Jennifer Dulin
Advisor: Raymond Grill, Ph.D.

There are more than 1.25 million Americans living with spinal cord injury (SCI). In addition to permanent paralysis and sensory loss, many SCI patients must also endure chronic pain, loss of bowel- and bladder function, infertility, and other complications which dramatically impact quality of life. Unfortunately, since there are no proven effective drugs available to treat SCI, those living with SCI have very little chance for functional recovery.

The primary research focus in the lab of Dr. Raymond Grill is to characterize the pathological processes that influence outcome following SCI, with the ultimate goal of identifying novel targets for therapeutic intervention. It is our hope that the translational research we conduct will pave the way for the development of new therapies for SCI patients. As a student in the Grill lab, I have worked on projects studying multiple aspects of SCI-associated pathology, within the spinal cord as well as in peripheral tissues.

My principal research project is an investigation into the development of drug resistance after SCI. By characterizing expression of spinal cord drug transporter proteins after injury, and assessing the spinal cord bioavailability of systemically-administered neuroprotective compounds, we have found evidence that increased expression of spinal cord drug transport systems may confer drug resistance to the injured cord.

This is an important finding, because many potential SCI drugs that have shown promising results in preclinical studies have proven ineffective when evaluated in clinical SCI trials. Our research indicates that this may be due in
part to insufficient penetration of these drugs into spinal cord tissue due to enhanced drug transporter expression following SCI. These results highlight a major, previously unknown barrier to effective drug delivery following SCI.

In order to overcome this obstacle and improve efficacy of drug treatment in SCI patients, we have begun to target the molecular signaling pathways which we suspect drive this phenomenon. We have found that inhibition of key enzymes can attenuate the SCI-induced increase in drug transport and enhance drug delivery to the spinal cord. We are now beginning experiments to evaluate whether this is also accompanied by improvements in neurological outcome; if so, then this finding will be a major gain for translational SCI research.

In addition to understanding the pathological changes occurring within the injured cord, I am also interested in characterizing the systemic response to SCI and its impact on peripheral organ systems. For example, the majority of male SCI patients experience infertility, a phenomenon which is largely attributed to a rapid deterioration in quality of semen following SCI. However, the mechanism causing this is unknown. In order to gain insight into the pathophysiological mechanisms which contribute to male infertility, we investigated the properties of the blood-testis barrier (BTB) post-SCI. We observed acute BTB breakdown, which is sustained through chronic SCI; we also detected extensive germ cell apoptosis, which may contribute to decline in seminal quality. The manuscript reporting these findings, “Spinal cord injury causes sustained disruption of the blood-testis barrier in the rat”, was recently published in *PLoS ONE*. This is a novel area of research in the Grill lab, and we are continuing these investigations with the ultimate goal of developing a therapeutic avenue to prevent SCI-associated BTB breakdown and improve the reproductive potential of males who have suffered from SCI.

### Recent Student Awards

**Jennifer Dulin**, continued

In addition to understanding the pathological changes occurring within the injured cord, I am also interested in characterizing the systemic response to SCI and its impact on peripheral organ systems. For example, the majority of male SCI patients experience infertility, a phenomenon which is largely attributed to a rapid deterioration in quality of semen following SCI. However, the mechanism causing this is unknown. In order to gain insight into the pathophysiological mechanisms which contribute to male infertility, we investigated the properties of the blood-testis barrier (BTB) post-SCI. We observed acute BTB breakdown, which is sustained through chronic SCI; we also detected extensive germ cell apoptosis, which may contribute to decline in seminal quality. The manuscript reporting these findings, “Spinal cord injury causes sustained disruption of the blood-testis barrier in the rat”, was recently published in *PLoS ONE*. This is a novel area of research in the Grill lab, and we are continuing these investigations with the ultimate goal of developing a therapeutic avenue to prevent SCI-associated BTB breakdown and improve the reproductive potential of males who have suffered from SCI.

**Jennifer Dulin** was awarded the 2010-2012 T32 training grant through the Center for Clinical and Translational Sciences (CCTS) for her proposal on “Investigation of P-glycoprotein modulation by inflammation in spinal cord injury”.

**Proleta Datta** - Sam Taub and Beatrice Burton Endowed Scholarship in Vision

**Bryan Hansen** - Dee S. and Patricia Osborne Endowed Scholarship in Neuroscience, Travel award to the Computational and Systems Neuroscience (Cosyne) meeting, 3rd place GSEC Research Poster Completion, and the Student Intercouncil Academic Scholarship.

**Audrey Nath** - City Federation of Women’s Clubs Endowed Fellowship

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**Natalia Rozas** - Gigli Family Endowed Scholarship

May 2011 - The UT Health – GSBS graduate student team raised over $5,700 benefitting March of Dimes, an organization geared towards spreading awareness and raising money benefitting premature baby research. The team was lead Brittany Parker and included neuroscience graduate students Curtis Neveu, Monica Gireud and Antonio Tito.

Former GSBS Neuro student, **Daniel Babcock**, was awarded the Larry Sandler Memorial Award by the Genetics Society of America. This is an international award for best graduate thesis using Drosophila as a research tool in the prior year.

With a life-long interest in biomedical science, the brother-sister team of Sam and former student **Cameron Jeter** are thankful for the many opportunities for personal and academic growth given to them during their academic careers at the UTHealth Graduate School of Biomedical Sciences. Sam is pursuing his long-term goal of increasing the use of MRI in the operating room. Cameron, the recipient of multiple scholarships, is now a post-doctoral fellow searching for biomarkers of traumatic brain injury.
**Recent Events**

**2010 Summer Fiesta** was held in the Museum District at NGP student council member Brittany Parker’s condo club house. We enjoyed great food, swimming and games! Look out for plans for the next Student Picnic which will be held Saturday, July 16.

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**The Fall Neuro-Staycation** (Student Retreat) was held Friday September 17, 2011 in the medical school building Art Gallery. Guest speakers included Dr. Xiaohong Denise Chen, assistant professor of Rice and past UTHealth at Houston Neuroscience Graduate Program Director, Michael Mauk. Dr. Mauk is currently professor of Neurobiology at UT Austin. In addition to student talks they also held a poster competition. First place went to Natalia Rozas, second to Audrey Nath and third to Brittany Parker.

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**Robert J. Zatorre, PhD** of the Montreal Neurological Institute gave the Fall Student Invited Speaker Seminar September 30, 2011.

Student Debates were held April 1, 2011. Caitlin Elmore, Curtis Neveu and Heather Turner gave talks.

April 14, 2011 Juan Dominguez of the department of Psychology at UT Austin, gave the Spring Student Invited Seminar.

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**Congratulations to the 2011-2012 Neuroscience Program Student Council**

Joseph Alcorn, Jon Flynn, Julia Hill, Brittany Parker, Natalia Rozas

Thank you to the most recent, hardworking 2010-2011 Neuroscience Program Student Council. You all did a great job this past academic year and we truly appreciate it!

Joseph Alcorn, Sarah Baum, Madeline Burgoyne, Caitlin Elmore, Brittany Parker, Natalia Rozas
Recent Student Publications


Leigh Curtis, Proleta Datta, Xia Qin Liu, Natalia Bogdanova, Ruth Heidelberger and Roger Janz. Syntaxin 3B is essential for the exocytosis of synaptic vesicles in ribbon synapses of the retina. Neuroscience. 2010 Mar 31;166(3):832-841


B.J. Hansen and V. Dragoi. (2011). Laminar-dependent adaptive synchronization in visual cortex. Accepted pending revision to PNAS.

Recent Program Faculty Publications

Tim Ellmore: Relationship between electrical and hemodynamic measures of working memory function in humans.


Jeter CB, Patel SS, Sereno AB. Novel n-back spatial working memory task using eye movement response. Behavior Research Methods, in press.


Program Faculty Awards

Andrew Bean, Ph.D., received the 2011 John P. McGovern Award for Outstanding Teacher at this year’s graduation ceremony. Having been nominated and voted for by GSBS students, Dr. Bean has demonstrated excellence in teaching and mentoring, and has been instrumental in helping students achieve their educational goals, overcome personal struggles, and maintain high overall academic standards.
Evan Antzoulatos
I earned my Ph.D. in Neuroscience in 2006, following my graduate work with Jack Byrne and Doug Baxter on cellular mechanisms of learning and memory. Since then, I have been working as a postdoc in Earl Miller’s lab at the Picower Center for Learning and Memory, MIT. My postdoctoral research is focused on the neural basis of rule-based behavior in the primate brain, with emphasis on category learning. When exposed to the immense diversity of everyday life, our brain displays its fundamental ability to abstract from our experiences, i.e., to focus on the commonalities that are relevant for guiding our behavior and ignore the variability that is irrelevant. Based on this process of abstraction, we can generalize previously learned behaviors to circumstances that we may have never experienced before, or respond to novel environmental stimuli drawing from our past knowledge. To understand how our brain supports the ability of abstraction, which is sometimes compromised in autism and other conditions, I recorded single-neuron activity from multiple electrodes in prefrontal cortex and striatum simultaneously. The former plays a well-documented role in various executive functions and the latter is important for gating our behavioral responses. The results of that study indicated that when exposed to a limited number of stimuli, the appropriate responses to these stimuli are primarily encoded in the activity of striatal neurons. An increase, however, in the complexity of the environment, as when exposed to a large number of novel stimuli, engages the prefrontal cortex. Under those conditions, activity in prefrontal neurons organizes the diverse stimuli in a small number of coherent groups, i.e., categories, while at the same time, activity in striatum switches to a lower-level motor-planning role. These results suggest that a malfunction in the prefrontal-striatal interactions could potentially be responsible for the observed impairment in abstraction-based category learning in some patients of autism and schizophrenia. Because simultaneous multi-electrode, multi-area recordings yield impressively rich datasets, I am currently analyzing the data in ways that will allow me to further explore more detailed questions as far as the prefrontal-striatal interactions are concerned. In addition, by collaborating with a computational team, we hope to reproduce these results in a mathematical model of cortico-striatal networks, which will then be used to generate further testable hypotheses.

Cameron Jeter
In May 2010, I graduated from Anne Sereno’s lab in the Department of Neurobiology & Anatomy. My project was highly clinical and translational, using eye movement measures of cognitive control (generating the proper response, inhibiting incorrect responses and maintaining working memory) in children who have Tourette Syndrome and its common comorbitides of attention deficit hyperactivity disorder (ADHD) and obsessive compulsive disorder (OCD). At the suggestion of Pramod Dash, one of my Supervisory Committee members, we began a collaboration to look at salivary biomarkers of Tourette Syndrome – yes, I asked kids to spit in a tube! Our symbiotic skill sets led Dash to ask me to be a postdoc in his lab; I moved from the blue hallway to the green hallway. As Dash described my new biochemistry project analyzing blood and cerebrospinal fluid samples from patients with traumatic brain injury, however, I was concerned that I would be a sponge, soaking up all this new knowledge with nothing to offer in return. But I quickly found my niche, offering to initiate his new clinical study. My ability to get the project off the ground made me proud of and thankful for my great training in the Neuroscience Program, as I knew how to write a clinical protocol, walk it through the IRB, and recruit and enroll patients in the clinic. Combining my ‘old’ and ‘new’ skill sets, I’m continuing the Dash lab’s work to identify biomarkers of traumatic brain injury, proteins or metabolites in body fluids that may prove utility in diagnosing patients, anticipating future outcome and selecting the best pharmacotherapy.

Outside of the lab I serve on the Postdoctoral Executive Committee, a student council of sorts for postdoctoral fellows at UTHealth (the University’s new brand name). Much like the Neuroscience Student Council, we work to foster social and professional development through monthly coffee breaks, international potlucks, biannual travel awards, a career forum and an oral presentation competition. I enjoy this administrative outlet and have found my graduate school networks helpful in receiving approval and support for our events. I’ve also taken advantage of the opportunity to gain teaching experience, co-directing and teaching Introduction to Cognitive Neuroscience to our first-year Neuroscience graduate students. Thanks to the Neuroscience Program for great experiences and memories.
Collaborative studies with Dr. Sadhan Majumder (MDACC Dept. of Genetics) uncovered the regulatory role of REST/NRSF, a transcriptional repressor of neuronal differentiation genes, in medulloblastoma oncogenesis, with results published in *Nature Medicine*.

Most recently, Dr. Fuller was elected President of the United States and Canadian Academy of Pathology (USCAP). The USCAP has a professional membership of over 10,000, and draws over 4,000 pathologists to its annual week-long meeting, which features the largest number of scientific abstracts presented at any pathology meeting world-wide. As President, Dr. Fuller will lead the USCAP in overseeing the educational and scientific activities of the Academy.

Dr. Fuller is a member of the editorial boards of ten scientific journals and has published over 220 research papers, 51 book chapters, and two textbooks: *Practical Review of Neuropathology* with Dr. J. Clay Goodman (Baylor College of Medicine) and *Genomic and Molecular Neuro-Oncology* with Dr. Wei Zhang.

### 2010–2011 Dean’s Teaching Excellence Awardees

- Vasanth Jayaraman, Ph.D.
- Leonard J. Cleary, Ph.D.
- Daniel J. Felleman, Ph.D.
- Alan C. Swann, M.D.
- David Marshak

**Grants**

- **Michael Beierlein** received a Research Grant from the Epilepsy Foundation ($50,000).
- **Christophe P. Ribelayga**
  
  NIH/NEI, R01-EY018640
  
  **Title:** *Circadian Clock Function in the Mammalian Retina*. This project examines the molecular components required to form functional circadian clocks in the mouse retina. The proposed experiments will be conducted on isolated mouse neural retinas maintained in *vitro* for several days in constant environmental conditions. A large variety of techniques and genetically modified animals will be used to better understand the cellular and molecular basis of biological timing in the mouse retina and increase our knowledge of how the circadian clock controls day/night differences in retinal function.
Jennifer Raymond is Associate Professor of Neurobiology at the Stanford University School of Medicine. Her research program investigates the neural mechanisms of learning and memory.

John Walsh: John Walsh, Ph.D., is an Associate Professor of Gerontology and a member of the Neuroscience Program at USC. He received his undergraduate degree in biology from the University of California, Irvine, and was awarded a Ph.D. in physiology and biomedical sciences from the University of Texas School of Medicine in Houston. Dr. Walsh’s research focuses on the electrophysiological analysis of brain areas that are targets of age related disease. Studies on aging, calcium, and free radical physiology are performed in Dr. Walsh’s laboratory as they relate to changes in synaptic plasticity and cell behavior. His research also examines how toxic environmental challenges affect nerve cell populations typically lost in Parkinson’s disease, Huntington’s disease, and Alzheimer’s disease.

“The focus of my laboratory is to understand dopamine and glutamate synaptic physiology in the striatum under normal and pathological conditions. We use the analysis of short and long-term synaptic plasticity at corticostriatal synapses to study striatal pathology and rely upon, whole cell voltage clamp, intracellular and field potential recordings in the analysis. We also use fast-cyclic voltammetry to study dopamine physiology in the same brain slices. A parallel study is being performed in aged animals to describe how aging impacts synaptic integration and the mechanisms for any observed changes caused by the aging process.

A second interest in the laboratory is to describe the modulation of synaptic function and key conductances in striatal neurons following the generation of reactive oxygen species (ROS) under conditions of hypoxia. Part of this NIH funded study uses the complex II inhibitor 3-nitropropionic acid (3-NP) to examine acute and long-term survival and the synaptic consequences of chemical hypoxia.

We also have been studying the impact of MPTP treatment on striatal physiology in mice and squirrel monkeys in collaboration with Drs. Mike Jakowec and Giselle Petzinger from USC’s Department of Neurology.

These research interests are connected by the underlying hypotheses that aging and disease create shifts in ROS homeostasis, which possibly follow similar pathways in the striatum.”

Dr. Walsh spends his free time surfing in southern Orange County.

Matt Swulius: After receiving my PhD from Neal Waxham’s lab in May of 2010, I packed up my things and moved to Pasadena, CA, where I am currently a postdoc with Grant Jensen at Caltech. While my main interest remains in neuroscience I have made quite a leap into the world of bacterial cell biology, where I combine light and electron microscopy to study a previously under-appreciated bacterial cytoskeleton at molecular resolution. I believe this major change in biological arenas has had two principal effects. First, as absence makes the heart grow fonder, my time away from neurons has only strengthened my desire to return to them one day. And second, it has opened my eyes to the amazing complexity and diversity of our not-so-humble cellular ancestors, giving me new eyes with which to come back and approach questions surrounding the most elegant of eukaryotic cells. From my experience so far, I would encourage anyone to stray off his or her current path for a bit and gain some new perspective. You may find a new love, or you may reaffirm the one you had. Either way you will broaden the scope of your future work.

My current plan is to stay on the academic path as long as it allows me. I would love to use the skills I’m accumulating to study the molecular architecture of synapses throughout development and how the arrangement of molecules is shaped by synaptic activity. Technologically, we are now at the edge of truly being able to address these sorts of questions in cells near a native state. I began to address this topic during my PhD using isolated synaptic protein complexes, but how these processes unfold in vivo is where the rubber really hits the road so to speak. I just hope that I’m lucky enough to take part in addressing these fundamental questions about development and plasticity in neurons.

Jennifer Raymond is Associate Professor of Neurobiology at the Stanford University School of Medicine. Her research program investigates the neural mechanisms of learning and memory.
Congratulations Neuro-graduates!

Ph.D. Graduates
May 2010
Cameron Jeter
William Kothmann
Leigh Curtis Latham
Matthew Swulius
May 2011
Audrey Nath
Joshua Neunuebel
Anne Netek

Master Graduates
May 2010
Wei-Li Liu
Vuvi Nyugen
Natalie Sirisaengtaksin
Alejandro Vila
Sheshali Wanchoo
May 2011
Timothy Graham
Lorena Maili

New Neuroscience Program Member!
Karik Venkatachalam of the department of Integrative Biology and Pharmacology joined the Neuroscience Program Faculty May 27th. His research interests include Drosophila neurobiology, neurodegenerative and neuropsychiatric diseases, systems neuroscience, sensory transduction, molecular genetics and developmental neurobiology.

Neuroscience Graduate Program
Co-Directors
Andrew Bean and Jack Weymire
Program Coordinator
Amanda Concha
Neuroscience Student Council Members
Joseph Alcorn, Jon Flynn, Julia Hill, Britanny Parker, Natalia Rozas
Newsletter Design
Roy Prichard

UPCOMING EVENTS
Rio de JaNeuro
Saturday, July 16
Valhalla, Rice University
6:00 p.m. - 10:00 p.m.

Neuroscience Program Orientation
Thursday, August 25
MSB 7.046 (includes program faculty lab tours)
Reception following

Student Retreat
Early Fall, to be determined