

# Engineering Neuroscience & Health

Department of Biomedical Engineering

Division of Biokinesiology and Physical Therapy



## ENH SEMINAR SERIES



**Presents:**

**Dr. George V. Lauder**

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**Monday**

**May 11, 2009**

**4:00 p.m.**

**Refreshments will be served 3–4 pm**

### *“Fish biorobotics”*

**Professor George V. Lauder**

Alexander Agassiz Professor of Zoology

Professor of Organismic and Evolutionary Biology

Harvard University

There are over 28,000 species of fishes, and a key feature of this remarkable evolutionary diversity is a great variety of propulsive systems used by fishes for maneuvering in the aquatic environment. Fishes have numerous control surfaces (fins) which act to transfer momentum to the surrounding fluid. Fishes are unstable and use several control surfaces simultaneously for propulsion and to maintain body position.

In this presentation I will discuss the results of recent experimental kinematic and hydrodynamic studies of fish fin function, and their implications for the construction of robotic models of fishes. Recent high-resolution video analyses of fish fin movements during locomotion show that fins undergo much greater deformations than previously suspected. Experimental work on fin mechanics shows that fishes possess a mechanism for actively adjusting fin surface curvature to modulate locomotor force. Fish fin motion results in the formation of vortex rings of various conformations, and quantification of vortex rings shed into the wake by freely-swimming fishes has proven to be useful for understanding the mechanisms of propulsion.

Experimental analyses of propulsion in freely-swimming fishes have led to the development of two self-propelling robotic models: a pectoral fin robotic device and a dual flapping foil model of fish median fin interactions. Data from both will be presented and discussed in terms of the utility of using robotic models for understanding fish locomotor dynamics.

### **Biosketch**

**George V. Lauder** received the A.B. and Ph.D. degrees in biology from Harvard University in 1976 and 1979 respectively. From 1979 to 1981 he was a Junior Fellow in the Society of Fellows at Harvard and he then joined the faculty at the University of Chicago. Since 1999 he has been Alexander Agassiz Professor of Zoology, and Professor of Organismic and Evolutionary Biology at Harvard University. His research interests focus on the biomechanics and evolution of fishes, with a special focus on laboratory analyses of kinematics, muscle function, and hydrodynamics of freely-swimming fishes. Current work involves application of analyses of fish locomotor function to the design of fish-like robotic biorobotic test platforms.

### **Locations:**

*Seminar is simultaneously presented*

**HSC: CHP 147— LIVE**

**Center for the Health Professional**

HSC Campus Map/Directions:

<http://www.usc.edu/about/visit/hsc/>

**UPC: HNB 100 – Video Conference**

**Hedco Neurosciences Building**

UPC Campus Map/Directions:

<http://www.usc.edu/about/visit/upc/>

**Organized by Professor Francisco Valero-Cuevas** <http://bme.usc.edu/valero/>

### **Web Cast**

<http://capture.usc.edu/college/Catalog/?cid=af180d48-ceff-42b9-a35c-eb199daed320>

**Information about all seminars can be found at**

<http://www-clmc.usc.edu/~heiko/ENH>