

The Signal

Monthly newsletter of the W. M. Keck Center for Behavioral Biology
at North Carolina State University
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A Critical Vote for Science



The outcome of this November's election will have a critical impact on the future of science and technology in the United States. Support for science and innovation has traditionally enjoyed bipartisan support. Few recent presidents, however, have been such outspoken supporters of basic science and higher education as President Obama. Allocation of 10 billion dollars to the National Institutes of Health as part of the stimulus package bears testimony to the importance this administration attaches to ensuring that the United States remains globally competitive in basic research. This requires not only support for established scientists, but also to ensure a pipeline of future scientists, able to establish themselves and carry the torch forward. This is a tall order under times of financial constraint, but essential for the economic wellbeing of the country's future which is critically dependent on keeping pace with scientific and technological innovations. Obama understands this connection, as, no doubt, does Governor Romney.

TEA party supporters at the extreme right, however, appear to be obsessed with deficit reduction and the looming fiscal cliff might pull the rug out from underneath the country's scientific future, and by inference its future competitiveness. Scientists also remember the "war on science" from the George W. Bush era, where political ideologies were allowed to infringe on scientific priorities. This undesirable scenario could happen again.

Early voting opens in North Carolina on October 18 and you can vote on the NCSU campus in the Talley Student Center. Your vote is important, now more than ever. To view the candidates' positions on science issues, you may visit the following website:

<http://www.scientificamerican.com/article.cfm?id=obama-romney-science-debate>.

Disclaimer: It should be noted that The Signal does not make political endorsements.

Sexual Conflict and Sperm Competition at the Keck Center

by Carlos A. Botero

On Monday, 24 September 2012, Dr. Lisa McGraw led an interesting discussion on seminal fluid proteins at the Keck Center's social evening discussion gathering. McGraw talked about how she originally became interested in this topic and walked us through a brief history of the study of sexual selection, extra-pair paternity and the opportunity for competition that is generated when females mate multiply. She discussed how the initial impetus in this field was on studying male traits involved in sperm competition and has more recently shifted towards female counter-adaptations. After covering some of the male basics (such as selection for larger testis size, sperm tail length, and penis bristles) she led a fascinating discussion on some of the striking effects of seminal fluid proteins, or SFPs, and talked about her earlier work on *Drosophila melanogaster* in Mariana Wolfner's laboratory at Cornell University.

Besides providing nourishment and improving sperm survival by balancing the pH of the female tract, male SFPs have also been linked to profound behavioral and physiological effects on females such as increased egg laying rates, increased capacity to store sperm, decreased attractiveness to other males, and a lower drive to mate again. Notably, they also appear to reduce female lifespan in *Drosophila*, as shown in selection experiments by William Rice at the university of California at Santa Barbara, in which survival decreased significantly after 50 generations of promiscuous mating (as compared to a monogamous-only mating line). This finding prompted a lively discussion among Keck Center members on the potential for adaptive benefits versus indirect effects of sperm toxicity. For example, we discussed the implications of the role of SFPs on female immune response and talked about the knock out experiments that helped uncover them.

The evening ended with a brief tour of McGraw's current work on voles. Prairie and meadow voles are respectively naturally monogamous and naturally promiscuous, thereby offering an opportunity to study the effects of very different degrees of sexual conflict on closely related species. McGraw is in the process of identifying the proteins in vole ejaculates through transcripts from testes and blast searches of known SFP sequences. She is also particularly interested in uncovering how SFPs may influence female behavior in this system, given that mammalian blood-brain barriers may prevent many SFPs from reaching the brain. Thank you Lisa for an interesting and insightful discussion!

Leslie Sombers Wins NSF CAREER Award



Leslie Sombers, assistant professor of chemistry at North Carolina State University, has received an Early Career Development Award, more commonly known as a CAREER Award, from the National Science Foundation. The award is one of the highest honors given by NSF to early-career university faculty in science and engineering, and is intended to advance the development of their research and careers.

Somers seeks to develop biosensors that will provide faster and more precise measurements of chemical activity in the brain and other biological tissues. Somers and her team will achieve these goals by using a voltammetric approach to monitor the enzymatic generation of hydrogen peroxide (H₂O₂) in tissue. The voltammetric approach is revolutionary because it offers selectivity, allowing for highly sensitive and location-specific biosensing in live tissue in real time.

In addition to facilitating basic science studies on chemical signaling in the brain, continued advancement of this technology addresses a growing need in industries from medicine and environmental monitoring to security and military biodefense.

Somers also hopes to use this work to engage future generations of scientists. A component of her grant will allow her team to develop K-12 educational and outreach programs in partnership with the NC Museum of Natural Sciences and The Science House.

Seminars

On Monday, **October 8**, at 1:30 pm, Dr. John R. Hibbing from the Department of Political Science at the University of Nebraska will present a seminar, titled "'Genetics and Politics: A Bridge Too Far?'"

The seminar will be in 3503 Thomas Hall.

On Thursday, November 8, at 3:30 pm, Dr. John C. Wingfield from the Department of Neurobiology, Physiology and Behavior at University of California at Davis will present a seminar titled "Putting the Brakes on Reproduction: Implications for Biomedicine, Conservation, and Global Climate Change?"

The seminar will be in 101 David Clark Laboratories.

Grants

Leslie Sombers received a five-year, \$600,000 CAREER award from the National Science Foundation for novel voltammetric biosensor design to promote interest and inquiry-based learning in electrochemistry.

Publications

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

Huang, W., Richards, S., Carbone, M. A., Zhu, D., Anholt, R. R. H., Ayroles, J. F., Duncan, L., Jordan, K. W., Lawrence, F., Magwire, M. M., Warner, C. B., Blankenburg, K., Han, Y., Javaid, M., Jayaseelan, J., Jhangiani, S. N., Muzny, D., Onger, F., Perales, L., Wu, Y. Q., Zhang, Y., Zou, X., Stone, E. A., Gibbs, R. A. and Mackay, T. F. C. (2012) Epistasis dominates the genetic architecture of *Drosophila* quantitative traits. *Proc. Natl. Acad. Sci. U.S.A* **109**: 15553-15559.

Patisaul, H. B., Sullivan, A. W., Radford, M. E., Walker, D. M., Adewale, H. B., Winnik, B., Coughlin, J. L., Buckley, B. and Gore, A. C. (2012) Anxiogenic effects of developmental bisphenol a exposure are associated with gene expression changes in the juvenile rat amygdala and mitigated by soy. *PLoS One* **7**: e43890.

Losa-Ward, S. M., Todd, K. L., McCaffrey, K. A., Tsutsui, K. and Patisaul, H. B. (2012) Disrupted organization of RFamide pathways in the hypothalamus is associated with advanced puberty in female rats neonatally exposed to Bisphenol A. *Biol. Reprod.* **87**: 28.

Cornman, R. S., Tarp, D. R., Chen, Y., Jeffreys, L., Lopez, D., Pettis, J. S., Vanengelsdorp, D. and Evans, J. D. (2012) Pathogen webs in collapsing honey bee colonies. *PLoS One* **7**: e43562.

Of note...

Trudy Mackay gave a seminar at the University of Virginia, Charlottesville (VA).

Lisa McGraw presented a seminar in the Department of Biology at East Carolina University, titled "Uncovering the neurogenomic architecture of social and reproductive behaviors."

Rüdiger Riesch gave a seminar in the Department of Biology at East Carolina University on ecological speciation in extreme environments. He also received a three-year postdoctoral fellowship funded by the Human Frontier Science Program to work on chemical communication and reproductive isolation within and between divergent *Timema* species with Dr. Patrik Nosil at the University of Sheffield (UK).

Leslie Sombers gave an invited lecture on voltammetric carbon-fiber microsensors for selective quantitation of rapid brain glucose fluctuations at the Monitoring Molecules in Neuroscience meeting in London (UK) and **Leyda Lugo-Morales** and **Marina Spanos** presented posters on enzyme-modified carbon-fiber microelectrode for the specific and sensitive quantification of choline using fast-scan cyclic voltammetry and on monitoring sub-second fluctuations in H₂O₂ and dopamine in the caudate putamen of anesthetized rats.

John Vandenberg has joined the Health Group at the Pew Charitable Trusts as a consultant on their "Food Additives" panel, which evaluates the risks associated with "food additives" such as bisphenol A from the lining of food containers and other sources. He has also been named a Reach Fellow sponsored by the School of Medicine at University of California at San Francisco and the Kresge Foundation to provide information to the Environmental Protection Agency on potentially harmful environmental estrogens. He presented a on "The science and policy of environmental estrogens" at the Vanderbilt School of Law.

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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