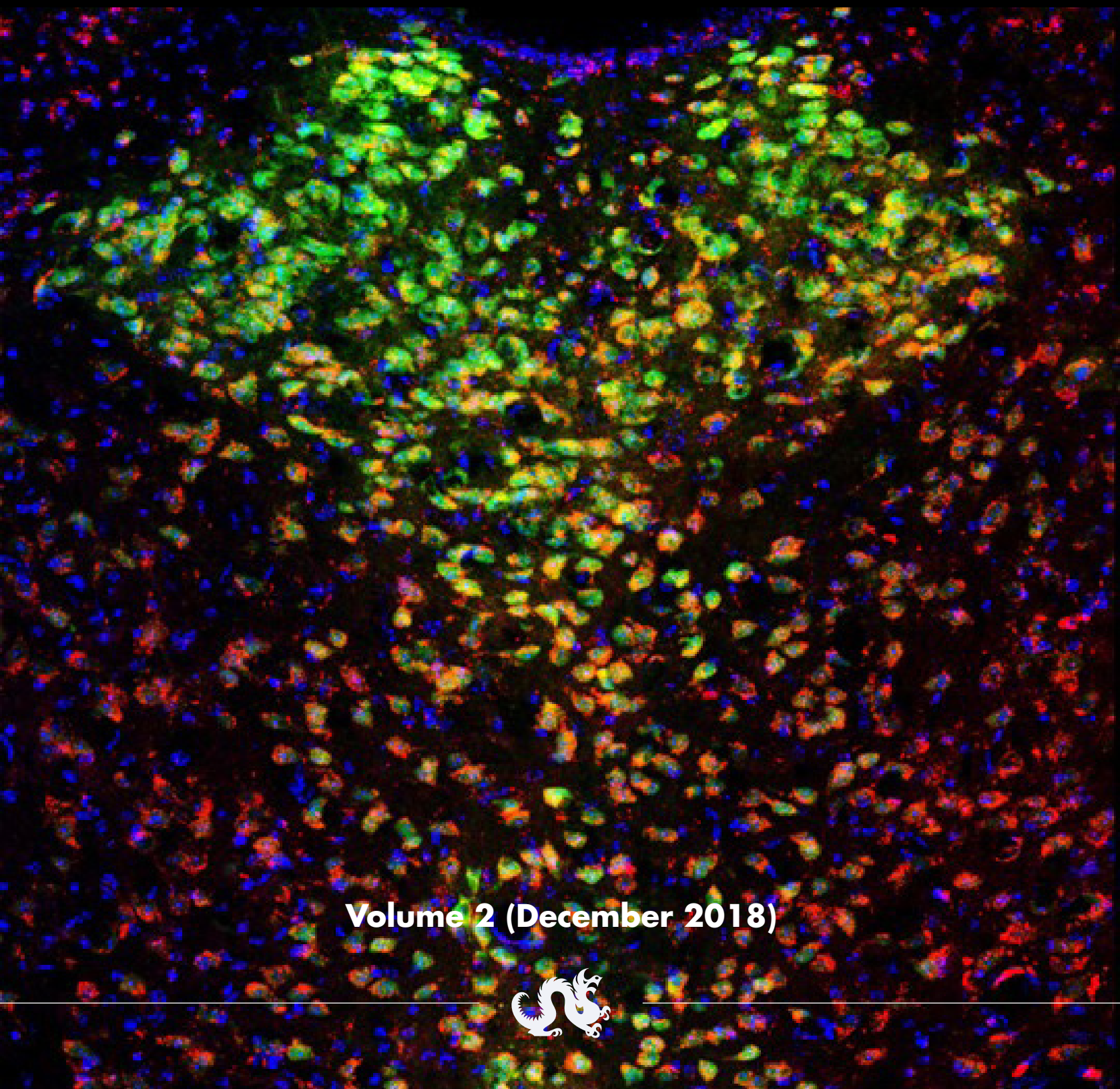
The Hillock

where efforts summate to actions

Newsletter of the Department of Neurobiology and Anatomy
Drexel University College of Medicine



Volume 2 (December 2018)

The Hillock

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We extend special thanks to the Drexel University College of Medicine Marketing and Communications Department for their assistance with the preparation of this newsletter.

On the Cover:

Front — Using vesicular glutamate transporter 2 (vGLUT2) - green fluorescent protein (GFP) mice donated by the Dougherty Laboratory, Andrew Gargiulo in the Barson Laboratory showed for the first time that 75-78% of all cells in the paraventricular thalamus (PVT), a limbic structure, contain glutamate and that nearly half (43-47%) of all cells in the PVT contain the neuropeptide, pituitary adenylate cyclase-activating polypeptide-27 (PACAP-27). The Barson Laboratory is studying the role of PACAP in the context of alcohol abuse and binge eating. This confocal image shows PVT cells expressing vGLUT2 (green), PACAP-27 (red), and 4′,6-diamidino-2-phenylindole (DAPI; blue).

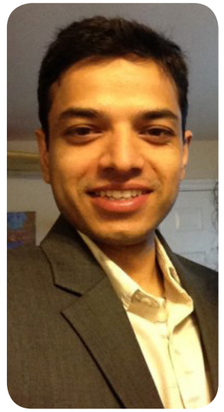
Gupta A, Gagriulo AT, Curtis GR, Badve PS, Pandey S & Barson JR (2018). Pituitary adenylate cyclase-activating polypeptide-27 (PACAP-27) in the thalamic paraventricular nucleus is stimulated by ethanol drinking. Alcohol Clin Exp Res, 42(9): 1650-60.

Back — An evaluation of pathological changes in the diaphragm neuromuscular junctions (NMJs) of a rat following five weeks of lateralized C3/C4 spinal cord contusion injury. This confocal image shows acetylcholine receptors stained with α-bungarotoxin (red) and motor axons and their terminals stained with SMI312+SV2 antibodies (green). Partial denervation could be seen for some NMJs.

The image was obtained by Dr. Tatiana Bezdudnaya from Lane lab with assistance from Dr. Vlad Zhukarev. The Lane lab studies respiratory functions in the context of spinal cord injury.

DREXEL UNIVERSITY
College of
Medicine
Department of Neurobiology and Anatomy

In This Issue:



Surya Pandey

Nancy Mack

Ankita Patil

Philip Yates

Letter From the Editors

We are extremely happy to bring to you the second issue of *The Hillock* as it signifies the establishment of a sustainable tradition that started last year. This also speaks to the enthusiasm our department members have for sharing stories about their science and their lives. We thank all the contributors for helping us in our endeavor.

In this issue, we continue to remember the history of our department with Chapter 2 written by former Chair Dr. Don Faber. Dr. Faber provides a glimpse of the battle our early leadership fought for the sustenance of this department, evoking great respect for their courage, and reminding us that the safety of a haven depends on the strength of its foundation. In this vein, we also pay tribute to one of these legendary figures, Dr. Marion Murray, who passed away recently, leaving behind an extraordinary legacy of scientific excellence, collegial leadership, and formidable friendships.

The success story of the department in the present is highlighted by featured research, student and faculty achievements, as well as community outreach efforts. In our interviews with post-doctoral fellows, staff, faculty, and alumni, we consistently notice an appreciation for our department's collaborative culture, which is also exemplified here by a story about our department's decades-long research exchange with institutions in Japan. The interviews, along with other personal stories, also portray diverse and spectacular expeditions our scientists have taken in pursuit of their curiosities and passion. Finally, we continue the tradition of showcasing the creativity permeating the department.

Our hope with *The Hillock* is to celebrate the shared humanity that extends beyond the experiments we perform and the manuscripts we prepare. We hope you will take delight in listening to these stories that sit near lab benches, rigs, and office computers.

The Editorial Team

A View From the Chair

With the publication of the second issue of our newsletter, *The Hillock*, we set in motion a new tradition that underscores our legacy and our achievements, highlights the story of individual students, faculty and staff and illustrates creativity in science and art.

In 2018, our faculty continued their remarkable progress with respect to funding of innovative research and mentoring of graduate students, resulting in an impressive portfolio of publications (see appendix) and promotions. Dr. Dong Wang has recently been awarded his first R01 (first submission, at 5% tile). Drs. Michael Lane, Rodrigo España, and Kim Dougherty have secured a second or renewed a R01 and were promoted to the rank of associate professor. Drs. Haviva Goldman, Francis Sessler and Jed Shumsky have been nominated for promotion to the rank of professor, and Dr. Goldman has also been appointed as vice chair of Medical Education. Our senior faculty led by Drs. Peter Baas, John Houle, and Wenjun Gao continued to provide leadership to our research groups (cell biology, spinal cord and systems, respectively), and continued our mentoring program to review every major grant application in designated committees and "chalk talks."

At the same time, many of our students have been awarded individual NIH Fellowships, Dean's Awards and other internal and external recognitions of excellence, following the goal that graduate students should be ready and able to submit their own fellowship once they have an approved proposal.

Our legacy section includes Chapter 2 by our previous chair, Dr. Don Faber, who arrived in 1992 to the Medical College of Pennsylvania (MCP), to build up the department with strategic recruitment focused on strengths in electrophysiology and developmental neuroscience. His own legacy includes the leadership he provided during the bankruptcy process to protect the medical school (he was the president of the committee to save the university), which led to the academic partnership with Drexel University. The newsletter also celebrates our partnership with Japanese medical schools for over 20 years, mostly with the orthopaedic surgery and neurosurgery departments at Nagoya University, under the leadership of professor Otsuka. This partnership included 14 fellowship exchanges, joint scientific research and the mentoring of several generations of academic physicians. The value of these exchanges transcended the professional benefits of biomedical research and included the coming together of people, traditions, languages and children, which will hopefully have a lasting effect.

Sadly, we lost Dr. Marion Murray, who passed away on September 9. We held a memorial service on October 7, which was attended by her friends and colleagues from all over the U.S. An endowment has been established in her memory to provide support for students and young investigators in the field of spinal cord research and the Spinal Cord Research Center has been named in her memory.

We had our first neuroscience retreat with 125 registered participants including students, postdoctoral fellows and faculty from 13 departments and institutes. The retreat was divided into four sections with presentations by junior faculty and students. The presentations included the subjects of circuits and behavior, development and plasticity, injury and pathology of the nervous system. Our educators, under the leadership of Dr. Haviva Goldman, have successfully transitioned to the new medical curriculum for years 1 and 2, continued their innovative online remediation course — creative Artistic Anatomy, and held summer courses for high school students mentored by our graduate students.

As a symbol of our shared goals and the joy of the holidays, we get together for our annual party with family and friends. We celebrate our achievements with good food and a slide show, acknowledge the excellence of individuals with awards, spoil the children with presents (compliments of Santa Claus, aka Dennis) and spend some time together, ready to face the challenges of next year.

Itzhak Fischer, PhD
Professor and Chair

Marion Murray, PhD

1937 – 2018

"Anatomy is Destiny."

Marion Murray, PhD, professor emeritus in the department of Neurobiology and Anatomy, passed away on September 9 of this year following complications of esophageal cancer.

Dr. Murray was a founding member of our Spinal Cord Research Center, leading its research activities for over 30 years to create one of the most prominent centers in the United States. She inspired and mentored countless students, fellows and faculty, established a world-class research program and published more than 150 scientific articles and reviews. She exemplified a scientific leader who passionately confronted significant problems for human health and then generously shared her knowledge with others.

1950s
High school years with Warren Beatty (really, they went to high school together)

1974
Marion and Michael move to MCP

1989-1990
WCBR downhill skiing (medal winner)

2013
Marion "retires"

1937

1960s-1970s
Wisconsin – McGill – Cornell – Chicago

1984
First Program Project Grant (PPG)

1998
Marion and Justin get married

2018

Remembering *Marion*

Marion garnered enormous respect from neuroscientists around the world and was beloved by her colleagues at Drexel. She seemed to be open and caring with everyone she came in contact with. I always walked out of her office feeling much better than when I walked in.

— Tim Cunningham, PhD, professor

Marion was extremely supportive but always expected full accountability too. She was always willing to read grant drafts and papers critically, and also unafraid to speak truth to power. The latter happened if she deemed it likely to be useful, which was based very judiciously on her experience and a healthy cynicism. In contrast, the helpful (but sometimes painful) "deep read" of papers or grants was never refused by Marion. This was even true as she became ill. Kiki Yang's first paper from the Giszter lab got the full "Marion treatment" from within Bryn Mawr Hospital, despite everything arrayed against it happening, and with her and Justin's fullest support. Incredibly, Marion saw the editing task as a boon, not a burden. For me this says it all. Plus, fearless ... she got tattoos while traveling outside the U.S. and rode a motor bike on sabbatical in the U.K.

— Simon Giszter, PhD, professor

One of my favorite stories was how she and Justin ended up in a bar in Mexico one afternoon and, after a few margaritas, decided that it would be a good idea to get matching tattoos. I hope everyone had the opportunity to see the beautiful lizard on Marion's foot.

— John Houle, PhD, professor

To me, Marion was a mentor and friend. She was resourceful, often an instigator and a nonconformist. Marion was passionate about whatever she was working on: science, music or politics. She liked to win (NCAA basketball pool, tennis and skiing) but could not remember the punchline to any joke she tried to tell! She could bring out the best in those around her.

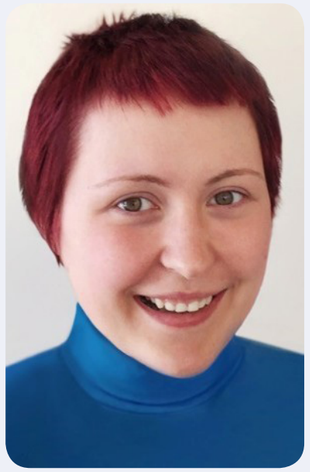
— Tim Himes, PhD, research assistant professor

More than just her scientific expertise, Marion was one of those rare people whose life was filled with a diversity of knowledge. That was evident by her effortless ability to discuss almost any topic at any time. Dos Equis made a mistake by not using her for their campaign as the most interesting woman in the world. Marion also had an amazing ability to critique an entire manuscript or grant proposal in just two sentences, and that was more than enough to convey all the issues.

— Eugene Mironets, graduate student

I met Marion for the first time during my interview for a post-doc in John's lab back in 2008. This "interview" was not an interview per se, but a very passionate tale relating the history of Woman's Medical College of Pennsylvania: I could barely place a word! This has left a lasting impression to say the least! My enrollment at Drexel coincided with Marion spending less time in the lab and more and more time for the greater good of spinal cord injury research, with her appointment as the scientific director of the Craig H. Neilsen Foundation and various other boards. Although I was not a witness to the fantastic achievements earlier in her career, Marion was clearly a passionate scientist and would never turn down a request to read some scientific material. She has been a merciless but invaluable reviewer of all my grants and manuscripts, always providing thoughtful comments, and I will be forever proud of co-authoring her very last paper. Above all, our friendship stemmed from our common passion for art and music, and most importantly we have shared a common "secret" (not so secret) love for Yannick Nezet-Seguin. I will forever cherish memories of joining her for Justin's newest painting exhibition or for her favorite operas at the Metropolitan Opera in New York. Cheers, Marion!

— Marie-Pascale Côté, PhD, assistant professor



In Memory of Katie Murphy

1993 – 2018

Kristina Katie Murphy, who liked to be called Katie, passed away unexpectedly on November 27, 2018. For the past two years, Katie showed extraordinary courage and fortitude in fighting an autoimmune disease, to which she succumbed following complications.

Born in Siberia in 1993, Katie was raised in a Russian orphanage and adopted at the age of 3 by Dr. Hazel Murphy. In addition to her loving mother, Hazel, her loving brother, Ruslan, and her adored daughter, Tala, Katie is survived by many fond relatives in the UK, and many friends and colleagues in the department and the community.

From left: Hazel Murphy, Marty Pinter, Donald Faber, Marion Murray, Martha Nowycky

The History of the Department of Neurobiology and Anatomy

CHAPTER 2:

To the Precipice and Back

by Donald S. Faber, PhD

Professor Emeritus in the Dominick P. Purpura Department of Neuroscience at Albert Einstein College of Medicine; chair of Drexel's Neurobiology & Anatomy department from 1992-1999

I was the department chair for 7 years, from 1992 to 1999. It was a truly tumultuous time encompassing an initial phase of significant growth due to both faculty recruitment and integration of neuroscientists and anatomists from MCP and Hahnemann into one geographically distributed department, followed by a roller coaster ride through bankruptcy.

When I arrived in late summer of 1992, the department was already quite strong, with its research program centered on the group studying spinal cord injury, as described in Marion's chapter. Yet, it was still recovering from the tragic loss of Michael Goldberger. The school had recently been bought by AHERF, the Allegheny Health, Education and Research Foundation, or, simply put, by Allegheny Hospital in Pittsburgh. It seemed to be a win-win situation, as Allegheny needed an affiliation with a medical school in order to succeed as a tertiary care center, and it could provide resources to strengthen and expand MCP. My recruitment was accompanied by an infusion of funds that would allow a significant expansion of the department's research program. Everything was quite rosy, especially since I was already on good terms with a number of the faculty, and, indeed, we benefited from a collegial and supportive environment, even in the darkest moments we faced. However, the laughter I provoked by relaying the dean's promise to expand the department's footprint by building out the 10th floor of Eastern Pennsylvania Psychiatric Institute (EPPI) was a harbinger of the future; apparently, it had been promised before. Nevertheless, we were hopeful, and at first, everything was positive.

The department's research portfolio initially expanded in the areas of neurodevelopment, molecular neurobiology and synaptic function, building on pre-existing strengths and interests complementary to the spinal cord injury group. Pat Leavitt, who had flourished in the "old" MCP environment, led the way in development, and was instrumental in selling Laura Lillien and Doug Baird on the advantages we offered. In the case of synaptic and cellular electrophysiology and biophysics, I joined up with Martha Nowycky and Marty Pinter, who were already here, and Alberto Pereda, who

To the Precipice and Back, *cont.*

had worked with me in Buffalo. Marty and I also brought a different perspective to the spinal cord group, at a time when it was becoming apparent that functional analyses, including quantitative measures of motor behavior, were required to move the field ahead. The last major recruit in that area was Simon Giszter, who added necessary expertise in motor control. And, the glue that held that group together, Marion, was strongly reinforced by Itzhak, who joined the department the same time I did and quickly became a driving force. He in turn attracted Raul Saavedra, whose interests were in glia and axonal dysfunction, such as in multiple sclerosis.

Thus, the addition of seven new faculty changed the face of the department significantly, but the collegial environment survived and flourished. There were the expected cracks in the armor, as some folks felt everyone should invest their efforts in spinal cord while others argued for some diversity and independence. We subsequently lost a few faculty, most notably the nascent developmental group, but by and large, we were in good shape and were generally very positive.

I note that the first and third paragraphs of this overview end with the word "positive." Well, the next phase of this story is dominated by a different valence! While our department was prospering, the College was growing at a much faster pace. Allegheny seemed to have an enormous appetite, buying a second medical school, Hahnemann, and its hospital, as well as another 6-8 hospitals throughout eastern Pennsylvania. They paid exorbitantly, competing with Penn and other academic medical centers for private practices needed to feed the high profile, high income specialists that were going to bring fame and fortune to AHERF. It seemed to be one of those times when health care systems were extremely profitable and everyone wanted to excel at all levels, from basic science and clinical research to health care delivery. The problem was that all plans were based on impossible expectations.

> **"The financial problems that eventually led to the bankruptcy can be summarized as an elaborate Ponzi scheme..."**

The purchase of Hahnemann is one example of the Allegheny appetite, and we were lucky that their Neuroscience program was also relatively strong. The cadre of "new" faculty included Barry Waterhouse, Tim Cope, John Chapin, Sherry Smith, Frances Sessler, Rick Lin, Lorraine Iacovetti and Dennis DePace, who was instrumental, along with Janet Smith and Nancy Minugh-Purvis, in ensuring that we could maintain excellence in medical school education in Neuroscience and Anatomy. At the same time our long distance interactions with faculty on the Pittsburgh campus, namely David Armstrong and Dennis Grayson, were solidified.

The financial problems that eventually led to the bankruptcy can be summarized as an elaborate Ponzi scheme: stars were hired at exorbitant expense and given budgets with unreasonably high projected revenue that only on paper was able to finance further expansion. At the same time, other glamorous expenses were incurred, such as a corporate jet for flights between Philadelphia and Pittsburgh and all expenses paid vacations in the Caribbean for the senior leadership, e.g., the AHERF CEO/University President, AHERF Chief Legal Officer and their spouses. Parenthetically, imagine the dismay when Sherif Abdelhak, the hospital CEO became the University President as well. There are hundreds of examples of how money was handled improperly but not necessarily illegally, such as depleting the corpus of endowed funds in an attempt to limit debt. In fact, when the dust settled, Sherif Abdelhak was indicted on more than 300 felony counts, but only one stuck – using Allegheny funds to finance renovations of the student athletic facility at his son's private school. Another example which made us chuckle at the time was spending hundreds of thousands of dollars to have external consultants conduct an expensive unbiased search for the best name for the integrated university, only to recommend the obvious, Allegheny University of the Health Sciences. That choice triggered a lawsuit by Allegheny University, a well-known school in Pennsylvania!

The signs of financial distress were subtle at first but grew steadily. First, our suppliers complained the school was paying its bills late and some suppliers would not take orders from us. I'll never forget the day I arrived in the lab to learn that an anti-vibration table was sitting on the loading deck waiting for me to pay personally – it had been shipped COD. Equally demoralizing, the *Philadelphia Inquirer* would not accept help wanted ads from the school even if we tried to pay by personal check. All of these warning signs were met with assurances from the administration that everything was fine and would be better if we just economized and the clinical departments improved their collection rates. In other words, the system was sound. Meanwhile, the members of the Board of Directors, which had fiduciary responsibility, all took out insurance to cover their liability in case of bankruptcy, providing more fuel for our lack of confidence in the leadership.

This mistrust fueled our involvement after AHERF did go into

Chapter 11 bankruptcy, with the goal of reorganization. The Hunter Group, which had extensive experience in restructuring health care systems, was appointed by the court to work with management toward a financially feasible solution. The problem was that the faculty, staff and students did not trust the management team that had taken the university into bankruptcy to protect our interests in the restructuring process. Joel Roslyn, Chair of Surgery, had unofficial discussions with representatives of the mayor, who did not want the school to close and suggested a local lawyer who might want to work with us to save the university. Joel and I organized some school-wide meetings, leading to the formation of the Committee to Save the University, with membership that included the groups listed above, as well as alumni associations. I was elected President, Joel was Treasurer, and Donna Murasko was the Secretary. Kit Turner was the lawyer, and she worked tirelessly, pro bono. We engaged the services of a consulting firm that had expertise in bankruptcy proceedings and reorganizing academic institutions. The Principal partner, Ed Hamilton, gave us invaluable advice throughout the process. We populated all the committees and work groups involved in planning for reorganization and met with all potential buyers. When it became apparent that most buyers were not committed to the survival of the university, we identified Drexel as part of a solution and facilitated their meeting and partnering with Tenet. Our task then was to convince Drexel's Board that the medical school was not responsible for dragging AHERF into bankruptcy. In fact, the Drexel Board first turned down a proposal to manage the university; I was one of two faculty invited to a second meeting, when the Board reversed its decision. That meeting was also attended by the Governor and the Mayor, and I suspect their support was more influential. I only regret that the meeting kept me from attending Joel's son's bar mitzvah, although we did celebrate later. Sadly, Joel died within a year, due to a skin cancer he suspected but ignored in favor of his commitment to the school. He was a true mensch.

> **"It turned out that the only component of the system valued by the top bidder was the medical school!"**

When the bids for ownership were received, I went to the penthouse at Hahnemann to collect the documents, but was kicked out by the Hunter representative. The dean and interim president appointed by Hunter consoled me by telling me he had previously taken them out behind the woodshed. After a little thought I went back in and demanded that the official observers give me copies of all bids. It turned out that the only component of the system valued by the top bidder was the medical school!

During the bankruptcy, we worked hard to maintain the department, but other institutions were cherry picking anxious faculty, and Neurobiology was the most successful basic science department. Consequently, we lost a number of valued colleagues and friends, including Marty, Martha, Tim Cope, Raul, Simon, John, Sherry, Lorraine and Rick. We did manage to retain the core of the spinal cord group, which never lost its NINDS Program Project. That was a tricky situation – fighting to preserve the school while being recruited en masse to other institutions. Despite these difficulties, we stayed together and even got Simon to come back!

My decision to leave Allegheny was difficult. The reality was that an empowered faculty served Drexel's purpose during the bankruptcy, but once the plan for restructuring and managing the new school was in place, the same force was seen as threatening to university leadership. I spent the next year with a bull's eye on my back. Thus, when I was offered an attractive position elsewhere, I chose to accept. Itzhak took the reins, Simon came back, and a new phase in the history of the department was initiated. •

Donald Faber and Janet Strabone

Itzhak Fischer and Donald Faber

Research Highlights

Bridging the Gap by Building Collaborations

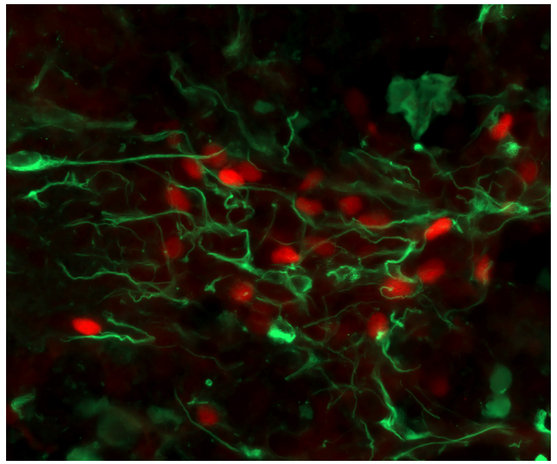
by Lyandysha (Lana) Zholudeva, PhD

As an undergraduate from a small liberal arts college, which allowed me to explore three different career paths simultaneously, I searched for a graduate program that would have the same collaborative and supportive environment. Much like my undergraduate campus, Drexel offered the potential for exploring different areas of neuroscience research and different career paths. During the interview day, I remember meeting with graduate students who spoke of their interests in working as scientists within the government as well as industry, alluding to faculty members who could counsel on those career options. As an undergraduate, I knew that this type of support and freedom for a student would be crucial to my success in graduate school.

Capitalizing on Drexel's collaborative environment, I decided to build my thesis work on a collaborative project I had initiated between Drs. Itzhak Fischer and Michael Lane. As part of Dr. Fischer's laboratory, I was able to master the methods necessary for culturing neural progenitor cells (NPCs) and for testing the therapeutic potential of grafting neuronal and glial restricted progenitors into the injured spinal cord of adult rats. As part of Dr. Lane's laboratory, I utilized my knowledge of NPCs to test whether transplantation of these cells can promote repair of a specific motor circuit that controls breathing. My findings have been well received by mentors and colleagues, sparking new and fruitful collaborations, and raising challenging questions for the field of cell transplantation.

One of these collaborations is with Dr. Shelly Sakiyama-Elbert (now Chair of the Biomedical Engineering Department at the University of Texas, Austin) whose research team has successfully engineered a cell-line of excitatory interneurons (the V2a class) that I have been using to enrich our NPC transplants. Our decision to test the V2a interneurons emerged from yet another collaborative project in our department between our lab and the lab of Dr. Kim Dougherty, a world-renowned expert on these interneurons. Our study revealed that spinal V2a interneurons become recruited into phrenic (respiratory) networks after injury. Building upon these findings, the second part of my thesis work assessed the therapeutic efficacy of these V2a cells transplanted into a contusion spinal cord injury, using a comprehensive battery of molecular, anatomical, behavioral and electrophysiological outcome measures. Our findings demonstrated that enriched V2a-NPC transplants were most effective at enhancing respiratory plasticity after injury, compared to either NPC or vehicle controls. This project brought together four separate laboratories to test an innovative transplantation strategy for repair of the injured central nervous system.

I am extremely grateful for the collaborative environment that resulted in several publications and awards, indicators not only of a student's success, but also of the mentors and institution. Besides the opportunities for excelling in academics, what I value the most about Drexel and the Neurobiology Department is the perception of a student not as a mere trainee but as a fellow scientist with valid thoughts and ideas. In part, this is due to the mentors Drexel has provided me with, including my advisor, Dr. Lane, who placed high importance on my personal and professional growth, not only advising on my research but also facilitating my networking in the field. The new relationships I gained in the process have yielded fruitful collaborations, future employment opportunities and, perhaps even more importantly, lifelong friendships. I am grateful for the skills and values that Drexel has contributed in my training as a graduate student and I am confident they will help me become an effective researcher and a mentor to my own students someday. •



(Above) A confocal image showing developing rat spinal cord-derived tissue (embryonic day 13.5) 3 days after it has been transplanted into an injured (cervical level spinal contusion) adult rat spinal cord. This transplanted tissue is rich with developing spinal interneurons (SpINs), which have been shown to be key cellular elements for neuroplasticity after injury. One particular subtype – the V2a SpINs - is immunohistochemically labeled with a transcriptional factor Chx10 (red). Immature neural tissue are stained with nestin (green). The V2a SpINs have been shown to play an important role in neuroplasticity of both respiratory and locomotor circuits after injury or disease and may represent important therapeutic target. Cover Image for Journal of Neuroscience Research, December, 2018 issue: Zholudeva and Lane (2018). J of Neuroscience Res.

Viewpoints

by Courtney Marshall, PhD

During my undergraduate studies, I had my first opportunity to conduct research in neuroscience when I was selected as an HHMI fellow to study long-term potentiation. As a post-baccalaureate fellow, I continued my research training at the NIA. I expanded my scientific perspective by joining a cardiovascular lab and continued to explore neuroscience research by attending other lab meetings, seminars and poster sessions. Having been exposed to such a variety of topics and techniques, I was drawn to the diverse research program at Drexel's Department of Neurobiology & Anatomy, where I could explore an array of topics and identify the type of neuroscience that piqued my interest.

Drexel's Neuroscience program enabled me to delve into cellular and molecular as well as systems and behavioral neuroscience. Early on I studied the 14-3-3γ protein and neuronal migration. 14-3-3γ is implicated in abnormal cortical layering observed in developmental disorders that also display migration defects. Using RT-PCR analysis, we observed changes in mRNA expression levels of 14-3-3γ in the cortical samples obtained from mice at several developmental time points. Furthermore, upon knocking down the protein using in utero electroporation in conjunction with shRNA, time lapse live imaging demonstrated abnormal migration and morphological patterns in 14-3-3γ deficient neurons. Working on this project exposed me to cellular and molecular techniques, and facilitated my investigation of the relationship between 14-3-3γ mutations and brain morphological disorders.

During the last three years of my PhD I focused on my thesis project in systems and behavioral neuroscience. My project utilized a pharmacological approach and behavioral techniques to examine the role of the dopamine (DA) D3 receptor (D3R) in a rodent model of mild cognitive impairment in Parkinson's disease (PD-MCI). PD is a movement disorder associated with the progressive degeneration of DA neurons in the mesocortical pathway. Motor symptoms coexist with non-motor symptoms such as cognitive impairment, which correlates with dysfunctional prefrontal mechanisms. Specifically, patients with PD display alterations in the expression of prefrontal D3R whose activity modulates cognitive function. A rodent model of PD-MCI consists of lesions to the mesocortical pathway, thereby disrupting DA signals to the cortical structures responsible for executing cognitive processes. Behavioral assays measuring cognitive function revealed that lesioned rodents display impaired performance, which is ameliorated after pharmacological treatment with a D3R agonist. These findings have been well received and have resulted in two first-author publications.

I enjoyed contributing to the fields of developmental and neurodegenerative research through my work at Drexel. However, my most meaningful experience at Drexel was volunteering to lead a group of high school students at Drexel's Neuroscience Summer Camp. Looking back, I had traversed through high school, college and graduate school without seeing another black person in an advanced scientific position (principal investigator, postdoctoral fellow, etc.). I took pride in mentoring these young, enthusiastic students.

During my time at Drexel I learned that my scientific passion is two-fold: neurodegenerative research and advocacy for a more diverse scientific community. I now work as a postdoctoral fellow at the Center for Neurodegenerative Disease Research at the University of Pennsylvania under the tutelage of Dr. Virginia Lee. During my time here I have seen growth in student diversity at the undergraduate, graduate and postdoctoral levels. I hope to add to this important trend by remaining in academia, where I can serve as a faculty role model and a source of inspiration to my fellow minorities in science. •

Research Highlights, *cont.*

Microtubule Mediated Nerve Regeneration

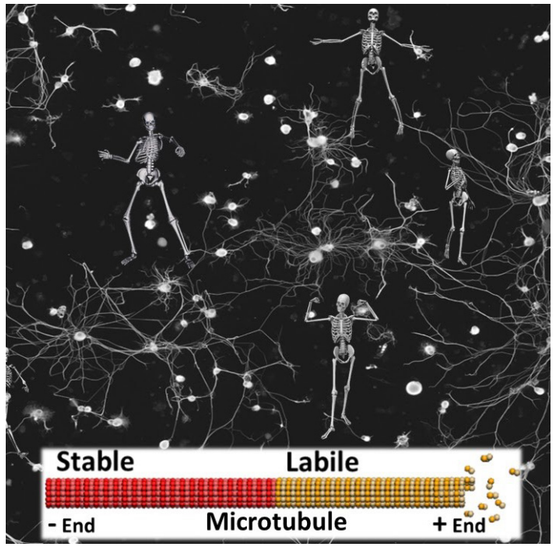
by Andrew Matamoros, PhD

My first memory of Dr. Baas is from his Core II lecture on microtubules. Armed with only a marker and a whiteboard, Dr. Baas walked us through the biology and importance of microtubules in the nervous system. We had to devise experiments to answer questions regarding neuronal microtubules. I get excited about these types of classes, so my hand was raised several times during class. After class, Dr. Baas asked me to see him in his office. Truthfully, I thought I was in trouble! Luckily, I was not. He told me that he was happy to see my enthusiasm in class and wanted to discuss a project that had the potential to promote regeneration following a nerve injury by targeting microtubules. This was the start of my dissertation work in the Baas lab.

If a city were a cell, microtubules are like the support beams in buildings and the highways we travel on. Microtubules are especially important in neurons of the nervous system to maintain a structure called the axon. The axon is responsible for transmitting chemoelectrical signals from one cell to the next and this cellular communication allows our body to function and our minds to think. If an axon is severed or injured, it is no longer capable of proper communication. The regenerative capacity of injured adult axons is limited, particularly in the central nervous system. Injured axons degenerate because they encounter obstacles such as scar tissue and inhibitory molecules, lack growth factors, and exhibit a much slower growth rate than a juvenile axon. Microtubules are an attractive target for therapy because they are crucial for the advance of a regenerating axon.

Microtubules in the axon consist of a stable region and a labile region, each of which has distinct properties and duties. The labile region is responsible for polymerizing more microtubule mass from free tubulin. My thesis work attempted to add labile microtubule mass to the regenerating axon by protecting the labile regions of the microtubules. This approach would mimic a state of axonal growth when labile microtubule mass is abundant. To accomplish this, I knocked-down a microtubule severing protein called fidgetin. You can think of fidgetin as gardening sheers that are used to prune plant growth; knocking-down fidgetin results in a notable boost in the microtubule mass of the axon via preservation of the labile mass from fidgetin's severing activity. As a result, axons grow faster, even on unfavorable substrates associated with spinal cord injury (SCI) as well as in vivo following a nerve-crush injury.

There are many novel microtubule-associated proteins and along with fidgetin, several have been implicated in regulating the microtubules in the growth cones of axons. I created a medium-throughput workflow for other microtubule-associated proteins to be tested in the Baas lab for augmenting nerve regeneration both in vitro and in vivo. Hopefully one day we will be able to utilize microtubules to help repair injured and degenerating axons. Microtubules are a lot like the bones in our body. If you break your arm, you must grow new bone for your arm to heal. If you injure an axon, you must restore microtubule mass for it to function properly and grow. Any therapy that helps an axon regenerate, must converge on microtubules. Approximately 50 years ago tubulin was first discovered and a variety of anti-cancer drugs that targeted microtubules followed. Hopefully, over the next 50 years, microtubules can help heal injured nerve cells. •



(Above) Microtubules are like the bones in our body, essential to the health and function of neurons. To illustrate this point schematics of human skeletons are added in this image of adult dorsal root ganglia neurons visualized by immunolabeling their microtubules with a fluorescent dye. Microtubules need to polymerize after an injury for an axon to regenerate. Modifying microtubule dynamics and stability properties can augment axon regeneration.

Faculty Interviews

Anatomy Aficionado

An interview with Dennis DePace, PhD, by Philip Yates

Dr. Dennis DePace has been with Drexel/Hahnemann for more than 40 years as an anatomy professor. In this conversation, we learn of his appreciation for human anatomy and his passion for educating the future generation of scientists and physicians in the long tradition of experiential learning.

PY: What brought you to Drexel (then Hahnemann)?
DD: In 1974, when I completed my PhD at the University of Buffalo, I attended the American Association of Anatomists meeting, where I met the chairman of anatomy at Hahnemann, who was rebuilding the department of anatomy and was looking for a neuroscientist. My research had been in neuroscience, so he hired me to be the course director of the neuroanatomy course. In subsequent years, I also had experience in gross anatomy. I moved into that and eventually gave up neuro in favor of gross, which is something I like more because there are more organs than the brain. Don't tell the neurobiology group I said that.

PY: How has the department changed over the years?
DD: It changed when Dr. Fischer became chair because he is very supportive of the educational mission in addition to the research. In my previous experience with other iterations of the department, that was not always the case, because the research brings in the money that supports the activities of the department. So it is really great for me now to be a part of a department that is so well funded, with research that is top-notch, and yet the support for the educational mission is still there.

PY: How has your role in the department changed over the years?
DD: My role hasn't changed that much, but teaching has definitely changed from when I started. When I began my career there was no technology. There were no computers, no internet. All of these things have evolved during my career. It's fun to take advantage of those resources now and incorporate new technologies into my teaching. Dr. Schidlow, as dean of the medical school, has been very supportive; our gross lab was equipped with new computers about four years ago.

PY: What is your favorite thing about working here?
DD: My number one favorite thing are my colleagues because we have a very good working relationship. The faculty and the staff we have are excellent people that interact very well in a very positive way that helps us to be as good as we can. And of course, I love the teaching. We have a very diverse student body that makes it interesting to meet students from different backgrounds and cultures. Those are two things that I value the most.

PY: What is the process for a cadaver to come to our lab?
DD: The cadavers come to us from a humanities gift registry that is a central organization in the Commonwealth for handling body donations, so all of our cadavers are willed bodies. When a person who has made a donation passes away, the humanities gift is notified by the family, and they send one of the local undertakers to take the body to one of the medical schools in a rotation, although there are people who specifically will their body to this school. Once the body comes here, we have an embalmer who embalms the body, after which the body is put in cold storage. We usually keep the cadavers in cold storage for six months before we use them, in order to allow more time for the embalming fluid to permeate and for the tissues to be well fixed.

PY: Have any of the cadavers surprised you with something unique or unusual?
DD: I have seen lots of interesting findings. One that stands out is that one year the students were dissecting the pelvis and something caught my eye. In the bladder were five rocks that were originally bladder stones. They had accumulated over the years to be quite large.This person went around life with these rocks in his bladder. I investigated about it and learned that in the 1800s people were trained to insert instruments into the urethra to crush bladder stones to remove them. Patients were instructed to sit back with the feet in stirrups in what is commonly called the lithotomy position, which is used for gynecological examination today. Another incident goes back many years, when we had a cadaver of a 95-year-old man at Hahnemann. When we opened his chest and abdomen, we discovered that he had situs inversus totalis with complete reversal of his organs from left to right. It can happen in varying degrees, but this was a total reversal. We had no medical history and didn't know whether he was even aware of it.

PY: What are you working on now?
DD: My current avocation is re-working the anatomy images that were published in the 1916 edition of Gray's Anatomy. They are in the public domain, so we can use them in our lectures without worrying about copyright. They are all black and white, so I am using the free image program Gimp, which is similar to Adobe Photoshop, to colorize and label the images. I uploaded a few of them to Wikimedia Commons so other people can access them. It's fun to see how you can display the illustrations to make certain things pop out, because sometimes it's hard to find good illustrations.

PY: What do you do when you're not teaching?
DD: For down time, I love to cook. I live in a great part of the city close

Faculty Interviews, *cont.*

to the 9th street Italian market and the Reading Terminal Market– so a ready abundance of ingredients. I have a large collection of cookbooks and I like to try new dishes. I also enjoy photography and gardening. We have a back garden patio in Center City where we do a lot of gardening. I record some of my lectures in my office at home and sometimes I leave my deck door open so you can hear birds chirping in the lectures. Students tell me they like that.

PY: Do you have any advice for young scientists and students?
DD: The anatomy teachers nationally are getting older, and there isn't a whole lot of replacements coming along. I would say if you have the ability to do it, learning anatomy is a good idea as a backup for a research career. Medical schools will continue to teach anatomy, whether it is done electronically or with cadavers. We still believe cadaver dissection is the best way to do it because there is a whole lot that comes from the experience besides learning the anatomy. There is the professionalism element. It is one of the first opportunities for medical students to work as a team on a long-term project. It gives an appreciation of human variation, as not every case you see in the clinic will be identical. You start to appreciate the nuances of different people. It's a very unique experience, and most physicians view it as a rite of passage into the profession. •

Plasticity: A Key to Adapting and Growing in Turbulent Environments

An interview with Veronica J. Tom, PhD, by Ankita Patil.

Dr. Tom is an associate professor at the Department of Neurobiology and Anatomy and has been here for 14 years. She started her career in the department as a postdoctoral fellow in Houle lab. Dr. Tom now runs her own laboratory where she studies various aspects of axonal regeneration and plasticity after spinal cord injury. Although she initially aspired to become a Supreme Court Justice, we learn that it did not take her too long to fall in love with research.

AP: How did you come to join our department at Drexel?
VT: I joined the department when John Houle was recruited, back in 2004, but we didn't come here until 2005. I did my graduate work with Jerry Silver in Cleveland, and my postdoc with John when he was still in Arkansas. John came to visit Drexel and they recruited him! When John decided to move here, I moved with him. I had been in his lab for about 2 months before he decided to move, so I started at Drexel as a postdoctoral fellow.

AP: What was the department like when you first joined, and how has it changed in the years since?
VT: When I first joined, Marion Murray was still here full time, Itzhak Fischer was chair, and John was brought in to head the Spinal Cord Research Center. Our lab had collaborations with Gianluca Gallo since we shared a hallway; I interacted with the Gallo lab a lot. Some personalities may have changed but I think the culture has stayed the same — very collegial and collaborative. I collaborate with Peter (Baas) and others, and that's not atypical for this department.

AP: What is your favorite thing about working in this department?
VT: By far — and I tell this to students when I'm doing interviews — it's the friendliest department I've been in. I was very happy in other places I have been in, but it's very friendly here, open to collaboration, and helpful. You hear horror stories about competitive workplaces, I haven't personally seen that here. In a lot of places, labs work on their own, but that isn't the case here; everyone helps each other with their research. Some people may think twice about that division of time, but here it's about the overall development of the department.

AP: Did you always know that you wanted to be a scientist? What helped shape your decision?
VT: I was actually just telling my kids that when I was young I wanted to be a lawyer. My aspiration was to be a Supreme Court Justice. Then it changed — I wanted to go to medical school. Then I worked in research labs in high school and in university, that's when I really knew I wanted to go the research route, to figure out answers to questions. I like the lab setting, the lab culture. I know it's not for everyone; there are people who are perfect for medical school, or perfect as lawyers — everyone has to match up with their interests.

AP: Academic research can often be frustrating/tedious. In moments like these, what drives you to carry on?
VT: Just know that that's part of it, that's part of science. Everyone wants it to go perfectly and to work the first time, but that often isn't the case. It's a learning experience and all part of the process. Something could go wrong, and then you have to revisit and work your way through it.

AP: What was the motivation for your pursuit of research on axonal regeneration and plasticity?
VT: Where I went for college, there was a strong neuroscience program, but a lot of it was systems-based, a lot of vision and audition. I took a developmental neuroscience course and part of the focus was on regeneration in the nervous system and I found it fascinating. That's how I decided I wanted to study axonal regeneration. One of the model systems for this field is the spinal cord. Spinal cord injury is a hard challenge and a bit different from injury to the brain. When I was looking for graduate school, I was looking for labs primarily focused on spinal cord regeneration. And it went on from there!

AP: What do you personally consider your favorite contribution to science?
VT: Our research group is finding things that are exciting and get funded because the results are meaningful to the community. I think it's important that members of my group are doing research they like, experiments they enjoy and find worthwhile.

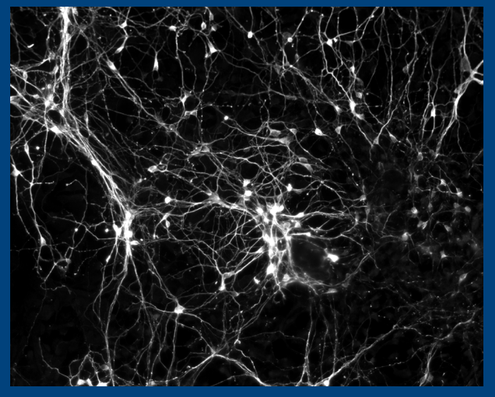
AP: As a younger female PI with a family, how have you balanced your personal and professional lives?
VT: I think it's all part and parcel. There's no perfect experiment, there's no perfect person, and there's no perfect process. You just have to roll with the punches, and work with what the day brings. This is true for lab — whether experiments work or don't work, you build from there. The same is true for my children. I always tell them, nothing is perfect, you have to do the best you can, and maybe you need to change things on the fly. You have to adapt and be flexible.

AP: Regarding the 'leaky pipeline' metaphor in academia, what advice would you have for students who are unsure about balancing multiple roles?
VT: I think the biggest factor is environment. I think in my case the hurdles were more self-imposed. You have to have a mentor who is supportive. When I was still a research faculty in John's lab, I also went through a period of difficult pregnancy. But John was very supportive. I had to stay home for a while, and even after that I was coming in on lighter schedules, writing from home a lot. So, it was important that people who were in positions of power were understanding and supportive. So, finding and putting yourself in that kind of environment is important. The big issue with the pipeline is that if people want families, women are the ones who will actually bear children. They just will need some time off. And they will have certain responsibilities that come with having a family. I was a recipient of understanding and support when I was in that position, so I try to provide that same space for my group now.

AP: How has your role developed since joining the department?
VT: It's very different. I used to do the experiments before and now I don't! I think the biggest shift for me, personally, was not being as hands-on with experiments. I do a lot more writing. There's a lot more administrative work. That's one aspect I think people aren't really trained to do. You're managing people, and budgets, and this isn't something that's discussed a lot during your training.

AP: If you had to choose a different career path for a day, what would it be and why?
VT: I'm still fascinated by Constitutional law. I still think it would be cool to be a Supreme Court Justice for a day, definitely if it's a big, groundbreaking case. It's such a huge responsibility– nine people making some very important decisions. But there are other careers I can imagine being interesting. The other day, we were just talking about Rover going to Mars, and my son says he wants to build Rovers! And I thought that would be cool– to build something that you then send up into space! Being an astronaut would be cool too, provided they can bring you back to Earth (and it isn't like the movie 'Gravity').

AP: What is your top advice for students like myself who are currently pursuing higher degrees in science?
VT: Work hard, have fun, and think about what you want to do. I like academia and it was perfect for me, for my personality. But it isn't for everyone. It's about finding out what's the right fit for you. Adapt to your life situations, priorities will change over time. There's no one answer or one way to do things. •



Human neurons derived from human induced pluripotent stem cells form a dense neuronal network, here labeled for total tau (TauR1).
Philip Yates

A Friendship Across the Oceans

In 1989, in its collaborative spirit, the Department of Neurobiology and Anatomy at Drexel (then MCP) reached across the oceans in Japan to commence research exchanges by inviting Japanese physicians to engage in research within the department. Last year marked the end of a long chapter of this friendship which awaits a new beginning. During the 28 years of collaboration, 14 physicians completed their fellowships, contributing significantly to the work produced by the department. Additionally, this exchange has also involved department members' visit to Japan to expand their research repertoire and to foster friendship. Through this collaboration, the department members have also cherished close relationships and rejoiced in the exchange of culture.

I have been the designated welcoming committee for Japanese fellows since 2010 when Dr. Takaya Yamagami arrived in Dr. Fischer's laboratory. "Taka #2" spent nearly 2 years with us and we developed a good friendship with mutual respect. So, when Dr. Kazuo Hayakawa arrived in 2014, I was ready to answer almost any questions that he might have.

Kazuo and I got very close, perhaps because we are the same age and shared a common culture growing up (Japanese kids' shows were -badly- translated and aired in France starting in the late 70's). But, it was not so easy in the beginning. It was only after a few weeks of being here that Kazuo felt comfortable asking me to clarify certain things. Among other things, this clarification process involved me telling him that it was okay not to arrive before and leave after Dr. Fischer, that he could take a day off to attend his kids' winter show and that, yes, here in the US, a two days old meal at the cafeteria is still considered "fresh."Over the two and a half years that Kazuo was here, we had the opportunity to share a lot of stories, challenges, and satisfaction of time well spent. We become close friends and, now that he is back in Japan, we talk on a weekly basis. Our morning coffee had become a ritual that we still miss. He still talks about Marie's Thanksgiving gravy and I still talk about Ayano's guidon.

Both Takaya and Kazuo have used their experiences gained in the department to grow professionally: Takaya has opened his own rehab clinic in Nagoya and Kazuo specializes in microsurgery. Last summer, my family and I had the pleasure to travel to Japan where we met with Kazuo and his family. We spent good times and also arranged for Takaya to be present one evening when we shared fond memories of their time in the department.

Julien Bouyer
Research Assistant

Akita University School of Medicine
Department of Neurosurgery
1989 – 1997
Dr. Yasunobu Itoh
Dr. Kenji Kikuchi
Dr. Taku Sugawara
Dr. Futoshi Mori

Nagoya City University Medical School
Department of Orthopedic Neurosurgery
1993 – 2012
Dr. Satoshi Hattori
Dr. Motohide Shibayama
Dr. Kosei Takahashi
Dr. Masato Shibata
Dr. Yoshikazu Hayashi
Dr. Hiroyuki Yoshihara
Dr. Kengo Ogata
Dr. Takaya Yamagami
Dr. Kazuo Hayakawa

Hokkaido University
Graduate School of Medicine
Department of Urology
2002-2005
Dr. Takahiko Mitsui

A Letter to Dr. Takanobu Otsuka, Chair of Orthopedic Surgery at Nagoya, Upon His Retirement:

Dear Professor Otsuka,

Dr. Hayakawa reminded me about your coming retirement and I thought that this will be an opportunity to share with you my strong sense of friendship and appreciation at the personal and professional level.

It is difficult to believe that our partnership has spanned a period of 20 years of fellowship exchanges, joint scientific research and the mentoring of a whole generation of academic physicians. Your leadership in this process has been remarkable given the financial pressures on clinical departments, and I am worried that few Chairs will follow your example. The fellows that came to our department have always considered the opportunity you gave them as a special privilege. And the value of this exchanges transcended the professional benefits of biomedical research and included the coming together of people, traditions, languages and children that will have a lasting effect after you and I retire.

My personal friendship with you is based on shared values of people who met only a few times and yet have a similar style of leadership of caring about our faculty and having a long-term vision, not just the immediate pressures and short-term goals. I feel honored to have sustained such a long relationship with you in good faith and mutual respect. I will carry the memories of my magical visit to Nagoya for the rest of my life and the incredible guidance I received from you and our fellows. I am particularly happy that the last fellow, Dr. Hayakawa, not only demonstrated his technical skills and commitment, but was such a delightful person to have together with his family.

Needless to say that if you come to the US I will love to host you not only in the department but also in my house.

I send you my warmest wishes for a happy post-retirement life. Somewhere across the ocean and continent you will always have me as a friend.

Itzhak

Itzhak Fischer, PhD
Professor and Chair

Faculty Reflections

The Orchestra of a Simple Rhythm

by Michael A. Lane, PhD, Assistant Professor

Breathing is one of the most fundamental behaviors essential to life. A simple rhythmic pattern of inspiratory and expiratory muscle contractions allows us to fill our lungs. Upper motoneurons firing in the brainstem send signals to interneurons and lower motoneurons in the spinal cord, resulting in contractions of inspiratory respiratory muscles (e.g. the diaphragm and external intercostal muscles) that draw air into our lungs. While expiration is usually a passive event, whereby inspiratory muscles relax, and the lungs deflate, expiratory muscles (internal intercostal muscles and abdominal muscles) can also help to force air out of the lungs if needed (coughing). This is a great example of neuronal network and muscle function that is constantly active, yet usually occurs without us thinking about it. Even modulating this rhythmic pattern to allow us to talk, eat or change our breathing when moving, often goes completely unnoticed, that is, until control of breathing is compromised. If the neuronal pathways controlling our breathing muscles are disrupted, and our ability to maintain gas exchange is affected, then life becomes threatened.

An underappreciated fact is that breathing can be impaired in a wide range of neurological diseases and injuries in the spinal cord (e.g. traumatic injury or amyotrophic lateral sclerosis) or brain and brainstem (e.g. TBI, stroke). In the most devastating of events, control of breathing is completely lost (respiratory arrest) and people require assisted ventilation. Being intubated and placed on a mechanical ventilator also puts people at greater risk of respiratory infection and increases the chance of mortality. Advances in neural interfacing have led to several preclinical studies using stimulators to drive activity within the central respiratory network or the nerves and muscles in the periphery. Some of these – like diaphragm pacing – are now also used extensively in the clinical setting. The advantage of such techniques is that sufficient diaphragm contraction can help to inflate the lungs and maintain muscle viability at the same time, while reducing the risk of infection. There is some evidence, both clinically and pre-clinically, to suggest that this might even stimulate plasticity.

Respiratory deficits are not limited to the inability to ventilate. Even when people retain the ability to breathe, they may not be able to adapt their breathing to changing requirements such as increased breathing frequency with exercise (respiratory insufficiency). The neuronal pathways controlling breathing under different conditions may also differ slightly. So even if breathing can be maintained while sitting at rest, it may become impaired when sleeping (sleep-disordered breathing).

While one of the most simplistic behaviors, breathing is also one of the most essential. Students and faculty in the department of neurobiology and anatomy at Drexel are among a growing field of scientists trying to better understand how we breathe, how breathing can become compromised, what potential exists for spontaneous or therapeutically driven plasticity, or how we can use treatments to repair respiratory networks. •

15 Years and Counting – The State of the Neuroscience Program

by Ramesh Raghupathi, PhD, Professor

The neuroscience program at Drexel University's Graduate School of Biomedical Sciences and Professional Studies (GSBSPS), housed within the College of Medicine, is thriving. In large part this success is attributed to you, the students in the program, and those that have come before you. We also have to acknowledge the faculty who have established successful research programs. Sure, you have to trudge through the core curriculum, endure the stress of preliminary and qualifying exams…but as they say, "hardship builds better neuroscientists." Well, if they don't say it, they should.

But first, you might be asking yourselves, why "fifteen years?" Surely, the neuroscience program at Drexel has been around much longer than that. The answer is simple: I have completed 15 years at Drexel and I thought it was a nice round number!

But in case you think that it's all about me (it most likely is, but I digress), a little bit of history before I provide a "State of the Program" update....

Drexel University College of Medicine has been through many name changes. The medical school began as two separate medical schools: Hahnemann Medical College and Woman's Medical College of Pennsylvania. Hahnemann Medical College started out in 1848 as the Homeopathic Medical College and changed to Hahnemann Medical College in 1867, when it converted to allopathic medicine and was renamed Hahnemann University Hospital in 1982. In 1850, the Female Medical College of Pennsylvania was incorporated as the first medical school in America for women, changed its name in 1867 to Woman's Medical College of Pennsylvania and then to Medical College of Pennsylvania in 1970, when it allowed men to matriculate. Each University had its own graduate school, training biomedical scientists since the early 70s.

In 1993, the Medical College of Philadelphia merged with Hahnemann University Hospital and created a combined Graduate School. In that year, MCP HU was renamed Allegheny University of the Health Sciences. In 1998, Allegheny declared bankruptcy and Drexel University was appointed as a caretaker of the medical and graduate schools. (As an aside, if you want to increase the blood pressure of Drs. Fischer, Cunningham, Sessler and Giszter, ask them about the "bankruptcy days!!!").

In 2002, the Drexel Board of Trustees unanimously agreed to make its relationship with MCP Hahnemann permanent and we became Drexel University College of Medicine. At that time, the PhD and MS programs in neuroscience were administered by the Division of Biomedical Sciences and was headed by Dr. Barry Waterhouse, whereas the Division of Professional Studies administered the post-baccalaureate programs and other Master's degree programs. In 2013, the College of Medicine created the GSBSPS which brought all non-medical graduate education under one roof and Dr. Elisabeth Van Bockstaele was appointed as the Dean.

Now, back to the neuroscience program…

What areas of research are represented in the neuroscience program?

Over the past 15 years, to say that the program has grown is putting it mildly. When I came here in 2003, there were 6 labs working in spinal cord injury, 3 labs doing systems and behavioral neuroscience, and 2 labs doing cell biology. It was a period of growth for the department, replacing faculty who had left because of the bankruptcy and expanding the research areas in neuroscience to offer students more options. The neurobiology department now has over 30 faculty (18 of whom have active research labs) and the neuroscience program has over 40 faculty (34 of whom have active research labs) spanning 5 departments. The research areas that these faculty engage in cover cellular neurosciences (16 labs), systems and behavioral neurosciences, including neuroengineering (15 labs), and brain and spinal cord injury (14 labs).

How many students has the neuroscience program taught, and where do they come from?

In 2003, there were 12 students in the program, 6 of whom were in their first year. Most of them were PhD students and the few MS students were waiting to convert to the PhD program. The program began to matriculate larger classes beginning in 2004 (entering class of 11 with 4 MS students), and from there has never looked back. The 2018 matriculating class has 11 students (6 PhD and 5 MS students). Over the past 15 years, the program has matriculated 154 students (99 PhD, 43 MS, 12 MD/PhD). These students come from all over the country and at least 27 of the 50 states are represented. We have a healthy number of international students, the majority from South, East and South-East Asia. Fifty-seven PhDs and MD/PhDs have been awarded along with 29 MS degrees. About 15% of the matriculating students withdrew in their first year of the program.

What do students do in the neuroscience program?

In addition to the core curriculum (see above), both MS and PhD students in the neuroscience program take the same required courses that provide a strong foundation in the neurosciences from the cellular to the systems, with a healthy helping of neuroanatomy thrown in. Over the past 15 years, the course offerings and content in each course have undergone significant changes primarily as a response to feedback from the students. In addition to the programmatic courses, the GSBSPS offers a variety of opportunities for professional development, career planning and ethics training. A number of students have also participated in community outreach, science communication–such as this newsletter—and public advocacy. The hope is that a graduate of the neuroscience program is a well-rounded individual who exhibits discipline-specific and science-directed core competencies.

Where do PhD students go after graduation?

Since 2003, the program has graduated 49 PhD candidates, 47 of whom started a post-doctoral fellowship at an academic institution immediately thereafter. Students have obtained post-doctoral positions at Stanford University, University of Pittsburgh, University of California at Irvine, University of Toronto and Utrecht University, among other places. After completing their first or second post-doctoral fellowships, the graduates have obtained positions as either teaching or tenure-track faculty (50%), in the pharmaceutical industry (25%), in the federal government (15%) or as medical writers (10%). Whereas the more recent MD/PhD graduates are still completing residency/fellowship, others have obtained faculty positions or have transitioned to industry.

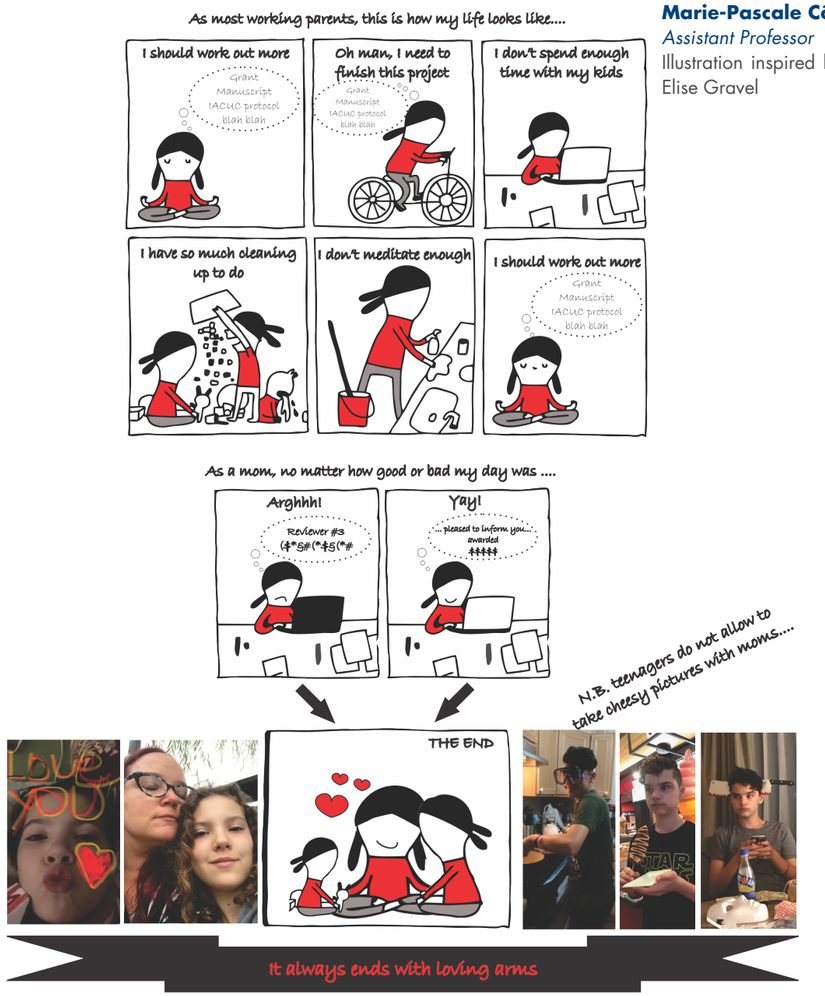
Where do MS students go after graduation?

Since 2003, the program has graduated 29 MS candidates. Of those 8 have matriculated into PhD programs (Drexel, University of Pennsylvania, SUNY Brooklyn), 2 have matriculated into MD programs and 11 have obtained jobs in either academic or pharmaceutical industry research laboratories.

Final Thoughts

All of you have heard this when you interviewed with us and it is worth reiterating – the research at Drexel's neuroscience program is driven by you, the students. We, the faculty, would not be here if it wasn't for you. When you are at meetings, or interviewing for post-doctoral positions, or for PhD programs, or jobs in industry, hold your head high because you have a pedigree. To paraphrase Stuart Smalley (Google him if you don't know who he is!), "you're good enough, you're smart enough, and doggone it, you're a neuroscientist!" •

Research & Motherhood



Marie-Pascale Côté, PhD
Assistant Professor
Illustration inspired by work from Elise Gravel

Theresa Connors
Instructor and Lab Manager
As a mom in science who is further along in the process (my son is 21 years old, but I'm not sure the process is ever complete), I may have a bigger picture view that parents of younger children haven't seen yet. I feel that parents in science have certain advantages even with the long hours and the pressures of having to compete for grants on a regular basis. Because this career choice is not motivated by the desire to make large amounts of money, we are here because we love the intellectual freedom and the challenges and the process of discovery that an academic science career affords. Job satisfaction makes you a happier person and I really think it helps you be a better role model for your children. I remember my son at about 10 years old telling some friends about what I do and saying, "Yeah, she really loves her job." I don't think I ever openly expressed that sentiment, but kids are good at picking up on moods and feelings. So, don't worry if you have some late nights in the lab or have to work some weekends, your children will come to understand that hard work and dedication are good things. The flexibility of a research lab schedule allows us to volunteer at school during workdays, take time off when kids are sick, and attend sporting events, performances and meetings that parents in other careers cannot. And, there is the fantastic prospect of free or greatly reduced college tuition for your children when you work at a college or university. So, take advantage of all of the opportunities, be the best parent you can be and then step back and watch what happens — it's actually pretty amazing!


Veronica J. Tom, PhD
Associate professor
I would imagine that many of the challenges I've experienced with juggling a career and parenting are not specific to me. I am guessing that many parents are trying to figure out how to squeeze more time out of the day and still manage some sleep. I'm fortunate that while research is not a typical 40 hours/week job, there is a lot of flexibility. This allows me to arrange some of my responsibilities around things that are not as flexible, such as taking my kids to school, picking them up, taking them to their scheduled games and lessons, etc. I make up for this by working at night and on the weekends. This really all comes down to using the same skills that I think everyone uses to help position him/herself to be successful in the lab—prioritizing, good planning, time management, adapting when things don't work out as expected, shrugging off the inevitable failure, and having a good sense of humor through it all. My hope is that, when I look back, I'll be able to say I was halfway decent at both and had quite a bit of fun through it all.


Jessica R. Barson, PhD
Assistant professor
I became a PI and a mother (twins!) at more or less the same time. While it is a lot of work to fill these roles, I think often of what child psychiatrist D.W. Winnicott termed the "good enough mother." Winnicott posited that children actually benefit when their mothers fail them in manageable ways, and longitudinal studies have now shown that children of good enough mothers develop into successful adults, both professionally and interpersonally. Remembering that you don't have to be perfect all the time, either as a parent or as a scientist, can help to ease the psychological burden. You are more effective in these roles when you are mentally and physically healthy. So, my best advice if you plan to become an academic mother is just to be kind to yourself. •

Researching Away From Home...

The Department of Neurobiology and Anatomy hosts researchers from all around the globe. We asked graduate students and post-docs on a temporary visa about the positive and negative aspects of pursuing science away from their home country.

Ankita Patil - Mumbai, India
Positive: The approach to research allows the student to develop as an independent thinker and scientist.
Negative: Issues of visa status and regulations surrounding immigration are constant sources of worry.

Anonymous
Positive: Research has more support in the US (financially, academically, socially, and politically).
Negative: High cost of living for students, poor social benefits like maternity leave and paid vacation, and poor food options with most of the fast and conveniently available food being unhealthy. American researchers also tend to be indifferent to matters of art and culture (lack of interest and support for symphony, opera, ballet, fine arts, etc.)

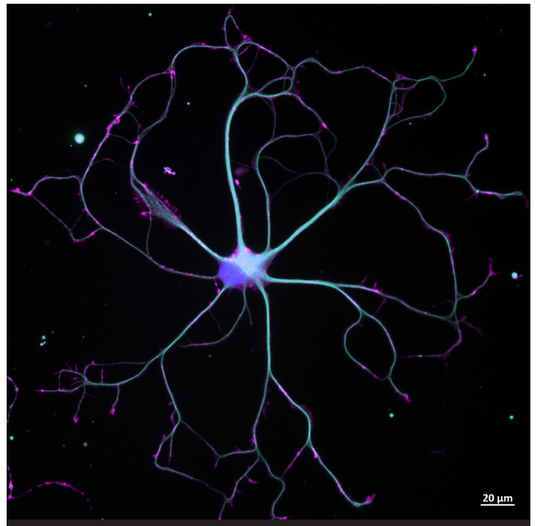
Bo Xing, PhD - Xi'an, China
Positive: You can do sound science because you are around excellent neuroscientists.
Negative: The competition is cut-throat, and it feels as though one is rushing rather than enjoying science.

Pamela Alonso - Mexico City, Mexico
Positive: In the US I have the exposure to top researchers in the field through attendance at seminars and in-person meetings. In addition, being in the US makes it easier to learn cutting-edge techniques, that are not easily accessible in my home country. Finally, the diversity of people in science is very unique to the US; in my opinion, diversity fosters different ways of thinking which is an important skill in science.
Negative: It is harder to find a job back home because it is difficult to maintain a network among scientists in your country.

Guillaume Caron, PhD - France
Positive: Since Science is and will primarily be a profession carried out in the English language, it helps to remain surrounded by native English speakers but also along with other foreigners going through the same issues as you. Working in a department rich in diversity surely makes everything a little easier. The US scientists are world class and being here makes it easy to meet and network with them. It also inspires one to strive to become experts and better scientists.
Negative: The English language is a barrier. The longer it takes to hone English language skills, the greater the hindrance to professional development (lab interactions, science communications, administrative tasks, grant submissions, etc). The differences in culture, lifestyle, values, norms, rules and regulations are curious in the beginning but soon become barriers, especially when it is hard to accept some points of view (gun laws, racism, health system, management of poverty, the list goes on). The line between professional and personal life is 'shady' in the US. It is typical for scientists to work overnight or during weekends. Yet, these expectations clearly vary among individuals; as a foreigner, it is complicated to justify not working the extra hours (no family to visit during Thanksgiving, no friends to visit on a weekend, etc.). It's not easy to stay away from home in a foreign culture, leaving behind your long-term friends and family. Yet, we make these sacrifices for unbounded possibilities of personal and professional growth in the US. If we are not happy, home always awaits.

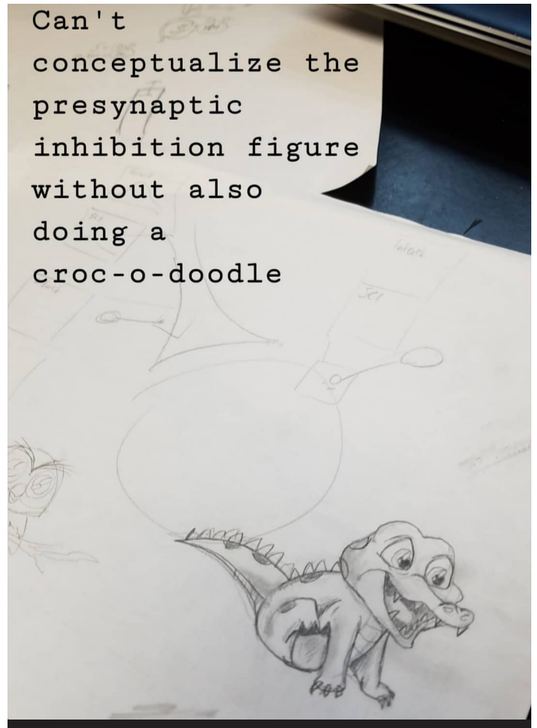
Shasha Yang - Anyang, China
Positive: Research environment is dynamic, and I get plenty of chances to get advice and feedback about my research from within and outside my field.
Negative: Stress related to the high demands of lab work and of the lab's funding situation which directly or indirectly affects students and employees. •

Creations

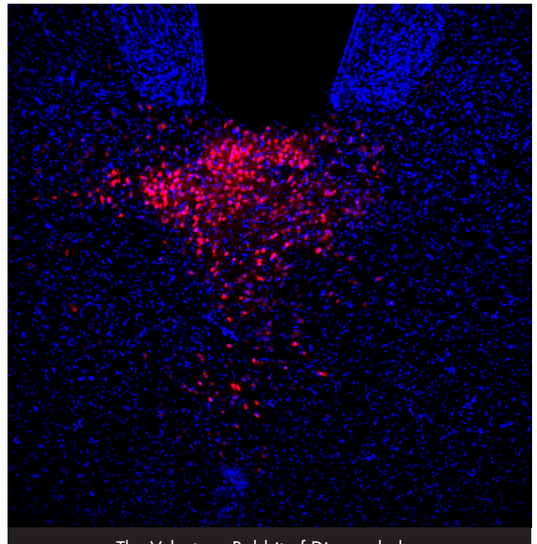


Anomalous Expansion of a Hippocampal Neuron
Ankita Patil

Weeping Orchid For MM
Megan R Detloff

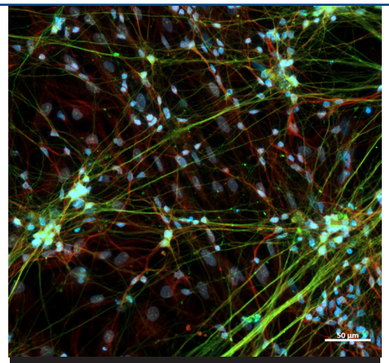


Croc-o-doodle
Jani Bilchak



The Velveteen Rabbit of Diencephalon
Surya Pandey

Complicated Sky
Megan R Detloff

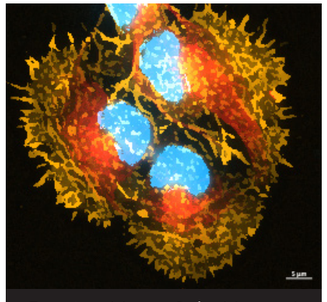


Neuronal Networking Night
Philip Yates

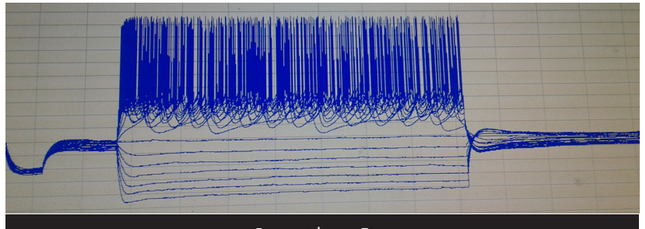
The Microtubble Questions its Existence
Ankita Patil

The First Flurries
Shrobona Guha

Cool Cat
Jani Bilchak

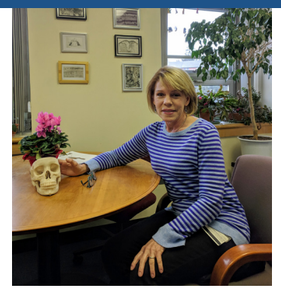


Eggs in a Nest or Baby Neurons!
Ankita Patil



Pyramids on Fire
Linda Chamberlin

Staff Interview



Goldfish and Gross

An interview with Theresa Connors by Ankita Patil

Theresa has served the department as an instructor and lab manager for nearly 40 years. However, her role in the department extends far beyond what her title indicates. She has been instrumental in assisting graduate student research, in facilitating neuroscience camps for high school students, in running the Gross Anatomy lab for medical students and in organizing various departmental events. Her contribution to our newsletters has been invaluable. Most importantly, Theresa has been a "go-to" figure for many in the department, helping everyone with issues big and small.

AP: How did you come to join our department at Drexel?
TC: I joined in 1979. It was my first big job, and it has remained that way. I interviewed with Hazel Murphy, who was looking for a technician. I didn't have the qualification Hazel wanted, but she said, "Oh, I have a friend who's looking for someone." That friend turned out to be Marion Murray. I joined, and I never left. At the time, Hazel was working on the cat visual system, I think, and Marion was working with goldfish. Visual systems were the common theme.

AP: What was the department like when you first joined?
TC: The department was very small, but many of the original members are still here. Dr. Cunningham was here, Dr. Himes joined shortly after me, and Kathy Golden was here. At that time, we had individual labs, no core facilities, but everybody was very interactive. We would have "color days" where everybody wore the same color. We were a small enough department that everybody would get the memo and we'd all wear the same color. We have a lot more people now.

AP: What has changed in the years since?
TC: I don't think it has changed much, which is what's cool about it – we've always been a bit unconventional, rogue! What has changed is the Drexel element. Back then we were the Medical College of Pennsylvania, a smaller institution, and now we're part of the much larger Drexel University, which is a good thing because it has opened a lot more options for collaborations and use of resources we didn't have. But other than that, the departmental culture has persisted. Other places sometimes have a closed-door, secretive culture, but here, everybody helps each other; we work together. It's always been that way. Another interesting thing is that back then we didn't know very much about plasticity and regeneration; it was all very new. We didn't even have a lot of molecular tools. We were working with anatomy! Now I can see people build on our work from back then; we can see things coming full circle. There's the clinical translational side of our basic research which is a big change, definitely for the better.

AP: Your primary responsibilities are in the Spinal Cord Research Center and with the medical school anatomy training; how is your time divided between the two?
TC: The research facility is primary. On the medical school side, the curriculum has changed drastically in recent years, requiring a bigger percentage of my time. When I first started teaching, it was a challenge for me to get the research done simultaneously, but over time I found the right balance. Historically, graduate students taught the anatomy courses, because they also took those courses! When the department's focus shifted from neuroanatomy to neurobiology, the decision was made to not have the anatomy studies be a part of the graduate curriculum. Hazel Murphy, who was acting chair at the time, asked me if I'd want to try taking charge of a few classes. I liked teaching, and gross anatomy has remained one of my specialties!

AP: What is your favorite thing about working in this department?
TC: Just the amount of opportunity I've been given to explore and figure things out for myself. I've had the support of a lot of very smart people, from the chair to the students. I've been given the independence and freedom to explore possibilities, think about what I like and don't like to do. People here care about each other, they help you explore opportunities that are right for you. My favorite part about the teaching aspect is the faculty I get to work with. Everybody in that group wants to be there. They love to teach these courses, and I learn a lot from them.

AP: What do you consider your favorite contribution to science?
TC: One of my favorite science moments was when I was working on a project with Marion Murray in the early 1980's – I had found neuronal phenotypes in the fetal medial habenula that no one had described in the literature. I repeated the staining three or four times because I was sure that I had done something incorrectly, and I furiously searched the literature, but the results were always the same. After discussing it with Marion, we determined that there must be transiently expressed phenotypes in the developing habenula, which explained why we were getting strange cell types in our transplants. This was the first time I had ever "discovered" something that had never been reported before, and it felt pretty special.

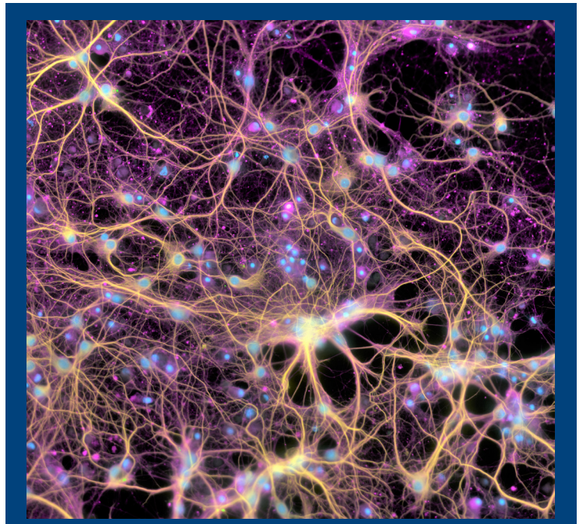
AP: How has your role developed since joining the department?
TC: I started as a technician with Marion Murray working with goldfish. As I look back, this was the perfect place to begin to learn about the nervous system, since the goldfish visual system is fairly simple and it regenerates after injury. Using this model, I learned histology and electron microscopy, techniques that have served me well to this day. We moved to the rat habenulo-interpeduncular system where I did my first embryonic cell transplants. Marion's ongoing collaborations with Michael Goldberger and Alan Tessler moved my lab work more to rodent and cat models of spinal cord injury using tract tracing, immunocytochemistry, autoradiography, in situ hybridization and behavior testing. Now things were getting more complicated. I took the Medical Neuroscience course to better understand CNS anatomy, pathways and responses to injury, and this introduced me to the medical educational part of our department's mission. My more recent work with the Fischer and Houle labs requires the use of all my acquired skills, with the addition of a few new ones. Management roles came along with experience. That's the beauty of my job – it is ever changing, but the things I learned many years ago are still evolving and are still relevant. And I have had the opportunity to work with a fantastic group of people along the way!

Our interview is momentarily interrupted...
Nick: What is the TwinGuard Freezer?
Theresa: The one outside Dr. Barson's lab. Do you need to find something? [Theresa faces towards me and says, "This is my favorite part of the day – helping everybody!"]
We take a brief pause while Theresa helps him find the antibody he's looking for. Theresa's office always has an open door. If you need any research or non-research related help, you just know she's the right person to check in with.

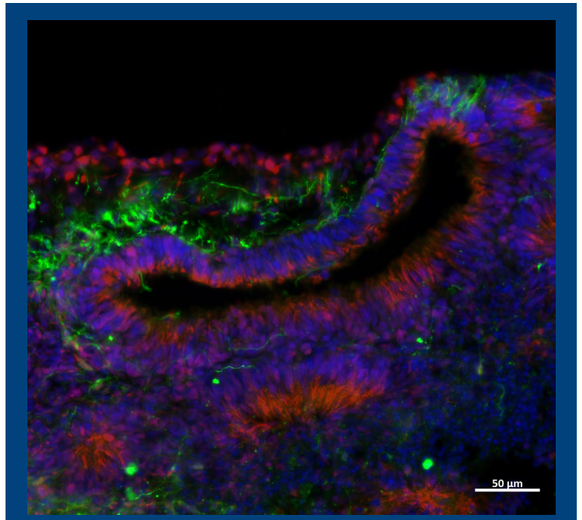
AP: When you're not in the lab/at work, what hobbies/ other activities do you engage in?
TC: Obviously gardening [Theresa's office houses many plants, and she's gifted some to other members of the department over the years], cooking – a passion I share with my husband, although both of us can get territorial in the kitchen. I watch baseball games – my son attends Drexel University and plays for the university team, so we follow the team games. These are good ways for the family to stay connected.

AP: If you had to choose a different career path for a day, what would it be and why?
TC: Maybe teaching young children, at the elementary level or younger. At that age they're so inquisitive and malleable, and excited to learn. It's odd, 20 to 30 years ago I would never have described myself as a teacher. I'd walk through the hallways with my head down – I was very shy. But with all the interactions here, with Drs. Murray and Fischer, I've developed as a scientist, as a teacher and as a person.

AP: What is your top advice for students like me who are currently pursuing higher degrees in science?
TC: My advice for graduate students would be to work really hard and to not be too discouraged when something doesn't work. Try to find the excitement in your work and in your lab's work, and keep up with what's going on in other labs in the department. It helps you keep the bigger picture in mind. A major strength of this department is the collaborative nature of our interactions with each other, from the top on down. Take advantage of this asset. •



Dense cultures of hippocampal neurons. Staining: Yellow - MAP2, Pink - Beta-III tubulin, Blue - Nuclei (DAPI)
Ankita Patil



3D human cerebral forebrain organoid showing a ventricle-like structure with neural progenitor cells in red (SOX2) lining the ventricle and mature neurons in green (Tau1) that have migrated away from the ventricle. DAPI in blue labels nuclei.
Philip Yates

Post-doc Interviews

From High School Teaching to Computational Modeling

An interview with Jessica Ausborn, PhD, by Nancy Mack

Dr. Ausborn is a recently appointed instructor in the department and conducts her research in the Rybak lab where she was a post-doctoral fellow. In this conversation, as she shares her academic journey, she offers unique insight into the world of computational neuroscience, showing us that computational modeling is not so different from experimental work.

NM: Do you remember when you first thought of becoming a scientist?
JA: It was a gradual thing. Initially, I studied to become a high school teacher in Germany. The state in Germany where I studied didn't have a particular program for that, so they put prospective high school teachers in the regular classes with bachelors and masters students and made them take some additional classes in pedagogy. I studied math, biology and computer science to teach high school students. When I finished my studies, my supervisor for my final thesis asked me to continue in his lab for a PhD. Back then we didn't have programs that you could apply to for a PhD–you would just agree with your prospective supervisor to work on a PhD project in their lab. So, when this offer came about, I thought I'd get a PhD and then go back to teach high school students. But somewhere along the way I got stuck.

NM: What was the topic of your PhD dissertation?
JA: I worked on a computational model of the locust flight system. I was looking at a sensory organ and its interaction with the locust flight central pattern generator. It was a really nice, small study which used computational model to produce some predictions and directly tested these predictions in the animal. We did some electrophysiological experiments where we, in real time, replaced the sensory organ with a computer simulation of that sensory organ and fed it back into the biological system. The locust flight system is one of the pioneer model systems to study central pattern generators and my thesis was mostly concerned with general questions about sensory-motor integration. I really enjoyed this work.

NM: You have done research at multiple institutions around the world, from Germany to Sweden to the United States. Have your scientific experiences varied across these locations?
JA: It's hard to say because it was also a progression from being a student, a PhD student, a post-doc and so on. So, it absolutely differs, but it's hard to know if it was the different position I was in, or the different countries I was in. For example, I feel like regulations have increased more and more, but that could be over the years or from country to country. I also changed model systems and approaches very dramatically. So, it's very hard to compare.

NM: You have a background in both experimental research and computational modeling. Do you have a preference or like different things about one or the other?
JA: I absolutely like different things about each one. I did exclusively experimental work in Stockholm, Sweden where I was working with zebra fish. Originally, I had planned to go there to start experimental work and to develop computational models of the data. But in the end, it wasn't realistic to do both well. I think there are certain model systems where you can do that, but with this one I only ended up doing experiments. I liked planning and coming up with experiments, thinking about what to do. I even liked setting up the experiments and maybe even performing the first few experiments of each type. But somehow, I'm not very good at doing repetitive tasks. As soon as I had an idea of what the outcome could be, it was really frustrating for me to continue with the experiments. In computational work, you obviously have much less of that. You have an idea and there are techniques and skills involved in implementing that idea, but it's not as repetitive as experimental work. What I like the most is working with concepts and ideas and discussing data. What we do here at Drexel is perfect for that. We work very closely with experimental biologists and we very often work closely with them while they're actually performing the experiments. We discuss with them what experiments to do and what types of simulations we would need, for example, to understand how the system works. So I get to do all of this planning, I just don't have to do the experiments.

NM: I personally study the activity of a single circuit, and even just looking at a single connection between two neurons can be so complex. I'm fascinated by the idea of modeling an entire network of connections. Can you describe what goes into the process of making a computation model?
JA: I think it sounds more complicated than it actually is. If you look at a single connection, you understand a lot about that single process in exquisite detail, and if you were to scale that detail into a larger model it would be very complex. But, it doesn't really make sense to model a network of neurons at such a level of complexity. You have to abstract, you have to sideline detailed processes such as vesicle release. You have to ask yourself, what question am I interested in? Very often, what our group is interested in is how different populations interact with each other. To try to understand how the system behaves, we often don't model all neurons individually but rather model the whole population as one unit. With that being said, we also develop models with individual neurons, especially if we want to know how neurons within a population interact. For example, if it's important for the neurons in this population to be connected amongst each other, then synchronization of action potentials within the population plays a big role, and that is hard to model in a more abstract way. We are trying to go as abstract as possible to still answer the questions that we're interested in, only adding detail if it's necessary for the question or the functioning of the model. What we're not trying to do is replicate

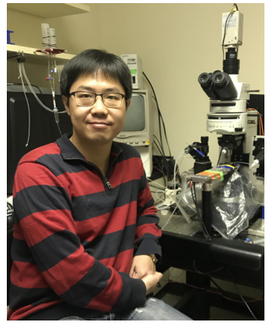
biology. I think many people assume what computational modeling is doing is taking all the data that's available, putting it into some equations, and hoping something comes out that resembles biology. But that never works. There are some really interesting studies in the stomatogastric nervous system of the crab. The core of that system comprises only 24 individual neurons, each responsible for a specific task. This is particularly advantageous since the same neuron is often identifiable from animal to animal. Researchers were able to characterize all of the ionic currents in a specific neuron by measuring over many animals, blocking other channels, and using voltage and current clamp recordings. The groups working on the stomatogastric system then averaged all their recordings for a specific neuron across many animals and made a computation model, but the model didn't do at all what this neuron was supposed to do. This sparked a whole field of studies that essentially found that if you average all of the measurements that you do, you won't get an average neuron but something that's nonsensical. This suggests for computational models that there's no point in measuring all the data and trying to make a model out of averages. Instead, we have to have a certain question and try to come up with possible solutions. We test our models by saying, if our hypotheses are right, if the biological system is really set up like that, then the perturbations we use in our model to elicit a change should produce similar behavioral change in the animal. For example, if we take out a certain population of cells, the network rhythm speeds up in the model. We can then tell experimentalists to inhibit or knock out this population and see if that rhythm really gets faster. If our model prediction is confirmed in the animal, that brings us one step closer to understanding the biological system. I actually see myself as a part of the experimental process, not as something separate. If you look at your own experimental data, you make a mental model in your head and you have this idea about how things should work out. The benefit of computational models is that you don't just make an intuitive model in your head. You can't just say I think it's like this. You actually have to put it into mathematical equations and these equations then have to produce a biologically relevant output.

NM: What is one of the biggest challenges you've faced thus far during your scientific career?
JA: It's very hard to come up with something unique and personal. I'm at a point where I think about where my research focus is going to go. I'm working with Ilya and he obviously has an established research direction and I need to find something independent that will fuel my own research path. I think that is the most difficult part, especially if you do computational neuroscience the way we do, where we heavily rely on experimentalists. I need to find people going in the research direction I want to go in to collaborate with me. I can't just say this is what I want to study. I am always dependent on experimentalists providing data. Many people, including us, often use published data to make models, but being involved in the planning of the experiments is the most fruitful part for me. So currently my biggest challenge is finding something to make my own and identifying collaborators for it.

NM: What do you like to do when you are not doing science?
JA: I'm pretty crafty. I like to draw, crochet, knit, decorate my apartment and things like that. I also like to go for walks and meet with friends.

NM: If you had to choose an alternative career path to science, what would you choose and why?
JA: Well, I like teaching. I've always liked teaching and that's never gone away. I don't think I'd go back and teach high school students, for various reasons. But I do like teaching, I think it's always a viable option.

NM: If you could go back and give yourself advice when just starting your doctoral training, what would it be?
JA: As I said, I started my PhD without actually planning to continue on in academia. If I had the foresight of knowing where I would end up now, I would probably just tell myself to keep doing what you're doing. I've had so many fortuitous opportunities and changes. I never applied to come here, for example. I was visiting Kim Dougherty – we have been friends since Stockholm. She was setting up her lab and I had some time and vacation to spend, so I took two weeks off to see where she lived and help her solder some cables, get things running in her lab. And since I was already here, I gave a talk. One thing led to another and Ilya offered me a position in his group. I was looking for a new job at the time but hadn't decided if I wanted to switch to computational work completely or if I wanted to do something in combination. Most of my career wasn't planned, I have often just followed new opportunities that came up. And I think that's a good way to do it as well. •



In Search of Etiology

An interview with Bo Xing, PhD, by Nancy Mack

Dr. Bo Xing is a senior post-doctoral fellow in the Gao lab. He shares his extraordinary journey of scientific curiosity that took him through medical school in China, a forensic research lab, a mental disease hospital, and the U.S.

NM: Do you remember when you first thought of becoming a scientist?
BX: It was 2005. When I graduated from medical school, I had a choice to either go to graduate school for a PhD or pursue the MD/PhD route; I chose to pursue PhD because I was more interested in research. In medical school I had trained in forensic medicine. So, although graduate school offered different choices for research topics, I decided to stay in the same department to study addiction. In medical training you only know a little about why things happen,

Post-doc Interviews, *cont.*

especially in mental processes. So, I thought it would be interesting to study the brain.

NM: Your PhD thesis was on the role of D1 and D3 receptors in learning and memory. Can you elaborate?
BX: My mentor and I wanted to study addiction, but at the time we did not have access to drugs for experiments. The contemporary view was that addiction was a learning and memory problem; so, I decided to test gene knockout animals to assess baseline learning and memory. The learning and memory field is a big field, so I decided to look at signaling changes when D1 is knocked out. Because D1 knockout caused significant effects in memory tasks like the water maze, I studied the hippocampus and prefrontal cortex as my thesis project. We concluded D1 was important for regular learning, i.e. if you knock out D1, animals cannot learn the tasks well; we also showed signaling deficits in the neurons. I planned to do rescue experiments by quickly recovering D1 signaling, but I couldn't succeed with the design of plasmids for conditional knock in and thus we decided not to do those experiments. Interestingly, we also found that D3 is not necessary for regular learning, i.e. if you knock out D3 the animals still learn the water maze task, but their performance declines slowly. We know that D3 plays some role in age-related cognitive decline including deficits in working memory.

NM: How did you transition to Drexel for a post-doc?
BX: Ultimately, Dr. Gao brought me here. I graduated with a PhD in 2010 and didn't want to do research in the forensic department anymore. Because I attended medical school in the same place, I had been in the department for 10 years. I left to do research in a mental disease hospital where many of the patients had schizophrenia and depression. I spent 3-4 hours every day talking with these patients to understand them and to see how the doctors treated them. After talking with these patients, it was clear that study of mental health disorders deserved attention. However, clinical research could never touch on the "whys" of the disease because you cannot do those kinds of studies in humans. I engaged in some clinical research and I felt that it was helping the drug companies test the efficiency of drugs, but it wasn't giving answers to why the drugs worked, and it wasn't helping the patients understand their disease. So, I was thinking of doing basic research to understand the etiology. I started looking for jobs and emailed Dr. Gao, who had a position open at the time. I knew how to run some behavioral tests and I knew western blots, but I didn't know how to do electrophysiology. At the time, Gao lab mostly used electrophysiology, but it had started to do some protein analyses, so it was a good match. I was excited that he was doing some schizophrenia work. I read some of his papers and it made sense to join his lab. I could learn some new techniques while studying my topic of interest.

NM: Now that you're doing a lot of electrophysiology, do you like it?
BX: Yes, this technique is very useful. It is my favorite technique that I've learned here because it can be used to answer some fundamental questions about neuronal function. But it's important to have some hypotheses, you can't just test everything.

NM: What is one of the biggest challenges you've faced during your scientific career thus far?
BX: I have struggled with the writing process. I am a bit slow with writing. If I do experiments, I know what I want to achieve, but sometimes your guess is wrong and your hypothesis changes. When you're writing, you know the answer, but you need to write like you don't know. And that is hard for me. I don't want every paper to look the same and it's not my forte to come up with new creative ways. So, writing has been a major hurdle.

NM: You have two kids. How do you deal with being a dad and a postdoctoral fellow?
BX: That's easy. You just do more [laughs]. My wife graduated this year and got a job. She drops our kids at school and I pick them up because we both work. So, what you can do is organize well, and you also need to ask people in the lab for help. For the kids, my wife helps me a lot. She takes care of most things before they go to school. To help at home, I cook a lot – a lot more compared to what I did before I had kids. But cooking is sort of like doing experiments, too.

NM: If you had to choose an alternate career path to science, what would you choose and why?
BX: Definitely a doctor. When I graduated, there was an equal chance of becoming a doctor or a researcher. My scores on my exams would allow me to do either. I was going to plan to be a surgeon or a neurologist and had spent most of my rotations in those areas in medical school. But finally, I decided to go for a PhD.

NM: If you had to give advice to someone just starting off their PhD, what would you say?
BX: Find a topic and be interested in it. There were two projects I could do in grad school. One was gene polymorphisms in the blood to better identify which criminals belonged to what population, using forensic genetics. This project was hot at the time and everyone in our lab was interested in it. I chose the project that no one had started or set up. If you set up a project and get it working well, everyone will want to use that tool. So, I suggest you try to choose a project that no one in your lab is doing, and you might discover something that no one has found before. •

Student Writings

A Crossroad for Schizophrenia Diagnosis, Treatment and Research

Wen-Jun Gao, MD, PhD
Professor

Schizophrenia (SZ) is one of the most devastating chronic diseases, impacting nearly 1.5% of the global population and creating an economic burden of up to 1.65% gross domestic product 1. We know that SZ is a highly complex neurodevelopmental disorder, but the diagnosis of SZ is usually extremely difficult due to its many comorbidities. Clinical assessment is largely based on observed behaviors, reported experiences, and other reports from those familiar with the person. Symptoms associated with SZ usually occur during development and must reach a certain severity and level of impairment before a diagnosis can be made. This reality makes diagnosis and research extremely difficult, if not impossible. Clinical doctors have started to doubt whether the concept of SZ remains valid 2, whereas basic researchers are confused because all of the animal models, including genetic, neurodevelopmental, lesion-based, or drug-based models appear to be limited or "invalid." Perhaps, because of this uncertainty, the National Institute of Mental Health (NIMH) has changed policy and has significantly reduced funding support for research with "animal models for schizophrenia."

Apparently, SZ studies have come to a crossroads. In this year's Graduate Neuroscience II exam, pertaining to the lecture on "Animal Models for Schizophrenia," most of the students chose to write a commentary on whether they would agree or disagree with Dr. van Os' idea of placing SZ within "psychosis spectrum disorders." All students wrote excellent essays, pointing out the pros and cons of abandoning the concept of SZ. Importantly, all students, regardless of their position on Dr. van Os' idea, thought that animal studies for SZ remain extremely essential. However, most of the students seemed unsure as to how basic research may be improved to address the aforementioned issues. The Research Domain Criteria (RDoC) of the NIMH provides "a research framework for new approaches to investigating mental disorders, including schizophrenia. It integrates many levels of information, from genomics and circuits to behavior and self-reports, in order to explore basic dimensions of functioning that span the full range of human behavior from normal to abnormal."3 Although the RDoC is not a diagnostic guide, it sets a goal "to understand the nature of mental health and illness in terms of varying degrees of dysfunctions in general psychological/biological systems."3 This RDoC framework mainly focuses on the individual symptom domain, instead of the disease itself. This seems to be a promising way to move forward for us basic research scientists, although the impact of this research strategy shift remains to be evaluated in the coming years.

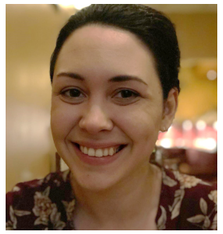
Micaela O'Reilly
2nd year graduate student

Within the neuroscience field, it is debated whether SZ is a dying and ambiguous term that confuses both patients and clinicians. Some researchers suggest shifting diagnostic practices by instead using a "Psychosis Spectrum" to score each symptom classification (i.e., positive, cognitive, negative, and affective symptoms) and their overlap. Current diagnosis of SZ consists of a wide variety of sub-classifications and subtypes, further misleading patients and evoking negative stigmatization of the disease. Moving toward a more clearly established, symptom-based spectrum for psychosis could be extremely beneficial for patients and clinicians. Furthermore, this change would have minimal impact on current pre-clinical research using animal models of schizophrenia.

Symptoms of SZ are uniquely human and therefore incredibly difficult to replicate in an animal model (e.g., paranoid thoughts, lack of reasoning, and dissociation from reality). However, current models can be used to mimic specific symptoms of SZ and investigate disease etiology. For example, genetic models have greatly contributed to our understanding of the heritability of SZ and identification of genetic mutations shared between disorders. Although researchers debate the clinical relevance of these models, this research has already contributed significantly to the understanding of pathophysiology of both SZ and psychosis disorders. Though genetic models may not be completely reliable, environmental and prenatal models are valuable to show how toxins, drugs, and socialization may alter symptom presentation. Therefore, animal models of schizophrenia-like symptoms are currently the best option for studying different aspects of underlying pathophysiology.

Creating a "Psychosis Spectrum" for diagnosing SZ could be extremely beneficial for clinicians, researchers, and patients. Although terming this a "psychosis"-specific spectrum is flawed, as SZ is not hallmarked by symptoms of psychosis, scoring and identifying the severity of each symptom allows patients to better understand their personal experience. Understanding disease etiology (e.g., prenatal exposures, genetic mutations, and environmental risks), through animal research, can illuminate patients on why they are affected by SZ, and can inform clinicians about treatment options and disease prognosis. Therefore, approaching SZ as a "Psychosis Spectrum" correlates with current trends in animal research and provides clearer diagnostic standards for clinicians and patients.

Student Writings, *cont.*



Cassandra Alexandropoulos
2nd year graduate student

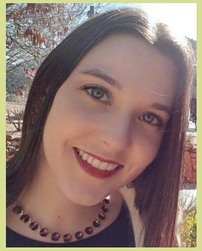
Some researchers including Dr. van Os posit that the concept of SZ, as defined by clinicians, is not useful for patient diagnosis. According to Dr. van Os, SZ should be classified under "psychosis spectrum disorders" (PSD), in the same category as bipolar disorder (BD). One of his arguments for listing SZ in PSD is that the term SZ, associated with phrases such as "devastating brain disorder", causes patients to internalize negative expectations. He argues that psychiatrists should focus on the possibilities, not the limitations, by empowering patients to adapt and self-manage SZ. It is admirable that Dr. van Os deeply cares about how patients diagnosed with SZ conceptualize their diagnosis; however, this logic for classifying SZ under PSD is deeply flawed and will do more harm than good in the long run, both for practicing clinicians and basic researchers.

The term PSD inappropriately focuses attention on positive symptoms of SZ, such as delusions and hallucinations, when negative and cognitive symptoms, including social and cognitive deficits, are the main predictors of poor prognosis. Thus, the term "psychosis spectrum disorders" will be a source of confusion for clinicians and basic researchers as it doesn't encapsulate the complete syndrome. For clinicians, it would be medically unethical to prescribe similar psychiatric medications to individuals with SZ and BD because mood stabilizers that may work for BD do not work for SZ. For basic researchers, PSD classification system lacks discrete operational definitions to accurately model distinct symptoms of SZ utilizing animal models. Additionally, the focus of research may shift towards positive symptoms of SZ, and not the negative and cognitive symptoms, which currently remain untreatable. Investigating mechanisms behind specific cognitive and negative symptoms of SZ, which precede positive symptoms, is a high priority in research due to unmet clinical need. In conclusion, replacing SZ with PSD denies the full spectrum of the disease and may have negative consequences for understanding and treating the disease. •

References

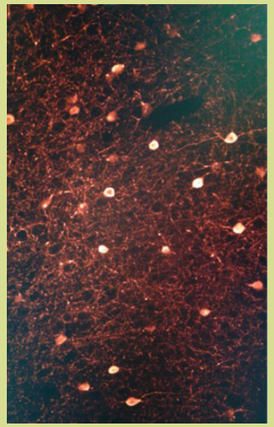
1. Torous, J., Staples, P., Barnett, I., Onnela, J.-P. & Keshavan, M. A crossroad for validating digital tools in schizophrenia and mental health. npj Schizophrenia 4, 6, doi:10.1038/s41537-018-0048-6 (2018).
2. Guloksuz, S. & van Os, J. The slow death of the concept of schizophrenia and the painful birth of the psychosis spectrum. Psychol Med, 1-16, doi:10.1017/s0033291717001775 (2017).
3. https://www.nimh.nih.gov/research-priorities/rdoc/index.shtml/
4. http://www.schizophreniaforum.org/forums/webinar-schizophrenia-dead-yet

Patch and Release



by Linda Chamberlin MD/ PhD candidate

I survey the stream,
the edges and the depths,
and settle on a spot where plump
pyramidals abound,
interspersed with living pebbles
all in grey.
I scan the darkness for a glimmer,
and trace the processes back to the source.
There I find my glowing target,
alive in the flowing surround.
With gluconate bait,
I lower my rod to the river,
releasing a ripple across the surface.
I approach the glowing body
until the dimple shows a nibble,
a tug on the line,
and I gently lure it in.
Caught, patched, sealed, trapped.
I look into the eyes of this alien earthling.
And through the eyes, I seek the mind,
and through the mind, I seek myself
and through myself, I seek the world.
Three questions for the magic fish:
What forces press upon you?
Where do we fit into this milieu?
And how do you sustain your aquatic fire?
Release.



Aquatic Fire
Linda Chamberlin

Alumni Interview

Healing the Cord

An interview with Angelo Lepore, PhD, by Surya Pandey

Dr. Angelo Lepore was a 2005 graduate of the Department of Neurobiology and Anatomy. He is currently an Associate Professor in the Department of Neuroscience at Thomas Jefferson University in Philadelphia where he also co-directs the Neuroscience Graduate Program. Dr. Lepore shares his research journey that began with stem cell transplantation in the Fischer lab where he discovered his passion for finding ways to heal the injured spinal cord.

SP: Do you remember your first day at Drexel?
AL: Of course. I remember the day vividly. My first rotation in graduate school was in the Fischer Lab. On my very first day, the Fischer lab, as well as the entire Department of Neurobiology and Anatomy, was moving from the EPPI building to Queen Lane. So, I actually spent that day helping the lab members with moving. I eventually was able to do some experiments.

SP: How would you summarize your experience at Drexel? Do you have any specific memories you cherish or can't forget?
AL: It was a fantastic time for me, both career-wise and in my life. When I started at Drexel, I was 21 years old and fresh out of college in a small town. I was a good student all of my life, but being a PhD student driving my own scientific projects was completely different than what I had experienced before, especially in Itzhak's lab where he gives students a huge amount of independence (which I loved). It wasn't until I was forced into this situation where school is an adult endeavor – and not just about getting good grades – that I realized how much a research career is right for me, and that I'm somewhat decent at it. On a personal level, my years at Drexel during my early to mid-20s were also the time in my life when I really opened up to different cultures, cuisine, music, art, books, etc. Combined with my maturation as a scientist, it was during this time (I think more than any other of my life) that I became the person I am today. My Drexel experience was largely defined by my interactions within the Department of Neurobiology & Anatomy. I loved being a student in the department, working in Itzhak's lab, and spending time with everyone there. I'm still always around and continue to work with a number of people at Queen Lane, which I guess means that my time there left a good impression on me. Actually, I remember that I was extremely sad on my last day before driving down to Baltimore to start my post-doc at Johns Hopkins. I think my sadness was partially due to my departure to a completely unfamiliar setting in a different city, but most of it was because I genuinely was going to miss working there.

SP: What would you have done differently in grad school?
AL: With anything in my life, I'm not usually a person who obsesses about what I could have done differently, which doesn't mean that I haven't screwed up a lot of stuff. With respect to my grad school career, I would have started even earlier actively seeking out the advice of others. I was a young man at the time, so it's understandable. I'm now very different; I constantly seek out the input of others for my career, grant applications and pretty much anything. In fact, I'm constantly hounding Itzhak for career guidance, and I even did a "chalk-talk" with faculty within your department when I was writing my R01 renewal. When I was a grad student, I enjoyed the freedom and independence that goes along with being in Itzhak's lab, so I think this led me to want to do experiments, etc., my way (and disregard some of the sage advice of Itzhak). Actually, Itzhak and I worked together incredibly well, but I should have been a little less stubborn with some things.

SP: You met your wife at Drexel and she is also a scientist. What is life like for a scientist couple?
AL: Yes. In my second year of graduate school, I was the GSA representative on a combined board with students from the Drexel undergraduate student association. Megan was a senior at Drexel and one of these undergraduates; this is when we first met. We were PhD students in the Neuroscience program and post-docs at Hopkins (in different labs at both places). Since we are both in science (she's a professor at Arcadia University), it's certainly helpful when we need to bounce ideas off each other, but honestly, we don't discuss much science at home. Megan likes to talk about work-related matters at home, but it's usually about university politics at Arcadia rather than science. We'll see if our daughter and son become neuroscientists like us!

SP: How did Drexel contribute to your career development?
AL: As I mentioned before, I didn't have much research experience prior to starting in the PhD program, so basically I learned most things I know about doing science during my five years at Drexel. Itzhak played (and continues to play) a huge role in my career development. He was a fantastic PhD mentor and his mentoring style perfectly fit what I needed. As a PhD student, I was very independent, so Itzhak was able to work with me to improve skills that are universally-applicable to my career such as writing, preparing talks and thinking about our data and their implications at a higher level. He did a great job preparing me for the next step.

Alumni Interview, *cont.*

SP: You have continued your relationship with Drexel through collaborative research efforts. Could you elaborate?
AL: We are currently working together with the Lane Lab on SCI-related respiratory dysfunction. Our two labs get together every few months to discuss science, and then we go out together for drinks. Dr. Lane is also on my Craig H. Neilsen Foundation grant. We also collaborate with the Detloff Lab on neuropathic pain; Megan is a co-PI on one of my NIH grants. Ying in Itzhak's lab has worked with us on a few transplantation projects over the past several years. I periodically bother Theresa for details about a protocol or where to order some reagent. Also, people in my lab are often at Queen Lane learning various techniques from different Drexel labs such as Veronica's. I also meet with Itzhak all the time, but our discussions are more about career matters and our families.

SP: How was your post-doc experience?
AL: As with my time at Drexel as a PhD student, I loved working in my post-doc lab. It was a large group with about 20 of us; we had a fun time together, and I still keep in close contact with Nicholas and Jeff (my post-doc mentors) and a number of my labmates. Also, Hopkins in general was a fantastic place to be a neuroscientist. And I actually really enjoyed living in Baltimore, despite the bad press it gets. As a post-doc, I learned to see the bigger picture of my work, which helped me mature further as a scientist. I also made a conscious effort to choose a post-doc lab that was very different from the work I did with Itzhak. I focused on neurodegenerative disease (specifically ALS), astrocyte biology and glutamate transporters at Hopkins, which allowed me to greatly expand my expertise and helped me transition to independence by incorporating my skills and knowledge from graduate school and post-doc training. Being a post-doc was also great because I was able to focus mostly on research, unlike during grad school where there were classes, journal clubs, thesis matters, etc. However, this idyllic time as a post-doc lasted only for the first few years. Unlike with grad school, where you know that you're going to get your PhD at some point, you're not guaranteed anything as a post-doc … PhD students, sorry for the spoiler. As a post-doc, you quickly start thinking, "What am I going to do next, and how will I actually get the job I want?" In my case, I started thinking about this very early in my post-doc career by writing fellowships and grants, trying to come up with projects that I could "take" with me to my own lab, and doing all of the other important things to improve my chances of finding a faculty position (but there was still no guarantee). So, being a post-doc is an exciting experience mixed with a sense of the unknown.

SP: How was the transition into your own lab?
AL: It was very exciting … probably the most rewarding career accomplishment of my life. Starting an independent lab is a daunting task for which you are not that prepared in many ways. Toward the end of my post-doc, while trying to get various things in place to establish my own lab, it felt as though I was holding two jobs. It's funny … when you get your own lab, the department/university basically gives you a few empty rooms, an office and access to a pot of start-up money; it's completely up to you to figure out whom to hire, what to fill those rooms with, and what types of scientific questions you want to ask. The thing is that no one holds your hand through this process; the department just expects you to figure it out on your own (i.e., get funding and publish papers), but it's completely up to you how to do this, which is what makes it so wonderful (but also a bit scary). After a few months, we actually started doing experiments. The next thing you know, we were getting data and publishing papers. The best feeling was when we published that first paper that came from my lab. Of course, things worked out mostly because of the good people I had working in my lab; I was just sort of the director.

SP: What questions are you asking these days?
AL: In a number of projects, we are asking which forms of plasticity can drive recovery of respiratory function after cervical SCI. This encompasses the biology of axonal regeneration and sprouting, synaptic rearrangement and neuroprotection, including both in the central nervous system and out at peripheral locations. We are also asking how astrocyte dysfunction contributes to the pathogenesis of both SCI and ALS, as well as how to therapeutically target these mechanisms using approaches such as transplantation. Along these lines, we are investigating the pathogenic mechanisms that drive hyperexcitability of nociceptive circuits that underlie development and persistence of neuropathic pain after SCI, including the role of astrocytes in these changes.

SP: What would you say is your most important contribution to neuroscience?
AL: I'd say the coolest thing I have done was as a post-doc in Nicholas Maragakis' lab, where we came up with the idea of transplantation-based astrocyte replacement for ALS. ALS is primarily a motor neuron disease, and neuronal transplantation has been extensively studied in this field. However, we know astrocytes also contribute significantly to the pathogenesis of ALS; specifically, dysfunction in astrocyte glutamate transport contributes to motor neuron loss in a non-cell autonomous manner. Therefore, using transplantation of astrocyte-restricted progenitors, we developed a strategy for astrocyte replacement in areas surrounding respiratory motor neurons in a model of ALS. We were able to restore functional glutamate uptake, protect respiratory motor neurons, preserve diaphragm function and significantly extend the lifespan of these ALS mice. This strategy is currently moving forward for clinical trial in ALS patients. It was very interesting scientifically, but also rewarding to see how our ideas and data led the way to a clinical trial for this extremely debilitating disease. In addition, this project stoked an interest for me in the study of respiratory function in SCI, which is now a major focus in my lab.

SP: Have you had any surprises while doing science?
AL: The fun surprises are usually those from experiments. You go into science thinking everything is exciting and that you are going to make wonderful important discoveries, but you quickly come to find out that there are a lot of mishaps and failures. So, you start to get cynical and expect things to not work out, but then all of a sudden, an experiment turns out very well and provides exciting data that makes you think about your work in a different way. That, in turn, provides you the drive to keep going. My personality is such that I don't get too worked up about these types of things, so that spares me some of the psychological damage from this rough job. In addition, I try to address a number of different scientific questions that I feel are important, in a manner that I'm proud of. If I have enough different things going simultaneously, some of them will hit and be appreciated by others, and will hopefully balance out the failures.

SP: What have you changed your mind about and why?
AL: I think I'm an extremely open-minded person and am flexible to new ideas. That being said, for some time I didn't realize that I wasn't as open to my trainees' suggestions as I should have been. They're all very smart and have great ideas, but when you're the boss you sometimes think (without actually realizing it) that you know best. I've come to realize that this is definitely not the case. I now always try my best to view all ideas equally and to just go with the one that makes the most sense after thinking hard about it. Importantly, this openness encourages the creativity of the trainees in my lab.

SP: Why do you do what you do?
Al: I do the science I do because I believe we are asking some important basic neuroscience questions and we are trying to understand and therapeutically treat serious disease conditions. As far as being a researcher in general, I really enjoy this job because it provides intellectual freedom, and hopefully my work will have some beneficial impact on human health and knowledge. Plus, I get to wear a t-shirt, shorts and a baseball hat to work every day. Importantly, I get to run a lab where we try to answer interesting scientific questions that I want to pursue. It's like a grown-up playground, as long as you have the grant funding. I also love being a mentor because I genuinely enjoy helping my trainees grow as people and scientists; the best part of my job is getting to watch them succeed.

SP: What do you do when you're not doing science
AL: I spend most of my time with my two kids (Ileana and Dante), my wife and my mom (who lives right down the street from us). I also spend a lot of time with my friends and other family; I'm from the Philadelphia area, so it's great that all of these people live close to me. Megan and I also love to travel, and we're looking forward to taking Ileana and Dante with us to different places. It's been tough in recent years to travel because the kids are both still young, but we'll be able to do more of it as a family now that Dante is getting old enough (he's almost 2) where it's easier to travel with him.

SP: With two kids and a spouse who is also a scientist, how do you balance work and family?
AL: I've always made it a point to not let work compromise the more important things in my life like family and friends. For the most part, I don't work at night when I get home or on weekends. Whatever I can get done for work within these time constraints is fine with me for my career. I love my job and am driven to be productive and successful, but, at the end of the day, it's not that important to me relative to my family and overall personal life.

SP: What is your advice for young scientists?
AL: Don't be afraid of change, in science but also in other aspects of life. Pursue something you enjoy, think is important and feel comfortable doing, but also don't be afraid to put yourself in uncomfortable situations that challenge you. I think this makes being a scientist more fun. In addition, it forces you to evolve, which is critical to being successful in this profession. •

First Years *of 2018*

Master's Program:

Taylor McCorkle
Breanne Pirino
Allie Tracy
John Walker
Samuel Wechsler

PhD Program:

Kathleen Bryant
Shrobona Guha
Harsha Ohri
Candace Rizzi-Wise
Trevor Smith
Jonathan Richards

Graduates *of 2018*

Timothy Austin, PhD
Adviser: Peter Baas, PhD
Thesis Title: New understanding of the effects of microtubule-associated proteins on dynamic instability, including the role of tau in neuronal function and disease
Defense Date: April 24th, 2018
Current Position: Telemetry technician at the George E. Wahlen Department of Veterans Affairs Health Center

Ashley Karnay, MS
Adviser: Felice Elefant, PhD
Thesis Title: Hippocampal Neuron Stimulation Promotes Intracellular Tip60 Dynamics with Concomitant Genome Reorganization and Synaptic Gene Activation
Defense Date: May 2nd, 2018
Current Position: 1st year PhD student in the Genetics and Epigenetics program in the University of Pennsylvania's Cellular and Molecular Biology graduate group.

Eric Prouty, PhD
Adviser: Barry Waterhouse, PhD
Thesis Title: Characterization of Target-Specific Neuronal Populations in the Dorsal Raphe Nucleus
Defense Date: May 24th, 2018
Current Position: 3rd year medical student at Drexel University College of Medicine

Lauren Plyler, MS
Adviser: Ramesh Raghupathi, PhD
Non-Thesis Title: Opportunities and Challenges for Research in Post-traumatic Headache
Graduation Date: May 18th, 2018
Current Position: Research assistant in the Jacqueline Barker lab in the department of Pharmacology and Physiology at Drexel University College of Medicine

Laura Giacometti, PhD
Adviser: Ramesh Raghupathi, PhD
Thesis Title: Sex-Specific Chronic Behavioral Deficits following Mild Traumatic Brain Injury in the Adolescent Rat
Defense Date: July 30th, 2018
Current Position: Postdoctoral fellow in the Jacqueline Barker lab in the Department of Pharmacology and Physiology at Drexel University College of Medicine

Andrew Matamoros, PhD
Adviser: Peter Baas, PhD
Thesis Title: Microtubule – mediated nerve regeneration: Knocking down the microtubule severing protein fidgetin augments nerve regeneration in vitro and in vivo
Defense Date: August 10th, 2018
Current Position: PennPORT (postdoctoral opportunities in research and teaching) fellow in the Yuanquan Song lab at Children's Hospital of Pennsylvania

Erin McEachern, MS
Adviser: Wen-Jun Gao, MD PhD
Thesis Title: PSD-95 deficiency alters GABAergic inhibition in the medial prefrontal cortex
Defense Date: September 10th, 2018
Current Position: Assistant scientist in the Doug Tilley lab at Temple University School of Medicine

Courtney Marshall, PhD
Adviser: Sandhya Kortagere, PhD
Thesis Title: D3 receptor agonism attenuates deficits observed in rodents with 6-OHDA-induced medial forebrain bundle lesions
Defense Date: September 28th, 2018
Current Position: Postdoctoral fellow in the Virginia Lee lab at the University of Pennsylvania

Nicholas Stachowski, MS
Adviser: Kimberly Dougherty, PhD
Thesis Title: The role of spino-parabrachial neurons in post-SCI affective pain
Defense Date: October 2nd, 2018
Current Position: Research assistant in the Kimberly Dougherty lab at Drexel University College of Medicine

Zachary Brodnik, PhD
Adviser: Rodrigo España, PhD
Thesis Title: Trauma Induced Alterations in Mesolimbic Dopamine System Activity and Cocaine Use Vulnerability
Defense Date: October 5th, 2018
Current Position: Postdoctoral fellow in the Marisela Morales lab at the National Institute on Drug Abuse Intramural Research Program

Jessica Shaw, PhD
Adviser: Rodrigo España, PhD
Thesis Title: Inherent individual differences in presynaptic dopamine dynamics govern cocaine-associated behavior
Defense Date: October 31st, 2018
Current Position: Postdoctoral fellow in the Mariella De Biasi lab at the University of Pennsylvania

Lyandysha Zholudeva, PhD
Adviser: Michael Lane, PhD
Thesis Title: The Neuroplastic and Therapeutic Potential of Interneurons in the Injured Spinal Cord
Defense Date: November 29th, 2018
Current Position: Postdoctoral fellow in the Michael Lane lab at Drexel University College of Medicine

Kirsten King, MS
Adviser: Sandhya Kortagere, PhD
Non-Thesis Title: The Role of D2-like Receptors in Compulsive and Impulsive Behaviors: Implicating Biased Signaling as a Therapeutic Target
Graduation Date: December 14th, 2018
Current Position: To be determined

2018 Awards & Grants

Eugene Mironets
Platform Presentation – 1st
Veronica Tom

Austin Coley
Platform Presentation
Wen-Jun Gao

Nicholas Stachowski
Technician – 1st
Kim Dougherty

Bo Xing
Postdoctoral Fellow -1st
Wen-Jun Gao

Philip Yates
Senior Graduate – 1st
Peter Baas

Linda Chamberlin
Senior Graduate – Honorable mention
Wen-Jun Gao

Ioanna Yiantsos
Junior Graduate - 3rd Place
Peter Baas

Sarah Bennison
Junior Graduate – Honorable mention
Kazu Tooyoka

Micaela O'Reilly
Junior Graduate – Honorable mention
Veronica Tom

Kyle Samson
Medical student – 3rd
Rodrigo Espana

Jensine Coudriet
Undergraduate – 2nd
Jessica Barson

2X MORE NEUROSCIENCE AWARDEES THAN 2017

F30/31 Fellowships
Andrew Matamoros, mentored by Peter Baas
Erik Li, mentored by Kimberly Dougherty

Bondi Fellowship
Eugene Mironets, mentored by Veronica Tom

Dean's Fellowship for Excellence in Collaborative or Themed Research
Ankita Patil, mentored by Peter Baas
Erik Li, mentored by Kimberly Dougherty

Dean's Graduate Student Travel Award
Surya Pandey, mentored by Jessica Barson
Hemalatha Muralidharan, mentored by Peter Baas

Christopher Reeve Award
Eileen Collyer, mentored by Veronica Tom

Outstanding Mentorship Award
Lyandysha Zholudeva, mentored by Michael Lane

Research Excellence Award
Zachary Brodnik, mentored by Rodrigo España

Research Excellence Award – Finalist for Terminal Master's
Ashley Karnay, mentored by Felice Elefant

Faculty Grants 2018

Ramesh Raghupathi
CURE sub from Temple

Peter Baas
SPA Foundation
Drexel Equipment Award
DOD sub from Boston
DOD

Veronica Tom
NIH

Jessica Barson
CURE

Kimberly Dougherty
NINDS

Rodrigo España
NIH

Simon Giszter
NINDS

Itzhak Fischer
Rowan Sub (CHNF)

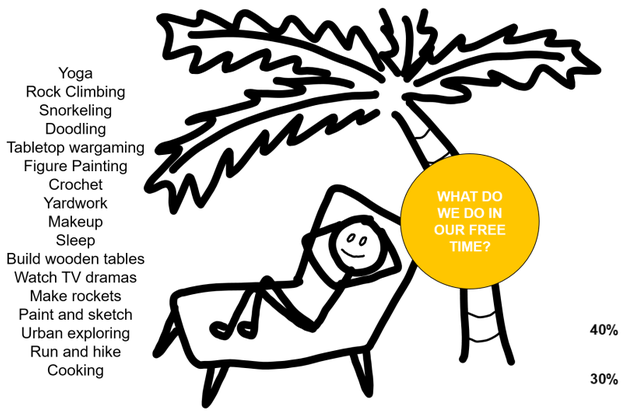
Michael Lane
NIH

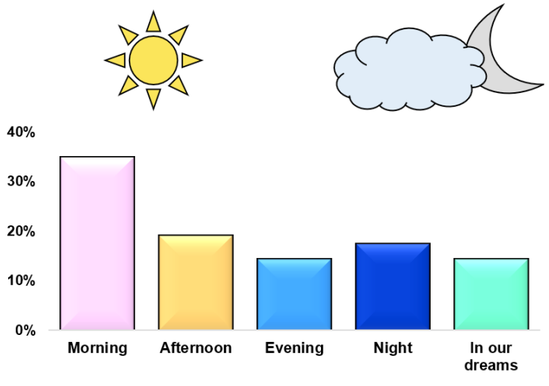
Dr. Megan Detloff
NIMH SBIR sub with Vulintus

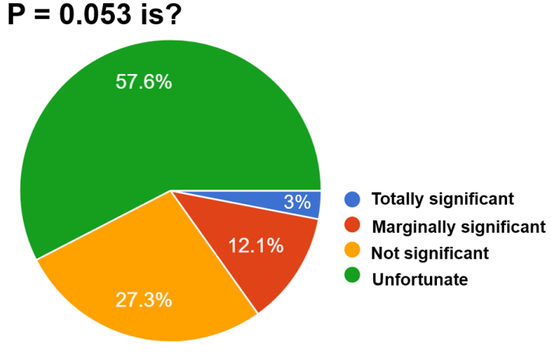
Jessica Ausborn
Jekkal Fellowship

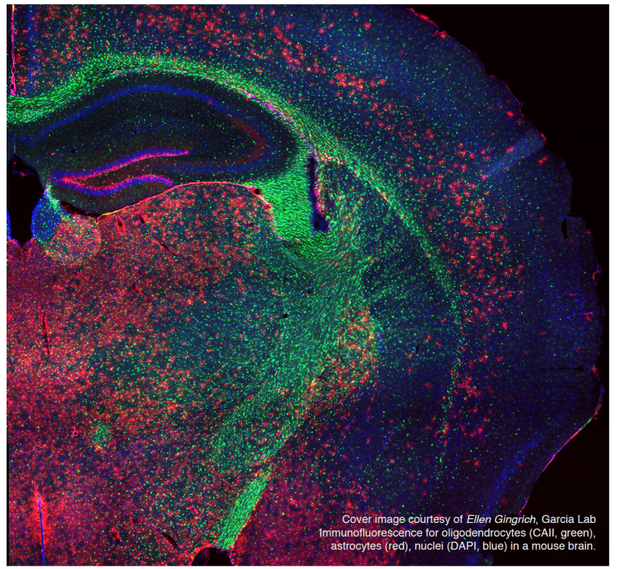
Culture

Illustrations by Ankita Patil









Cover image courtesy of *Ellen Gingrich*, Garcia Lab
Immunofluorescence for oligodendrocytes (CAII, green), astrocytes (red), nuclei (DAPI, blue) in a mouse brain.

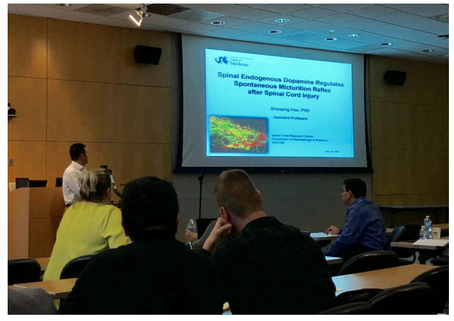
Neuroscience Retreat and Research Day

May 16, 2018

Queen Lane
SAC Room A and B

On May 16 of this year, the Department of Neurobiology and Anatomy at the College of Medicine, in partnership with the Department of Biology at the School of Arts and Sciences, successfully organized the first annual Neuroscience Retreat and Research Day. The event brought together over 100 students, faculty and staff from across Drexel's campuses for a full day of neuroscience research exchanges. This event was designed to highlight the diverse neuroscience research being conducted in various labs throughout the university. Organized under four themed sessions, namely Circuits and Behavior, Development and Plasticity, Injury, and Pathology of the Nervous System, the event featured students and faculty talks that spanned the breadth of the neuroscience research. The talks were followed by a networking reception.

The event was organized and led by six faculty members including Dr. Denise Garcia and Dr. Michael Akins from the Department of Biology, Dr. Catherine Von Reyn from the School of Biomedical Engineering, Science & Health Systems and Dr. Veronica Tom and Dr. Rodrigo España from the Department of Neurobiology and Anatomy. Support and funding for the event were provided by Dr. Itzhak Fischer, Chair of the Department of Neurobiology and Anatomy, and Dr. Kenny Simansky from the Office of the Vice Dean for research at the College of Medicine. •



Outreach

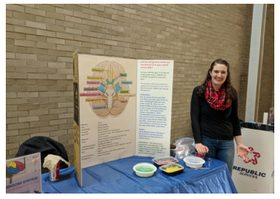
Taste of Science

Six of our students - Genevieve Curtis, Andrew Matamoros, Eugene Mironets, Sarah Monaco, Hemalatha Muralidharan and Ankita Patil - form the Philadelphia team for Taste of Science, a nation-wide science outreach event where local researchers are invited to restaurants to present short talks on their research. An average of 60 people attended each of their three events at venues in Center City, South Philadelphia and Manayunk. This year's talks covered a broad range of topics like optogenetics, traumatic brain injury, flu vaccines, oceanography and materials engineering.

Philadelphia Science Festival

The Association for Women in Science (Philadelphia Chapter) (AWIS) volunteers painted and decorated lab coats to commemorate the research of living female scientist. They wore these coats at the Philadelphia Science Festival Science Carnival and spoke with attendees about women in science. Ankita Patil donned the lab coat she decorated to highlight Dr. Jennifer Doudna, a pioneer behind the CRISPR-Cas9 technology.

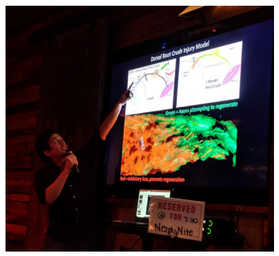
Brain Awareness Week



Brain Awareness Week is a week-long event in March aimed at highlighting neuroscience research and its significance for society. This year, four students from the department, Ilse Pamela Alonso, Emily Black, Sarah Monaco and Ankita Patil, participated in Brain Awareness Week events at The Franklin Institute. They conducted interactive demonstrations on neuroanatomy, traumatic brain injury and taste and perception.

The Philadelphia Human Rights Clinic

The Philadelphia Human Rights Clinic is a student-run initiative that provides free-of-cost psychiatric and physical evaluations for survivors of persecution who are seeking asylum in the United States. Linda Chamberlin, an MD/PhD student in our Department, is a member of the team organizing the clinic. She says, "a major part of what we do involves connecting asylum seekers with physicians or psychologists to conduct the evaluation, and assigning a medical student to serve as scribe to write up a first draft of the affidavit." The findings from these evaluations serve as evidence in the immigration court, often having a major impact on whether asylum is granted. In addition, the initiative also focuses on medical student education by organizing a monthly speaker series.



Nerd Nite Philadelphia

Andrew Matamoros presented his research on microtubule-mediated nerve regeneration at Nerd Nite Philadelphia, a monthly speaker series where speakers discuss their research with a lay audience.

Medical Student for a Day Workshops

The Medical Student for a Day Workshops have been an annual tradition since they were first conducted by Theresa Connors in 2003. Middle and high school students are invited to visit the Gross Anatomy and Medical Neuroscience labs, where they can learn about the techniques and practices associated with studying human anatomy. The students also interact with our own graduate students, faculty and staff, and discuss broader topics like career options in the biomedical sciences.

Activities

Courtney Marshall, PhD, a recent graduate, with high school students at Drexel's Neuroscience summer camp.

Neuroscience students at the GSA Halloween Party

Neuroscience student members of the Graduate Student Association, at their pumpkin carving event

Neuroscience students at the Salk Institute in San Diego prior to SfN

The Tom Lab at a lab lunch

Andrew Gargiulo, PhD candidate, attending SfN in San Diego

Neuroscience graduate students and post-docs at ASCB in San Diego

Publications

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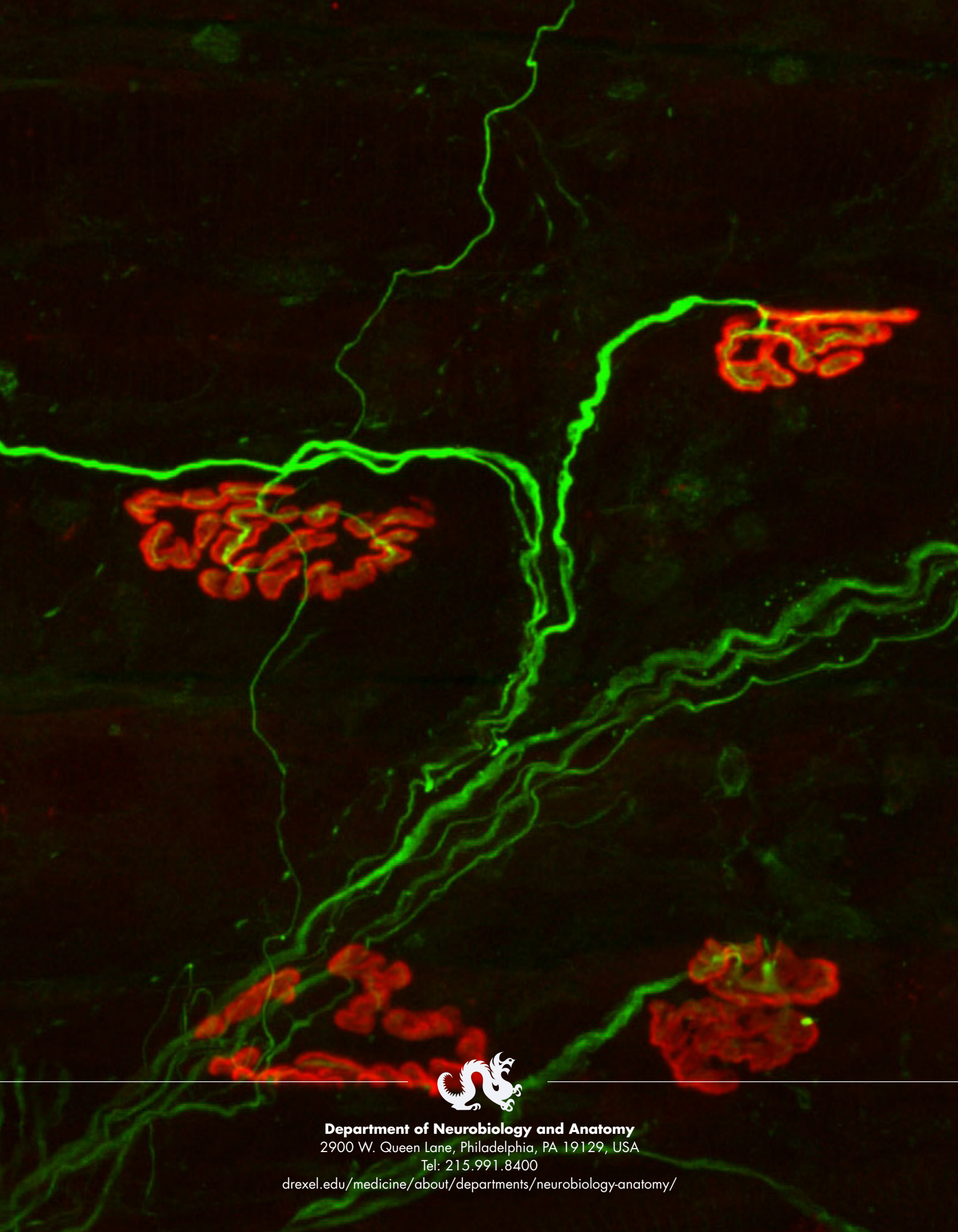

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