



# 2001 GRASS FELLOWS

May 21st - August 27 2001

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Paul Gray  
Benjamin Hall  
Kim Hoke  
Sabina Hrabetova  
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Kathryn Richards  
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## Jerod S. Denton

*Regulation of intrinsic CO<sub>2</sub>/H<sup>+</sup> chemosensitivity and intracellular pH regulation in Helix aspersa neurons in situ.*

My goals this summer are to 1) record the effect of hypercapnia on electrical activity of identifiable and unidentified neurons in the subesophageal ganglion of the snail central nervous system, and 2) examine the role of electrical excitability in intracellular pH regulation in these neurons.

The most important outcome of my work this summer is that our model for CO<sub>2</sub>/H<sup>+</sup> chemoreception from isolated somata appears to hold up well in the intact nervous system. Moreover, I have mapped identifiable chemosensitive and non-chemosensitive neurons in the subesophageal ganglia to facilitate their identification and study with more sophisticated tools (single channel analysis and molecular techniques) in the future.

### PhD project:

Biophysical characterization of potassium currents underlying spike frequency modulation and CO<sub>2</sub>/H<sup>+</sup> chemoreception in *H. aspersa* neurons

### PhD Advisor and Institution:

James C. Leiter, M.D.  
Dartmouth Medical School

### Postdoctoral project:

Molecular, cellular, and biophysical characterization of sensory (mechanosensitive, osmosensitive) perception in *C. elegans*

### Postdoctoral advisor and Institution:

Kevin Strange, Ph.D.  
Vanderbilt University



## Paul A. Gray, Ph.D.

*Identification of neurons responsible for breathing in non-mammalian species.*

We will never understand how the brain generates behavior until we can understand what role specific molecularly identifiable neurons play in the generation of those behaviors. Here I am trying to find a class of neurons likely to generate one of the simplest vertebrate behaviors, breathing, in genetically tractable species.

My most exciting observation this summer was that neurons that express receptors for drugs known to modulate locomotion appear to be expressed in alternating lumbar spinal cord segments.

### PhD project:

Identification and specific ablation of neurons responsible for respiratory rhythmogenesis in rats.

### PhD Advisor and Institution:

Jack Feldman, Ph.D.  
Department of Neurobiology  
UCLA School of Medicine  
Los Angeles, CA

### Postdoctoral project:

Identification of transcription factors involved in development of functional brainstem circuits.

### Postdoctoral advisor and Institution:

Quifu Ma, Ph.D.  
Department of Neurobiology  
Dana Farber Cancer Institute  
Harvard School of Medicine  
Boston, MA

## Benjamin Hall

### *Cholinergic Modulation of Olfactory Bulb Granule Cells in an In Vitro, Frog, Nose and Brain Preparation.*

Granule cells of the vertebrate olfactory bulb receive strong cholinergic innervation from the basal forebrain. Inhibitory feedback provided by these intrinsic interneurons is necessary for supporting stimulus-induced oscillations in the bulb. This summer I'm investigating the possible role(s) cholinergic modulation plays in defining these spatially coherent activation patterns.

Most exciting observation this summer: The muscarinic acetylcholine receptor agonist, oxotremorine, enhances a component of the oscillatory response correlated with granule cell mediated GABAergic inhibition.

#### PhD project:

Demonstration of a calcium-activatable non-specific current in granule cells of the olfactory bulb and modulation of this conductance by cytoplasmic Ca<sup>2+</sup>. This intrinsic current interacts with NMDAR Ca<sup>2+</sup> influx, via a positive feedback mechanism, to specifically enhance strong synaptic inputs to granule cells.

#### PhD advisor and institution:

Kerry Delaney, Simon Fraser University

#### Post-doctoral position:

January 2002, Anirvan Ghosh, Johns Hopkins.



## Kim Hoke

### *Mechanism of cone mosaic rearrangement during metamorphosis in the winter flounder.*

During metamorphosis, photoreceptors in the winter flounder change from a hexagonal arrangement with a single cone opsin to a square mosaic comprised of single and double cones with three adult cone opsins. I will examine the roles of cell birth, death, and cellular rearrangement in the transformation of the cone mosaic.

My most exciting observation this summer was that the flounder juvenile and adult green opsins are highly conserved.



#### PhD project:

I have isolated molecular markers for developing rod photoreceptors and have established techniques for retinal cell transplantation in an adult cichlid fish.

#### PhD Advisor and Institution:

Russell Fernald

Stanford University



## Sabina Hrabetova, Ph.D.

### *Diffusion in the synaptic cleft of giant synapse calyx of Held*

The main goal of this proposal is to directly measure unknown diffusional properties of the synaptic cleft. In addition, it is proposed to test whether the diffusion of substances changes during simulated synaptic activity.

The Most exciting observation I made this summer so far was to see the images of fluorescent molecules inside the synaptic cleft.

PhD project:

Role of protein kinase C isoforms in long-term plasticity in hippocampus.

PhD Advisor and Institution:

Todd C. Sacktor, M.D.  
SUNY Downstate Medical Center, Brooklyn

Postdoctoral project:

Brain extracellular space: modulation during physiological and pathophysiological conditions.

Postdoctoral advisor and Institution:

Charles Nicholson, Ph.D.  
NYU Medical Center, New York

## Jasmina N. Jovanovic, Ph.D.

### *Functional Analysis of Conserved Domains and Phosphorylation Sites in Squid Synapsins.*

Synapsins belong to a family of neuron-specific phosphoproteins localized specifically to the presynaptic element of the synapse (Greengard, 1993). As such, they have been shown to mediate interactions between synaptic vesicles and/or terminal cytoskeleton, and thereby serve to define the dynamics of transition between two functionally distinct pools of synaptic vesicles: the reserve pool of vesicles and the readily releasable pool of vesicles undergoing exocytosis in response to nerve terminal activation. This project aims to examine the mechanisms involved in a mobilization of synaptic vesicles from the reserve pool to the releasable pool, and the specific role of phosphorylation of synapsins in this process using squid giant synapse preparation. The most exciting result so far in this project is that squid synapsins are indeed phosphorylated at most but not all of the conserved phosphorylation sites originally characterized in mammalian synapsin isoforms.

PhD Advisor and Institution:

Laboratory of Molecular and Cellular Neuroscience  
The Rockefeller University, New York, USA.

PhD Advisor and Institution:

Paul Greengard, Ph.D.,  
Synapsin I is a Presynaptic Target for the Acute Action of Neurotrophins in Neurotransmitter Release. of the for the Acute Action of Neurotrophins in Neurotransmitter Release."



Postdoctoral advisor and Institution:

The Wellcome Trust Postdoctoral Fellow  
Department of Pharmacology  
University College London, UK

## Kat(hryn) Richards, Ph.D.

### *The Role of Serotonin in Developing Rhythmic Generating Networks.*



The Role of Serotonin in Developing Rhythmic Generating Networks. I am interested in understanding how networks that generate rhythmic behaviours develop. Specifically, I hope to understand if serotonin is instrumental for the maturation of the lobster stomatogastric nervous system (STNS).

The most exciting observation this summer was that serotonin seems to amplify calcium currents in the muscles of the STNS. In addition, histamine silences the rhythmic activity in embryos and larvae.

#### PhD project:

For my Ph.D. thesis I described the activity of one of the pattern generating networks in the STNS during development.

#### Postdoctoral project:

In my last postdoctoral project I measured  $I_h$  in interneurons of the molecular layer in the rat cerebellum.

#### PhD Advisor and Institution:

Eve Marder  
Brandeis University.



## Kevin Sauve

### *The Temporal Properties of Tropical Flounder Camouflage*

This project quantifies the speed of camouflage responses to static and dynamic visual stimuli projected onto the bottom of the flounders' aquarium.

The most exciting observation has been to see the rapid coloration changes, from sandy brown to mostly dark, that occur in seconds as the peacock flounder moves from a light to a dark background.

#### PhD. Supervisor:

Rodolfo Llinas  
NYU Medical School

#### Ph.D. Project:

Being in Time: Correlations between Quantal Sensations and Gamma-band Oscillations



## Daphne Soares

*In search of the modality of the sensory organs present on the faces of alligators*

In preparation for this fellowship I used a variety of techniques to describe the anatomy of the abundant facial receptors present in crocodylians. There are about 2000 facial receptors distributed over the upper and lower jaws of adult alligators. Scanning electron microscopy shows no hairs or pores, but rather a “press button-like” morphology. Tract tracing results show that the receptors are innervated by the trigeminal (V) nerve. The jaw bones contain fenestrae that appear to allow the passage of only one nerve branch per fenestra. The fenestrae are precise markers of the innervation of the facial receptors. I have examined the extensive Crocodylomorph fossil record and confirm the presence of these characteristic fenestrae in many specimens in the Cretaceous, with one specimen in the Jurassic. One of the most exciting things about this project is that these receptors provide a unique opportunity to examine the behavior of extinct Crocodylomorphs.

My most exciting finding this summer was to learn that these receptors are mechanosensitive and tuned to surface waves of water (yay!).

### PhD project:

The evolution of the nucleus angularis in archosaurs: comparative physiological and morphological studies of single neurons.

### PhD Advisor and institution:

Catherine E Carr  
University of Maryland

## Gilad Twig

*Cellular mechanisms involved in the pathophysiology of microglial response to Chromogranin A, an endogenous component found in Alzheimer's plaques*



Interesting findings: CGA activates microglia in nanomolar range where bA, does so in the micromolar range. In addition it seems that these two endogenous proteins act in synergy to activate microglia.

### PhD project

Color information processing in the outer retina of the turtle

### PhD Advisor and Institution

Ido Perlman, Ph.D., Technion-Israel  
Institute of Technology



## Melissa A. Vollrath

*Transduction currents and sensory processing in hair cells in the statocyst of the squid, Loligo pealei.*

To compare squid hair cell transduction to those in vertebrate hair cells, I am measuring transduction currents and looking for ultra-structural clues to how these channels are gated.

Most exciting observation this summer: Hair cells of the squid statocyst have transduction currents that can be elicited with deflection of their hair bundles. To my knowledge, this is the first time these transduction currents have been measured.

### PhD project:

How voltage-gated K<sup>+</sup> channels and mechanosensitive channels contribute to sensory processing by hair cells in the mouse utricle, a vestibular organ.

### Ph.D. Advisor and Institution:

Ruth Anne Eatock, Baylor College of Medicine

Jerod Denton	jerod.denton@dartmouth.edu	Physiology, pH,CO <sub>2</sub> sensitivity
Paul Gray	pgray@ucla.edu	Comparative anatomy,physiology,breathing
Benjamin Hall	bhall@sfu.ca	Physiology, olfactory, pharmacology
Kim Hoke	khoke@psych.stanford.edu	Molecular biology, development, eye
Sabina Hrabetova	sabina@balrog.aecom.yu.edu	Imaging,extracellular space diffusion
Jasmina Jovanovic	j.jovanovic@ucl.ac.uk	Physiology, phosphorylation, synapse
Kathryn Richards	dontmesswiththischick@yahoo.com	Physiology, Development, CPG
Kevin Sauve	sauvej01@endeavor.med.nyu.edu	Imaging, behavior, camouflage
Daphne Soares	daph@wam.umd.edu	Physiology, alligator,mechnosensory
Gilad Twig	giladt@techunix.technion.ac.il	Microglia, Alzheimer's disease
Melissa Vollrath	vollrath@cns.neusc.bcm.tmc.edu	Physiology, hair cell, statocyst

**David Bodznick Ph.D. director**

*On the development of the skills necessary for  
managing eleven energetic  
scientists with lots of demands and no sleep*

The most exciting observation I made this summer was that a well raised eyebrow is guaranteed to shame grass scientists into submission.



p.s. Dear Dave, thanks for indulging us and our bad sense of humor...



**Brian Link Ph.D. associate director**

*Time lapse analysis of interkinetic nuclear  
migration in the zebrafish retina*

The most exciting observation I made this summer was to see regulated mitotic cleavage plane orientations.

PhD project:  
Reciprocal neuron-muscle interactions during avian development

PhD Advisor and Institution:  
Rae Nishi,  
Oregon Health Sciences University

Postdoctoral project:  
Genetic Analysis of retinal lamination in zebrafish

Postdoctoral advisor and Institution:  
John Dowling,  
Harvard University