

The Signal Wishes All Its Readers a Happy New Year!

The Signal

Monthly newsletter of the W. M. Keck Center for Behavioral Biology
at North Carolina State University
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The Passing of the Year

*by Robert W. Service,
"the Bard of the Yukon" 1874-1958*

My glass is filled, my pipe is lit,
My den is all a cosy glow;
And snug before the fire I sit,
And wait to feel the old year go.
I dedicate to solemn thought
Amid my too-unthinking days,
This sober moment, sadly fraught
With much of blame, with little praise.

Old Year! upon the Stage of Time
You stand to bow your last adieu;
A moment, and the prompter's chime
Will ring the curtain down on you.
Your mien is sad, your step is slow;
You falter as a Sage in pain;
Yet turn, Old Year, before you go,
And face your audience again.

That sphinx-like face, remote, austere,
Let us all read, whate'er the cost:
O Maiden! why that bitter tear?
Is it for dear one you have lost?
Is it for fond illusion gone?
For trusted lover proved untrue?
O sweet girl-face, so sad, so wan
What hath the Old Year meant to you?

And you, O neighbour on my right
So sleek, so prosperously clad!
What see you in that aged wight
That makes your smile so gay and glad?
What opportunity unmissed?
What golden gain, what pride of place?
What splendid hope? O Optimist!
What read you in that withered face?



And You, deep shrinking in the gloom,
What find you in that filmy gaze?
What menace of a tragic doom?
What dark, condemning yesterdays?
What urge to crime, what evil done?
What cold, confronting shape of fear?
O haggard, haunted, hidden One
What see you in the dying year?

And so from face to face I flit,
The countless eyes that stare and stare;
Some are with approbation lit,
And some are shadowed with despair.
Some show a smile and some a frown;
Some joy and hope, some pain and woe:
Enough! Oh, ring the curtain down!
Old weary year! it's time to go.

My pipe is out, my glass is dry;
My fire is almost ashes too;
But once again, before you go,
And I prepare to meet the New:
Old Year! a parting word that's true,
For we've been comrades, you and I --
I thank God for each day of you;
There! bless you now! Old Year, good-bye!

***This Issue of The Signal Contains the Announcement and Call for
Abstracts of the Fourteenth Annual Student/Postdoc Symposium.***

A Touch of Roach Love

by Ayako Katsumata

Adrienn (Ada) Uzsák, an Entomology and W.M. Keck Center for Behavioral Biology student, defended her Ph.D. dissertation on 12/12/12, just minutes after 12:12. The title of her dissertation under the direction of Dr. Coby Schal was “Social facilitation of reproduction in the German cockroach”. Ada was born in Budapest, Hungary, and entered the Ph.D. program at NCSU in 2009. Her dissertation addressed the behavioral and physiological mechanisms of the so called “grouping effect”, where social interactions accelerate reproduction in the German cockroach.

In animals, sociality can be beneficial for individuals because it may increase access to resources, provide greater protection from predators, and create opportunities for mating. Work in the Schal lab more than 20 years ago showed that German cockroach females reproduce faster in groups than in isolation. However, little is known about the mechanisms that underlie this phenomenon. Ada demonstrated that females at different reproductive stages respond differentially to grouping. She characterized hormonal changes that occur with social interactions, and investigated the sensory modalities that mediate this phenomenon.

Her work focused on two main topics. First, she looked at differential physiological responses to social interactions during the ovarian cycle. Oocyte development in the German cockroach is regulated by juvenile hormone III (JH), which is produced by the corpora allata (CA). Production of this hormone is accelerated by social interactions, and Ada examined the effects of female density on JH production, and whether the female experiences critical periods during which she responds physiologically to social interactions. She found that social cues accelerate JH production only when the CA are active. Thus, social interactions could stimulate JH production (and oocyte maturation) during the pre-oviposition period, but not during gestation when JH production is suppressed by the brain. This work (*J. Exp. Biol.* (2012) 215: 3037) highlights how animals integrate social and other cues with hormonal regulation to either accelerate or put the brakes on reproduction. Ada also conducted similar experiments on adult males, and found that their JH production is socially facilitated as well.

Second, she investigated sensory cues involved in the social facilitation of reproduction. Insects have many types of peripheral sensory systems such as sight, hearing, touch, smell, and taste. In most insects, visual and/or chemical cues are most important in the recognition of conspecific individuals. Ada tested the effects of visual and chemical cues on social facilitation



Adrienn (Ada) Uzsák

tion of oocyte development. Surprisingly, she found that tactile cues are the primary sensory input associated with social conditions - with no evidence for involvement of the visual and olfactory systems - and that the antennae play an important role in the reception of these tactile cues. Tactile stimuli induce the gregarious phase in locusts, but their role has not been examined in other insect species. The key elements of tactile cues which induce behavioral and physiological responses are poorly understood, because tactile stimuli are composed of numerous physical features such as intensity, frequency and duration.

Ada undertook the challenge of finding out the key elements of antennal tactile cues for social facilitation of reproduction. She collaborated with the Bozkurt lab in the Department of Electrical and Computer Engineering and developed artificial, motor-driven antennae that mimic the tactile stimulation. She found that tactile stimulation with a broad array of artificial materials, some deviating significantly from the native antennal morphology, can elicit a physiological response in females. This indicates that the processing of social cues for oocyte development is supported by mechanoreception via the antenna. The next step will be to understand the details of the mechanosensory pathways and how social cues are processed by the brain and affect JH production.

Ada intends to continue in further research and aspires to do that working in two fields close to her heart: conservation and sustainability.

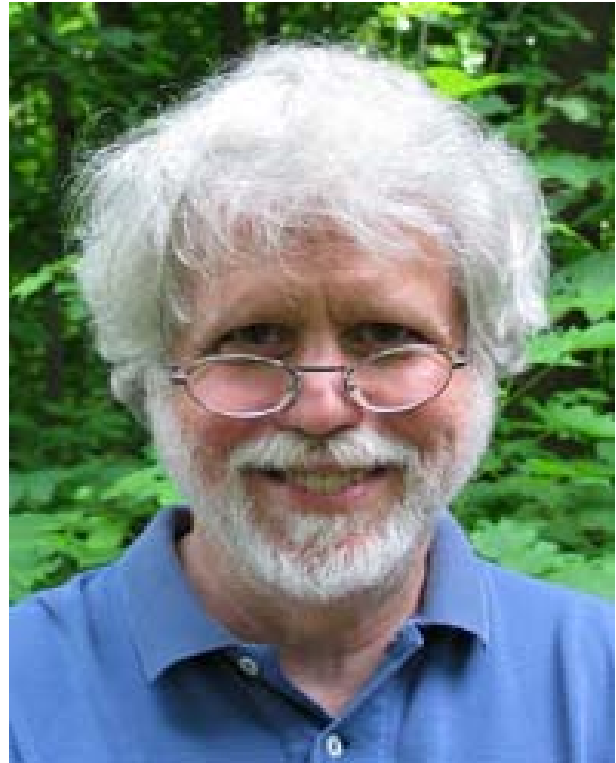
Monarchs on the Move

by D. Magdalena Sorger

For its December seminar, the W. M. Keck Center hosted Dr. Steven Reppert from the Department of Neurobiology at the University of Massachusetts Medical School Worcester, MA). The seminar was titled “Monarch butterfly migration”. Monarch butterflies (*Danaus plexippus*) are unique among butterflies by migrating both north and south on a regular basis, like many birds do. It is even more notable that no single butterfly completes the whole trip but a new generation emerges en route and still continues in the right direction. However, during the seminar it became quickly apparent that the butterflies were not the only ones who have been migrating. Reppert started the seminar by talking about his own professional “metamorphosis”. Although the Higgins Family Professor of Neuroscience has been fascinated with insects since early on—rearing silk moths during his childhood in Nebraska—he decided to pursue a different career path. Reppert earned an M.D. degree from the University of Nebraska and did his pediatric residency at Massachusetts General Hospital and Harvard Medical School. So how did he end up studying butterflies? When Dr. Coby Schal introduced Reppert, he humorously called him a “closet entomologist” since he put his passion for insects on the backburner for almost half a century. Only at the turn of the millennium, things changed and Reppert shifted his professional focus from pediatrics to entomology and started studying monarch butterfly migration.

Monarch butterflies congregate in eastern North America in the fall and when the butterflies get ready to migrate several changes occur: their reproductive system shuts down, they live much longer, and they travel south – 4,000 km south to be specific, to arrive in Central Mexico in the spring. The butterflies reproduce and oviposit their eggs on-site. The new generation that hatches from these eggs is short-lived and is reproductively active during spring and summer. Each year these butterflies commence their maiden voyage as they are two generations removed from the ones that have been at the respective site before. In order to navigate to a precise location over such a long distance, a map and a compass are undoubtedly necessary. Where this compass lies and how it works are key research questions Reppert and his lab address.

Reppert explained that monarchs use a so-called time-compensated sun compass (sun movement paired with a circadian clock) for orientation. The cues are sensed by the eyes, although the antennae also play a crucial role in clock-compass interactions. Reppert and his lab found out that clipping both antennae left the butterfly disoriented, while clipping only one was



Dr. Steven Reppert

sufficient for orientation. His laboratory then proceeded to paint one antenna black and leave the other one clear. This disrupted the signal too and left the butterfly disoriented. However, when the black-painted antenna was then clipped the signal could be restored and the butterfly regained orientation. These exciting findings point to a yet unknown neural circuit between the antennae and the central complex, a structure which directs movement in the butterfly brain.

Reppert and his group also showed that the monarch circadian clock mechanism has a vertebrate-like component (with the photoreceptor located inside the clock) and a *Drosophila*-like one (photoreceptor outside the clock). They showed that almost all arthropods have a vertebrate-like clock component - except *Drosophila* that is, for once, the “odd insect out”.

Reppert also uses zinc finger nucleases as genomic tools to modify and knock out genes in order to genetically prove which components are used in the butterflies’ circadian clocks. This technique was successfully applied and resulted in modified monarchs with broken circadian clocks.

Reppert closed with the words: “A new era is here.” Indeed. Thanks for an exciting seminar!

Symposium 2013

Announcement and Call for Abstracts

The Fourteenth Annual Student/Postdoc Symposium of the W. M. Keck Center for Behavioral Biology will be held on Friday, March 1, 2013, in the Stanley G. Stephens room, 3503 Thomas Hall, at North Carolina State University. Participation is open to all students, postdoctoral fellows and faculty, and is mandatory for students enrolled in the Concentration for Behavioral Biology.

Preliminary Program

8:30	Breakfast
9:15	Welcome and opening remarks by Dr. Robert Anholt, Center Director
9:30	Symposium
10:45	Coffee break
11:15	Symposium
12:30	Lunch
2:00	Symposium
3:15	Break
3:45	Symposium
5:00	Adjourn and dinner buffet in Thomas Hall

Presentations will be 12 minutes with 3 minutes for discussion. Participants should submit an abstract by e-mail to Justa Heinen (justaheinen@gmail.com) or John Shorter (john_shorter@ncsu.edu) no later than **February 15**. The abstract should contain no more than 300 words without figures or tables. It must provide a title and the name of the presenting author (without co-authors or affiliation).

Trainees within their first year may present their future research objectives. Advanced trainees will present progress of their research. Computer-assisted projection and a PC-type laptop will be available for PowerPoint presentations. All presentations must be rehearsed with the mentor.

Faculty, students and postdocs who plan to attend the symposium MUST RSVP to Suzanne Quick (ssquick@ncsu.edu) no later than February 15.

Seminars

On Monday, **January 14**, at 1:30 pm, Dr. Jing Wang from the Division of Biological Sciences at the University of California at San Diego will present a seminar titled “Metabolic modulation of olfactory circuit and behavior in *Drosophila*.”

The seminar will be in 3503 Thomas Hall.

Publications

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

Cornman, R. S., Tarpy, 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.

Oppenheim, S. J., Gould, F. and Hopper, K. R. (2012) The genetic architecture of a complex ecological trait: host plant use in the specialist moth, *Heliothis subflexa*. *Evolution* **66**: 3336-3351.

Of note...

Robert Anholt, Trudy Mackay and Lisa McGraw participated in a tri-national consortium workshop on Genes and Behavior at the University of Surrey (Guildford, UK) aimed to promote student exchange and research collaborations between North Carolina State University, the University of Surrey, and the University of Sao Paulo (Brazil). Robert Anholt gave a talk on “Genetic architecture of behavior” and Trudy Mackay on “Charting the genotype-phenotype map: Lessons from *Drosophila*.” Lisa McGraw presented a talk, entitled “Uncovering the neurogenomic underpinnings of monogamy.”

Lisa McGraw presented a seminar, entitled “The neurogenomics of social and reproductive behaviors in voles” at the Edward Grey Institute of Field Ornithology at Oxford University (UK).

David Tarpy was an invited symposium speaker at the Entomological Society of America meeting, Knoxville (TN), where he delivered a talk on “The honey bee colony as an extended phenotype of its queen.” Members of the Tarpy laboratory also presented abstracts titled “Artificial in vitro infection of honey bee pupae with IAPV reveals viral interference with fundamental cell functions” and “The effects of commonly used miticides on honey bee (*Apis mellifera*) colony growth and queen survival.” David Tarpy also presented a seminar in the Department of Entomology at Virginia Tech, and presented “An evening of insects’ at the North Carolina Entomological Society. He was also an invited speaker at the Science Café Public Lecture Series of the North Carolina Museum of Natural Sciences.

John Vandenberg has been appointed to the joint NCSU/UNC Large Animal Facility Planning Committee, which is charged with planning for an animal facility for large laboratory animals, such as dogs, cats, and monkeys, likely on the campus of the NCSU College of Veterinary Medicine.

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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