

School of Biological Sciences
Spring 2019



**THE LECTURE SERIES AND ITS
PURPOSE**

The R. Omar and Evelyn Rilett Family Life Sciences Lecture Series was established in April 2007. It recognizes Dr. Rilett's vision and leadership, which built a Department of Biological Sciences at Illinois State University that advanced education in the natural sciences, fostered scholarly endeavors, and nurtured the development of research to the benefit of all who chose to teach and learn at this institution. The purpose is to bring outstanding life scientists and lectures to Illinois State University to benefit academic and local communities.

**The R. Omar and Evelyn Rilett Family
Life Sciences Lecture Series**

Co-Sponsored by the School of Biological Sciences,
Phi Sigma Biological Sciences Honor Society,
College of Arts and Sciences, and the Harold K. Sage Fund

PAUL S. KATZ, Ph.D



Professor
Department of Biology
University of Massachusetts Amherst

Thursday, March 7, 2019 at 6:00 PM
Prairie Room, Bone Student Center

LECTURE SERIES PROGRAM

WELCOME AND HISTORY OF LECTURE SERIES

Dr. Craig Gatto
Director, School of Biological Sciences

INTRODUCTION OF SPEAKER

Dr. Wolfgang Stein
School of Biological Sciences

PRESENTATION

Phylogenetic and individual variability of neural circuits underlying swimming behaviors in sea slugs

Darwin puzzled over the origin of behavior. However, Darwin had little knowledge about how nervous systems produce behavior. Modern neuroscience has made great strides in understanding the neural basis of behavior but has focused on a limited number of species. To understand how behaviors and neural circuits evolved, it is necessary to examine more closely related species to determine similarities and differences.

We have been studying the neural basis of swimming behaviors in several species of nudipleura molluscs. These sea slugs have brains with a relatively small number of neurons, many of which are individually identifiable. Furthermore, the same neurons can be identified across species, allowing neural circuits to be compared. We have studied two distinct forms of swimming that each evolved independently several times. We found convergent evolution in the use of particular neurons and even in the expression of orthologous serotonin receptors. However, details of the circuitry differs. We have also found examples of divergence of the neural circuitry while the homologous behavior is conserved. This suggests that behavior and neural circuitry represent separable levels of hierarchical organization that can have independent evolutionary histories.

In summary, it is essential to compare species in order to understand which components of the circuit are essential and which are subject to evolutionary change.

DR. PAUL S. KATZ

Starting his career with a B.A. from Northwestern University, Dr. Katz is now a Professor of Biology and Director of Neuroscience in the Department of Biology at the University of Massachusetts Amherst. He is best described as a true Neuroethologist in that he employs evolutionary and comparative approaches to study natural animal behavior and how nervous systems control it.

Following the footsteps of Karl von Frisch, Erich von Holst, and Theodore Bullock, Dr. Katz uses sea slugs as his "champion animals", because their brains have only 10,000 neurons and their behaviors can be easily identified. He has identified homologous neurons in several slug species, which allows Dr. Katz to explain how neurons and behaviors evolve, how animals adapt to different ecological niches, and how homologous neurons come to differ in properties and connectivity.

His lab uses a wide variety of techniques, including electrophysiology, immunohistochemistry, bioinformatics, computational simulations, and 3-D electron microscopic reconstruction. A new direction in his lab used Next Generation RNA sequencing to determine the sea slug transcriptome, which now enables the mapping of gene expression onto distinct neural circuits and the behaviors.

Dr. Katz is the former President of the International Society for Neuroethology, and has been the Director of the Neural Systems and Behavior course at the Marine Biological Laboratory in Woods Hole, MA, one of the highest NIH-rated neuroscience training courses. He held the ranks of Distinguished Professor and Regents' Professor at Georgia State University and is on the editorial board of several highly valued scientific journals, including the Journal of Neurophysiology and the Oxford Research Encyclopedias.

Dr. Katz has been continuously funded by NIH and NSF since 1992 - the year he finished his postdoc at Brandeis - totaling more than 7.5 million dollars. His publication record shows more than 80 peer-reviewed papers and over 20 book chapters. He has trained 9 postdocs, and many graduate and undergraduate students.

<http://tinyurl.com/katzlab>