

# HHMI

HOWARD HUGHES MEDICAL  
INSTITUTE

## Undergraduate Science Education Program at the College of Charleston

### EDUCATION

#### Living and Learning as a Community

**Principal Investigator:**

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Chemistry & Biochemistry

**Co-Investigators:**

Elizabeth Meyer-Bernstein, Ph.D.  
Biology & Neuroscience

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Psychology & Neuroscience

Sorinel Oprisan, Ph.D.  
Physics & Neuroscience

Meta Van Sickle, Ph.D.  
Foundations, Secondary and Special  
Education

Christopher Korey, Ph.D.  
Biology & Neuroscience

**Administrative Assistant:**

Alma Hurd

Activities and Events are funded by:

# HHMI

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Through the:



In conjunction with the College's First Year Experience Program, the HHMI grant is supporting the development of several interdisciplinary learning communities in the sciences for incoming freshmen students. The first of these entitled, "Pre-Med Success" was offered in the 2008 Fall semester. This course coupled a traditional Freshmen Biology course with an introductory Chemistry course. Special peer-led sessions, called synthesis seminars, were used to enrich the course content, to introduce students to College programs and resources, and to focus the students on requirements for pre-Health careers. As in other First Year Experience courses on campus, the students were challenged to write more and to participate in community service activities. In September, some of the students



Seven of the learning community freshmen who participated in the Beach Sweep activities are pictures here with Dr. Stephanie Dellis (on the right).



Alumni Alexis Hoeflerlin, Loretta Hoover, Faisal Siddiqui, and Kiesha McCausland came back to campus to discuss their College of Charleston and post-graduate experiences in medical and graduate school.

participated in the annual Beach Sweep event. The students climbed into the marsh to remove trash from the Waterfront Park area. Students were also able to talk to College of Charleston alumni who are now in graduate school and medical school in a panel discussion and were introduced to Ms. Karen Eippert, the College's Pre-health advisor. Following in the successful footsteps of the 2008 offering, the HHMI sponsored additional learning communities in the Fall 2009 semester, including two Chemistry-Biology Pre-Health focused communities and one Psychology-Biology neuroscience focused community. Participating faculty included Mark Hurd (Psychology & Neuroscience), Deb

Bidwell (Biology), Kathleen Janech (Biology), Wendy Cory (Chemistry) and Pam Riggs-Gelasco (Chemistry).

The program underwent further expansion this fall with the addition of a living learning community in Glenn McConnell Hall. Here, forty students of the Chemistry-Biology Learning Community chose to live and study side by side. Alumni of last year's learning community, currently sophomores at the College, took advantage of a similar opportunity by moving into a new Pre-Med house on Bull Street. Ms. Karen Eippert was the driving force behind this new addition and HHMI sponsored the outfitting of a new study/conference room in the house.

## A successful merger between biology and physics.

One of the specific goals for the HHMI grant is to develop a new interdisciplinary lecture course. The new course, Physics 296/Biology 396, entitled "Biophysical modeling of excitable cells" has just finished its first semester. It is being offered by Dr. Sorinel Oprisan, Assistant Professor in the Physics and Astronomy Department.

This new course introduced students to the basic biophysical models of excitable cells including neurons, muscles, heart and secretory cells. The course used experimental data from the squid's giant axon as a blueprint for developing and implementing other excitable cell models. The course highlighted the underlying common electrophysiology of the cell membrane. These properties include the diffusion of different ions across the membrane and membrane resting potential due to the permeability of different ions, membrane excitation and recovery, and electrotonic interactions between excitable cells. The class met for three hours each week and combined lectures with in-class computer simulations. The computational part of the course used the NEURON package and the friendly user interface developed for the "Neuron in Action" by John W. Moore and Ann E. Stuart.

**PHYSICS 296/ BIOLOGY 396**  
**Biophysical Modeling of Excitable Cells**

**What will we learn?**

- Search neurobiology databases for models or experimental data
- Perform virtual experiments with *Neuron* and observe wet labs at MUSC
- Use your imagination in designing your own virtual neuron/neural network

**Why take it?**

- Gain computational biology experience and count it toward your Physics/Biology major with this three-hour PHYS 296/BIO 396!

**When?**

- Fall 2009, MWF 9:00 am - 9:50 am, room Science Center 126

**Prerequisites?**

- Basic cell biology & physics (electricity), or permission of the instructor
- No programming experience required

**What's after this class?**

- Possible CoC/external paid research assistant opportunities in neuroscience
- Work at CoC/MUSC and publish in scientific journals with faculty mentors
- Build strong resume for medical/graduate school

**Interested?**  
 Contact Dr. S. Oprisan  
 Email: [oprisans@cofc.edu](mailto:oprisans@cofc.edu), Phone 843 953 0780

The students used 10 new dual-core MacBookPro laptops purchased with the HHMI grant. They used the computers for searching computational databases (Model DB at <http://senselab.med.yale.edu/modeldb/>) for experimental data and computational implementations. Students examined specific ionic currents, fit experimental data with smooth analytic functions, and integrated membrane equations with freely available packages (e.g., Neuron and XPP).

Additionally, students used interactive graphics and virtual experiments on digital excitable cell models to test and strengthen their understanding of physiology. By the end of the semester, the students completed a computational project related to excitable cells.

For students majoring in Physics, this interdisciplinary course offers a possible bridge between the theoretical knowledge gained from the study of individual disciplines (e.g., electricity, magnetism, quantum physics, etc.) and life sciences. Fifteen students were enrolled in the fall from Biology, Psychology and Physics. The course will be offered every year during the fall semester. The goal of this interdisciplinary course is to facilitate critical thinking skills at the interface among several disciplines.

## More computer power

The Computational Biology program, funded by HHMI, acquired a new top-of-the-line HP ProLiant DL380HP G6 Server in July. Equipped with the latest Quad-Core Intel® Xeon® Processor E5560, loaded with 48GB of memory, and a network storage array of 9TB, the server provides the Computational Biology program with the necessary computational power for studying real-world applications. The server was used this past summer by Dr. S.A. Oprisan and his research students to run numerical simulations related to a complex neural network for timing in prefrontal cortex circuitry. The server worked with all eight cores at 100% capacity for about four hours to return a solution for a network made of 1000 neurons. A similar simulation required over three days to process on a dual core machine. The server is being used for both computational biology research and teaching projects including, "The Biophysical Modeling of Excitable Cells" class taught by Dr. S.A. Oprisan.

## Imaging animal behavior

The Neuroscience Program has purchased a new image analysis system from Noldus Information Technology with HHMI funds. The new system, Ethovision XT, will be used by students and faculty within the Neuroscience program for undergraduate research projects as well as for the new neuroscience laboratory course. This flexible software platform will allow faculty and students to automate behavioral testing using various experimental animals in a variety of conditions.



Dr. Mark Hurd (Department of Psychology) and Dr. Beth Meyer-Bernstein (Biology) configure the new Noldus system to track aquatic animals while the Noldus representative, Wilant van Giessen (black shirt), Dr. Mike Ruscio (standing) and undergraduates students from Psychology and Biology observe.

## UNDERGRADUATE RESEARCH IN SCIENCE

Undergraduate students from Biology, Chemistry, Physics and Psychology received scholarships from HHMI to conduct summer research projects with College of Charleston faculty.

This past summer, 23 students were awarded scholarships from the HHMI program to engage in cutting edge research at the College of Charleston. The program demonstrates a commitment of HHMI and the College of Charleston faculty to provide research opportunities to undergraduate students. HHMI gave scholarships to faculty with a demonstrated commitment to summer research in an effort to increase the number of student research opportunities which are often limited by funding for student stipends. The \$4500 awards provided student stipends, a small faculty stipend and project supply money. In addition to the 10 weeks of faculty-guided research, students participated in a Biomedical Research Skills summer course run by Biology faculty, Drs. Ayme-Southgate and Korey, and presented their work at a poster session on Convocation Day.

This year's recipients were:



**Anna Baur/Dr. McElroy/Biology**  
Biomechanics of locomotion in lizards



**Laura Boduch/Dr. Rutter/Biology**  
Gene dispensability and evolutionary rate in a multicellular organism



**Emily Cloessner/Dr. Lavrich/Chemistry**  
A microwave study of hydrogen-transfer-triggered methyl-group rotation in 5-methyltropolone



Some of the student and faculty members who participated in the Summer Undergraduate Research Program in 2009.



Dr. Agnes Ayme-Southgate gives a Biomedical Research Skills lecture to students as part of their Undergraduate Summer Research '09

**Erin Cartwright/  
Dr. Wyatt/Chemistry**  
Analogue synthesis of the antibiotic Cytosporone E



**Sarah Crotts/Dr. Hurd/Psychology**  
The effects of environmental toxins  
on zebrafish behavior



**Andrea DeSantis/Dr. Cory/Chemistry**  
Degradation of pharmaceuticals as a  
function of storage conditions



**Emily Devol/Dr. Lavrich/Chemistry**  
Determination of the preferred secondary  
structure(s) adopted by peptidomimetics



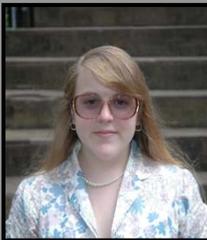
**Erica Flores/Dr. Byrum/Biology**  
Skeletal muscle specification in the  
sea urchin *Lytechinus variegatus*



**Whitney Gibbs/Dr. Riggs-Gelasco/Chemistry**  
Metal specificity of ribonucleotide  
reductase from *C. Ammonia*



**Joanna Gillespie/Dr. Oprisan/Physics**  
What can a computational model of  
pyramidal neurons tell about schizophrenia?



**Katherine Gumps/Dr. Ayme-Southgate/Biology**  
The evolution of calcium ATPase  
pump across insect phylogeny



**Jillian Kyzer/Dr. Wyatt/Chemistry**  
The synthesis of a combretastatin A-4  
anticancer analog



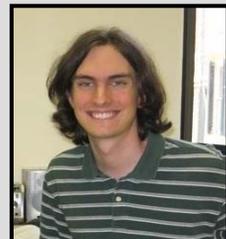
**Thomas McFadden/Dr. Beam/Chemistry**  
Novel syntheses of heterocyclic and other  
compounds using polyolithiated intermediates



**Michael Miner/Dr. Ruscio/Psychology**  
Social environment, neurogenesis and  
estrogen receptors in the prairie vole



**Krzysztof Romanowski/Dr. Zimmerman/Biology**  
IgD usage in Zebrafish



**Stacey Sangtian/Dr. Meyer-Bernstein/Biology**  
Molecular mechanisms of circadian rhythms



**Matthew Strickland/Dr. Rogers/Chemistry**  
Catalytic intermediates of the enzyme nitric oxide synthase in the presence of the novel cofactors



**Melissa Strickland/Dr. McElroy/Biology**  
A comparison of habitat use, performance, and morphology among populations of the green anole

**David Thieker/Dr. Riggs-Gelasco/Chemistry**  
Metal specificity of ribonucleotide reductase from *C. Ammoniagenes*



**Margaret Thomasson/Dr. Cory/Chemistry**  
Analysis of glucosinolates in plants from the Brassicaceae family



**Larchinee Turner/Dr. Ayme-Southgate/Biology**  
Projectin analysis in basal insects



**Patrick Van Woert/Dr. Rutter/Biology**  
Developing a predictive framework for mutation effect: redundancy and environmental context



**Tiffany Williams/Dr. Korey/Biology**  
Investigating a role for Ppt1 in *Drosophila* circadian behavior



Dr. Byrum's lab in the Biology Department



Dr. Meyer-Bernstein's lab in the Biology Department



Dr. Lavrich's lab in the Chemistry & Biochemistry Department



Dr. Riggs-Gelasco's lab in the Chemistry & Biochemistry Department



Dr. Wyatt's lab in the Chemistry & Biochemistry Department



Dr. Hurd's lab in the Psychology Department

## NEW FACULTY SPOTLIGHT



Dr. Jeffrey D. Triplehorn joined the Biology Department at the College of Charleston in the Fall 2009. Dr. Triplehorn received his B.A. in Psychology from Rutgers University and earned his M.S. and Ph.D. from the University of Maryland, College Park in the Psychology Department's Integrative Neuroscience program. He then went on to post-doctoral positions in the labs of Dr. Donald Edwards in the Department of Biology at Georgia State University and Dr. Johannes Schul in the Department of Biological Sciences at the University of Missouri-Columbia. His research interests include sensory neurobiology, the neural control of behavior, and the neuroethology of predator-prey interactions using primarily invertebrate model systems. Dr. Triplehorn's hire was supported by the HHMI grant.

## OUTREACH: SHARING SCIENCE WITH THE COMMUNITY

### PROJECTS for School Age Children:

Boy Scout Chemistry Merit Badge  
National Chemistry Week  
Brain Awareness Week  
Burke High School Science  
Lowcountry Hall of Science and Math

### Boy Scout Chemistry Merit Badge

The Chemistry and Biochemistry Department sponsored a Boy Scout Chemistry Merit Badge activity on October 4<sup>th</sup>, 2008 held at the Hollings Science Center. The HHMI grant helped fund the event by purchasing activity materials and snacks for the students. The event was attended by local grade school Boy Scout members. All the activities were led by students in the Chemistry & Biochemistry Department and by members of the Chemistry student organization, Alpha Chi Sigma.

### National Chemistry Week

The Lowcountry Hall of Science and Math (LHSM) coordinated events for National Chemistry Week on Oct. 25<sup>th</sup> 2008 also at the Hollings Science Center. The HHMI grant was one of the sponsors for the event by helping LHSM purchase activity kits. The theme for the event was "Having a Ball with Chemistry." There were 250 students from grades preK-12 children that participated in the event. Our HHMI Biochemistry students were also involved in the outreach activities.



### Brain Awareness Week (BAW)

BAW is an international campaign dedicated to advancing public awareness about the progress and benefits of brain research. During BAW, campaign partners across the world attempt to convey the wonders of the brain and nervous system to the public through exciting and innovative activities. The faculty members and students in the Neuroscience Program at the College of Charleston wanted to be a part of this exciting initiative by sharing their interest in neuroscience with the young people in the Charleston community.

The Neuroscience Program at the College of Charleston sponsored the 1<sup>st</sup> annual



Dr. Beth Meyer-Bernstein and her students give a short lecture to grade school students about the importance of the human brain.

Brain Awareness Week on March 15-21, 2009 held at the Children's Museum of the Lowcountry. The event was open to the public and funded by HHMI through the College of Charleston. Dr. Elizabeth Meyer-Bernstein, Co-Director of the Neuroscience program organized the outreach event. She says, "Our goal is to increase community awareness of the brain and nervous system. In particular, we want children to learn to appreciate the complexities and capabilities of the brain and the value of Neuroscience research that they may not be exposed to in their schools. What better way to reach children than at the Children's Museum? " The students from the Neuroscience program at the College of Charleston, worked one-on-one with children at the Whiz Kids after-school program. The team returned later that week and brought coloring sheets, illusions and memory and tactile activities for the Museum's Free Friday Family Fest. Dr. Meyer-Bernstein added, "The brain and nervous system are critical to our health, behavior and performance. Diseases of the brain and nervous system such as depression, stroke and Alzheimer's disease have profound impacts on our community. By increasing awareness and understanding of neuroscience, people can better appreciate the significance of the nervous system and research designed to alleviate these ailments."



Ms. Kimberly Christensen (College of Charleston, Department of Biology, Neuroscience minor) demonstrates to grade school students on how to make a brain model by using play dough.

## Laboratory Supplies for Burke High School

As outreach for PK-12 teachers and students, the HHMI grant provided funds for equipment upgrades in the Science Department at Burke High School. The support for Burke High School started with a purchase of \$30,000 worth of laboratory supplies. The faculty at Burke has been working with Dr. Meta VanSickle, Professor, Department of Teacher Education at the College of Charleston, to develop new activities for the students and to develop methods for assessing their effectiveness. The supplies will provide high school students with new biotechnology exercises. The delivery was made on January 7<sup>th</sup>, 2009 and the Burke science teachers were very pleased to receive the laboratory supplies.

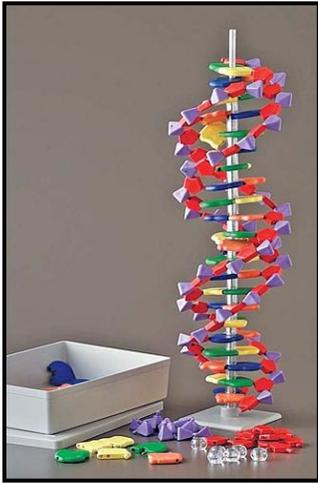


Dr. Mark Hurd (Psychology) helps unload boxes from one of the two vehicles needed to bring all the supplies to Burke High.

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## Lowcountry Hall of Science and Math

The Lowcountry Hall of Science and Math (LHSM) at the College of Charleston is an established PK-12 teacher resource center. This resource center provides a mechanism for communication, collaboration, and coordination between The College and the Science, Technology, Engineering, and Mathematics (STEM) education communities in the area. The HHMI grant contributed to the current holdings of LHSM by purchasing DNA and brain models.



Molymod mini DNA/RNA Model

These models are available for loan to teachers for their science activities at their schools. The Neuroscience Program and the Chemistry Department at the College of Charleston are using these resources for their outreach efforts.



Giant Brain Model 2.5 times full-size, 14 parts

## NEUROSCIENCE OUTREACH for COLLEGES and UNIVERSITIES

### EVENTS:

#### Neuropalooza

Symposium for Young Neuroscientists and Professors of the Southeast (SYNAPSE)

This year, the HHMI grant supported two outreach activities geared towards fostering a community between local and regional neuroscientists and neuroscientists in-training.

### Symposium for Young Neuroscientists and Professors of the SouthEast (SYNAPSE)

The College of Charleston hosted the 6<sup>th</sup> annual Symposium for Young Neuroscientists And Professors of the SouthEast (SYNAPSE) on March 28<sup>th</sup>, 2009. This one day, regional undergraduate neuroscience conference provides opportunities for students to present their research, to obtain feedback from neuroscientists from other institutions, to discuss important issues in neuroscience, to hear about cutting-edge research from keynote speakers, to attend training sessions and panel discussions and to network with other neuroscientists in the region.

Two keynote speakers presented at SYNAPSE2009. Dr. Marcy McDonald from the Department of Neurology at Massachusetts General Hospital and Harvard University gave her keynote address entitled "Huntington's Disease: Genetics and Neuroscience". Additionally, Dr. Misha Angrist from Duke University and the Institute for Genome Sciences and Policy gave his keynote address entitled "And the Crowd Goes Wild: The Eruption of Personal Genomics." Approximately 150 undergraduates and professors attended the conference. The conference was funded by The South Carolina EPSCoR/IDeA program and HHMI.





(L to R) Dr. Misha Angrist (Keynote Speaker), Dr. Dana Waring (Workshop Leader) and Dr. Marcy McDonald (Keynote speaker).



The CofC Neuroscience minors at the SYNAPSE conference.



## Neuropalooza

The College of Charleston Neuroscience Program in collaboration with the Neuroscience Institute at the Medical University of South Carolina (MUSC) held the 1st annual Neuropalooza Symposium on Feb. 13th, 2009 at the College of Charleston. This meeting offered undergraduate students at The College an opportunity to meet and interact with graduate students, post-doctoral researchers and faculty from MUSC. Dr. William Carlezon, Harvard Medical School, gave the keynote address entitled "Neurobiology of depressive behavior." Five students from the College of Charleston also gave talks during the course of the symposium. A total of 70 undergraduate and graduate students, post-docs and researchers attended the symposium. HHMI helped to sponsor the MUSC/CofC event.



The plenary speaker, Dr. William Carlezon, from the Departments of Psychiatry and Neuroscience at McLean Hospital and Harvard Medical School gave the keynote address entitled "Neurobiology of depressive behavior."



Ms. Kimberly Christensen (College of Charleston, Department of Biology, Neuroscience minor) describes her work entitled "The Role of the Homer 2 Protein in Mammalian Circadian Rhythms".