.

Juliana Rangel Posada, who recently joined the Entomology Department as a postdoc with Dr. David Tarpy, presented her dissertation research on the signals and signalers initiating the departure of a honey bee swarm from its hive. Her research uncovered that nest-site scouts initiate the signals for departure by piping and producing buzz-run signals. The study showed how the meaning of common signals used in a context-dependent manner can alter behavior and in this case, promote group cohesion.

The second session began with Virna Saenz's presentation investigating genetic diversity in bed bugs. She noted that, with the recent resurgence of insecticide-resistant bed bugs, proper genetic characterization is necessary for developing management strategies. Using microsatellite markers, Virna genotyped bed bugs from up and down the US east coast, and discovered low genetic diversity within distinct populations. Her results suggested that populations are founded by a singly-mated female, with extensive inbreeding within populations.

The next speaker was Heather Hines, who discussed the use of transcriptomics to uncover candidate genes underlying wing patterning in *Heliconius* butterflies. Heather gauged differential gene expression in two genetic intervals associated with color pattern variation, combining data from microarrays and RNA sequencing.

Amy Ross receives the Best Speaker Award from Center Director, Dr. Robert Anholt, as presentation judges Drs. Ed Vargo, John Godwin and Stephanie Curtis look on.

Ayako Katsumata discussed her studies to better understand glucose aversion, a behavior in some German cockroach populations which deters them from eating glucose. While this trait may prevent cockroaches from consuming toxic glucose-containing baits, it also impacts foraging. One important result of her study was that glucose-averse cockroaches showed response to glucose not only in sweet taste receptor neurons, but also in bitter taste receptor neurons in electrophysiological tests. Because activation of bitter receptor neurons generally deters feeding, this unusual characteristic may be driving the aversive behavior.

Shifting away from insects, the final speaker of the session was Ian Hall, a visiting student from Indiana University. He used voltammetry to detect changes in the level of serotonin, a neurotransmitter thought to regulate social interactions, in the auditory region of mouse brains during interaction with an intruder mouse. He found increased serotonin levels during

these interactions; this response was correlated with the mouse's investigation of the intruder.

And with thoughts of cockroaches and mice in our heads, we enjoyed lunch.

The third session exemplified the diversity of research within the Genetics Department. Sarah Cash presented her work on sexual communication in *Heliothis virescens* and *H. subflexa*. The two moth species show important differences in the amount of (Z)-9-hexadecanal (Z9-16:Ald), which serves as an attractant for *H. subflexa* males. Sarah used fine-scale mapping to locate the Δ11 desaturase gene, the final enzyme in the biosynthesis of Z916:Ald. Quantitative real-time PCR revealed an increase in expression of this gene in *H. subflexa*. She will continue to investigate how coupled traits such as sexual signal and its reception evolve. Sarah was a runner-up for the Best Speaker award.

Fructose is commonly added to consumer products in North America and is even found inside Mr. Incredible- "it's everywhere". Amy Ross from Georgia State University is studying the effects of a high fructose diet on cognition using rats as a model. Rats were fed diets differing in fructose level and tested in a Morris water maze. Both juveniles and adults on high fructose diets showed impaired memory. Hippocampal insulin signaling, which is known to benefit memory, becomes impaired on a high fructose diet. This decreases hippocampal-dependent memory function. Amy was given the Best Speaker award consisting of Anholt and Mackay's new book on Principles of Behavioral Genetics and a W.M. Keck Center coffee mug!

Shilpa Swarup is using RNAi to dissect olfactory behavioral response profiles of odorant binding proteins (OBPs) in *D. melanogaster*. OBPs may be functionally important as transporters for hydrophobic odorants. Shilpa systematically suppressed the expression of each of 16 OBPs using a GAL4-UAS driver system with interfering RNAi and measured behavioral responses to a variety of different odorants. The suppression lines showed altered response profiles, as well as sexual dimorphism.

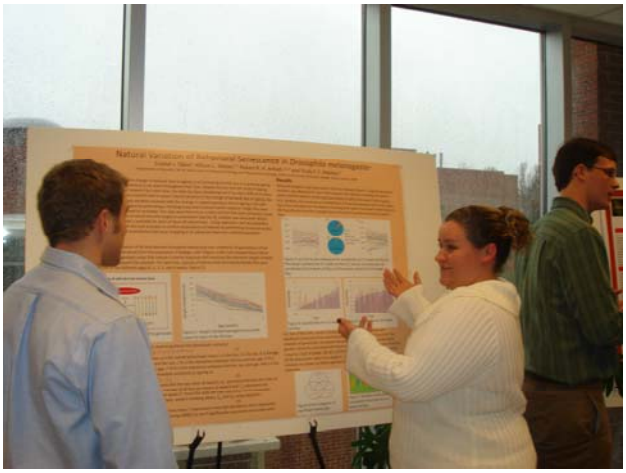
Megan Myrick presented a proposal to study the genetic drivers of brown adipose tissue response to changes in ambient temperature and dietary fat. She will be using the Collaborative Cross, a mouse reference population created for the analysis of complex traits, to investigate the genetic basis of metabolic variation that affects the deposition and activity of brown and white fat. Megan will measure gene expression and search for regulatory elements that may be involved with varied metabolic and adipose responses in her treatment groups.

The final session of the day began with Yazmin Serrano, who discussed her plan to investigate startle behavior in *Drosophila*. Atypical startle reflexes have been associated with many human psychiatric disorders. Using an intercross population, Yazmin proposed QTL mapping to identify candidate genes for startle behavior, and to possibly identify human orthologs.

Jennifer Hackney, a visiting postdoc from Indiana University provided the next talk of the session. Jennifer's work investigated the mechanisms underlying global developmental delay in response to injury. In insects like *D. melanogaster*, injury to specific tissues can result in prolonged developmental stages. Jennifer found that, in response to injury, the decreased expression of a specific set of genes regulated the levels of molting hormone to trigger systemic developmental delays.

Next, Lauren Dembeck discussed the use of the MAKER pipeline to annotate a genomic interval associated with color pattern variation in *Heliconius* butterflies. Her results will help identify functional loci within this large interval.

The final speaker of the day was Kultaran Chohan. Kultaran is investigating olfactory and gustatory responses to ethanol in *D. melanogaster*. While ethanol can signal flies to a fermenting food source, actually consuming the ethanol can be detrimental. In separate choice assays, he found that flies were attracted to ethanol as an odorant, yet avoided ingesting ethanol, even in the tiniest amounts. Kultaran was also a runner-up for Best Speaker.



Crystal Tabor shows her award winning poster on natural variation in behavioral senescence in Drosophila melanogaster.

In conjunction with the symposium talks, six undergraduate students presented posters of their research. Susan McGee presented a poster on negative geotaxis in *Drosophila*. James Oxendine's poster focused on a *Drosophila* model for glaucoma. Simona Dereje's study characterized where phosophofructo-kinase was expressed in the brains of bluehead wrasses. Kyle Craver analyzed aggression in *Drosophila*. Crystal Tabor's poster on behavioral senescence in *Drosophila* was awarded first place.

John Patrick McQuilling's poster on differentiation of adult human adipose-derived stem cells was awarded an honorable mention.

After a successful day, the evening was topped off with a delightful dinner at the Grossfelds. It was a full house and provided the opportunity for insightful conversations, relaxation, and even billiards. We would like to thank Bob and his wife for their hospitality, as well as all of the people who made this day possible.

Will the Meek Really Inherit the Earth?

by Stephanie Gorski

Our most recent social evening discussion featured a lively talk by John Godwin, entitled "Will the meek really inherit the earth?"

Research has been done on the genetic propensity in humans to respond to major stressors with an episode of depression. According to Caspi et al, people with the long promoter genotype of the serotonin transporter gene have a nearly even chance of becoming depressed regardless of life events, while those with the short promoter genotype become much more likely to experience depression when external events (such as the death of a loved one) trigger stress reactions. Some research has been done on anxiety and stressors in animals, but no one has yet isolated such a gene.

Godwin proposes that there might be a bimodal distribution of behavioral traits in the wild, with timid animals occupying one behavioral niche and aggressive ones occupying another. It is easy to see how a population of laboratory-reared animals might be unnaturally biased towards nonaggression, since problematic animals might not be bred.

There appears to be a distinct correlation between different types of anxious behavior. In one experiment, adult male rats were exposed to a rival and time spent in offensive aggression displays was measured. The same rats were also exposed to a novel stimulus, a shock probe, and could either actively bury the probe or passively freeze at the sight of it. Rats that spent more time in offensive aggression displays when introduced to another rat also spent more time burying the probe and less time freezing. Rats used in this experiment were all laboratory-reared, wild type rats. Interestingly, though, laboratory strains of rats under the same pressures were clustered towards the nonaggressive end of the spectrum.

Godwin has also spent time investigating the personalities of fish. He gave "Schrekstoff", an alarm pheromone released by club cells in fish, to wild and pet-store bred fish. The wild fish were much more likely to freeze after being given Schrekstoff, but there was no significant difference in time spent stationary before and after the pheromone was given to commercial fish. However, not all anxious behavior in fish is genetic; some of it appears to be learned. Lab-reared fish whose parents were exposed to predators will exhibit a fear response to a predator when they see it behind a glass panel. Fish whose parents were not exposed to predators will not.

Godwin has a detailed model of what an anxiety gene would look like, but he has not identified the gene. He wishes to search for the gene responsible for anxious behavior in rats and fish in the future.

Course Announcement

Drs. Fred Gould, Marce Lorenzen, and Max Scott will teach a course on Genetic Pest Management (ENT591/791 and GN810) in Fall, 2010. Genetic Pest Management or GPM is an approach for manipulating genomes of pest populations to decrease their density or render them harmless. The classical concepts behind GPM were developed over 40 years ago, but until now application of GPM has been limited. Advances in molecular genetics have made possible more precise manipulation of pest species' genomes, promising more efficient and sophisticated application of GPM to a much broader array of pest species. For information, contact Dr. Fred Gould (fred_gould@ncsu.edu).

Grants

Rob Dunn received an NSF Career grant to use citizen scientists around the world to explore the consequences of climate on ants under current and future climates.

Seminars

On **March 10**, 4:00 pm, Dr. Dan Ariely, James B. Duke Professor of Behavioral Economics at the Fuqua School of Business, Duke University will give a seminar, titled "Who Put the Monkey in the Driver's Seat?"

The seminar will be in 101 David Clark Laboratories. **Note, this is a Wednesday seminar.**

Publications

The following publications from the W. M. Keck Center for Behavioral Biology have appeared in print:

Menke, S. B., Booth, W., Dunn, R. R., Schal, C., Vargo, E. L. and Silverman, J. (2010) Is it easy to be urban? Convergent success in urban habitats among lineages of a widespread native ant. *PLoS ONE* **5:** e9194.