July 2015

THE OPEN READING FRAME

News and Recent Events

from the Biology Graduate Program at the University of Kentucky

Thoughts from the DGS

This second issue of our newsletter wraps up an exciting academic year. As you will see from the contents, the students in the Biology Graduate Program continue to do excellent work which is being recognized both within the University and around the country. Our three graduates this spring are moving on to excellent opportunities elsewhere. Current students are receiving awards to attend meetings and workshops and getting their work published. Some are even creating art and having it shown in local art galleries! The trial run of the 4th year symposium was a great success with 6 very good talks by some of our senior students. And, I must thank the BGSA for the Friday barbecues, which have managed to dodge all the rain this year and have been a great way for the whole department to mingle.

This newsletter, and future ones, will highlight graduate student publications. This spring the graduate program added a publication requirement for obtaining a Ph.D. I quote from part of the new policy, "The central requirement of a Ph.D. is to generate original scholarship, which in Biology constitutes new scientific information. The value of research is realized only after it is shared with the broader scientific community, and publication is the primary way we communicate original findings. Multiple publications are often necessary for entry into the most desirable career paths post-graduation. As a program, we expect students to be scientifically ambitious and prolific in the publication of their research findings, and we will support them in doing so in a variety of ways." As this language implies, the requirement itself is not as important as is developing a culture of doing good work and then disseminating that work to the scientific community. The program thus plans to celebrate student publications with much fanfare, and fortunately some have been very good at getting things in press this spring! Excellent job!

Finally, we had a great recruiting year in 2015. Thanks to the BGSA officers for doing so much to make Recruiting Day a success and to all the faculty and staff who pitched in. In August, 13 new students will join the program.

They are:

- **Nicholas Carrara**, Longwood College (MCDB)
- **Varun Dwaraka**, University of California – Santa Cruz (Voss)
- **Kaylynne Glover**, University of Central Arkansas (Crowley)
- **Lauren Guerriero**, Ohio Northern University (MCDB)
- **Kara Jones**, George Mason University (Weisrock)
- **Allyssa Kilanowski**, St. Lawrence University (Crowley)
- **Allison McLaughlin**, Ohio State University (Westneat)
- **Rebecca Petersen**, Bellarmine University (MCDB)
- **Warlen Piedade**, Sao Paulo State University (Cooper)
- **Cody Saraceno**, State University of New York – New Paltz (Smith)
- **Kristyn Van Der Meulen**, Wittenberg University (MCDB)
- **Megan Weaver**, University of Kentucky (MCDB)
- **Stephen Zumdick**, Wittenberg University (Crowley)

Please do all you can to welcome them and make them feel at home. I'm looking forward to having them enrich our program. Here's to a great fall semester!

Dave Westneat,
Director of Graduate Studies
Department of Biology

Getting it done!

Ph.D. Defenses

Lakshmi Pillai-Kastoori (Morris lab) successfully defended her dissertation in April and graduated with a Ph.D. in May. She is taking some well earned time off with her husband in Nebraska before starting a Post-Doc at LI-COR Biosciences in Lincoln, NE. She is in the Biology R&D core group spearheading the development of an imaging technology for tumor tissue microarrays.

Master's Degrees

Leslie Potts (Krupa lab) received her Master's in Biology in May and is now in Entomology's PhD program.

Qualifying exams

Kim Duong Vertacnik Qualifying Exam 1/23 (Linnen Lab)

Jacqueline Dillard Qualifying exam 2/24 (Westneat Lab)

Melissa Keinath Qualifying exam 6/9 (Smith Lab)

Awards, Honors and Publications

Graduate Student Fellowships and Grants

Cagney Coomer Lyman T. Johnson Award (fall 2015)

Jacqueline Dillard Graduate School Academic Year Fellowship (fall 2015)

Luc Dunoyer received the Karri Casner Environmental Sciences Fellowship ($2,400) from the Tracy Farmer Institute for Sustainability and the Environment to support his research on ecosystem engineering, predation, and regeneration in crayfish.

Swagata Ghosh Kentucky Opportunity Fellowship (fall 2015)

Kaylynne Glover, Wimberly C. Royster Graduate Excellence Award (2015-16 Academic Year)

Scott Hotaling Ribble Fellowship (2015-16 Academic Year)

Kara Jones, Kentucky Opportunity Fellowship and Wimberly C. Royster Graduate Excellence Award (spring 2016)

Allison McLaughlin Daniel R. Reedy Quality Achievement Fellowship Award (2015-16 Academic Year)

Megan Rhoads Lyman T. Johnson Award (fall 2015)

Tim Salzman Graduate School Academic Year Fellowship (spring 2016)

Kat Sasser Lyman T. Johnson Award (spring 2015)

Mansi Sethi, Lyman T. Johnson Award (fall 2015)

John Terbot II, Graduate School Academic Year Fellowship (fall 2015)

Kim Duong Vertacnik Lyman T. Johnson Award (spring 2016)

Megan Weaver Lyman T. Johnson Award (fall 2015)

Wen Wen, Graduate School Academic Year Fellowship (fall 2015)

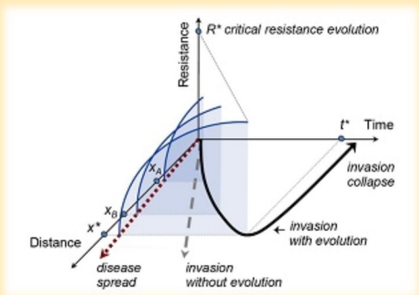
Awards, Honors and Publications (Continued)

Graduate Student Publications

Al Haj Baddar, N. W., Woodcock, M. R., Khatri, S., Kump, D. K., Voss, S. R. (2015). Sal-site: Research Resources for the Mexican Axolotl. In A. Kumar and A. Simon (Eds). Salamanders in Regeneration Research: Methods and Protocols (pp. 321-336). New York, NY: Springer Science + Business Media.

Sal-site is a web-based portal that provides and shares genomic information for the Mexican Axolotl to serve research and education efforts locally and globally. The chapter provides the investigator with a detailed description of Sal-site content along with the best practices to extract useful information. Also, the chapter describes the various services provided by the Ambystoma Genetic Stock Center (AGSC) that houses a historically significant population of axolotls at the University of Kentucky.

García-Ramos, G., **L.A. Dunoyer, K.L. Sasser**, and P.H. Crowley. Evolution of resistance by a native competitor can lead to invasion collapse in disease-mediated invasions. *Biological Invasions,* in press.



Invasive species are often able to establish and spread with the help of diseases they bring that can infect native competitors. But sometimes, seemingly successful invasions, in which the invasive species may reach high densities, suddenly collapse, with abrupt decline and extinction of the invader. Diseases have been implicated in invasion collapses, though the underlying mechanism accounting for the entire invasion arc is unresolved. In this study, we simulated a disease-mediated invasion (DMI) by constructing a susceptible-infected-susceptible model for infection and population dynamics of a native and an invasive species.

Franklin, Brandon M., Xiang, Lin, Collett, Jason A., **Rhoads, Megan K.**, and Osborn, Jeffrey L. "Open Problem-Based Instruction Impacts Understanding of Physiological Concepts Differently in Undergraduate Students. *Advances in Physiology Education, in press.*

Smith JJ, **Keinath MC** (2015) The Sea Lamprey Meiotic Map Improves Resolution of Ancient Vertebrate Genome Duplications. *Genome Research*, In Press.

It is generally accepted that two whole rounds of genome duplication occurred deep in the ancestry of the vertebrate lineage, but the timing and outcome of the duplications are not well resolved. In the paper, we present a high-density meiotic and comparative genomic maps for the sea lamprey (Petromyzon marinus), which diverged from other vertebrates ~550 MYA. Comparative mapping data yield strong support for the hypothesis that a single whole genome duplication occurred in the basal vertebrate lineage, but do not strongly support a hypothetical second event. Rather, these comparative maps reveal signature of several evolutionarily independent segmental duplications occurring over the last 600+ million years of chordate evolution. This refined history of the vertebrate genome duplication should permit more precise investigations of vertebrate evolution.

Li Ye, Cassone VM. A simple, specific high-throughput enzyme-linked immunosorbent assay (ELISA) for quantitative determination of melatonin in cell culture medium. Int Immunopharmacol. 2015 Jun 17;28(1):230-234.

Melatonin, an important hormone involved in the regulation of circadian and seasonal rhythms in vertebrates, is a direct output of circadian oscillators within the retinae and pineal gland. The chick pineal gland is an excellent experimental model for circadian rhythms, which directly perceives light as an input, contains a circadian clock and rhythmically releases melatonin as an output. The high throughput melatonin measurements by commercial methods are expensive and inconvenient. In this paper, a simple, specific high-throughput enzyme-linked immunosorbent assay (ELISA) for quantitative determination of melatonin was developed for directly measuring melatonin in cell culture medium with 10% FBS. This assay adopts a commercial monoclonal melatonin antibody and melatonin-HRP conjugate, so it can be applied in multiple labs rapidly with low cost compared with commercial RIA and ELISA kits.

Awards, Honors and Publications (Continued)

Graduate Student Publications (cont.)

Majeed, Z.R., Ritter, K., Robinson, J., Blümich, S.L.E., Brailoiu, E., and Cooper, R.L. (2015). New insights into the acute actions from a high dosage of fluoxetine on neuronal and cardiac function: *Drosophila*, crayfish and rodent models. Comparative Biochemistry and Physiology - Part C: Toxicology & Pharmacology. (Accepted pending minor revisions).

The commonly used mood altering drug fluoxetine (Prozac) in humans has a low occurrence in reports of harmful effects from overdose; however, individuals with altered metabolism of the drug and accidental overdose have led to critical conditions and even death. We addressed direct actions of high concentrations of fluoxetine (Prozac) on synaptic transmission at neuromuscular junctions (NMJs), neural properties, and cardiac function unrelated to fluoxetine's action as a selective 5-HT reuptake inhibitor (SSRI). The results demonstrate that Prozac blocked action potentials in crayfish axons, although, surprisingly, it enhanced occurrences of spontaneous synaptic vesicle fusion events (mEPSPs) in the presynaptic terminals at NMJs of both Drosophila and crayfish. In mouse cultured cortical neurons, fluoxetine application increased the cytoplasmic Ca^{2+} by enhancing the release of Ca^{2+} from intracellular store. The use of various animal models in demonstrating the potential mechanisms for the toxic effects with high doses of fluoxetine maybe beneficial for acute treatments in humans.

Malloy, C., Ritter, K., Robinson, J., and Cooper, R.L. (2015). Pharmacological identification of cholinergic receptor subtypes on Drosophila melanogaster larval heart. (Accepted pending minor revisions).

The Cooper lab is using Drosophila as a model to study the cellular mechanisms underlying heart development and function. Primarily, we are using a combined pharmacological and genetic approach to study the role of various neuromodulators in regulation of heart rate in this popular model organism. My study focused on the modulation of heart rate by acetylcholine and additional cholinergic compounds as a means of identifying cholinergic receptor subtypes that are expressed in the larval Drosophila cardiac tissue. I utilized an approach in which larval Drosophila were dissected in a manner that exposed the heart. In using this technique, I was able to bathe the larval heart in various solutions containing cholinergic receptor agonists and antagonists as way to identify their modulation of heart rate. I found that both cholinergic receptor agonists/antagonists displayed modulatory effects on heart rate, providing evidence that both receptor subtypes are expressed in larval cardiac tissue. While previous research had confirmed the acetylcholine modulation of heart rate, this was the first study that utilized an isolated, exposed preparation that permitted the examination of specific cholinergic receptor agonist and antagonist modulation of heart rate without the influence of confounding variables. This study, along with additional studies performed by students in the Cooper lab, will help to promote Drosophila as a useful model in investigating the cellular and molecular mechanisms underlying heart function.

Purushothaman, Sruthi, et al. (2015). Proteomic and gene expression analysis of zebrafish brain undergoing continuous light/dark stress. Journal of Sleep Research.

In this study, the adult zebrafish brain was analyzed for its differential proteome and gene expression during perturbed light/dark cycle. A total of 53 and 25 proteins including sncb, peroxiredoxins and TCR alpha were identified based on two-dimensional gel electrophoresis Fourier transform mass spectrometer/ion trap tandem mass spectrometer and differential in-gel electrophoresis MALDI TOF MS/MS analysis, respectively, with at least 1.5-fold changes between the control and experimental brains. Real time-polymerase chain reaction revealed that many circadian pathway -associated genes, such as per1b, bmal1b, cry1b, bmal2 and nr1d2, were differentially regulated during continuous light/dark exposures.

Awards, Honors and Publications (Continued)

Graduate Student Publications (cont)

B.L. Slabach, T.B. Corey, J.R. Aprille, P.T. Starks, and B. Dane (2015) "Geophagic behavior in the mountain goat (Oreamnos americanus); support of meeting metabolic demands" Canadian Journal of Zoology.

We investigated the role of geophagic behavior - intentional consumption of earth or earth matter - in an isolated population of mountain goats in southwestern British Columbia, Canada. Our findings demonstrate that geophagy may be an obligate behavior in this population, being driven primarily by elevated sodium and phosphorus levels. Elevated phosphorus levels increased the probability of soil ingestion by twice that of sodium levels, suggesting phosphorus is an important nutritional component. Access to nutritionally enhanced soils may shape movement patterns and grazing behavior, particularly of alpine species.

Graduate Student Presentations/Workshops

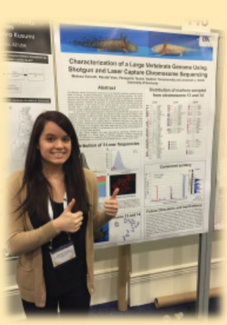
Shishir Biswas (Seifert lab) was selected as 1 of only 14 students to attend the Cold Spring Harbor Labs course on *Mouse Development, Stem Cells and Cancer*. This 3-week course brought together leaders in the field of mouse developmental biology including novel laureates. It is an extremely competitive course to attend.

Brandon Franklin (Osborn lab) was the recipient of the Research Recognition Award from the American Physiological Society, Teaching of Physiology Section at the 2015 Experimental Biology conference in Boston, MA. This award was selected for Brandon's research abstract and poster entitled, "Open Inquiry Based Learning Elicits Deeper Understanding of Complex Physiological Concepts Compared to Traditional Lecture-Style or Guided-Inquiry Learning Methods". This study assessed the effects of different pedagogical styles of instruction on typically low-achieving students in a problem-based learning animal physiology course. This work was conducted in collaboration with Biology Department faculty Drs. Lin Xiang and mentor Jeffrey Osborn.

Paul Hime (Weisrock lab) ranked in "Top 300 Reviewers for *Molecular Ecology*, 2013-2014" and he attended the 7th Biennial Hellbender Symposium in St. Louis, MO this June and gave two talks:

* Discovery and utility of sex-linked genes in cryptobranchid salamanders
* Genome-scale resolution of species boundaries and demography in the endangered hellbender salamander (*Cryptobranchus*)

Melissa Keinath (Smith Lab) was awarded two travel grants from the American Genetic Association to attend and present her research. In March she attended the Genome 10K Meeting in Santa Cruz, CA and then in August she presented at the American Genetic Association Presidential Symposium on "Chromosome Evolution: Molecular Mechanisms and Evolutionary Consequences". The meeting was held on Bainbridge Island, Washington. At both meetings Melissa presented "Characterization of a Large Vertebrate Genome Using Shotgun and Laser Capture Chromosome Sequencing", a poster describing her work to sequence and assemble the axolotl genome using targeted chromosome isolation in the Smith lab.



Awards, Honors and Publications (Continued)

Graduate Student Presentations/Workshops (cont.)

Kat Sasser (Westneat lab) received a Marcy Brady Tucker travel award from the American Ornithologists' Union to present a paper entitled "Unusual patterns of nestling loss in House Sparrows: infanticide or neglect?" at their annual meeting in July.

John Terbot (Linnen lab) and **Jacqueline Dillard** (Westneat group) both had work featured at the Mill and Max Gallery and John was selected to give a 30 min talk at the event. The Mill and Max Gallery decided to showcase artwork from the BioArt class for a month long exhibition in May. Furthermore, they have agreed to make this an annual event which strengthens outreach between the community and UK. Despite opening night falling on Derby Day the event attracted over 100 people. This unique class had graduate students from both art and science.

4th Year Symposium

On April 11th, Biology held the first 4th Year Symposium at the Ecological Research and Education Center. This will become a regular event each year in which our 4th year Ph.D. students present their dissertation research to the Department. Our intrepid volunteers this year gave impressive talks and the BGSA organized a tasty lunch making for a great kick-off to this annual event. The line-up was:

Wen Wen: *Sox4 Regulates Ocular Development in Zebrafish through Hh signaling*

Michelle Giedt: *Mutation of upd3 affects polar cell behavior and micropyle formation*

Shreyas Joshi: *Identifying novel sleep genes from KOMP2 data*

Justin Kratovil: *Species boundaries in dusky salamanders (Desmognathus)*

Robin Bagley: *Population structure and demographic history of the redheaded pine sawfly, Neodiprion lecontei*

Zana Majeed: *Modulatory action of serotonergic system in in Drosophila melanogaster (not pictured)*

Graduate Student Life Events

Paul Hime, his wife Nicole and big sister Charlotte, welcomed twin girls, Genevieve Nicole and Natalie Andrea on March 20.

Kim Duong and Peter Vertacnik were married this summer.

Jim Shaffer and Stacey Gutman married on June 12 in the Grand Tetons of Wyoming.