Department of Evolutionary Neuroethology

# Schneiderhaus Day

## June 11, 2013

## MPI for Chemical Ecology, Seminar Rooms

# Programm

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| 09:00 - 09:05 | **Prof. Bill Hansson**<br>Welcome address |
| 09:05 - 09:50 | **Prof. Karl-Ernst Kaissling**<br>Die kaiserliche Werft, or stories from our pet *Bombyx mori* |
| 09:50 - 10:35 | **Dr. Markus Knaden**<br>Measuring olfactory valence in moths and flies |
| *10:35 - 11:00* | *Coffee Break* |
| 11:00 - 11:45 | **Dr. Thomas A. Keil**<br>Insect Sensory Cilia |
| *11:45 - 13:30* | *Break* |
| 13:30 - 14:15 | **Prof. Thomas C. Baker**<br>Old Principles Live On In Neuroethological Studies of Moth Sex Pheromone Olfaction |
| 14:15 - 15:00 | **Prof. Mark A. Willis**<br>The electroantennogram as a bio-sensor for revealing mechanisms underlying odor orientation |
| *15:00 - 15:30* | *Coffee Break* |
| 15:30 - 16:15 | **Prof. Rudolf A. Steinbrecht**<br>The Beauty of Bombyx or<br>A morphologist's experience in the Schneider group |
| 16:15 | **Prof. Bill Hansson**<br>Closing remarks |

# Abstracts

**Prof. Karl-Ernst Kaissling**

Die kaiserliche Werft, or stories from our pet *Bombyx mori*

In the mid thirties in Berlin Adolf Butenandt together with his wife, one of his technicians, has learned to raise silk worm moths from their eggs. His aim was to analyse the chemical nature of the female sex attractant hoping that such chemicals could provide an elegant means to introduce specificity in insect pest control. In the early fifties in Tübingen Dietrich Schneider got contact to Butenandt via his coworkers Peter Karlson and Erich Hecker, while the chemical analysis was still under the way. Schneider started electrophysiological recordings from the antennae of the silkmoth and found summated receptor potentials elicited by the female gland extracts, called electroantennogram. In 1958 Schneider moved to München and initiated with a group of coworkers electrophysiological, morphological, radiometrical, biochemical, behavioral, and later in Seewiesen ecological work on insect olfaction. The talk will review a few findings mainly from *Bombyx mori*.

**Dr. Markus Knaden**

Measuring olfactory valence in moths and flies

Insects use odors to localize e.g. food, mating partners, and predators. Therefore, many odors are innately attractive or repellent to insects. In the Schneiderhaus we have established two wind tunnel systems that allow us to test fruit flies and moths for their olfactory preferences.
By using the high-throughput paradigm FLYWALK we automatically record the responses of flies to a large set of odorants. Individual flies are exposed within tiny wind tunnels to short odor pulses. Attractive odors provoke upwind movement, while repellent odors provoke downwind movement. FLYWALK provides us with detailed knowledge about the odor-specific response strength and latency of the flies. In a next step – by consecutively silencing each of the fly's odorant receptors – we will identify those receptors that govern positive and negative responses in Drosophila.
By using our large wind tunnel facility we investigate the olfactory preferences of foraging and ovipositing moths. As flying is extremely costly, the tobacco hornworm Manduca sexta relies on olfaction to estimate a flower's or a host's value already from distance. We try to identify those odors that help the moth e.g. to discriminate between nectar-rich "moth flowers" and pollen-rich "bee flowers". Having identified attractive and repellent odors we will than test, whether we find valence-specific activity patterns in the first olfactory processing center, the antennal lobe.
Hence, we set out to understand odor valence, i.e. we investigate which odors are ecologically relevant and how are they detected and processed in the insect brain.

Department of Evolutionary Neurobiology, Max Planck Institute for Chemical Ecology

**Dr. Thomas Keil**

Insect Sensory Cilia

Cilia have mainly been known as organelles of movement. However, their presence in sensory neurons has been documented since 1956. Today, they have taken a central position in cell biology as sensors and regulators. Especially in insects, they show an enormous spectrum of morphological and physiological adaptations for different sensory modalities which I will try to demonstrate.

**Prof. Tom Baker**

Old Principles Live On In Neuroethological Studies of Moth Sex Pheromone Olfaction

The value of marrying studies of the behavioral responses of male moths responding to sex pheromone with electrophysiological recordings from antennal neurons was apparent to me from my first days in the Roelofs lab in 1972. During each of the next few years I recorded thousands of electroantennograms (EAGs) from an endless variety of moth pest species in the mornings and then conducted behavioral bioassays using some of these same compounds during afternoons. Dietrich Schneider's influence on the Roelofs lab, and me in particular, was profound due to the nearly 100% success rate of the EAG for guiding the identification of new and behaviorally optimal sex pheromone blends. A landmark pressure-packed historical moment for me was when Karl-Ernst Kaissling, the esteemed neurophysiologist from the Schneider lab, visited Geneva, N.Y., and I had to perform EAGs in his presence using our almost embarrassingly crude but effective apparatus. Through subsequent decades, research in my own lab and others' has continued to be guided by an awareness of the importance of looking "upstream" first, i.e., understanding the degree to which any observed behavioral responses to sex pheromone can be explained at the primary afferent level of the male moth olfactory system.

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**Prof. Mark A. Willis**

The electroantennogram as a bio-sensor for revealing mechanisms underlying odor orientation

I was fortunate to have met and discussed insects and their behavior with Dietrich Schneider in person, and not just to have read his contributions. Many of his most interesting ideas came from simple "eyeball" observations sparked by his fascination with insects. Our own preliminary observations of walking cockroaches tracking plumes have led to a series of comparative experiments aimed at understanding the similarities and differences in how plume tracking moths (flying) and cockroaches (walking) control their behavior. A key to understanding the differences in behavior we see has been the ability to measure the odor environment and where and when the animals are interacting with it. We have used the tried-and-true electroantennogram preparation to measure and compare our experimental odor environments. So far our results show that flying moths locate the odor source more often in high than low turbulence environments, and walking cockroaches are equally successful in all but the most turbulent environments. Experiments manipulating the ability of these animals to extract and use odor information are ongoing.

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**Prof. Rudolf A. Steinbrecht**

The Beauty of Bombyx
or
A morphologist's experience in the Schneider group

Being myself a "living fossil", I'll try - beginning in the late fifties - to commemorate those moments when morphology significantly contributed to scientific progress in Schneider's group. I'll also try to illustrate this by some handsome pictures and hope to entertain the audience with stuff from "way back in the last century".