

The Signal

Monthly newsletter of the W. M. Keck Center for Behavioral Biology
at North Carolina State University
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Keck Center Welcomes Lisa McGraw



Lisa McGraw has joined the W. M. Keck Center for Behavioral Biology as an Assistant Professor in Biology with an associate membership in the Department of Genetics. Her recruitment was made possible by NC State's recent Initiative for Biological Complexity aimed at strengthening the Life Sciences at North Carolina State University.

Lisa received her Ph. D. at Cornell University under the mentorship of Dr. Mariana Wolfner with whom she studied the genetics of postmating changes in *Drosophila melanogaster*. Subsequently, she moved to the laboratory of Larry Young at Emory University, where she spearheaded efforts to generate genomic resources to study the genetics of social organization in voles. Her research utilizes a unique model organism, the prairie vole. These hamster-sized rodents differ

from more traditional laboratory animals in that they are highly social and socially monogamous. McGraw employs comparative studies between prairie voles and other closely related, but asocial, promiscuous vole species to explore the neurogenomic architecture of both social and reproductive behaviors.

Her research combines approaches derived from molecular biology, genetics, genomics, and neuroscience rooted in an evolutionary biology framework to uncover functional links between genes, the brain and complex behaviors. "Having Lisa join the Keck Center is a major boost for our programs," says Center Director Robert Anholt, "Her work bridges neuroscience, behavior and genomics, exactly the type of interdisciplinary research the Keck Center wants to foster."

The W. M. Keck Center for Behavioral Biology and the NCSU Initiative for Biological Complexity Announce the 2011 Professional Development Workshop on "The Future of Science in the USA; A Survival Guide for Young Scientists" on October 28, 2011, at Sigma Xi in Research Triangle Park. Registration and Program Information will be announced in the October issue of The Signal.

Shanshan Zhou Defends Her Thesis

by Lauren Dembeck and Shilpa Swarup

On March 9th, Shanshan Zhou, who studied under the direction of Drs. Robert R. H. Anholt and Trudy F. C. Mackay successfully defended her doctoral dissertation. Shanshan was a doctoral candidate of the Biology Department and the W. M. Keck Center for Behavioral Biology; her dissertation is titled "Genetic Basis of Phenotypic Plasticity in *Drosophila melanogaster*". Shanshan is a native of Beijing, China. Before coming to North Carolina State University, she attended Beijing No. 4 High School (Beijing Sizhong) and subsequently earned a Bachelor's degree in Biology from Tsinghua University.

Shanshan delved into the less studied corner of the genotype-phenotype-environment paradigm by studying phenotypic plasticity - the ability of organisms to produce distinct phenotypes under different environmental conditions. Using *Drosophila melanogaster* as a model species, she researched the transcriptome and how regulatory networks are influenced by and interact with the environment. With a focus on chemosensation, she constructed customized cDNA microarrays representing all classical odorant receptor genes, gustatory receptors and odorant binding protein genes of *Drosophila*. She investigated their expression patterns under different developmental stages, physiological status and social conditions. Shanshan found that cytologically clustered chemoreceptor genes undergo independent transcriptional regulation during different developmental stages and between sexes. Distinct subgroups of chemoreceptor genes are sensitive to reproductive state and social interactions. Fascinatingly, simply the exposure of flies to the odor of the opposite sex alters transcript abundance of chemoreceptor genes in a manner that is different than when flies are allowed physical contact.

She then decided to broaden her study in an ambitious pursuit to measure transcriptional variation in a synthetic outbred population termed 'Flyland' under 20 different environmental conditions. Flyland was constructed by crossing 40 inbred lines of *D. melanogaster* derived from a natural population. This was advantageous because the progenitor lines have sequenced genomes and published transcriptome data. She associated transcriptional variation induced by the environment with the environmental variation of different fitness traits including development time, life span, chill coma recovery, and starvation stress resistance.

She found that about 15% of the transcriptome is highly responsive to environmental changes. Of the environmentally sensitive transcripts, 1249 are highly significant for treatment and responded differentially to

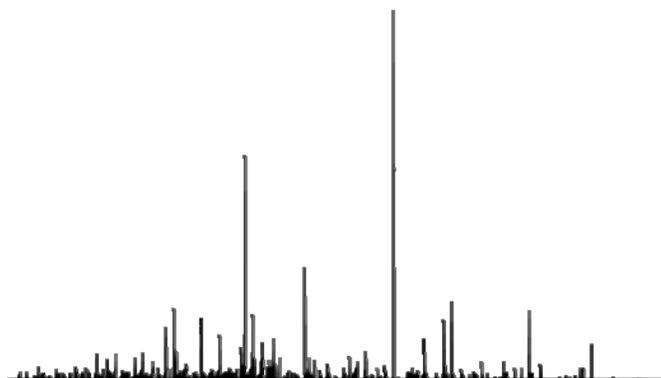


different environments. These transcripts are associated with response to heat shock, xenobiotic and energy metabolism, immune defense, proteolysis, transcription, computationally predicted transcripts of unknown function, and non-coding RNAs. She also identified 970 environmentally sensitive transcripts with low genetic variation that showed extensive sexual dimorphism and were enriched for transcripts associated with reproductive functions. She named these two groups of transcripts Class I and Class II transcripts. Her analysis of sequence conservation across 12 *Drosophila* species indicated that environmentally sensitive genes, especially the Class II transcripts are more rapidly evolving than genes with robust expression under different environments.

Shanshan's research provides intriguing insights into transcriptional co-regulation and is the largest most detailed study of environmental plasticity to date. She is currently continuing as a postdoctoral associate with Drs. Anholt and Mackay. We wish Shanshan all the best with her future endeavors and will miss her greatly when she leaves the "MacAnholt" lab.

The 59th Mass Spectrometry Conference in Denver

by Shilpa Swarup



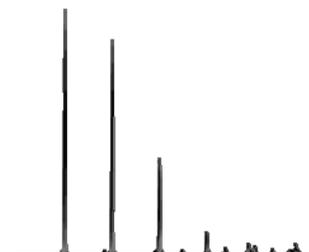
The American Society for Mass Spectrometry Conference was held this summer in Denver, CO. Being a graduate student of behavioral genetics, I thought the Mass Spectrometry conference would be a collection of unrelated area of research and speculated that I might struggle to understand exhibited research work. But then I came across a series of short courses being offered before the beginning of the conference and I was thrilled to see “MS of Peptides and Proteins” as one of them. I had used proteomics approaches in my research project, and hence decided to avail the opportunity to attend this short course. This is how I spent my two days before the conference - understanding material that spanned from characterization of proteins by mass spectrometry to emerging technologies in proteomics. We also learned to use computational tools such as String and Skyline to create and analyze targeted proteomics experiments. There were theoretical sessions backed up with problem solving sessions during the entire course period. We learned how to perform peptide mass fingerprinting searches, peptide sequencing and mass determination, and how to search databases on sequence data. During the second half of the course the instructors focused more on quantitative proteomics, bioinformatic tools and emerging technologies. At the end, students received participation certificates. There were five concurrent courses. Lunch breaks, as part of the workshop, proved to be a nice time to interact with people from scientific, industrial and academic backgrounds.

After completion of the two-day short course I was interested in knowing more about recent tools and methods in the mass spectrometry field. Hence, on the first day of the conference I attended a workshop that offered tutorial style presentation on how to use the freely available and open-source suite of software tools



for the analysis of proteomics shotgun datasets (called Trans-Proteomic Pipeline). They also showed us how to use other resources such as PeptideAtlas and SRMAtlas for planning targeted proteomics experiments.

I was aware that mass spectrometry could be used to quantify proteins in biological samples, but was amazed to see its wide applications in vast areas of research such as energy, petroleum and biofuels, drug metabolism and pharmacokinetics, posttranslational modification, protein structure and function, protein therapeutics and drug discovery, plant proteomics, environmental contaminants determination, analysis of dried blood samples and identification of bacterial strains in food samples. I was happy to present my research on ‘behavioral response profiles of odorant-binding proteins in *Drosophila melanogaster*’. Last but not the least, being in downtown and close to nice restaurants we explored various cuisines during our 4 day visit in Denver.



Keck Center Welcomes New Students and Postdocs

The Keck Center is looking forward to having new incoming graduate students join the Keck Center for Behavioral Biology community and extends a warm welcome to new postdoctoral fellows Ryan Wong, who comes to us from the University of Texas at Austin and will work with John Godwin, and Wen Huang, a postdoctoral fellow of the Initiative for Biological Complexity directed by Trudy Mackay who joins us from the University of Wisconsin at Madison.

Announcing the Keck Center's Popcorn Movie Series



The Keck Center is proud to announce its new monthly film series, organized by Shanshan Zhou. The first screening will be on **September 2** at 4:00 pm in 101 David Clark Laboratories, featuring *Animals are Beautiful People*. This movie, written and directed by Jamie Uys, who became well known for his movie *The Gods Must Be Crazy*, provides a beautiful and humorous account of adaptations of animals to different, often extreme, habitats in South Africa, including the Namibian and Kalahari deserts. Popcorn and soft drinks will be provided.

Seminars

On Monday, **September 12**, at 1:30 pm, Dr. Anandasankar (Anand) Ray from the Department of Entomology and Center for Disease Vector Research at the University of California at Riverside will present a seminar titled "Modulation of Olfactory Responses in *Drosophila* and Mosquitoes."

The seminar will be in the Stephens Room, 3503 Thomas Hall.

On Thursday, **September 29**, at 3:30 pm, Dr. Brenda Milner from the Neurological Institute of Montreal and the Department of Neurology and Neurosurgery at McGill University will present a seminar titled "Brain and Memory: Lessons from Neurosurgical Patients."

The seminar will be in 101 David Clark Laboratories.

On Thursday, **October 20**, at 3:30 pm, Dr. Nirao M. Shah from the Department of Anatomy at the University of California at San Francisco will present a seminar, titled "Sex, Genes, and Videotape: Representation of Gender in the Brain."

The seminar will be in 101 David Clark Laboratories.

On Friday, **October 28**, the W. M. Keck Center for Behavioral Biology organizes a professional development workshop, titled "The Future of Science in the USA: A Survival Guide for Young Scientists" at Sigma Xi in Research Triangle Park.

Look for complete information in the next issue of *The Signal*.

Grants

John Godwin received a two-year \$403,000 grant from the National Institute of Mental Health for a study on wild-derived zebrafish as models for anxiety and stress responsiveness.

Publications

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

Riesch, R. and Deecke, V. (2011) Whistle communication in mammal-eating killer whales (*Orcinus orca*): further evidence for acoustic divergence between ecotypes. *Behav. Ecol. Sociobiol.* **65**: 1377-1387.

Riesch, R., Colston, T. J., Joachim, B. L. and Schlupp, I. (2011) Natural history and life history of the Grijalva gambusia *Heterophallus milleri* Radda, 1987 (Teleostei: Poeciliidae). *Aqua, Int. J. Ichthyol.* **17**: 95-102.

Plath, M., Riesch, R., Culumber, Z., Streit, B. and Tobler, M. (2011) Giant water bug (*Belostoma* sp.) predation on a cave fish (*Poecilia mexicana*): effects of female body size and gestational state. *Evol. Ecol. Res.* **13**:133-144.

McCoy, E., Syska, N., Plath, M., Schlupp, I. and Riesch, R. (2011) Mustached males in a tropical poeciliid fish: emerging female preference selects for a

novel male trait. *Behav. Ecol. Sociobiol.* **65**:1437-1445.

Köhler, A., Hildenbrand, P., Schleucher, E., Riesch, R., Arias-Rodriguez, L., Streit, B. and Plath, M. (2011) Effects of male sexual harassment on female time budgets, feeding behavior, and metabolic rates in a tropical live bearing fish (*Poecilia mexicana*). *Behav. Ecol. Sociobiol.* **65**:1513-1523.

Bierbach, D., Schulte, M., Herrman, N., Tobler, M., Stadler, S., Jung, C., Kunkel, B., Riesch, R., Klaus, S., Ziege, M., Rimber Indy, J., Arias-Rodriguez, L. and Plath, M. (2011) Predator-induced changes of female mating preferences: innate and experiential effects. *BMC Evol. Biol.* **11**: 190.

Schlupp, I. and Riesch, R. (2011) Evolution of unisexual reproduction. In: *Ecology & Evolution of Poeciliid Fishes* (Ed. J. Evans, A. Pilastro and I. Schlupp). Chicago: University of Chicago Press, pp. 50-58.

Jackson, J. T., Tarpy, D. R. and Fahrback, S. E. (2011) Histological estimates of ovariole number in honey bee queens (*Apis mellifera*) reveal lack of correlation with other queen-quality measures. *J. Insect Sci.* **11**: 82.

McCaffrey, K., Hawkins, M. B. and Godwin J. (2011) Sexual phenotype differences in *zic2* mRNA abundance in the preoptic area of a protogynous teleost, *Thalassoma bifasciatum*. *PLoS One* **6**: e23213.

Swarup, S., Islam Williams, T. and Anholt R. R. H. (2011) Functional dissection of *Odorant binding protein* genes in *Drosophila melanogaster*. *Genes Brain Behav.* **10**: 648-657.

Groot, A. T., Classen, A., Inglis, O., Blanco, C. A., López, J. Jr, Téran Vargas, A., Schal, C., Heckel, D. G. and Schöfl, G. (2011) Genetic differentiation across North America in the generalist moth *Heliothis virescens* and the specialist *H. subflexa*. *Mol. Ecol.* **20**: 2676-2692.

Wada-Katsumata, A., Silverman, J. and Schal, C. (2011) Differential inputs from chemosensory appendages mediate feeding responses to glucose in wild-type and glucose-averse German cockroaches, *Blattella germanica*. *Chem. Senses* **36**: 589-600.

Legros, M., Magori, K., Morrison, A. C., Xu, C., Scott, T. W., Lloyd, A. L. and Gould, F. (2011) Evaluation of location-specific predictions by a detailed simulation model of *Aedes aegypti* populations. *PLoS One* **6**: e22701.

Aitman, T. J., Boone, C., Churchill, G. A., Hengartner, M. O., Mackay, T. F. C. and Stemple, D. L. (2011) The future of model organisms in human disease research. *Nat. Rev/ Genet.* **12**: 575-582.

Of note

Robert Anholt presented a poster, coauthored by **Shilpa Swarup**, at the Genetics of Behavior Symposium in Lausanne, Switzerland.

Jim Hunt participated in a working group on “Large-scale demographic, network, and behavioral trait analyses of sociality” at the National Evolutionary Synthesis Center.

Trudy Mackay delivered an invited lecture at the Genetics of behavior Symposium in Lausanne, Switzerland.

Sarah Oxendine and **Detric Robinson** won an award for their poster at the Global Change Meeting/Event at the NC Museum of Natural Sciences. Their poster was titled “America's next top model: what a little fish can tell you about yourself.”

Ruediger Riesch gave a presentation on “Speciation in subterranean habitats: experimental evidence that permanent darkness promotes reproductive isolation” at the Evolution Conference in Norman, OK.

Shilpa Swarup presented a poster at the annual Mass Spectrometry Conference in Denver, CO.

David Tarpy presented a seminar at the Entomology Department at Clemson University titled “The curious promiscuity of queen bees” causes and consequences.”

Ed Vargo gave an invited talk on “How genetic studies can help with subterranean termite management” at the International Conference on Urban Pests in Ouro Preto, Brazil.

John Vandenberg has been elected to Chair the Board of Directors of The Endocrine Disruption Exchange, a non-profit organization that monitors research on endocrine active substances and provides information to the public as well as promoting relevant legislation actions. He has also served as a consultant to the National Toxicology Program and chaired a special peer review committee at the NIEHS to evaluate a cellular and molecular based assay for detecting endocrine disruptors. He also serves as a consultant to the Health Section of the Pew Charitable Trusts and has been appointed by the National Academies of Science to be the review coordinator for an NRC report on “Guidance for adequate description of animal research studies in scientific publications to support reproducibility.”

To contribute to The Signal, to be placed on our mailing list or for information about the W. M. Keck Center for Behavioral Biology, contact Dr. Robert Anholt, Department of Biology, Box 7617, North Carolina State University, Raleigh, NC 27695-7617, tel. (919) 515-1173, anholt@ncsu.edu.

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