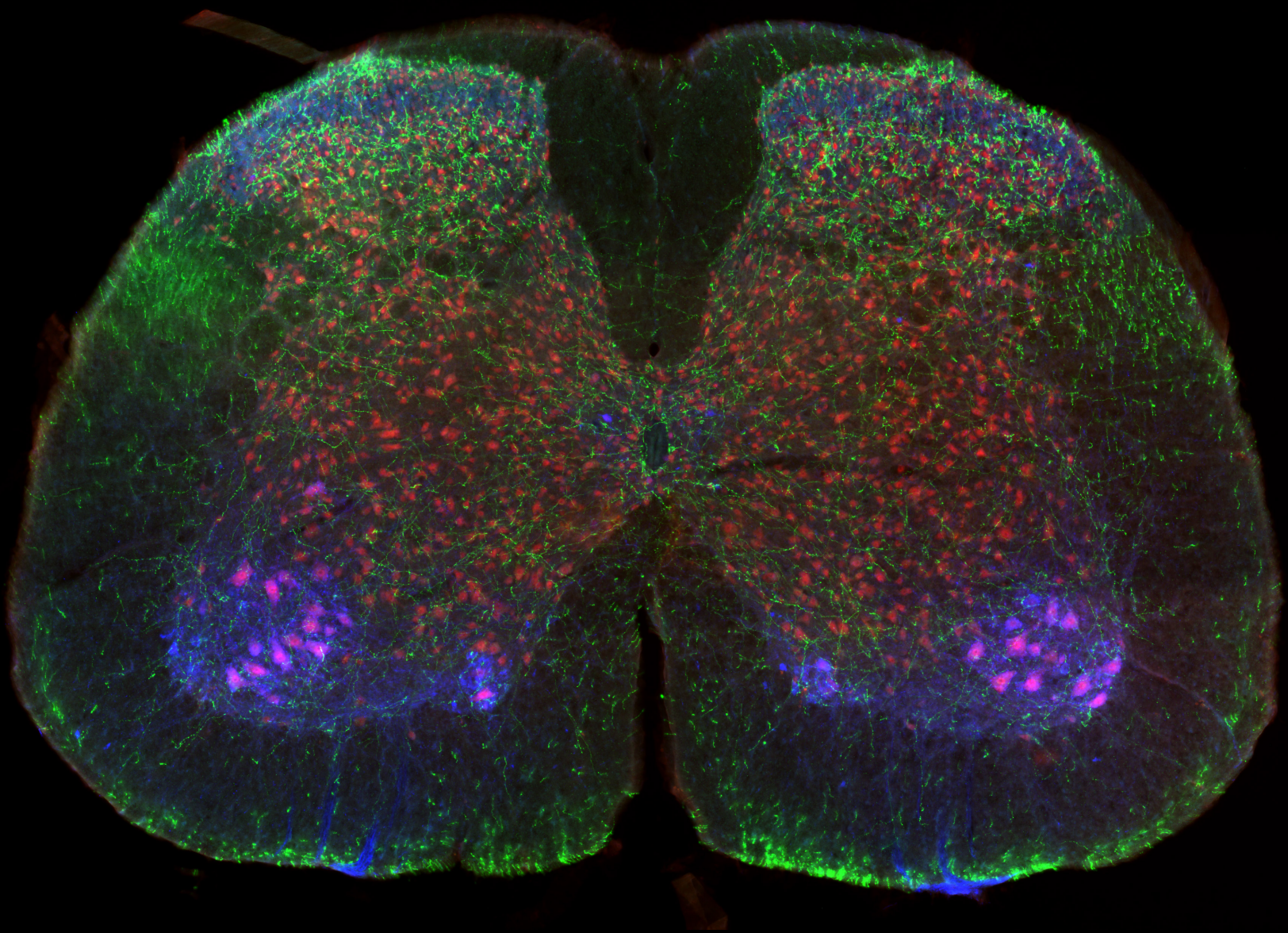
The Hillock

where efforts summate to actions

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



Volume 3 (December 2019)

The Hillock

Volume 3 (December 2019)

On the Cover:

Front — We tend to simplify the components of the spinal cord as we focus on a particular question for research when the reality is that the spinal cord is beautifully complex. This simple image of a cross-section of the lumbar cord highlights this complexity, revealing the diverse populations of neurons (in red) that reside in the spinal cord. Smaller neurons are located dorsally (toward the top of the image) while larger neurons (putative motor neurons) are seen more ventrally (toward the bottom of the image in purple). A subset of spinal neurons – cholinergic neurons — are labeled with choline acetyltransferase (in blue) highlighting their diversity distributed through the dorsal, intermediate and ventral parts of the spinal cord (many of the latter are motor neurons). Apart from their phenotypic diversity, these spinal neurons also receive descending drive in a complex and heterogeneous way – from the brain and brainstem, from other spinal levels and primary afferent feedback (note the small piece of dorsal root tissue attached on the left dorsal surface). One example of this innervation is shown here with a marker for tyrosine hydroxylase (in green), which innervates both spinal inter- and moto-neurons heterogeneously.

Lyandysha Zholudeva, PhD
Lane Lab

DREXEL UNIVERSITY
College of
Medicine
Department of Neurobiology and Anatomy

In This Issue:

Back — In the Toyooka lab, we study the cellular and molecular mechanisms of cortical development. When studying a newly discovered protein, it is important to uncover its cellular localization so we can hypothesize its functions in driving neuronal morphology and connectivity. My protein of interest, Activity-dependent neuroprotective protein (Adnp), has known roles in both microtubule regulation in the cytoplasm and as a transcription factor in the nucleus. In order to elucidate which function is likely responsible for regulating neuronal morphogenesis, I performed immunofluorescence staining to detect Adnp localization in primary cortical neurons before and after undergoing neuritogenesis. This is the after picture, from 48 hours in culture, where I was optimizing our Adnp antibody for the first time. You can see that Adnp (red) is completely co-localized with Dapi (blue nuclear marker), and not at all with B-III tubulin (green) the neuronal tubulin isoform exclusively expressed in the cytoplasm. However, all markings from the blue and the red channel (making a pink/purple color) appear almost completely identical suggesting that the antibody was not correctly optimized. I repeated this experiment at multiple antibody concentrations in triplicates and concluded that this was a failed experiment with artificial staining in the Dapi channel and some background. However, I enjoy the image because it reminded me of strawberries growing on a vine.

Sadie Bennison
Toyooka Lab

Letter From The Editors

While we are in awe that two years have passed since the emergence of this tradition, it is with great joy that we present to you the third issue of The Hillock. The success of this tradition is rooted in the exuberance of our department members to share with us their personal stories, and for that, we'd like to thank all of our contributors for making this edition possible.

We established The Hillock with the goal of uniting the community by sharing the rich narratives that weave through the fabric of our department but may not appear on the surface. In this endeavor, the inaugural issue of The Hillock marked the beginning of an effort to document the foundation and history of our department. In this issue, the history of our department reaches the inevitable present in Chapter 3, written by Dr. Itzhak Fischer. Dr. Fischer takes us through his ardent journey of leading our department from an orphaned spinal cord group to being ranked 24th among 140 NIH-funded medical schools. Through his journey, he reminds us that in order to sustain strong foundations we must turn towards future generations, a theme which is also exemplified here in a feature about the department's Neuroscience High School Summer Camp.

As usual, we cherish the culmination of our successes throughout this past year by highlighting featured research, faculty and student achievements, and community outreach efforts, including anatomy training for the FBI School of Operational Medicine (FBI-SOM) for its high-risk personnel.

The spirit of individuality and uniqueness that ultimately weaves us together is evident in written pieces from students and staff, and interviews of postdoctoral fellows, faculty, and alumni. We carry on old traditions, such as highlighting the creativity of department members, while also starting new traditions, such as showcasing our science support animals.

Our wish is that The Hillock nurtures the unique collegial nature of our department. We hope you enjoy reading these interviews and personal stories that shed light on our community members in ways that extend beyond lab benches and computer desks.

The Editorial Team
Sadie Bennison, Jani Bilchak, Shrobona Guha
Nancy Mack, Ankita Patil and Philip Yates

A View From the Chair

In this third issue of The Hillock, I had the privilege of writing the third chapter of our legacy section following the late and beloved Marion Murray and our previous legacy Chair Don Faber. It brought fond and amusing memories from the time we were located at EPPI (a state psychiatric institute), but also a reminder of the horrendous events of the bankruptcy, with feelings of loss and betrayal. But most importantly, it underscored the healing and rebuilding of the department and the resiliency of our staff and faculty.

We now have an amazing department in the Goldberger/Murray tradition of collaboration, mentoring and excellence, with a wide range of superb scientific projects, inspiring students and creative educators. Dr. Megan Detloff was promoted to assistant professor (tenure track), Drs. Michael Lane and Rodrigo España received their tenure, Dr. Jessica Barson was awarded her R01 grant, and Dr. Ramesh Raghupathi got his at the 1 percentile. That means that all the faculty we recruited over the last seven to eight years are funded by NIH grants and they are steadily moving along the promotion and tenure process. Soon enough we may have the same "predicament" that we had 10 years ago, of all senior faculty with no assistant professors in our ranks. Not a bad problem to have, but our system of promoting senior postdoc/junior research faculty has a pipeline of promising investigators like Dr. Liang Oscar Qiang, who has already submitted an R01. We have now achieved a record of more than $9 million in our grant portfolio, corresponding to a ranking of 24 among neurobiology/anatomy departments, out of 140 medical schools.

Our students received individual NIH fellowships, dean's awards, and other internal and external recognitions of excellence. Some, like Zachary Brodnik from Dr. España's lab, set records of excellence and productivity, in his case with seven first author articles and five as co-author. Our investigators also continued to receive awards for outstanding achievements, including Peter Baas, who was the recipient of the 2018-2019 Provost Award for Outstanding Scholarly Productivity – Career; Theresa Connors and Janet Smith who received Golden Apple Awards; Wen-Jun Gao, who received the Julian Marsh Faculty Scholar Award; and Kimberly Dougherty who received the Young Investigator Award. This year we have also started the process of postdoctoral progress review, which will allow us to track the quality of their mentoring and preparation to become independent investigators. We are the first department at Drexel to implement postdoctoral training policies and annual reviews, and I hope others will follow.

Our educators, under the leadership of Dr. Haviva Goldman, vice chair of medical education, led the successful transition into a new medical curriculum for Years 1 and 2 of the MD program. We have recruited a brilliant new educator, Caitlin Howe, who as she was moving to Drexel, managed to organize an anatomy training for the FBI School of Operational Medicine (FBI-SOM) for its high-risk personnel. In appreciation, we received a letter from Michael Biamonte, the manager of FBI-SOM. I hope that Caitlin will continue these types of programs for the military as well, as she has done in her previous position. The creative Artistic Anatomy course we have had for seven years received additional recognition from National Geographic in their story, "Leonardo – A Renaissance Man for the 21st Century" (May 2019 issue). They cited our course as one of its kind in the tradition of Leonardo, and included a nice summary and photograph of both art and medical students at the Anatomy Lab.

In this end of the year holiday event, beside the good food, we acknowledge the excellence of individuals with awards, we spoil the children with presents from Santa (aka Dennis and his elves) and we spend happy time together ready for the challenges of next year.

Itzhak Fischer, PhD
Professor and Chair

Itzhak Fischer with Don Faber at a Drexel tuxedo event.

The History of the Department of Neurobiology and Anatomy

CHAPTER 3:

My First 28 Years

by Itzhak Fischer, PhD

Professor and Chair of the Department of Neurobiology & Anatomy. He has been with Drexel and its predecessor institutions since 1991.

Coming to MCP, 1991-1994

The first thing I remember about Medical College of Pennsylvania (MCP) is an invitation I received to come and give a seminar following collaboration with Pat Levitt. Hazel Murphy was serving as interim chair together with the elite female faculty including Marion Murray and Rhea Levine, and the colorful characters of Michael Goldberger and Tim Cunningham. They were certainly different from the Harvard community in which I had worked, first as a postdoc and then as an Assistant Professor. It turned out that they wanted to recruit me, which I initially did not consider seriously. (We had just bought a house in the Boston area, and Philadelphia looked like a disaster area because our friends who hosted us took us through the worst parts of the city). But Jonathan, my oldest child, was already in middle school and we could not wait much longer. Besides, Hazel offered me a fantastic salary of $63,000. So, I tentatively accepted. Gloria, my wife, was upset and did not cooperate. She decided to take the children to "visit home" (Israel) and return when all was ready. A few weeks later, I was ready for a second visit to organize my new lab space…

And then, I received an urgent call to come for an important meeting. It turned out that the spinal cord group received an offer to move to Jefferson, and they wanted to update me. It was, however, a false alarm, and in September 1991 I found myself on the 8th floor of the EPPI (Eastern Pennsylvania Psychiatric Institute). I continued my research work with the cytoskeleton, but also wrote a supplemental grant to the existing spinal cord PPG and started to show interest in regeneration and in vivo work. Essentially, Marion seduced me into the darker force of SCI, and I lost my status as the lone cell biology Jedi.

Michael tragically died in 1992, less than a year after my arrival. Hazel nursed him in her house, and I never forgot her generosity. So, when she named me as a guardian of her children, Kristina and Rus, adopted from an orphanage in Siberia, I could not refuse. I was praying for good health of their mother, but she did not stop getting into financial, marital, emotional and physical troubles. I followed Kristina and Rus as they became adults. Sadly, Kristina died last year from complications of vasculitis.

Michael and Kristina's deaths were not the only terrible losses in our history. Lesley Boyne, an incredibly talented and wonderful person, who was a postdoc in my lab, died of cervical cancer as she completed her final stages of adopting a child, on February 7, 1996. In her

Itzhak Fischer with John Houle in a meeting (mid 90's).

Itzhak Fischer with Marion Murray at her house.

last few weeks, she showed up at court in a wheelchair to finalize the process and a short time later passed away. During the final months of her life she was hospitalized at MCP and, at some point, when the chemotherapy and radiation treatments did not work, she decided together with her parents, Linda and David, to terminate further interventions. I vividly remember our visits during the Hanukkah holidays a few months prior, when we lit the candles with her, realizing that we were going to lose her soon. Then Rhea Levine died of colon cancer on January 19, 2002, bravely fighting her illness until the last few weeks. We established in their memory the Goldberger, Boyne, Levine Endowment, which funds special awards and small grants to young faculty and postdocs in their memory.

The Arrival of Don, 1994-1999

The tradition of a shock arrival continued with Don Faber as our new chair. A few weeks before his starting date, he had a bicycle accident that sent him flying over the handlebars, hitting his head and suffering a concussion and temporary amnesia. He recovered and started a recruiting program, bringing electrophysiologists and molecular biologists, and we became a very successful department. The PPG group met regularly at Marion's house for professional discussions and fun with families and children. In the meantime, at EPPI, our departmental home, the elevator operator decided that Don and I were brothers, probably because of our curly hair and moustaches (in fact, we now call each other brothers, as we only have sisters). The 10th floor above us had been promised to Don for major expansion in the future, but it was never renovated. Apparently, these promises had been made to all new chairs in the past. The basement of the building (called "the cage" because of the wire barrier), became the dumping ground for old equipment. It was a scary place where you could get lost or buried by an avalanche of junk.

All was well, and then…

The déjà vu of moving the spinal cord group repeated with Don at the helm. This time it was an offer to move to University of Louisville where Chris Shields, chair of neurosurgery, Scott Whittemore, director of the spinal cord research center, and their dean, invited us for a visit. We came with our families to a royal reception including viewing of the fireworks from the top of the neurosurgery tower and meeting with realtors to inspect houses (often with a yard set for a horse). Don was negotiating a multi-million-dollar deal, but at the end it was clear that not enough of the group would be willing to trade the Mummers Parade for the Kentucky Derby.

All was well, and then…

At first, everyone was excited about the expansion and opportunities to hire new faculty and build new programs. It started with the merging of MCP and Hahnemann. It sounded great in theory, but not the way it was done, when equivalent departments from both medical schools were melted into an academic mess and confusion.

Leadership hired a consulting company to come up with an appropriate name for the new University and health system (for the modest fee of $50,000). They were instructed to find a name that would encapsulate the legacy of MCP and Hahnemann in Philadelphia, but our leaders in their great wisdom decided on Allegheny University, which refers to a county in Western Pennsylvania. Allegheny College, which is in Western Pennsylvania, sued and we received another bill for settlement.

This was just the beginning. The uncontrolled expansion became a major disaster and eventually led to the collapse of the system. Vendors refused to accept orders, our retirement statements were delayed, recruitment stopped, support staff were fired, and one day the announcement of bankruptcy hit, shocking and frightening us. It was not clear that we would have a place to return. The health system dragged the medical school down to the tune of $1.5 billion (with a B). It did become a textbook case about disastrous management (see Burns et al., 2000), but it is no longer unique compared to current events.

Becoming Chair, 1999-2013

By 1999, the rescue plan included a tentative partnership with Drexel, the arrival of Tenet Health System and the closure of MCP. For us the plan was to move from EPPI to the Queen Lane Campus. I was nominated as interim chair to lead a decimated department with most senior faculty leaving, including Don, who had a great offer to become chair at Einstein in New York City near his family, and

Pat who left for Rutgers also to become chair. Our grant portfolio decreased dramatically to just over $2 million, and we felt betrayed, moving into an unknown future. Although we received a training grant during that period, we found it difficult to attract students and postdocs. Following a search, Warren Ross, appointed me as the official chair. Moving to Queen Lane was a somewhat surrealistic affair because we had a small budget for renovation, while most of the space remained as empty labs for future recruitment. I remember getting the floor plans and having to design a virtual department with regard to structure, chemical hoods, shared rooms, tissue culture, etc.

We developed a plan with the following principles:

- Build and focus on existing strength using the current leadership, with Marion leading the spinal cord group and Barry Waterhouse the systems group. The plan was to build cohesive and collaborative groups and offer guidance to assure success of new investigators, helping them set their labs, sharing equipment and reviewing their papers and grants.
- Keep the culture that Marion and Michael established – supportive, diverse and friendly – embrace families, and promote a sense of community. Indeed, our end of the year departmental party included an in-house Santa (Dennis DePace) with a count of children for presents.
- Deal with the first phase of rebuilding and recruitment as a crisis management project. Make speedy and decisive moves, take personal responsibility, minimize lengthy deliberations: what Marion used to call my "tank commander" syndrome.
- Integrate our educators by adjusting their salaries to be competitive and having our entire faculty teach the medical courses (although the teaching burden for research faculty remained modest).
- Encourage a research faculty track (non-tenure) to establish "in-house scientists" to help senior faculty run the lab and mentor students.

The Fischer Lab 2005 (standing – Courtney Paul (technician, now MD), Joe Bonner (graduate student, now at the NIH), Dr. Fischer (still here), Birgit Neuhuber (Res Assistant Professor), Carla Tyler-Polsz (technician), Maryla (lab manager), kneeling – Alissa Barshinger (technician), Robert Kushner (technician)

Itzhak Fischer with the office (Joy, Janet, Kathy and Anna)

It was very fortunate that a core leadership remained, as well as our amazing educators who continued the medical teaching uninterrupted (Dennis DePace, Janet Smith, Jed Shumsky, Francis Sessler), with Francis also planning and supervising our computing facilities and our accounting shadow system. Greatly contributing to my confidence in rebuilding the department was the office staff with Kathy Golden becoming my assistant and loyal partner, Janet orchestrating essentially all the departmental activities (which she described as managing 20 small businesses run by prima donnas) and Joy Hudson sharing her expertise as teaching and grant coordinator.

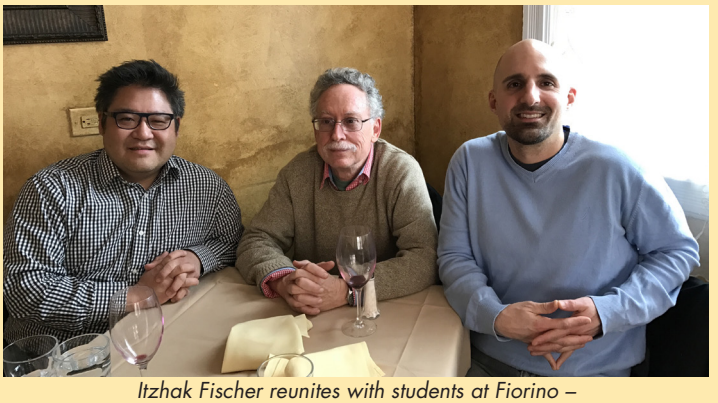
Within a few years we had new faculty, who are bright, energetic and collaborative, including Wen-Jun Gao at the associate professor level and Peter Baas as professor. We also had faculty who came from Drexel Biomedical Engineering including Ilya Rybak. Rybak assembled an amazing computational group with international reputation, and I discovered that he is eight hours older than I am (we have since celebrated our birthday at Fiorino). Another faculty member, Ramesh Raghupathi, came from Penn as a TBI expert to complement the spinal cord group. John Houle arrived as the new director of the spinal cord research center, assembling an incredible group of talented postdocs, students and technicians, and leading the renewal of our PPG. John proved himself to be an outstanding scientist, a generous person and a great mentor. As described later, three of his postdocs (Veronica Tom, Marie Pascale Cote, and recently Megan Detloff) have been mentored into tenure track positions in our department.

The partnership with Drexel continued to evolve, and eventually we merged with the University (separated until recently by a financial firewall because of worries about medical liability). We also developed a joint neuroengineering program with Biomed and then a collaboration with Biology, and we had a feeling of a secure academic environment. Drexel was giving a bonus of $5,000 to investigators who received more than $1 million in grants (the 10^6 Club). However, they soon realized that, as a typical NIH R01 grant in the medical school was >$1 million, they could not afford this benefit. I managed to receive two of them, which included dinner at the president's villa with valet parking.

Our teachers were amazing, taking full responsibility to navigate three major courses with labs in two different curriculum tracks including the PIL, which required managing multiple small groups. The teaching mission got a major boost with the recruitment of Haviva Goldman, who was not only a terrific educator, but also extremely well organized; she managed for a while to continue her bone structure research while teaching. She even convinced the Department of Orthopedic Surgery to pay for her imaging facility in return for training residents in research.

Our educators also generated outside income from teaching Gross Anatomy for Arcadia University and developing online remediation courses. Dennis loved to produce dissection videos, Haviva started the digital slide project at the local and national level, and Bruce Hirsch, our other educator recruit, brought respectability to the profession with his bow tie and ponytail.

My research was going well, and one of my grants had a score of 1.2 percentile, but my enthusiasm was dampened by my NIH program officer, who assured me that "from here on there is only a downhill route." I had a sequence of brilliant graduate students (Steve Han, Angelo Lepore and Joe Bonner) who published numerous great papers and were able to secure positions at Harvard, Jefferson and NIH, respectively. I also started a new research program using neural stem cells (at the very early days of the field) in an exciting collaboration with a pioneer in the field, Mahendra Rao, with whom we have more than a dozen papers. And so, we have grown to a mid-size department, with a grant portfolio of about $5 million, and a ranking of about 40 among similar departments of all 140 U.S. medical schools.



Itzhak Fischer reunites with students at Fiorino – Steve Han and Angelo Lepore

Becoming a Chair Again, 2013-2017

And then it started all over again when we realized that the department had "matured" with the promotion and tenure of the faculty recruited over the previous 12 years, and that we no longer had junior faculty at the assistant professor rank to build and sustain future programs. I had no recruitment packages, and considered stepping down, in the hope that a new chair would get new resources for renewal of our faculty ranks. But the school had budget difficulties and no appetite for expansion, so it became apparent that it was unlikely to invest new resources in recruiting a new chair and young faculty. We needed to create a new model for recruiting and mentoring junior faculty, and develop new strategies for supporting such growth without the standard packages allocated by the university. Basically, we had to reinvent the department as a small business entity with creative academic and financial attitude as follows:

1. Develop in-house mentoring for identifying and training new faculty, starting with promising senior postdoctoral fellows; promote them to a PI status as junior research non-tenure track faculty (instructor), allow them to submit grants (mostly to foundations) and gradually let them develop PI skills. By the time they obtained a major NIH R01 grant, they would not need much of a recruiting package (as they already had space, equipment and a major grant to fund their salary and lab expenses), and we got a known and well-trained faculty member. This strategy led to the appointments of Veronica (by now associate professor), Marie, Megan and Shaoping Hou (the first three were mentored by John Houle and the fourth by Veronica as a third-generation mentor).
2. Leveraging the budget formula and external sources of income to generate recruitment funds. The budget formula (based on partial indirect cost return and "excess" faculty salary coverage by grants) allowed us to accumulate and roll over funds into a faculty development cost center. At the same time, steady income from online remediation courses, teaching Gross Anatomy for the PT program of Arcadia University, Neuroscience summer camp and a Gross Anatomy course for art students (the only of its kind in the U.S., see link to an NPR program on this unique course), allowed us to create a special fund account for departmental needs. These funds were leverage for recruitment with our own money, making a compelling argument for a new position with no package by the university. This strategy was used to recruit candidates with NIH K99 funding, which provided a critical financial boost to the modest departmental package. In some cases, we received partial support from the school, mostly equipment for replacement positions when faculty left (Michel Lemay and Barry Waterhouse). Again, our priorities were focused on team players who were a good fit into existing programs. This way we recruited four additional assistant professors (Rodrigo Espana, Kim Dougherty, Jessica Barson and Michael Lane) for an amazing total of seven new faculty in the last five years. Number eight is pending in the promotion of Megan Detloff to a tenure track position.
3. All of the new faculty are NIH funded, and as a result our grant portfolio increased from $5 to $7.5M and our Blue Ridge departmental ranking rose to 21 (among all 140 medical schools based on NIH funding).
4. **Update for 2019:** Megan got her R01 and was promoted to assistant professor; Rodrigo, Michael, Veronica and Kim were promoted to associate professors. We recruited Dong Wang, who received his R01 funding within a year. Our grant portfolio increased to $9.1M. Tenet left, and the new owner had the hospitals (Hahnemann and St. Christopher's) going bankrupt within a year. On a personal level, I celebrated 45 years of marriage, Danny, my son, graduated from Drexel medical school and began his residency at Abington Hospital, and I have two grandchildren (Jack and Fiona).

References

L R Burns, J Cacciamani, J Clement and W Aquino
The fall of the house of AHERF: the Allegheny bankruptcy
Health Affairs vol19, no.1 (2000):7-41

Supporting Biomedical Science Career Diversity at Drexel

by Elisabeth Van Bockstaele, PhD

Dean, Graduate School of Biomedical Sciences & Professional Studies; Vice Provost of Graduate Education; Professor of Pharmacology & Physiology

When I arrived at Drexel in Fall 2013 as founding dean of the Graduate School of Biomedical Sciences and Professional Studies in the College of Medicine, I had many ideas about how our Graduate School could support graduate students. Of utmost importance was ensuring that graduate students understood the many diverse career paths that exist for graduates with a PhD in a biomedical science discipline. The key was to expose them to these careers early in their scientific training and help them develop a network of professional contacts as they progressed in their academic studies. Another critical element was to engage the faculty in this important endeavor. I was fortunate to find like-minded faculty who were eager to join the effort and senior graduate students who were willing to contribute their time and talents to developing the programming. Over the past several years, we have hosted several successful professional development events, most recently Building Bridges Between Academia and Industry. We have had significant input from Neuroscience program faculty and students (Dr. Jed Shumsky, Dr. Ramesh Raghupathi, Dr. Paul McGonigle and Ankita Patil, among others) in the development of the programming. Below is a summary of tips from these events:

Be Open-Minded

Speakers at our events worked in diverse scientific careers including medical writing, marketing/sales, medical science liaison, nonprofit administration, government positions, biotech, big pharma, patent law, regulatory affairs, entrepreneurship, medical/clinical operations and clinical research. Common to many of their stories is that their career paths took unexpected twists and turns. Importantly, they were always open to investigating different career opportunities and exploring whether different jobs might be a good fit for them.

Acknowledge the Value of Transferable Skills

PhD training affords students the opportunity to develop a host of important skills away from the bench. Some of these include working in a team setting, writing manuscripts, reviews and grant applications, giving oral presentations, receiving and responding to criticism, working on tight deadlines, mentoring others (such as undergraduate students and junior graduate students), leadership via service on GSA and committees, and coping with failure. These experiences provide foundational support for many different scientific careers.

Be True to Yourself

PhD training is a time to discover what you like and don't like spending your time on. If you discover that you do not enjoy public speaking, it's probably not wise to take a job where this is what you will be doing most of the time. Similarly, if you have young children and need to be at home to provide for them, a job with a lot of travel is probably not ideal. Understanding priorities in your life and factoring in work-life balance is key to identifying a career that complements your lifestyle.

Be Prepared to Pivot

Adaptability is another trait that our speakers highlighted for success. In big pharma, it is possible for an entire division of the company to close on short notice. Being adaptable and embracing change is key to successfully navigating these times. Our speakers and panelists valued the multiple positions they held and acknowledged that moving from one job to another enabled them to mature and grow in their professional careers, as opposed to become stifled in one position.

Common to all speakers and presenters at these professional development events is that they found their time obtaining their PhD rewarding and highly valuable. This was particularly true when their PhD advisors were supportive mentors. I have found Drexel to be a place that firmly believes in supporting its graduate students. From my arrival, it has been clear that graduate students drive the research enterprise. I have also found a genuine desire to support graduate students in and out of the classroom and, importantly, in guiding their future career paths.

The graduate program in Neuroscience is a leader in this area, with engaged faculty and senior leadership who prioritize student success and wellness. I was delighted to learn of an outreach by a third-year PhD student in Neuroscience, Andrey Borisyuk, who attended the recent conference on bridging academia and industry. Andrey stated: "The event last night was so informative, eye opening, and organized so well that I wanted to thank you and your team for realizing this event. Personally, these types of events should be held yearly for us grad students and especially introduced during orientation to the graduate program." It was gratifying to learn of the interest of current Neuroscience students in volunteering for future professional development events, as we are always looking to include graduate students in our program development.

Finally, our events have been enriched by our Drexel alumni who have gone on to satisfying and successful diverse biomedical science careers and who return to campus to share their journeys and tips for success. Our speakers, panelists and roundtable participants give willingly of their time to help the next generation of scientific leaders. Our Drexel graduates recognize and value the strong mentoring environment and support they received during their graduate training in the College of Medicine and want to give back.

I look forward to 2020 and continued input from the Drexel Neuroscience community in shaping future professional development events that assist our current graduate students in finding rewarding careers that match their interests and lifestyles. •

Research Highlights

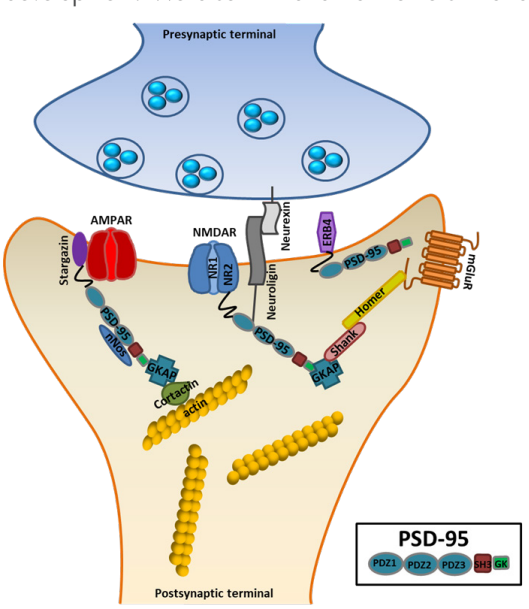
Revealing the Effects of PSD-95 Deficiency in the Prefrontal Cortex

by Austin A. Coley, PhD

I joined the PhD program in the Neurobiology and Anatomy Department at Drexel University College of Medicine in Dr. Wen-Jun Gao's Laboratory in 2014. Dr. Gao's laboratory focuses on understanding the cellular and molecular underpinnings of neuropsychiatric disorders such as schizophrenia and autism. His laboratory combines electrophysiology techniques with biochemical and behavioral assays to address these questions. My thesis project focused on the development and synaptic function of the prefrontal cortex (PFC), which is responsible for cognition, working memory, emotional control and sociability. The goal of my project was to determine the effects of postsynaptic density protein-95 (PSD-95) — a highly abundant scaffolding protein involved in trafficking NMDARs and AMPARs to the postsynaptic membrane — in the PFC (Figure 1). PSD-95 is responsible for synaptic maturation and has recently been implicated in schizophrenia and autism. However, the effects of PSD-95 deficiency within the mPFC remained unknown. To test this, I utilized a combination of techniques to identify the effects of NMDAR and AMPAR presence and function due to PSD-95 deficiency within the medial prefrontal cortex (mPFC). For instance, using Western Blot techniques, I showed PSD-95 deficiency causes a significant increase in NMDA receptor subunits and a decrease in AMPA receptor subunits at the adolescent age range in a PSD-95 knock-out mouse model. Using whole-cell patch clamp techniques, I showed a significant increase in NMDAR/AMPAR-transmission in layer V pyramidal neurons in the mPFC of PSD-95 knock-out mice. These results revealed PSD-95 deficiency alters PFC glutamatergic transmission during a critical period of PFC development. We also showed PSD-95 deficient mice exhibit behavioral deficits that include learning and working memory impairments, and reduced sociability. These findings were recently published in the *Scientific Reports* journal entitled "PSD-95 deficiency disrupts PFC-associated function and behavior during neurodevelopment" (Coley and Gao, 2019).

In an additional project, I examined mPFC neural circuit function in response to PSD-95 deficiency. The mPFC contains major reciprocal connections with the MD (mediodorsal thalamus), which is responsible for the development and function of the mPFC via glutamatergic transmission. The MD also contributes to mPFC-associated behavior such as cognition and working memory. Our goals were to explore how PSD-95 deficiency impairs mPFC connectivity by utilizing a PSD-95 deficient mouse model to better understand mPFC neural circuitry and associated behavior and further determine the effects of PSD-95 deficiency at a pathway or input-specific manner. We utilized optogenetics and *ex vivo* whole-cell electrophysiology techniques to examine NMDAR- and AMPAR-mediated synaptic functional properties at intra-cortical (IC), cortico-cortical (CC), and thalamo-cortical (TC) inputs to the mPFC. Our results showed there are profound differential effects of NMDAR function at CC and TC synapses in PSD-95 deficient mice compared to control mice, indicating input-specific changes that occur in response to PSD-95 deficiency. This study provided greater insight into understanding mPFC connectivity and the effects of PSD-95 deficiency at specific inputs that may relate to mPFC-associated behavioral abnormalities.

Outside of the laboratory, I aimed to assist in community outreach programs to enable minority students into STEM at St. James School and Trenton's Upward Bound program in Philadelphia and New Jersey, respectively. I also facilitated a visit for Virginia Union University (VUU) students to tour the Gao Lab. Additionally, I was an invited seminar speaker in the Natural Sciences Department at VUU in 2018. During these talks, I discussed my research as well as the journey to obtaining my PhD. I have now begun my postdoctoral fellowship at the Salk Institute for Biological Studies under the mentorship of Dr. Kay Tye. My work will investigate the neural circuits and behavior, as well as state-dependent and region-specific cellular aberrations implicated in schizophrenia and major depression disorders using ex-vivo electrophysiology and Ca2+ imaging techniques. I will continue my goal of becoming an academic professor in the neuroscience field where I can mentor and train others in a laboratory and classroom environment. •



(Left) PSD-95 interactions in the PSD. An illustration describing the molecular organization of the postsynaptic density (PSD) located in the dendritic spine of glutamatergic synapses. Postsynaptic density-95 (PSD-95) contains direct and indirect interactions with many macromolecules at the PSD. PDZ1 domains of PSD-95 bind directly to N-methyl-D-aspartic acid receptors (NMDARs), more specifically, GluN2-containing NMDA-receptors. PSD-95 also interacts with ErbB4, neuroligin, and nNos. PSD-95 has indirect interactions with α-amino-3-hydroxy-5-methyl-4-isox-azolepropionic acid receptors (AMPARs) via stargazin. Other indirect interactions include group 1/5 mGluRs via GKAP, shank, and homer; and actin polymers via GKAP and cortactin. nNos, Neuronal nitric oxide synthase; GKAP, guanylate kinase-associated protein; mGluR, metabotropic glutamate receptors.

Perspectives as an MD/PhD Candidate

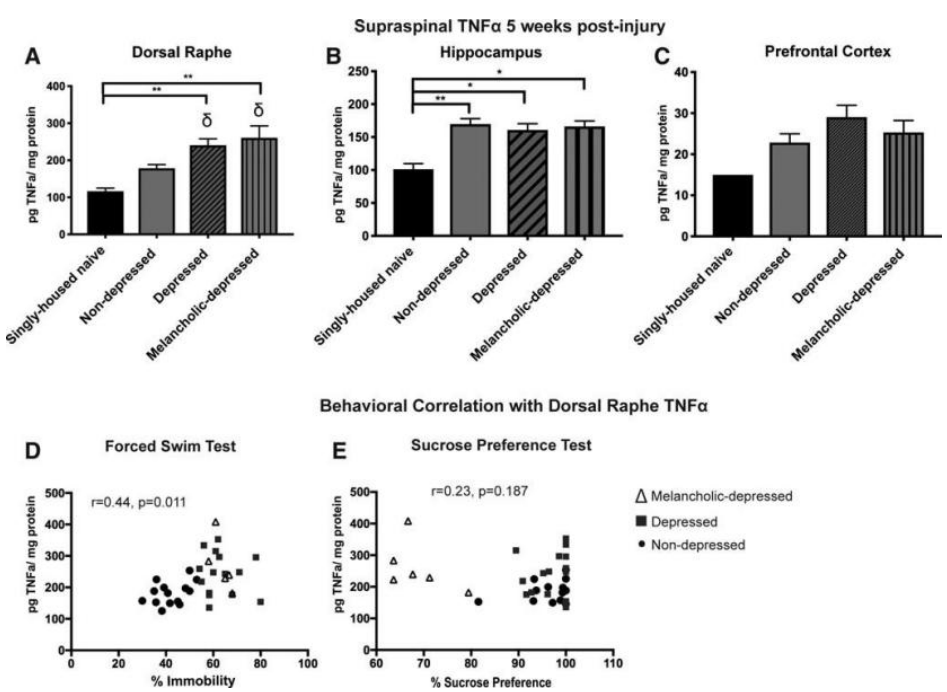
by Kaitlin Farrell, PhD

I developed an interest in neuroscience at a fairly young age, after dissecting a sheep's brain in high school biology. My undergraduate experience in the neuroscience department at the University of Pittsburgh afforded me fantastic opportunities to explore both research and clinical aspects of the field, fueling my desire to obtain a dual degree. As such, we have a unique opportunity for both of these aspects to inform the other: bench-to-bedside-and-back. My initial research centered on movement disorders and dopaminergic circuitry, so spinal cord injury research felt like a natural progression for me. However, during my first two years of medical school, I felt drawn to neuroinflammation and the use of biologics to treat autoimmune disorders. My dissertation work combined these areas of interest to explore a lesser-studied aspect of SCI: affective disorders after injury.

Major depressive disorder (MDD) is attributed to an imbalance of the serotonin system that includes neurons of the dorsal raphe nucleus (DRN) involved in modulation of affective features such as attention, working memory and emotional control. In addition to motor, sensory, and autonomic dysfunction, patients with spinal cord injury (SCI) are at three times the risk for MDD compared to the general population. Not only is this condition frequently underdiagnosed in the SCI population, but it has a serious adverse effect on morbidity after injury. Inflammation is implicated in MDD pathology as elevated levels of pro-inflammatory cytokines (TNFα and IL-6) frequently are detected in the serum of MDD patients, and intracerebral administration of TNFα can elicit depressive-like behaviors in rodents. In a rat model we correlated elevated DRN levels of TNFα at 5 weeks post-SCI with depressive phenotype. My next step was to utilize a novel biologic, XPro1595 (a dominant-negative inhibitor), to attempt prevention of the development of depression after SCI. Acute peripheral inhibition of soluble TNFα with XPro resulted in an increased incidence of depression, yet central intracerebroventricular (i.c.v.) administration had no effect on incidence. These results revealed the complex nature of the immune response after SCI and highlight the progress we need to make in the area of immune modulation.

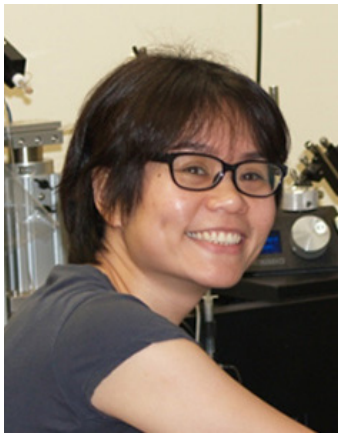
For the next part of my dissertation, I explored a technique that was novel to both myself and my mentor. Using whole-cell patch-clamp electrophysiology, I discovered a decrease in excitability of DRN serotonergic neurons of post-SCI depressed mice based on intrinsic membrane properties. Our findings suggest that intrinsic neuronal changes in serotonergic excitability may contribute to the development of SCI-depression, providing beneficial insight in identifying potential future therapeutic targets.

After defending my dissertation, I returned to the clinical years of medical school. My doctoral training has drastically shaped the way that I approach diagnosis and treatment planning. Knowledge of basic science is crucial to understanding the vast symptomatology of each pathological condition. Additionally, my training in scientific testing and interpretation provides a solid foundation to analyze laboratory values for each patient. Although the next few years of my training are pre-determined, I look forward to applying my scientific training to advancing therapeutic treatment in the field of neurological disorders. •



Above: An increase in the inflammatory cytokine TNFα in the dorsal raphe is seen to correlate with a depressive phenotype.

Research Highlights, *cont.*



Intrinsic Properties and Connectivity of Spinal Central Pattern Generator Interneurons

by Nesta Ha, PhD

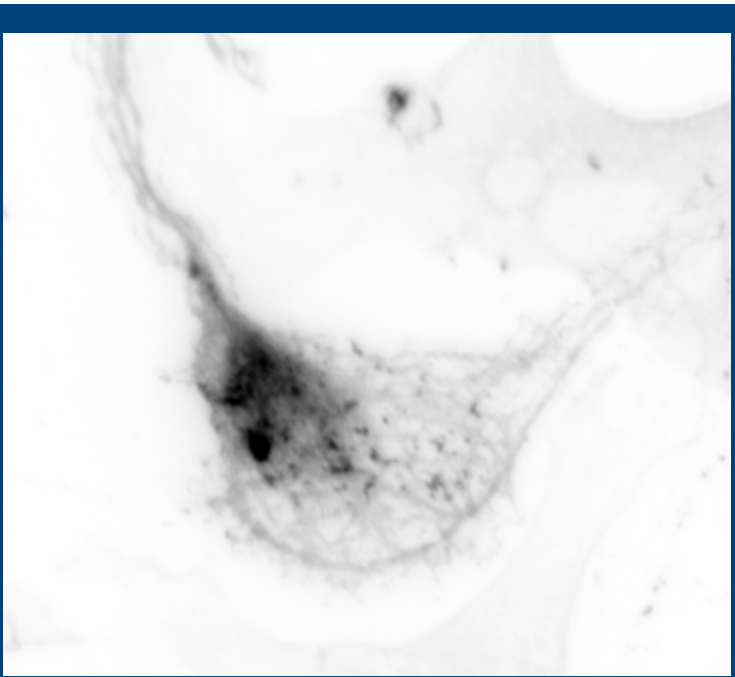
Hindlimb locomotion, or walking, is a highly stereotypical and coordinated activity that is characterized by alternation in flexor and extensor muscles on the same side of the body and alternation of the same muscle types on the opposite side of the body. Even though we do not think about walking (as it is so basic to our daily life), it is a complex motor behavior that involves many neuronal circuits and can be heavily influenced by the information gathered from the sensory system.

The initiation of walking takes place in the brainstem, but the basic rhythm and pattern of locomotion can be generated and controlled entirely by a neuronal network located in the lumbar region of the spinal cord. At the top of this network lies the rhythm generating neurons, which are capable of producing the rhythm or timing and regularity of locomotion and activate downstream neurons in a coordinated fashion without the need for higher-level input from the brainstem. The mechanisms by which these spinal rhythm generating neurons generate the rhythmic signal are generally unknown; however, studies from other systems have suggested that rhythm generation can arise from intrinsic properties of component neurons, their network connections, or an interaction between the two. My interest has always lay in spinal circuitry and specifically in how the rhythm is generated and the determination of the neurons that are involved. Therefore, the main goal of my PhD project was to investigate the mechanisms underlying spinal rhythm generation in a population of rhythm generating neurons that can be identified by the transcription factor Shox2.

I used spinal cords isolated from transgenic neonatal mice in which Shox2 interneurons are fluorescently labeled. This preparation allows me to elicit a fictive locomotor pattern that mimics the basic form of walking with neurotransmitters and, at the same time, has the ability to visualize and record Shox2 interneuron activity during the static condition and during fictive locomotion using whole-cell patch clamping. I have identified two types of connections between these neurons: unidirectional connections mediated by chemical transmission and bidirectional connections mediated by electrical transmission. Interestingly, electrical coupling, though prevalent in neonatal mice, starts to decrease in strength and incidence roughly three weeks after birth, suggesting developmental changes and that electrical coupling might be implicated in promoting locomotor rhythmicity in young mice. In addition, I found that a subset of these neonatal Shox2 interneurons are capable of maintaining rhythmic activity in the absence of fast excitatory drive from the network, suggesting that both intrinsic properties and connectivity play a role in the rhythmic activity seen in Shox2 interneurons.

The results found in my neonatal studies can be used as a stepping stone for the investigation of mechanisms contributing to spinal rhythm generation during development. My studies, therefore, complement nicely another line of work in the lab, which is spearheaded by Dr. Leonardo Garcia, suggesting that there are differences in the intrinsic properties of these Shox2 interneurons in the mature spinal networks. Given the changes that we see, this might be one of the explanations as to why spinal rhythmogenesis remains elusive. Now, combining our experimental data with computational modeling, we can test for the possibility of a developmental switch in the arrhythmogenic mechanisms underpinning locomotion.

Besides being a PhD student, my second career/passion is soccer (and if you did not know by now, "Nesta" is from Alexandro Nesta, the greatest Italian soccer player!). Therefore, I am extremely grateful to be surrounded by friends and colleagues at Drexel who share the same interest. We always joke that we belong to the National Academy of Soccer and that we should publish/create our own soccer journal. Hopefully, one day I will be able to combine my love for soccer and science! •



Growth Cone BIII Tubulin
Philip Yates

Faculty Interviews

Journey from Drexel and Back

An interview with Liang Oscar Qiang MD, PhD, by Shrobona Guha

Liang Oscar Qiang, MD, PhD, is a research assistant professor in the Department of Neurobiology & Anatomy.

SG: So, you have an MD degree and a PhD. What made you decide to pursue a PhD after an MD?

LQ: I thought I wanted to be a doctor originally, but then after medical school, I found it interesting to do basic research. I had done summer internships in universities as a medical student back in China. I found science really interesting with all the techniques and use of new, ever-evolving technology. I think medical education is different from science and science involves more creative thinking. I wanted to be a doctor who could also conduct research, but at one point when I had to choose, I chose science.

SG: Why did you choose to move to the United States for your further studies?

LQ: I think there is a lot of freedom in the U.S. in terms of what you can do. The medical science in the U.S. was way better at the time I decided to pursue a PhD but now the research in China is catching up. The U.S. is a hub for research, where it is easier to collaborate and learn new technologies.

SG: How did you come to join Dr. Peter Baas' lab as a graduate student?

LQ: During my interview for the program, Peter interviewed me as the program director. I had a lot of interest in cell culture work. I had previously used non-neuronal cell culture work in China. Peter introduced me to the work in his lab and I was very impressed by his work. So, when I joined the program, I thought that was where I should go. I did do one rotation with Dr. Gianluca Gallo, who works with actin. Both of the mentors were really nice, and it was a very difficult decision for me to make at the time, but I went with my first instinct and chose Peter's lab.

SG: After graduating, you were a postdoc at Columbia University. Can you tell us a little bit about the kind of research you conducted there?

LQ: I did my research on using the reprogramming of stem cell technology to model neurodegenerative disease. I studied Alzheimer's and Parkinson's disease in Asa Abeliovich's lab. I learned a lot of techniques and technologies in cell reprogramming, as well as iPSC. The transition from microtubule research to stem cell research was hard for the first half of the year and I had to read a lot. A bit of advice for students seeking to transition would be that all the students should be prepared for the stress. When you stay in the same field there is an adaption in the new lab environment but when you decide to change your field, sometimes you may want to broaden your environment, broaden your research. I think it's healthy to want that, but I think it is normal for people to feel stressed out and anxious because you're going into a new field.

SG: Then you moved to an industry job after your postdoc? How did you make that decision to move from academia to industry? Why did you move back?

LQ: I was looking for both academic and industry jobs before I joined a startup company. The company gave me the freedom to try my own ideas, utilize my knowledge to plan my research. It was different and I enjoyed my time there. Industries focus more on profit, like how to get a patent, how to get a product; while in academia, you think more about how to get your grant funded, how to get your papers published. I was in that company for 2 years; I got the industry experience, but I still liked the uncertainties that came with science. In an industry, you know what your goal is and that's what you should get with a product. I can't say which one is better. I liked the hypothesis-driven nature of science in academia. I also like to be surrounded by young people and talking to people who want to learn things. It's very refreshing and rewarding to see that. So, when Peter had a grant on stem cells and he needed a person to work on it, he reached out to me. I kind of wanted to come back to academia, so here I am. And it's Drexel! I like Drexel; it's less stressful and the people here are very nice so I came back. A big challenge though was the pay cut, because in industry they paid you double the salary in academia. I decided to take that cut to do what was interesting to me.

SG: Having worked on varied fields of research what do you consider your true research passion?

LQ: Oh, I think it's to work on neurodegenerative or neurodevelopmental disease, mostly because of my medical background. I also want to learn about the plasticity of neurons. What can a normal or diseased neuron do to fight on their own? What's the molecular basis of plasticity, the molecular basis of developing and treating a disease? That is very interesting to me.

SG: What would you consider your most memorable discovery?

LQ: I think it was my first paper with Peter, where we found that Tau protects the Katanin severing of microtubules. It has now been proved by different labs, but we were the first ones to show that Tau is regulating the activity of severing proteins by protecting the microtubules. I think it was my favorite also because it was my first project. The paper was accepted on the first submission without any revisions. I won multiple awards for that discovery, including the platform presentation for the work as a first-year graduate student.

SG: How would you describe the perfect balance between teaching, benchwork and running a lab?

LQ: I don't have a lot of teaching responsibilities, but I do enjoy

Faculty Interviews, *cont.*

teaching in small groups, more like a stimulating discussion, problem-based learning. Stimulate students to participate instead of learning mechanically, which is very important as a graduate student. As much as I like to do research on the bench, I find myself less and less involved with benchwork because I have to write a lot of grants. I have to read a lot and think of experiments. But I think it's a very interesting balance. Once in awhile I still want to do experiments, to teach someone the little things you have to keep in mind when you're on the bench that can really make a difference. I think I would like to keep both benchwork and grant writing active but less benchwork is my future goal. You don't have enough time to do both, and you want to move to the next stage of your life. You want to reach the level when you can foresee everything, can see how the project goes and make a decision where to go. As a PI, I believe your knowledge should be broad and you must read more than you should.

SG: What would be your top tips for graduate students?

LQ: Firstly, I think a graduate student should make their priority their research. Your goal should be to make the best out of your research, to impress yourself and to be proud of your work. Secondly, make friends in grad school. Socialize with people, talk to people and by doing so you might get ideas about your own project. You are surrounded by scientists in grad school and there is always an opportunity to get new ideas that can lead to collaborations. Lastly, I think meetings are very important for graduate students. Conferences are passionate events where everyone likes to talk about their work and interesting people come to talk to you.

SG: Finally, where do you see yourself in five years?

LQ: In five years, I would like to make myself more recognizable in the field. I would like to study what I am really passionate about and contribute important findings to that field. •

Generating Your own Rhythm

An interview with Kimberly Dougherty, PhD, by Sadie Bennison

Dr. Kimberly Dougherty is an associate professor in the Department of Neurobiology and Anatomy and has been here for five years studying rhythm generating circuitry in the spinal cord. Dr. Dougherty is an engaging young scientist who recently reached the exciting milestone of graduating her first doctoral student, Ngoc (Nesta) Ha. In this conversation, we learn how Dr. Dougherty has generated her own rhythm from being a postdoc at the Karolinska Institute, where the Nobel Prize in Physiology and Medicine is awarded, to being recruited to join the department where she has flourished as a mentor running her own laboratory.

SB: You had the experience of being at the Karolinska Institute for your postdoc. What was that like?

KD: Oh, I loved it over there! It was a good opportunity to get an international experience. I had planned to go for two years, for the traditional two to three-year postdoc, but I ended up staying for eight.

SB: Oh wow, so was that by virtue of the lab that you were in? You loved the location?

KD: Yeah, it was both. I really liked the lab, and I think even as a postdoc, it takes two years to really get things to the point where they are up and running. So then, projects were moving forward, the first paper was coming out at around three years. The main project took time but I knew it had the potential to be big. My supervisor had just gotten a big grant and he had said before that if he got the grant, he would be able to keep me for an additional five years.

SB: So, tell me a little bit about this exciting project.

KD: We were looking at a cell population in the spinal cord that had the potential to be rhythm generating, and it began as a collaboration between our lab and Tom Jessell's lab. They had created the mouse, and the postdoc from their lab came to Sweden often. Initially, she taught me how to do all of the genotyping and the crossing for the experiments, and she came to see some of the preliminary electrophysiology experiments that I took on. The electrophysiology experiments were difficult to get up and running but the results were exciting, and we were able to reconfirm them with other mouse lines that became available as we were completing the first set of experiments.

SB: That sounds great! We have a lot of international postdocs from abroad studying here in the U.S., but I don't hear a lot of opinions from U.S. scientists who go abroad. I was wondering firstly, what was it like being an American postdoc abroad and secondly, I know that different countries view science differently, so I was wondering if you had any experiences like that.

KD: The Karolinska Institute, especially the department that I was in, was highly international. So it was actually very easy to be a postdoc abroad there. Even when I was interviewing for other postdocs I interviewed for positions in the U.S. where I would've been one of the few American postdocs there. For your first question, it didn't really matter. It made it a very different environment where you have so many people that are international who just picked up and moved there so I was one of many with few connections when I first moved. In that case, it is easy to make friends and form your family away from your family pretty quickly.

Faculty Interviews, *cont.*

Dr. Kimberly Dougherty is an associate professor in the Department of Neurobiology and Anatomy and has been here for five years studying rhythm generating circuitry in the spinal cord. Dr. Dougherty is an engaging young scientist who recently reached the exciting milestone of graduating her first doctoral student, Ngoc (Nesta) Ha. In this conversation, we learn how Dr. Dougherty has generated her own rhythm from being a postdoc at the Karolinska Institute, where the Nobel Prize in Physiology and Medicine is awarded, to being recruited to join the department where she has flourished as a mentor running her own laboratory.

SB: You had the experience of being at the Karolinska Institute for your postdoc. What was that like?
KD: Oh, I loved it over there! It was a good opportunity to get an international experience. I had planned to go for two years, for the traditional two to three-year postdoc, but I ended up staying for eight.

SB: Oh wow, so was that by virtue of the lab that you were in? You loved the location?
KD: Yeah, it was both. I really liked the lab, and I think even as a postdoc, it takes two years to really get things to the point where they are up and running. So then, projects were moving forward, the first paper was coming out at around three years. The main project took time but I knew it had the potential to be big. My supervisor had just gotten a big grant and he had said before that if he got the grant, he would be able to keep me for an additional five years.

SB: So, tell me a little bit about this exciting project.
KD: We were looking at a cell population in the spinal cord that had the potential to be rhythm generating, and it began as a collaboration between our lab and Tom Jessell's lab. They had created the mouse, and the postdoc from their lab came to Sweden often. Initially, she taught me how to do all of the genotyping and the crossing for the experiments, and she came to see some of the preliminary electrophysiology experiments that I took on. The electrophysiology experiments were difficult to get up and running but the results were exciting, and we were able to reconfirm them with other mouse lines that became available as we were completing the first set of experiments.

SB: That sounds great! We have a lot of international postdocs from abroad studying here in the U.S., but I don't hear a lot of opinions from U.S. scientists who go abroad. I was wondering firstly, what was it like being an American postdoc abroad and secondly, I know that different countries view science differently, so I was wondering if you had any experiences like that.
KD: The Karolinska Institute, especially the department that I was in, was highly international. So it was actually very easy to be a postdoc abroad there. Even when I was interviewing for other postdocs I interviewed for positions in the U.S. where I would've been one of the few American postdocs there. For your first question, it didn't really matter. It made it a very different environment where you have so many people that are international who just picked up and moved there so I was one of many with few connections when I first moved. In that case, it is easy to make friends and form your family away from your family pretty quickly.
SB: Oh that's great to hear! And what about the science? Is there any way they think about science differently? Since it was such an international melting pot I imagine it might be more similar.
KD: The structure of everything is different compared to here. I don't know how much of it is Sweden versus the U.S. versus other particular places. As far as viewing science, Northern Europe has very strong funding relative to most other places.

SB: When you came back to the U.S., did you feel any differently about being back here?
KD: Yes, I had reverse culture shock. It was rough and it took a while to overcome. Even more so than when moving abroad because then I expected everything to be different, and it was probably less different than I expected. Even with the language, everyone there speaks English because they're taking it from the time that they are in first or second grade. Also, none of the movies or video games or anything like that are dubbed, so they're exposed to it on a continuous basis. And then coming back you expect to know what you are coming into, and I think it's a combination of two things. Things in the U.S. have changed, and I'm sure I have changed as well based on the experience. I think it was just a case of expectations that were different.

SB: That is very interesting, and it makes sense. When you came back, did you come right back to Drexel?
KD: Yes.

SB: What brought you to Drexel?
KD: I was really impressed with Drexel when I interviewed here. I applied here after talking to Ilya Rybak at SFN. He let me know that there was a position available. My former lab had collaborated with Ilya as well, so I knew him from that. I also knew, of course, Simon Giszter, and several of the other spinal cord researchers here before as well. So I came to interview, and I did not know what to expect. Firstly, I didn't realize that this was a separate campus. I expected that we would be down in University City initially, and I had looked at UPenn for undergrad and I did not like the environment. I came here thinking that I was coming for the science and we would see how it went with meeting the people, and I was really, really impressed.

SB: What impressed you most?
KD: The interaction of the people, and I think that is pretty common. How genuine everybody was here and how supportive everyone was. I got that impression from everyone I spoke with, within Drexel and outside. There was plenty of other faculty who were relatively new at the time as well. Also, I was impressed by how interested people were in my work and in collaborating. At other places where I interviewed, I would've been the only person or one of the two people working in spinal cord. At other

places, the views were different and some asked why I wasn't looking at more of the interactions from the brain to the spinal cord, whereas here my interests in spinal circuitry were really embraced and it was seen as a natural fit with several other labs. The excitement from others about my work really helped me reach my decision. And, Itzhak Fischer and John Houle have very strong reputations for mentoring faculty as well, and for having their junior faculty succeed.

SB: And do you feel like you've been provided with that mentorship?
KD: Yes, absolutely.

SB: What do you like most about being a research scientist and having your own lab?
KD: About being a research scientist, I like that we can be curious and we can be driven by our curiosity. So if we are curious about something, we can actually think about ways to test it and go into the lab and actually carry that out. And about having my own lab, I like teaching the students and postdocs and other people in the lab. As a postdoc, I was focused more on a single project although I was coordinating many aspects of the project and had students and technicians working with me. Having many different projects running at the same time in my own lab is both one of the high points but it is also one of the toughest aspects to keep track of everything and to get used to the fact that you don't see exactly how every experiment run. It is both very rewarding to see results coming and that many things are working in parallel when you have good people who know what they are doing and are doing it well.

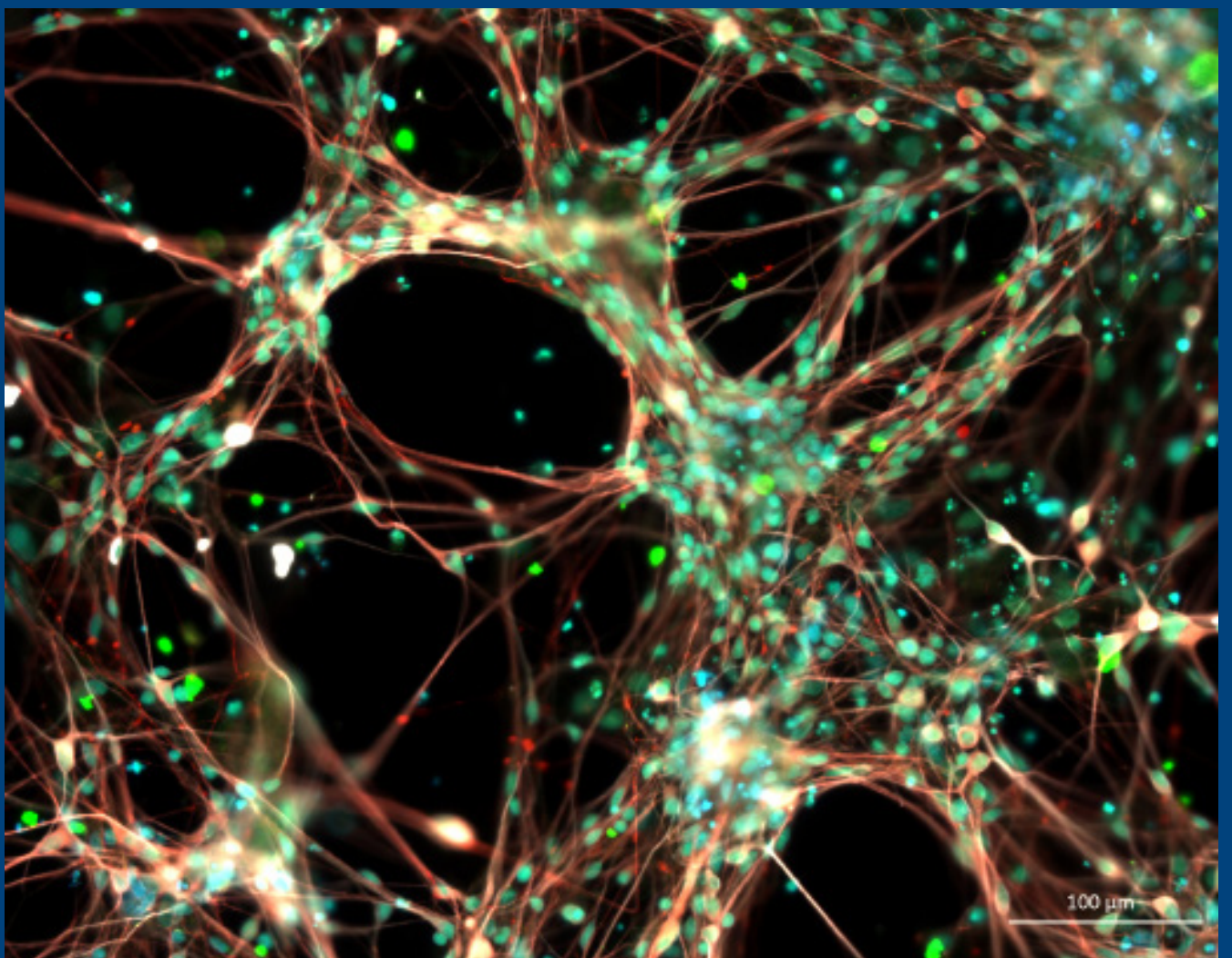
SB: How many years have you been at Drexel?
KD: Five years this week.

SB: Congratulations! Have you noticed that Drexel has changed at all, or has there been any growth throughout the years?
KD: I was kind of in the middle/tail end of the new faculty hires so I think the environment has changed in that way, but I didn't see much of what it was like before. I think the excitement and momentum in the spinal cord group, for example, was present when I arrived and that has maintained. I have seen more additions to the Systems group since Drs. Barson and Wang joined the department after me. I've seen that group build up and strengthen. Comradery and collaboration have always been high but I've become more involved in those groups and in specific collaborations.

SB: Do you have a favorite moment at Drexel? You can have a few if it's hard to decide.
KD: I've had a few, its hard. A lot of the firsts, like first MS and PhD students defending, the first student receiving a fellowship, the first paper as an independent were all big. If I think about back to the earlier times, I think after I was here for a year and a half I did a PPG seminar and for that, we were supposed to talk about the progress our lab has made in a year. Pulling up the pictures of the lab being unoccupied the previous March, and equipment kind of in the middle of the room to be away from the flood-ravaged area and then comparing to the year later showing that it was a fully functioning lab — that was super rewarding.
SB: What do you like to do when you're not doing science?
KD: I actually started taking piano lessons three or four years ago now. So I try to do that some. I also like urban hiking, city walking. I usually walk to clear my head. I also enjoy traveling both to new places and places where I have friends and family.

SB: I noticed that you signed up to be a mentor for the Association for Women in Sciences (AWIS) this year. What made you want to sign up and be a mentor for this program?
KD: It was Ankita. She came to me and I agreed because I think it's important to mentor others and to share your experiences. But also to learn from others. I also thought it would be a good opportunity to meet people who are in science but are not doing exactly what we do as well, to get some diversity of opinions.

SB: Along the lines of being a mentor do you have a piece of advice that either helped you when you were an early career scientist or anything that you'd like other young early career scientists to know?
KD: I have many little snippets from mentors, which I say in the lab that are funny and are related to specific moments. I'm sure he got this from a book, but my postdoc mentor used to always stress that to succeed in science, people have to both be smart and work hard. Doing one or the other is not good enough. •



Neuronal Networking Night
Philip Yates

Nurturing Future Neuroscientists

Summer of 2019 marked the 7th Annual Neuroscience High School Summer Camp, a two-week immersive science experience that is offered through the Department of Neurobiology and Anatomy in collaboration with the Graduate School of Biomedical Sciences and Professional Studies. It was founded and is led by Dr. Jed Shumsky along with newly appointed co-director Dr. Michael Lane. With just a handful of other neuroscience-related experiences for high school students across the country, Drexel's Neuroscience Camp plays a critical role in nurturing future neuroscientists by providing hands-on opportunities to explore the brain and biomedical research during an important developmental period.

The Neuroscience Camp is my favorite thing that I do all year! The real purpose of the camp is to expose young students to what scientific research actually is. We demonstrate that science is not so mysterious and the students can actually think of themselves doing it. One benefit of working with high-school students is that they are unjaded by the college experience, so everything provides a sense of wonder for them. They truly cannot learn enough about it, asking question after question, and as an educator, that is an incredibly rewarding experience.

We receive about 45 applicants a year and take as many students as we can. The camp runs daily from 10 a.m. to 4 p.m., with the first half of the day being a lecture component either by faculty or senior graduate students, and the second half comprised of lab technique demonstrations. The first week is more demonstration and clinical case application. The second week involves a group project overseen by a graduate student who helps the student write up the project as a PowerPoint presentation, which they then present to the faculty. We also take the students on field trips to both the brain exhibit at the Franklin Institute and the Academy of Natural Sciences. At the Academy, lead paleontologist Dr. Ted Daeschler shares his knowledge and experience on archeological digs and takes the students on a behind-the-scenes tour of special collections.

One of the ways that the camp runs well is because it's an opportunity for our neuroscience graduate students to obtain additional teaching experience. In my role as course director for the teaching practicum, I am happy and able to provide course credit for helping with camp. The Neuroscience Camp offers three different teaching experiences to our grad students: 1) give a lecture, 2) run a demonstration which involves an afternoon where they show a lab technique, explain it to the students, and then repeat it a second or third time depending on how many groups of students we have going through, or 3) lead the week-long research component (worth more credit of course!).

At the end of camp, we confer students a certificate at a graduation ceremony where the parents are invited. The last thing we do is go around and ask everyone, "What are you taking away from this?" The students tell me all kinds of things like, "This is what I thought college would be like" or "I met a whole group of like-minded people, I thought I was the only one at my school." We also invite the students to come back for Discovery Day and each year we have a few students who come. They're a little overwhelmed, but they really love it. Again, this is about showing them the spark of what science is really like. One year, a graduate student who led a group project gave a platform talk. Several high-school students who had been a part of that group project were there and they all stood up and applauded at the end, and it was awesome.

Jed Shumsky, PhD, Founder and Director of the Neuroscience High School Summer Camp and Professor of Neurobiology and Anatomy

Graduate Student Testimonials

"I have been doing live-cell microscopy demonstrations for the Neuroscience Summer Camp high school students for a few years now, and this past year I was also able to give a short lecture on neuronal growth. It's nice to be able to interact with younger students and give them a glimpse of how neuroscience research is conducted. The students always have really insightful questions on the basic science of what I'm showing them. Whether it's fluorescent mitochondria or EB3 comets, they want to know more about the hows, whats and whys. Not only are these discussions fun, but they also help me stay up-to-date with the science, and practice my ability to communicate effectively to different audiences."

– Ankita Patil, Baas Lab

"After hearing about NeuroCamp for a few years from some other fellow students, I decided to get involved. This past year I was a part of the research component and was able to work with two high school students. I initially thought it was going to be difficult to convince a group of high school students that bladder function following SCI is a "cool and fun" topic because let's be real, what 17-18 year old is going to hear the word "urine" and get excited about that? To my surprise, two brave souls decided to work with me and the experience couldn't have been better. Since I only had two students I was able to let them learn the whole process of immunohistochemistry, explain in detail why urinary dysfunction after SCI is so important to patients in the clinic, and what we are trying to accomplish in our lab. I was really proud of my students as they presented the work they completed in the lab and handled questions from faculty members so well. NeuroCamp as a whole was not only an invaluable learning experience for me and my students, but was also a lot of fun. Needless to say, I look forward to participating in the High-School Summer Camp again next year!"

– Jaki DeFinis, Hou Lab

"I demonstrated electrophysiology and optogenetics research, which included electrode/optic fiber assembly and in vivo recording in freely behaving mice. I also explained why this information is meaningful with a preview of data analysis at both the single-neuron and local field potential levels. The students were especially amazed by the tiny size of the electrode wire, about the thickness of a single hair strand, and how hard it was to see without a microscope. It was great to expose high school students to advanced neuroscience techniques because many students do not hear about these until undergraduate studies or later."

– Ashley Opalka, Wang Lab

"The NeuroCamp is a great experience for not just the high school participants, but also us as students, scholars and educators. Personally, it has helped me to step back and put our research into a greater perspective and has allowed me to communicate with individuals who aren't versed in 'our' vocabulary, which I think is crucial to our training. All the while, I think the most rewarding part about the program is seeing the students' excitement about being in the lab and being able to participate in research."

– Lyandysha Zholudeva, PhD, Lane Lab

"I was one of the project coordinators this past summer in the neuroscience summer camp for high school students interested in a biomedical career. I led a project teaching the students about stem cell biology, neuronal differentiation, cerebral organoids, immunocytochemistry, microscopy, and Gulf War illness. I really enjoyed showing the students around the lab and all the cool things we do as graduate students. It was so rewarding at the end of the week to watch how much the students learned in such a short time and how well they presented their work to the department. These visits are incredibly valuable because they provide the students with a hands-on opportunity to see what it is really like to work in a lab and pursue a career in biomedical science."

– Philip Yates, Baas Lab

"This summer was my third year being involved in the Neuro Camp program! I led a lecture on sensation and perception where we used different interactive activities to help them connect the lecture topics for each of the sensations. The lab also did a demo on sham spinal cord injuries and I led a group through their group project on using anatomical tracers to visualize neuronal circuitry. I think the students' favorite experience in the lab was getting to see a pseudorabies virus (PRV) tracing surgery and having the opportunity to practice their 'surgery skills' by suturing oranges. I think the most rewarding point for me was seeing some of the students get more interested in science where a few of them even asked to come back to the lab next year!"

– Margo Randleman, Lane Lab

Faculty Reflection

Resilience, Repair & Regeneration: The College of Medicine and MMSCRC Over 25 Years

by Simon Giszter, PhD

Dr. Giszter is a professor in the Department of Neurobiology & Anatomy. Prior to coming to Drexel in 1994, he spent several years with Emilio Bizzi at MIT, first as a postdoctoral researcher, and subsequently as a research scientist. He is also joint faculty in the School of Biomedical Engineering, Science & Health Systems at Drexel. He has a long history of collaboration with members of the Spinal Cord Injury Research Center and with laboratories in the School of Biomedical Engineering, Science & Health Systems and in the College of Engineering.

First, an apology to other Hillock readers who know more than me about all this (I'm talking about you, Tim, Hazel, Itzhak, Theresa, Tim, Kathy and Joy)... this piece is necessarily idiosyncratic, occasionally apocryphal, and possibly may have inaccuracies, and clearly is rife with omissions both intentional and inadvertent, hopefully protecting guilty and innocent alike. That disclaimer in hand...

I was recruited to the spinal cord group and then MCP in 1994, shortly after Michael Goldberger's passing and Pat Levitt getting recruited away. The reason for my hire was partly to add electromyography, kinematics and motor control dimensions back into the group, just prior to one of innumerable program project grant (PPG) renewals. I was recruited by Don Faber and Marion Murray. The fact that they worked, or had at one time worked, on zebrafish and goldfish, and understood the comparative neuroscience perspective was a big plus for me in the recruitment process.

I knew Marty Pinter from some motor conferences, and he and Don emphasized that my own motor research in frogs could be supplemented with rat PPG work, but both were valued. This was very reassuring. Labs in the department were on the 8th and 9th floors of the Eastern Pennsylvania Psychiatric Institute, down the road from MCP hospital. I visited Germany for a workshop I had been invited to at Zentrum für interdisziplinäre Forschung, before starting in earnest, and while I was away I got my very first "do not be alarmed" email from colleagues, one of many to come. MCP and Hahnemann were merging. Allegheny Health Education and Research Corporation had purchased Hahnemann and would merge it into a combined medical school, to be named MCPHU, then renamed Allegheny University of the Health Sciences (AUHS). I arrived in a different department than the one that had recruited me, with more than twice the faculty. A plus was primate work was now part of the department mix, but not for long. The PPG was awarded, and included projects with Don Faber PI, Marion PI, or Itzhak as PI. I settled in, wrote grants, started up a physiology and motor core for the new PPG, got my first student, Bill Kargo; got a postdoc, Cynthia Smeraski; and had a Jefferson attending physical medicine and rehabilitation doctor, Ginny Graziani, join me for a K award in the basic science component of her award, under Alan Tessler's auspices.

I soon had frogs and rats running in parallel. I had an excellent born-again biomedical engineering tech who was a creationist. Lab discussions were robust. The department had successfully renewed the PPG, I had received an R29 (the entry level to R01 at the time, equivalent to a big K), NIH proposals were still 25 pages long, and all was well with the world! By 1998 my lab was publishing rat and frog research papers.

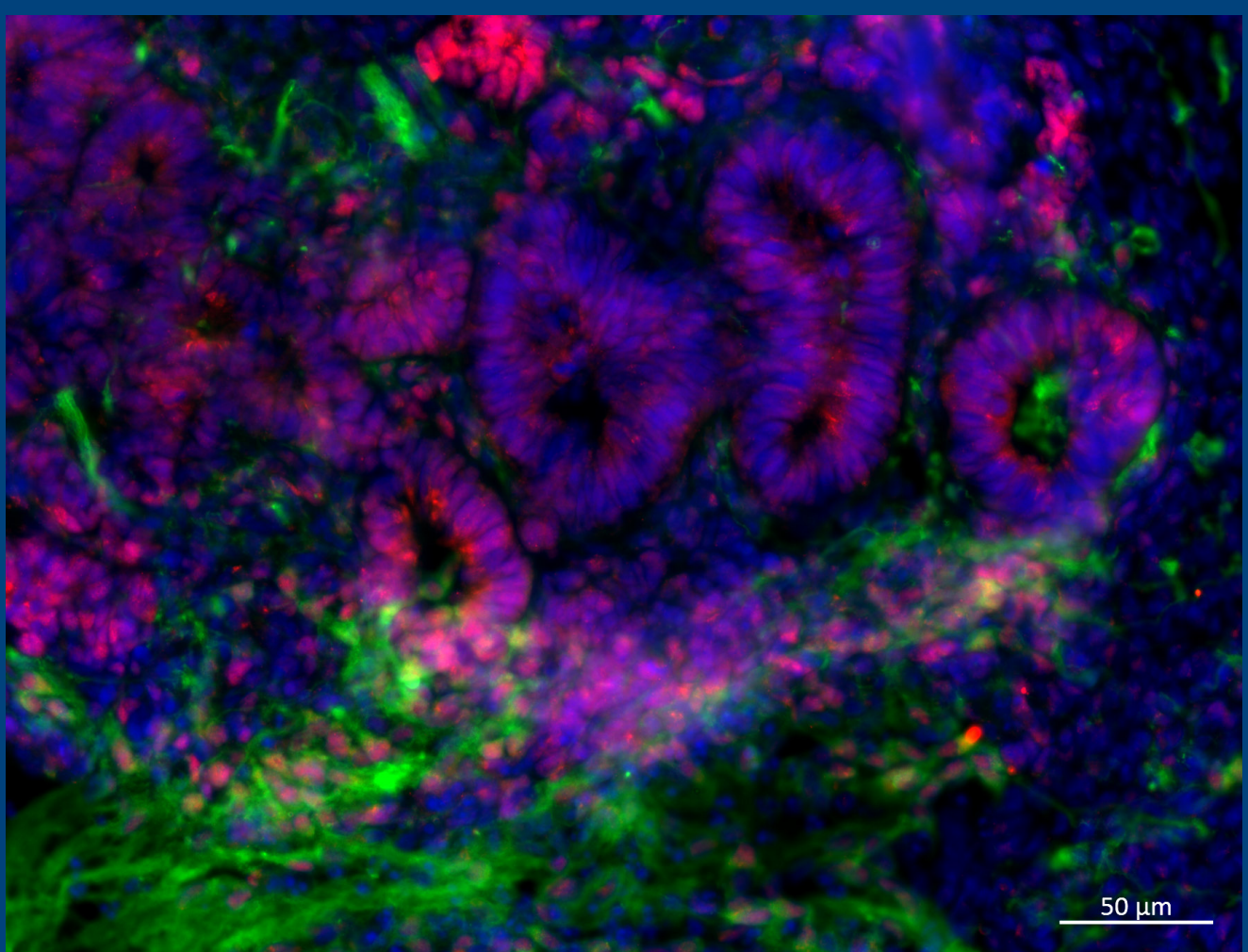
The only dissonance for me in early '98 was when I spoke about transplantation at an FES conference where they had expected me to discuss intraspinal microstimulation (ISMS), and I discovered how siloed the two fields were at that time. Dick Stein explained the problem to me at the meeting, from the FES perspective. The positive was that, despite discussing neonatal fetal transplants in my talk, I met Warren Grill, Michel Lemay and Vivian Mushahwar there, and we did discuss ISMS in an impromptu workshop. The subsequent breakdown of the barriers between these different areas in SCI is one of the great pleasures of working in the present-day SCI field, compared to that time. Life is more complicated, but better. Cautionary tale there somewhere... competition versus cooperation?

At a conference in Lanzerote on bioinspired robotics and "Animats" organized by Holk Cruse and David McFarland, while with my family in the summer of 1998, I got another "do not be alarmed" email. The Allegheny wave had crested and was toppling over on us, and we were surfing into bankruptcy, with the medical school entangled in AHERF mismanagement. The MCP and HU originating faculty became rapidly and fully united in a fight for survival. The spinal cord group considered possible moves: Jefferson, Louisville, other options. For junior faculty it was a very uncertain time. By 1999 it was clear we were secure and being managed by Drexel in the aftermath, and faculty regrouped and looked to the future. Meanwhile, the clinical side of the house was run by Tenet, a for-profit and publicly traded entity, changing the experience quite a bit. Drexel's main campus at the time was not as research oriented as now, and there were some issues. Some faculty bailed out. President Papadakis had a 10^6 club.

Another PPG renewal was now also in the offing, a bit riskier after the bankruptcy. The group leveraged the physiologists again in a changing of the guard from Pinter and Faber to Chapin, Moxon and me. The renewal included Marion, Itzhak, John Chapin and Karen Moxon following their 1999 Nature Neuroscience BMI demonstration, and included me as a project PI looking at corticospinal modularity. I also renewed my R29 into a full R01. Over time MCP hospital closed and Tenet divested other hospitals. All in all, this period was a truly awful time to be junior faculty at the institution. Only the faculty camaraderie and ethos made it manageable. Some summers in this period I taught inthe University of Minnesota graduate neuroscience lab course in Itasca, Minnesota. This was organized by Dick Poppele, a grand old man of muscle spindle physiology and dorsal spinocerebellar tract research. He took to introducing me: "This is Dr. Giszter, who will help teach you about frog and spinal physiology... and Simon, what is your institution called this year?"

Tenure at the College of Medicine was on hold for a prolonged period, so beside the bankruptcy it was double jeopardy every time grants came up for renewal for us all. At the same time, we were hiring cool faculty, and doing great stuff, though not always agreeing on priorities. When the grass looked greener, you looked at what we had in-house in terms of overall support and reconsidered the pros and cons. This is likely what a bunch of ex-hippies and '60s radicals founding a Neurobiology Department gets you.

In the next round of PPG renewal, John Houle, Jeff Twiss and Michel Lemay added their expertise, with John Houle leading the final iteration of PPG support to date. Through this latter period, we perfected our game as a department, in my humble opinion, emerging from the prior stressors. It's not perfect, we don't always agree 100%, but we very rarely if ever eat our own, or engage in Borgia-like behavior. The fact that we, and our clinical colleagues, all weathered the financial and merger storms strengthened the general esprit de corps, and dissolved any lingering residues of resentments from mergers and consolidation of MCP and HU. Our hospital colleagues have unfortunately faced another storm now, with Hahnemann closing. •

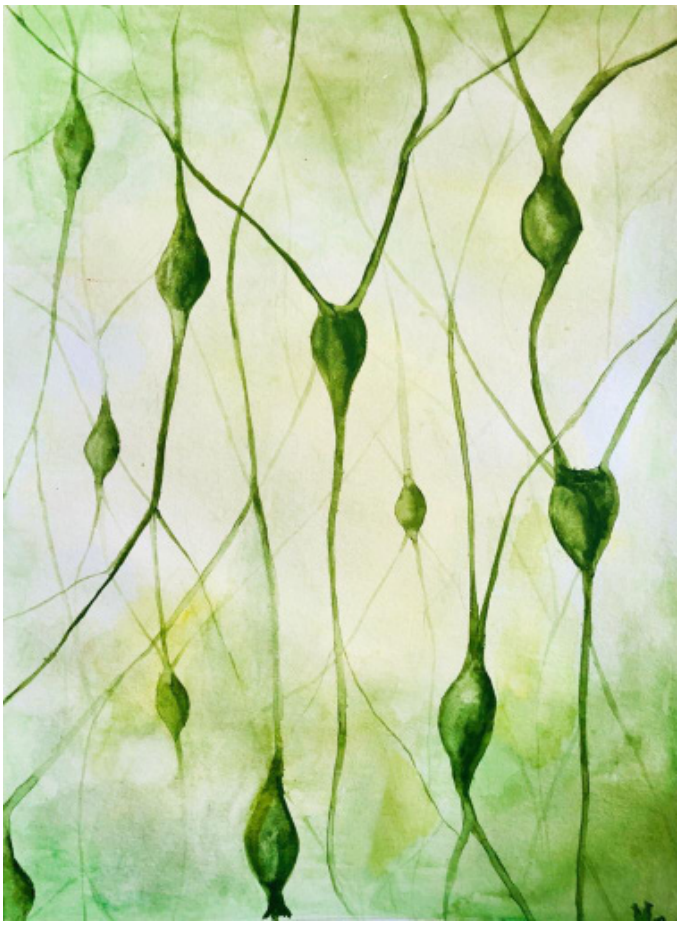


Organoid Paint Nite
Philip Yates

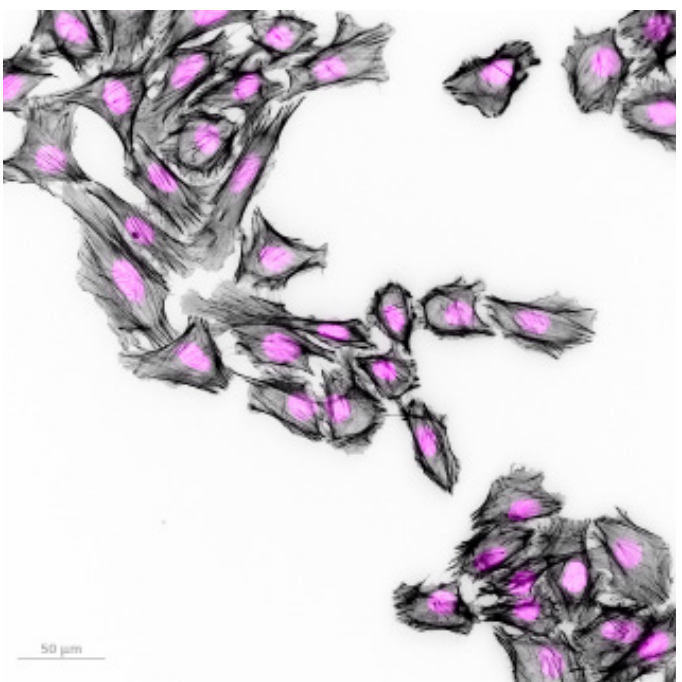
Creations

Painted While Eating Pizza
Jani Bilchak

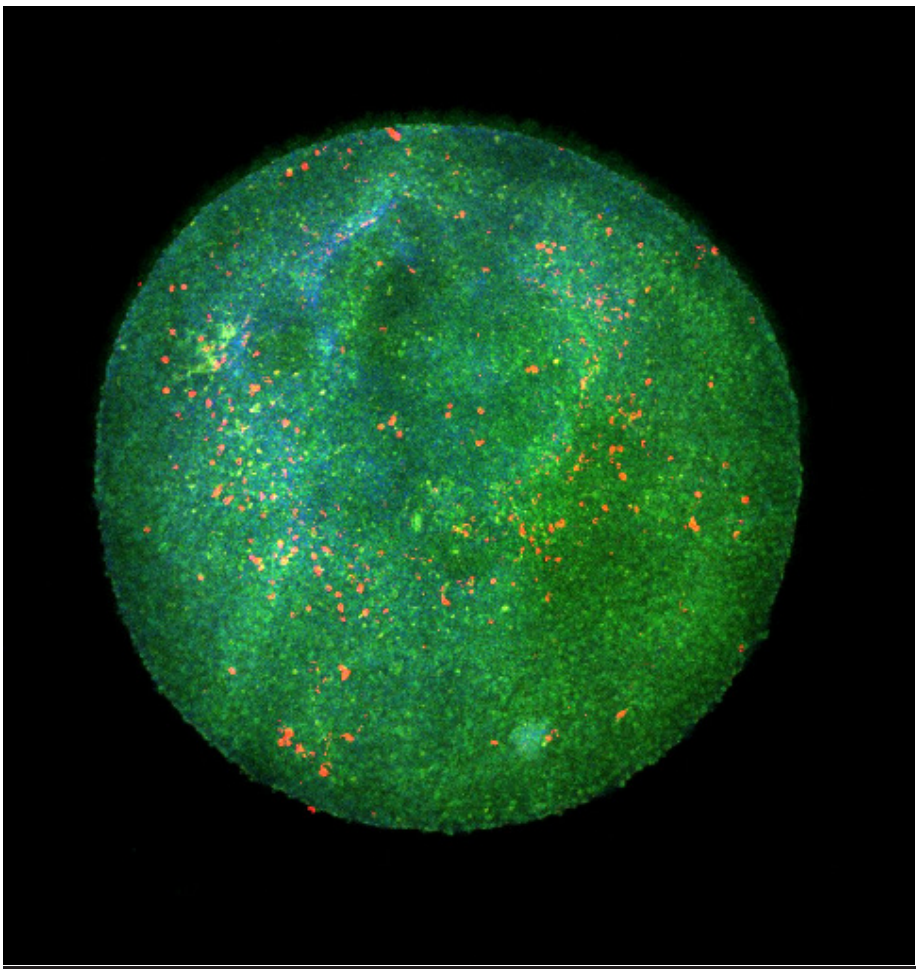
Dynamism of Optics (Oil on canvas)
Cote Lab



Neurons
Hemalatha Muralidharan



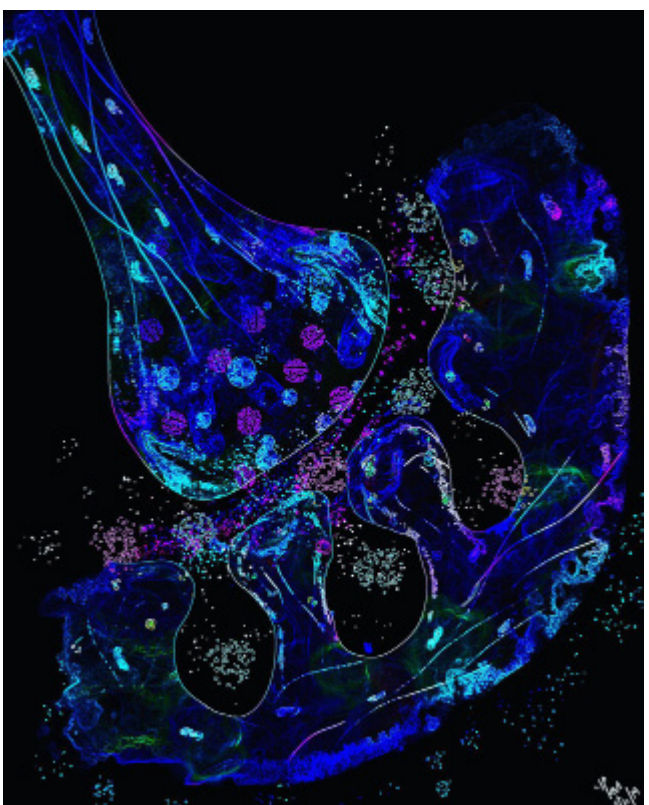
Fibroblasts Are Pretty, Too!
(Stained for actin in black, nuclei in pink)
Ankita Patil



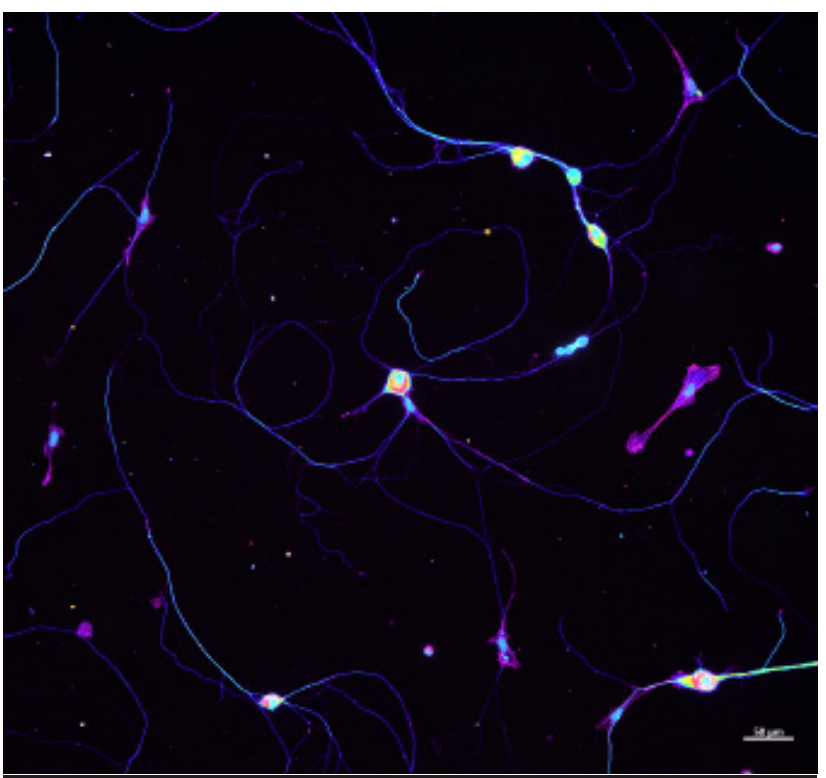
The Moon Is Made of Neurospheres
Sadie Bennison

Squirrel
Philip Yates

Trash Squirrel
Philip Yates



The Synapse Is a Complex Place
Hemalatha Muralidharan



SCG Neurons
Ankita Patil

Post-doc Interviews

Serendipity Works Best If You Keep an Open Mind!

An interview with Eileen Collyer, PhD, by Ankita Patil

Dr. Eileen Collyer has had a colorful research journey prior to joining the department here at Drexel. After completing her PhD studies in Chile, she did her first postdoctoral fellowship at the University of California San Diego (UCSD). She is currently a postdoctoral fellow in the laboratory of Dr. Veronica Tom.

AP: What was your path in science prior to coming to this department?

EC: I did my undergraduate and PhD studies in Chile, at the same university. I started in ecology, then moved to physiology, and finally neuroscience. When I started my PhD, my adviser was working on peripheral regeneration. They needed a model of central non-regeneration, so he gave me a paper on SCI (spinal cord injury) and asked, "Can you do this?"And I said, "Sure!" even though we had no idea what we were doing. Nobody was studying SCI in Chile, but serendipitously, I ended up going to the Spinal Cord Injury Training Program at Ohio State University. It was an amazing three-week boot camp where you learned how to perform surgeries, behavioral tasks and analysis, and also meet the SCI community. This opened up a lot of avenues for my thesis and I ended up working on Wallerian degeneration in collateral sprouting after injury. I then secured a position in Dr. Mark Tuszynski's lab at UCSD. Again, this happened by serendipity. He (Dr. Tuszynski) was coming to Chile for a conference. I emailed him but didn't hear back. So, I emailed a friend of mine who was in his lab and she told him about me. He was able to offer me an initial year of funding in his lab, on the premise that I could stay on if I found additional funds for after. I ended up staying in San Diego for 3.5 years studying stem cell-based rehabilitation after SCI. I received a Wings for Life grant but when it ended, there was no other funding available for me in the lab and I had to look for other opportunities. Veronica (Dr. Tom) had an open position. We met and I was invited to come to Drexel. At the time, I actually had two options. The other option was a staff position, which meant more money, but when I came to Drexel, I fell in love with the group, the environment, the lab and chose that option instead! It's been two years (at Drexel), and I do not regret it. This department has an environment that is absolutely unique. I have never worked in a place like this, and I don't believe I will find something similar.

AP: Your academic career has taken you into different research areas. Was there any overlap between the various projects you'd been part of over the years?

EC: The main topic was always SCI, but there wasn't too much overlap in the hypotheses. The specific objectives were not the same but, at the end of the day, they were all in the context of injury, which is what I cared about. At the training program in Ohio, I was able to meet SCI patients, which was an eye-opening experience. There was one patient, a man a few years younger than me. When I asked him what would he want to be able to do again, I was naïvely thought he would say that he wanted to walk again. Surprisingly he said, "I want to be able to pee!" I had never thought about that, of all the everyday problems that result from SCI. Nowadays in developed countries, you can have a life in a wheelchair. It isn't easy, but it is manageable to some extent. The everyday little things are what make your life much harder. That thought has stayed with me, and I would like to continue researching in the field of SCI.

AP: What are you currently researching in the Tom Lab?

EC: My primary project is a collaboration between the Tom and Bethea Labs here. We are looking at the immune response after SCI. It is known that there is a depression in immune response after injury, but we are trying to understand what this actually means when an SCI patient experiences a challenge, like a viral infection. What does the depressed immune response lead to? How do different neuronal types factor into this? The Bethea Lab has multiple mice lines with different receptor knockouts that will help us identify which neurons or which cell types contribute to the aberrant immune responses that we know occur. We are also collaborating with Dr. Patrick Osei-Owusu on a project looking at the regulation of blood flow in kidneys after SCI.

AP: Going further back, what made you want to be a scientist?

EC: A couple of years before I finished high school, I had a special science class. It was basically one of those classes you took for credits. However, that year, they changed the teacher for the class and our new teacher was awesome. He really made us think. He gave us an issue of Scientific American and we would discuss articles in it, all of which I found fascinating. I was on a career path to dental school. You give a national test and you rank programs by your preference. I took the exam and put dental school as my first preference. I put biology as my second choice, which is what I ended up getting into. First day of school, first class, and I was hooked. It was a Bio 101 class and we learned about abysmal fauna that lived in extreme environments, like at the bottom of the sea. That's what made me initially decide to study ecology! I did a summer project where I collected marine algae next to mining run-off sites. It was very interesting – we were mixing biochemistry with ecology, understanding how levels of contamination affected the algae. But then a position opened up in a physiology lab

and I just decided to try it! So, I have worked in many different labs, on many different kinds of projects. And a lot of times it has been serendipity (again!), people offered me opportunities to come work with them, and I said, "Sure!" The same is true for the training program in Ohio. There were two sites that offered the program, one in Miami and the other in Ohio. And when I was researching, I clicked on the link for Ohio, because I had to pick one! And the moment I got there, I thought, "Wow, this is the place I have always wanted to be in!" The network I made there became references for a lot of my thesis work. And the next steps just seemed to follow!

AP: As an international student, I definitely felt some culture shock when I first moved to Philadelphia. What was your experience leaving Chile to work in the United States?
EC: That was a difficult decision. I knew that the research opportunities were better in the United States, but I was worried about the culture shift. But when the opportunity presented itself, to work with Dr. Tuszynski, I just decided to go for it! I was only guaranteed a year of funding, so I didn't think I would end up staying there for nearly four years. Meanwhile, I had an entire life back in Chile – my friends, my relationship, job offers. My partner was in his PhD program at the time and couldn't move with me immediately. This was very challenging, but we wanted to work through it. Ultimately, he ended up moving away from the PhD track and into clinical trials, which was where his interests really lay. After our marriage, he moved with me to the States and got a job in clinical trials very quickly. We now have a young daughter (Sofia). Sometimes I think about moving back home, but then I wonder, "Will I really fit in?" I have the feeling that I don't truly fit in here, I am a foreigner and I will always be. But I've lived outside of Chile for so long, I don't feel truly Chilean either. It's a strange sort of in-between place to be.

Dr. Eileen Collyer with her husband and daughter.

Somebody told me that it would take six months (after moving to a new country) for you to feel like yourself and two years before the new country felt like your home, and this was absolutely true for me. Everything was so different – the currency, setting up a bank account, applying for your social security number, even applying for credit cards! You are really lucky if you have someone working with you who can also explain these things to you. I didn't and so I took my concerns to the UCSD Postdoctoral Association. They asked if I would be willing to coordinate efforts to make transitions for international scholars easier. Long story short, I reached out to an Argentinean postdoc at the Salk Institute, where they have an ambassador program to match new international scholars with someone of a similar cultural background who is already established there. It makes such a difference, even just having someone to speak to in your own language! I was able to use this connection to then create a database of postdoctoral fellows at UCSD so that we could also start this practice.

AP: What has the experience of having to balance life as a scientist with being a new mother been like?
EC: It's definitely overwhelming. As a new parent, you want to search for everything on Google. And as a scientist, you want to go even deeper into the searches! I realized how critical it was to have a network that understood these challenges. Luckily, I found a Facebook group for parents in the East Falls area. This led to me a few other groups for new parents in this area. Balancing parenthood with work can be tricky. My life has definitely changed! I have until 4 p.m. to do my bench work and then I have to go pick my daughter up from daycare. This means when I'm at work, I really have to make that time count! Long experiments have to be planned meticulously and in advance. I am more efficient; I know how much work I can get done in 30 minutes.

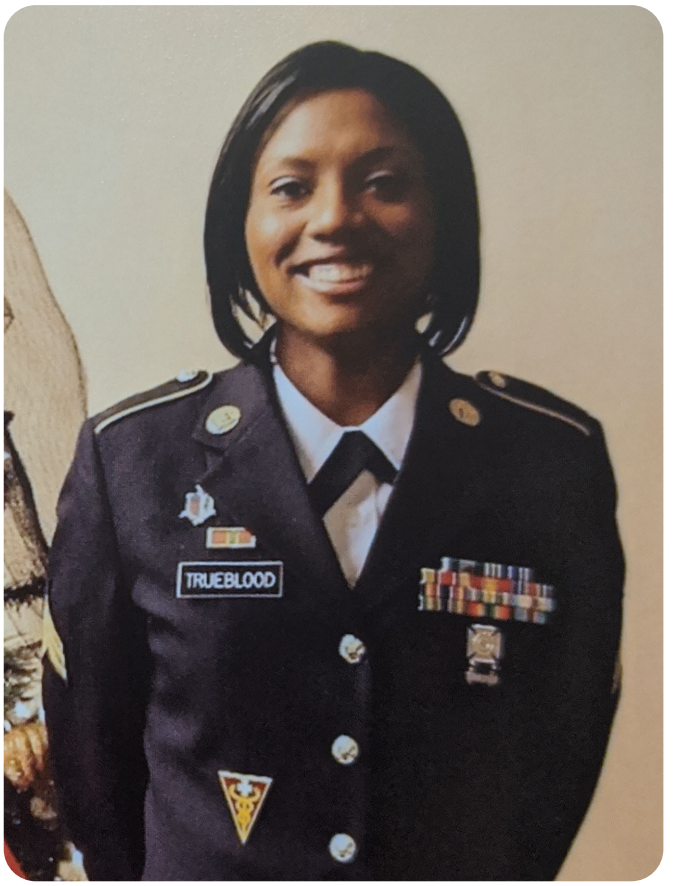
AP: Do you have any advice for trainees who may be considering starting families during their graduate studies or postdoctoral training?
EC: There's never a "good" time so if you think you are ready, just do it! And reach out, try to build a network and ask for help when you need it. Often enough, the advice you're looking for is out there, but it may not be very easy to find, especially when you're so busy and have to juggle these different roles. It is very rewarding, and it is very fun as well, but it's definitely something to make sure you feel ready for. •

A Career in the Military & Science

An interview with Cameron Trueblood by Philip Yates

PY: How did you decide to combine working in the military with being a graduate student?

CT: Honestly, my decision to go to grad school came after my decision to join the military. I joined the military in 2011 and applied to the program in 2013. My interest in how the mind works evolved from my interest in psychology during undergrad. However, after accumulating student loans, joining the army seemed like a good way to pay down my debt. Over the years I grew to really love being in the service, and being a combat medic in the army turned into a second passion of mine.



PY: What kind of work do you do in the military?

CT: I am a health care non-commissioned officer (AKA a medic). So essentially I am a first responder for soldiers. During peace time however, I more serve to manage and guide the soldiers I have under me. When we are called to a mission, my duties can range from working in a clinic, to administration, to working in an emergency room or ICU stateside.

PY: What is it like to combine both disciplines in your training? Has it been difficult to interrupt your training?

CT: Honestly, my background in health care has helped me quite a bit during my years in the graduate program, from simple things like knowing how to suture to the more complex, such as understanding a bit of human anatomy prior to my matriculation. However, my neuroscience discipline has yet to really translate over to my military career. And unfortunately, yes, it has been quite difficult, especially when it comes to returning to my graduate studies after a long military mission. Being a medic is not nearly as mentally challenging as grad school. I had to keep refreshing myself on what I learned in my classes while I completed the mission so I wouldn't fall behind mentally when I returned to Drexel. It's definitely a challenge.

PY: How long is your commitment?

CT: My first contract was for eight years, but I recently completed that contract and signed on for an additional eight years. As I said earlier, being in the military has truly become a second love of mine, so I plan on retiring from the military after 20 years: eight down, 12 to go.

PY: What are your career goals? Do you want to continue to work in military science/health?

CT: Currently, I would like to work for the Department of Defense researching spinal cord injury as a senior research scientist. However, that is a very fluid goal. I am still looking at other career options in the neuroscience field. As for your second question, although I do love being a medic, I must say, that part of my life will more than likely end once I complete the program. In the long run, I plan on merging my neuroscience background with my military career.

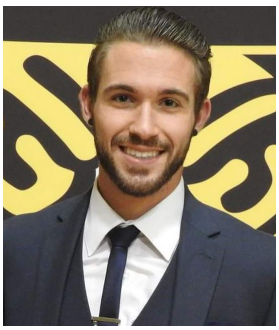
PY: What other opportunities are there for graduate students in the military?

CT: For many graduate students who are serving, your expertise can be used in the military, especially those pursuing degrees in the science fields. For example, there are biochemists who not only serve as officers in the Army, but also get to utilize their expertise in the service either as a reservist or active duty. On the other hand, if you prefer to keep your current job in the military, you could work as a DOD civilian in your desired field while still serving. Additionally, if you have a top-secret security clearance through the military, your options expand exponentially. Whether you decide to merge your two worlds or keep them separate, you have abundant opportunities if you stick with both. So although it is quite challenging to be both a graduate student and a military service member, in the long run it will be worth it. Just make sure you love what you do. •

Student Writings

Challenges for Neuroscience

Question: What is the biggest challenge for neuroscientists in the next 10 years?



Dillon C. Malloy

3rd year PhD candidate

I believe the biggest challenge for neuroscience in the next 10 years is translating research findings into the clinical population or clinical setting. Although this is an ongoing challenge for all basic science research, I believe this to be increasingly complicated for neuroscience. The field of neuroscience has been fortunate to continuously experience growth and innovation in technical skill and methodology for answering basic science research questions over the past decade. The advanced development of tools ranging from cell lines, viruses, and gene editors to implantable devices and electrodes has allowed for controllable manipulations of the nervous system down to the single-molecule level in various in vitro and in vivo animal models. This growth has been exciting within the field for answering basic science research questions and prompting new insights into the many diseases, deficits, and disorders affecting the nervous system.

However, although the discoveries made and questions answered with these advancements in technical skill will always be invaluable, the same excitement, in my opinion, is not shared by the layman community due to the inapplicability of these manipulations in the human/ patient population. It is important that the field is continuously advancing to answer the complex questions regarding nervous system structure and function, especially in a disease context, but if the field is not cognizant of the lackluster growth in applicable manipulations of the human nervous system, then this growing disparity, in my opinion, will result in neuroscience being viewed as an 'abstract science' like physics (sorry, physicists) to the lay community. The field of neuroscience needs to focus on expanding the applicable advancements of nervous system manipulations to the human/patient population within the next decade in order to spark continued hope and excitement for the future of this field.

Sara Blazejewski

4th year PhD candidate

The next decade will present the field of neuroscience with many ethical, technical, and conceptual challenges. However, every challenge we will be met with will have one thing in common – the challenge will need to be fully understood before it can be overcome. Thus, the ultimate challenge for neuroscience in the 2020s will be improving communication with our fellow neuroscientists, our colleagues working in other scientific disciplines, and the public. By building on our communication skills, we will be better equipped to deal with the other challenges we will surely be met with. This may seem overly simplistic, but the simplest things are often the most difficult. The amount of information that neuroscientists are responsible for knowing is continuously and rapidly increasing. The ability to identify credible and relevant information is crucial in this age. We must strive to improve our communication skills so we can better work together and educate the public, so that our work may be received in the best possible way and create the most impact.

Trevor Smith

2nd year PhD student

The neuroscience frontier continues to expand as evidenced by a cursory retrospective glance even a decade ago. Yet one area, neuropsychology, evokes sentiments of curiosity and trepidation. Herein, the components classically conceived as elements of the soul — the mind, decision-making, fundamental tenets of personality, deep-seated beliefs, political persuasions and philosophies — find origin in biological substrates. Thus, the once-ethereal aspects of character are reduced to variables and outcomes for one experiment or the next.

Human curiosity is not satiated with mere knowledge, but application. Knowledge is now pursued to engineer further adaptations of human beings to their artificial niche. This focus on altering biology has led to powerful innovations, but also a paradigm where behavioral deviations individuals may display apart from social norms require pharmaceutical intervention. As a result, we are actively engineering both our environment and the version of humanity that shall inhabit it. The existing research tools can already alter pillars of human personality and shall only improve with time.

If there are no limits to how much we are willing to sacrifice, there are no limits to how much we can lose. I fear the consideration of the mind as a thing to be actively shaped and molded to fit society, and of morals, dreams, and aspirations as artificial programmed elements to accomplish that goal. Within the next decade, we as neuroscientists will gain increasing control over what it means to be human, and the greatest challenge before us will be developing the framework to do so properly, if at all.

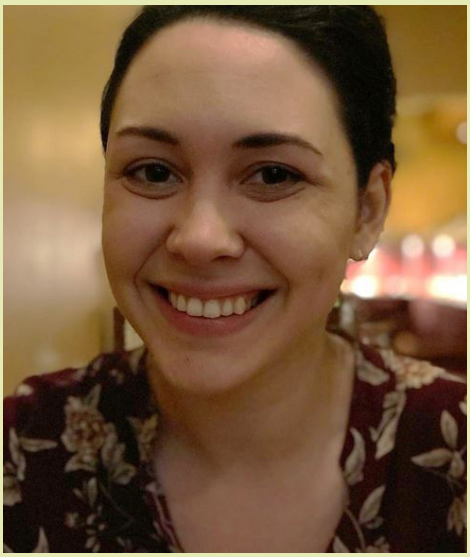
Student Writings, *cont.*

Jason Wickman
1st year PhD student

Despite the extensive advances of benchside neuroscience in the past decade, there has been little movement within the clinical setting, even in the most well-characterized CNS disorders and injuries. There is an inherent difficulty in the translation of treatments and therapies to a patient population that is dramatically more diverse than the preclinical models used to demonstrate efficacy in early development. Even with our best efforts to identify key mechanistic targets in the pathology of CNS disorders, if the specificity of clinical diagnostic criteria lags behind it will be difficult to see meaningful effects in clinical trials. Researchers are continually reaffirming that neuroscience is an integrally multi-disciplinary field, and in order to see clinically meaningful outcomes it will need to be approached as such in the clinic. Simply identifying a putative target for treatment will not be sufficient. Better integration of clinical research and basic science at the early stages of research and development will be essential to: identify more specific diagnostic criteria through biomarker validation, validate preclinical models and their primary endpoints, apply multi-disciplinary approaches towards treatment design (i.e. medical device, pharmaceutical, physical, dietary and social), and identify cost-effective therapies to decrease payer-burden. Advances in targeted therapies and delivery systems will continue to evolve, but the most difficult challenge will be transforming the healthcare system to incorporate these advances alongside multi-disciplinary treatments and better patient stratification. If we do not advocate for these, fewer treatments will be approved and even fewer will be cost-effective and accessible to those who need them. •

The Sun Also Rises Over DUCOM
Philip Yates

Research Tech Perspectives



Cassandra Alexandropoulos
Giszter Lab

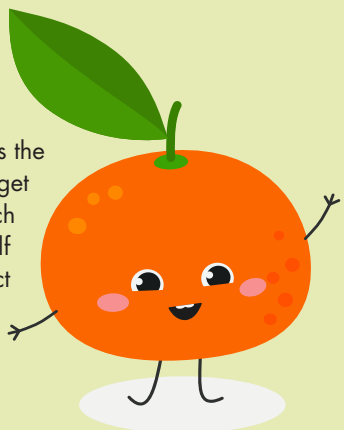
One of my favorite lab moments in the Giszter Lab is feeding the frogs. I've had a few people ask me if working with large frogs is scary, and my answer is always no because frogs are ridiculous and feeding time is a perfect example of that. If I drop a cricket into their aquarium and the cricket happens to land on a frog, usually a different frog that sees the cricket will strike... right onto the other frog's face. After all the drama, when frogs do eat a cricket, they need to close their eyes in order to swallow, and they look super cute when doing so. Even though frogs aren't really capable of higher-order emotions, I like to think at that moment they're thinking, "Aaaah... yum, delicious crickets."

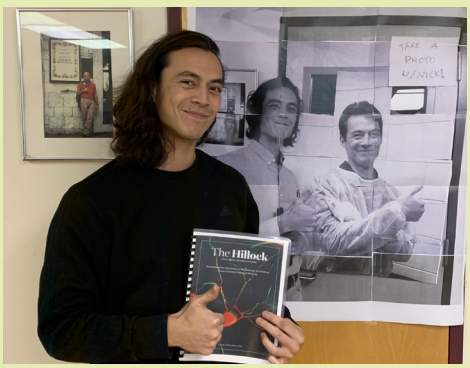
Jeremy Weinberger
Hou Lab

My favorite Drexel moment would be when my computer "broke." I struggled with finding a possible solution to making it work and eventually called for Julien to help me fix it... turns out I only turned on the monitor and never turned on the CPU. I don't think I'll ever live that day down.

Kyle Yeakle
Côté Lab

One of the best parts of working in Cote Lab was the people I worked with. In particular, I'll never forget coming in each day with a clementine for lunch and giving half of it to Jani in exchange for half of her clementine. Even though it was an exact exchange, it was a really sweet gesture.

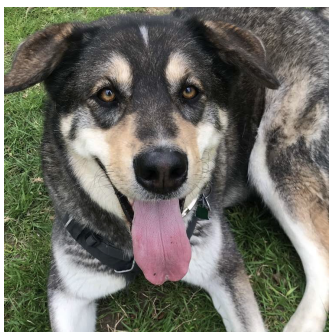


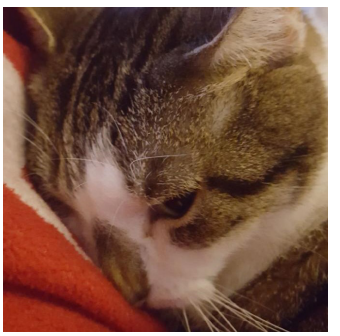


Nick Stachowski
Dougherty Lab

The past year as a tech has been full of experiments and devoid of journal club. I have always enjoyed the daily interactions in the department and continue to do so. I've even talked with med students on occasion. I've most enjoyed settling into a routine that allows me to stay productive in lab and enjoy my time outside of lab as well. I've always wanted a job that would pay me to learn and work with my hands and I've been fortunate enough to do so amongst people that I respect and admire. •

Scientist Support Animals

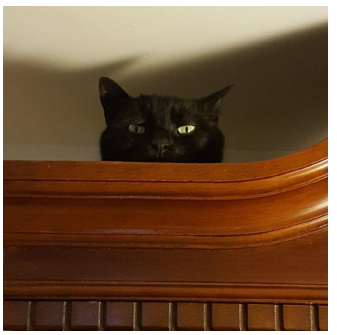
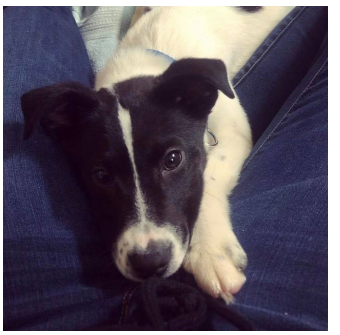




Bella *Nancy Mack*

Bunny *Linda Chamberlin*

Delilah *Katie Bryant*

Jazz *Hemalatha Muralidharan*

Loki *Katie Bryant*

Mazie *Sadie Bennison*

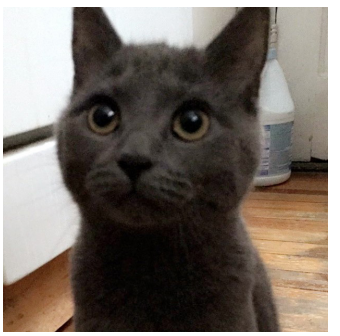


Minxy *Lana Zholudeva, PhD*

Mota Alonso, PhD *Pamela Alonso*

Odin *Margo Randelman*



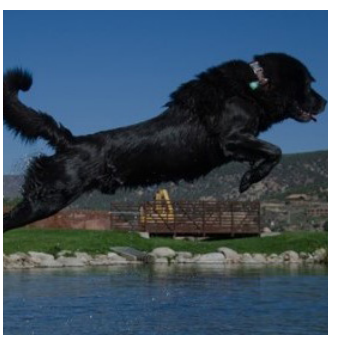


Ollie *Silvia Fernandes*

Robin *Ankita Patil*

Sangria *Micaela O'Reilly*



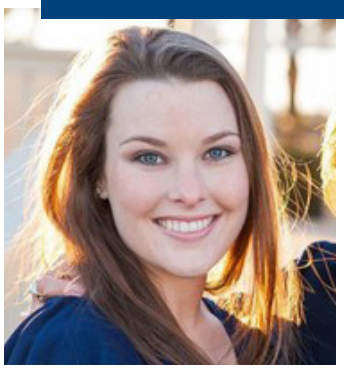


Scully *Katie Bryant*

Winter *Jani Bilchak*

Wyatt *Dr. Janet Smith*

Alumni Interview



Perspectives From a Post-Graduate Fellowship Beyond-the-Bench: Extramural Programs at the National Institutes of Health

by Victoria Spruance, PhD, Drexel University College of Medicine, 2017

Dr. Spruance received her PhD from the department in 2017. She did her dissertation work in the laboratory of Dr. Michael Lane, where she worked on transplantation of neural progenitor cells to improve respiratory function after cervical spinal cord injury. Dr. Spruance is currently a presidential management fellow at the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK, NIH).

Over the course of my graduate education at Drexel University, my scientific passions became more focused. I grew increasingly interested in science policy, education, networking and the "big-picture" view of my field. I also realized that these interests didn't necessarily translate to a traditional academic career at the bench. However, it required a little more time and effort to identify careers that would allow me to engage more fully in these aspects of science that I loved. Luckily, during both my graduate and undergraduate training, I worked with mentors who understood the importance of professional networking and imparted this value to their students. Dr. Michael Lane and Dr. Paul Reier supported my travels to multiple conferences each year and facilitated my interactions with leaders in the field. I was able to speak with professionals in all walks of scientific life – from academic institutions; small, medium and large biotechnology and pharmaceutical companies; science communications; nonprofit and government funding agencies; and policy and advocacy groups. This large, diverse network became my key to identifying which non-academic careers would be best suited for me. During this process, I came to know Dr. Lyn Jakeman, an accomplished neuroscientist (and fellow "Reiercyte") who had made the professional leap from Principal Investigator at an academic institution to a Program Director at the National Institutes of Health (NIH). She eventually became another mentor to me, as she always found time to check-in with me at meetings and offered honesty and candor while discussing different career paths. Through these conversations, I started to identify a Program Director position as a great fit for me and I became determined to find a way to get my foot in the door at NIH.

Dr. Spruance receives the NIDDK Innovation Award from Institute Director Dr. Griffin Rodgers.

Shortly before my dissertation defense, I applied for the Presidential Management Fellowship (PMF). This two-year leadership development program is intended to launch recent, advanced-degree graduates into successful, public service careers in the federal government. I was selected as a PMF finalist and accepted a placement offer at the National Institute of Diabetes and Digestive and Kidney Diseases in the Extramural Programs Division of Kidney, Urologic and Hematologic Diseases (KUH). Luckily for me, it has been the perfect match and has allowed me to learn the ins and outs of the program director job description. My main responsibility at KUH is to oversee a small portfolio of grants. This means that I often spend time talking with our grantees to learn about their work, and doing what I can to help them through the grant application and review processes. The portfolios in our division span all different areas of science – from basic science consortia to fully-fledged clinical trials to start-up biotechnology companies. As such, we regularly engage with various populations: patients, physicians, PIs, science trainees, industry professionals and other program staff at different Institutes at NIH. The other half of the program director job stems from the birds-eye-view of the field that these portfolios provide. Having the "big picture" allows us to identify gaps in the research and propose new funding strategies or policies to help move the science forward. We can convene workshops to highlight a previously understudied area and bring together key stakeholders to generate new ideas. We often write review or perspective papers and participate in NIH-wide program endeavors (such as the Common Fund Initiative for Stimulating Peripheral Activity to Relieve Conditions). As you might imagine, no two days in our office are the same, and every day brings something new. However, perhaps my favorite part of this experience at NIDDK has been the opportunity to see leadership at its absolute best. The support and encouragement provided by our institute and division directors is unparalleled, and constitute a big part of why NIH is such a joyful place to be.

All in all, the PMF has proven to be the perfect next step for me as a fresh PhD graduate. By the end of my two-year fellowship, I will have completed over 160 hours of leadership development training and a 5-month detail assignment as a policy analyst at the U.S. Department of Health and Human Services (HHS) in the Office of Science and Data Policy. Commonly thought of as the policy "think tank" for the HHS Secretary, this office handles high-priority policy issues related to health, science and data (such as the opioid epidemic, combating antibiotic-resistant bacteria, and health data privacy). These detail assignments are required as part of the PMF program to provide diverse experiences in government, training, and networking opportunities. At the end of these two-years of fellowship, I can confidently say I will be ready to convert to a full-time position at NIDDK and continue my career in public service – beyond the bench. •

Graduates *of 2019*

Kaitlin Farrell, PhD
Adviser: John Houle, PhD
Thesis Title: Neuroinflammation and circuitry changes in the dorsal raphe nucleus with depressive phenotype after spinal cord injury
Defense Date: April 4, 2019
Current Position: 3rd year medical student at Drexel University College of Medicine

Rachel Nolan, PhD
Adviser: Peter Gaskill, PhD
Thesis Title: Role of dopamine in the modulation of macrophage-mediated inflammation: Implications for the neuropathogenesis of NeuroHIV and drug abuse
Defense Date: April 8, 2019
Current Position: 3rd year medical student at Drexel University College of Medicine

Ioanna Yiantsos, MS
Adviser: Daniel Marenda, PhD, and Peter Baas, PhD
Thesis Title: Development and manipulation of a Drosophila model for toxic effects of mutated M1 spastin in Hereditary Spastic Paraplegia treatment
Defense Date: April 11, 2019
Current Position: Virology technician II at WuXi AppTec in Philadelphia

Eugene Mironets, PhD
Adviser: Veronica Tom, PhD
Thesis Title: sTNFa mediates plasticity of the spinal sympathetic reflex circuit implicated in cardiovascular and immune dysfunction following spinal cord injury
Defense Date: April 15, 2019
Current Position: Postdoctoral fellow in the Kelly Jordan-Sciutto Lab at the University of Pennsylvania

Kendall Schmidt, PhD
Adviser: Simon Giszter, PhD
Thesis Title: Optogenetically mediated neuromodulation paired with exercised based rehabilitation in adult transected rats enhances voluntary control of trunk muscle segments below injury leading to alterations in spinal circuitry
Defense Date: June 28, 2019
Current Position: Postdoctoral fellow in the Simon Giszter Lab at Drexel University College of Medicine

Austin Coley, PhD
Adviser: Wen-Jun Gao, MD, PhD
Thesis Title: PSD-95 deficiency disrupts PFC function and connectivity leading to sociability and cognitive deficits
Defense Date: July 25, 2019
Current Position: Postdoctoral fellow in the Kay Tye Lab at the Salk Institute for Biological Studies

Avery Runyan, MS
Adviser: Ramesh Raghupathi, PhD
Thesis Title: Social behavior deficits in adolescence following neonate traumatic brain injury
Defense Date: July 26, 2019
Current Position: Research technician in the lab of Natura Myeku at Columbia University in the City of New York

Sarah Monaco, PhD
Adviser: Wen-Jun Gao, MD, PhD
Thesis Title: The role of GSK3B in the parvalbumin-pyramidal prefrontal cortex microcircuit
Defense Date: August 7, 2019
Current Position: Postdoctoral fellow in the lab of Eric Marsh at the Children's Hospital of Pennsylvania

Josephine Vanloozen, PhD
Adviser: Simon Giszter, PhD
Thesis Title: Kinematics of locomotion in the neonatally spinalized rat
Defense Date: August 12, 2019
Current Position: Employed

Tucker Collins, PhD
Adviser: Sandhya Kortagere, PhD
Non-Thesis Title: Kynurenine pathway in Parkinson's Disease
Graduation Date: August 15, 2019
Current Position: PhD student in the Department of Chemistry at Drexel University College of Arts and Sciences

Moriah Harling, PhD
Adviser: Ramesh Raghupathi, PhD
Non-Thesis Title: Examining the clinical relevance of preclinical pediatric TBI modeling
Graduation Date: August 15, 2019
Current Position: To be determined

Cassandra Alexandropoulos, MS
Adviser: Wen-Jun Gao, MD, PhD
Thesis Title: Effects of IgSF9b knockdown in the prefrontal cortex on behavior, cell morphology, and synaptic proteins
Defense Date: August 27, 2019
Current Position: Research associate in the Simon Giszter Lab at Drexel University College of Medicine

Soha Chhaya, PhD
Adviser: Megan Detloff, PhD, and John Houle, PhD
Thesis Title: Neuroimmune contributions to pain development after spinal cord injury: Exploring macrophage-mediated dysfunction in the dorsal root ganglia
Defense Date: September 19, 2019
Current Position: Postdoctoral fellow in the lab of Allan Basbaum at the University of California at San Francisco

Graduates of 2019, *cont.*

Ngoc Ha, PhD
Adviser: Kimberly Dougherty, PhD
Thesis Title: Intrinsic properties and connectivity of Shox2 interneurons in spinal locomotor networks
Defense Date: November 1, 2019
Current Position: Postdoctoral fellow in the lab of Julius Zhu at the University of Virginia

Andrew Gargiulo, PhD
Adviser: Jessica Barson, PhD
Thesis Title: The role of pituitary adenylate cyclase-activating polypeptide (PACAP) in alcohol drinking
Defense Date: November 20, 2019
Current Position: Bucher-Jackson postdoctoral fellow in teaching and research at Bryn Mawr College

Surya Pandey, PhD
Adviser: Jessica Barson, PhD
Thesis Title: Regulation of excessive alcohol consumption by neurotensin signaling in the paraventricular thalamus
Defense Date: December 6, 2019
Current Position: Postdoctoral associate in the Courtney Miller lab at Scripps Research

First Years *of 2019*

PhD Students:

Xiaohuan "Beanie" Sun
Ashley Opalka
Ashraful Islam
Jason Wickman
Jeremy Weinbeger
Jennifer Pastorino
Marissa Cusimano
Shayna Singh

Master's Students:

Zack Merkle
Emily Zihal

MD/PhD Student:

Kyle Samson

MD/MS Student:

Gal Daskal

2019 Awards & Grants

Dr. Itzhak Fischer
Dean's Distinguished Award for Outstanding Support of Pre- and Post-doctoral Education

Dr. Emanuela Piermarini
Outstanding Postdoctoral Fellows Poster
1st Place

Dr. Victor Rovira
Outstanding Postdoctoral Fellows Poster
2nd Place

Dr. Leonardo Garcia-Ramirez
Outstanding Postdoctoral Fellows Poster
3rd Place

Margo Randelman
Barry Waterhouse Outstanding Platform Presentation
1st Place

Andrew Gargiulo
Platform Presentation

Jadwiga "Jani" Bilchak
Outstanding Senior Graduate Student Poster
Honorable Mention

Philip Yates
Outstanding Senior Graduate Student Poster
Honorable Mention

Student Awards

F31 Fellowship

Emily Black, mentored by Dr. Rodrigo España
Jaclyn DeFinis, mentored by Dr. Shaoping Hou

Dean's Fellowship for Excellence in Collaborative or Themed Research

Ilse Pamela Alonso, mentored by Dr. Rodrigo España
Hemalatha Muralidharan, mentored by Dr. Peter Baas
Shasha Yang, mentored by Dr. Wen-Jun Gao

Finalist for the Outstanding Dissertation Award

Zachary Brodnik, mentored by Dr. Rodrigo España

Finalist for the Research Excellence Award (post-candidacy)

Austin Coley, mentored by Dr. Wen-Jun Gao
Sarah Monaco, mentored by Dr. Wen-Jun Gao

Finalist for the Research Excellence Award (pre-candidacy)

Shasha Yang, mentored by Dr. Wen-Jun Gao

BSGSA Student Travel Award

Jadwiga Bilchak, mentored by Dr. Marie-Pascale Côté
Micaela O'Reilly, mentored by Dr. Veronica Tom
Margo Randelman, mentored by Dr. Michael Lane

Faculty Awards

Best Professor Award, Drexel University, Graduate School

Peter Baas, PhD

Provost Award for Outstanding Scholarly Achievement, Drexel University

Peter Baas, PhD

Young Investigator Award, Drexel University College of Medicine

Megan Detloff, PhD

Postdoctoral Fellowship

Cotswold Fellowship

Victor Rovira Zambrana, PhD

Faculty Grants 2019

Ramesh Raghupathi, PhD

NIH

Michael Lane, PhD

Wings for Life
Moseley Foundation

Megan Detloff, PhD

NIH
Commonwealth of Pennsylvania (CURE)

Veronica Tom, PhD

NIH

Shaoping Hou, PhD

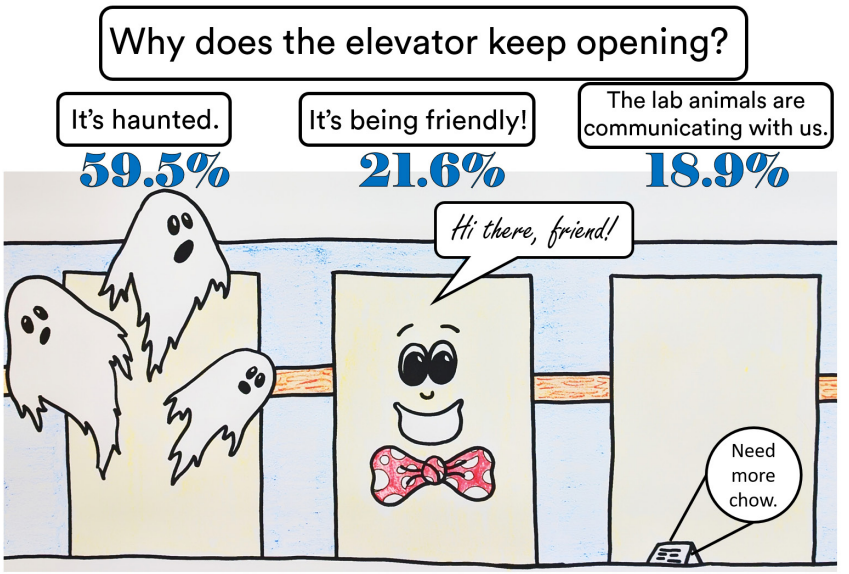
NIH

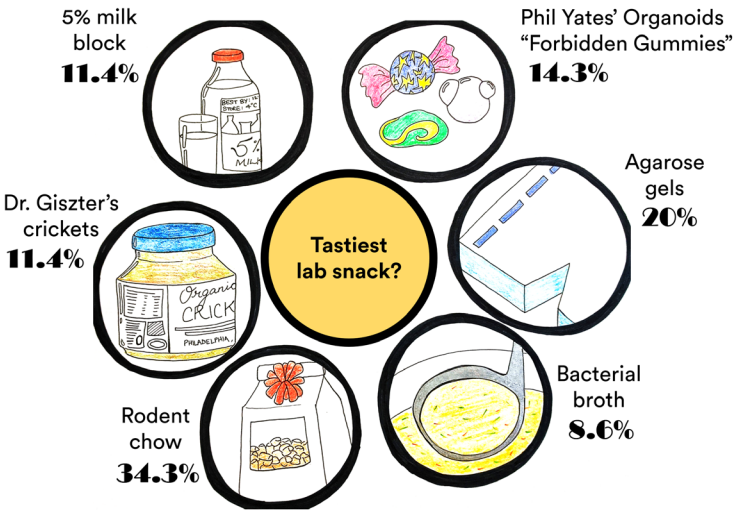
Ilya Rybak, PhD

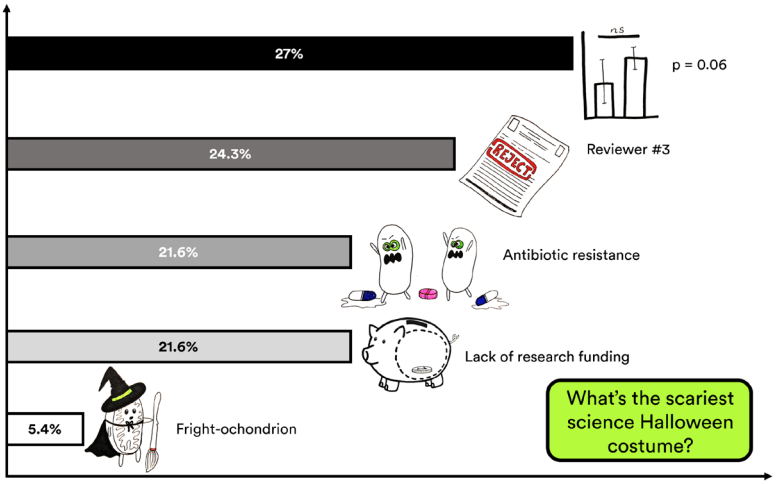
NIH

Culture

Illustrations by Ankita Patil







FBI Training Session

by Caitlin Howe, PhD

In August, the Department of Neurobiology and Anatomy had the honor of hosting 17 FBI SWAT emergency medical technicians at the College of Medicine for a medical technique refresher class. The curriculum consisted of hands-on training in the Simulation Center and cadaver lab focusing on clinically related anatomy and life-saving techniques, such as tourniquet placement, needle decompression, wound packing and airway management.

Dr. Caitlin Howe directed the session with help from Dr. Kathleen Ryan from the Office of Educational Affairs. Special thanks to Army Captain Justin Howe, Dr. Dan Minczak, Dr. Haviva Goldman, Ms. Theresa Connors, Ms. Jeanine Gravatt and Mr. Allen Ribblett for helping coordinate and participating in the session.

Mr. Michael Biamonte, manager of the School of Operational Medicine at the FBI, stated, "Our program was an overwhelming success, due in no small part to your team. Your personnel were instrumental in the planning, set-up, and execution off the class. Their professionalism, modesty and expertise in their fields was apparent and well received by all the students. It was truly a pleasure to watch them work."

We hope to continue to train law enforcement here at the Drexel University College of Medicine as a way to give back to those protecting our communities. •

Outreach

1

2

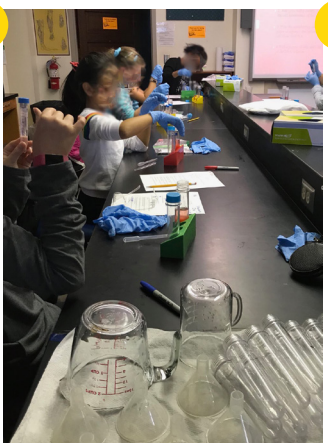
3

4

5

6

7



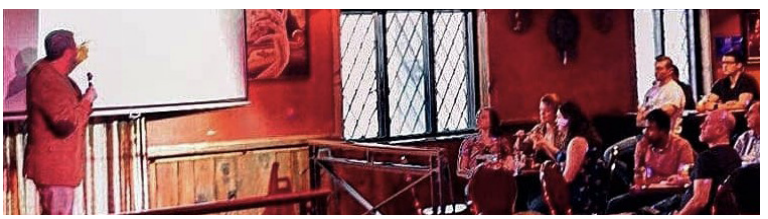
8

9

10

11

12



Medical Student for a Day Workshop (1)

Medical Student for a Day is a day-long program that invites high school students of diverse backgrounds to participate in lectures and hands-on laboratories at the Queen Lane Campus. Students (medical and graduate), faculty and staff gave lectures and demonstrated parts of human cadaver dissections, including gross brain and spinal cord. This program was founded by Theresa Connors in 2003 and has since enabled almost two decades' worth of students to explore the possibility of a profession in medical and research fields they may not have previously considered.

Outreach at Springside Chestnut Hill Elementary Schools (2, 3, 4)

This program was initiated by members of the Lane Lab, where they spent a day teaching neuroscience to elementary school children at the Springside Chestnut Hill School. The program featured a general introduction to neuroscience and then separated members of the class into three groups. These groups rotated through stations that featured topics like comparative neuroanatomy, building a "thinking brain cap" that represented parts of the brain, and a station with activities that enabled them to use their five senses while learning how some of the senses are co-dependent (e.g., olfaction and gustation).

Brain Health Fair (5)

The Brain Health Fair was a free, one-day event presented by the American Academy of Neurology that connected students interested in neuroscience, neurology patients and caregivers affected by CNS disease. As part of this program, students, staff and faculty from our department volunteered their time to answer questions about neuroscience, CNS injury and disease by setting up a gross brain anatomy station. Previously dissected brains and spinal cords, as well as plastic models of the brain and spinal cord, were transported to the Pennsylvania Convention Center and set up for visual and hands-on presentations.

PAGES: Philadelphia Area Girls Enjoying STEM (6,7)

Students from our department participated in science workshops organized by PAGES, a program that allows sixth-grade girls to engage in hands-on STEAM activities. Nancy Mack helped conduct an experiment in which the girls were shown how to extract DNA from strawberries, while Pamela Alonso and Ankita Patil conducted a demonstration on vision, optical illusions, and how the brain processes these phenomena.

Women in STEM at the Philadelphia Science Festival (8,9)

Members of our department volunteered with the Association for Women in Science at the Philadelphia Science Festival Carnival. Volunteers decorated lab coats to showcase the work of female scientists. They also wore these coats at the carnival and engaged with visitors to highlight the significant contributions of female scientists to different areas of research.

Esteem Girls (10)

In July, girls from the Philadelphia School District visited our campus as part of their summer STEAM Camp. Medical students, Neurobiology and Anatomy personnel and the Sim Center helped provide a fun and educational program for these students with the highlight of the day being a presentation and discussion centered on normal and diseased anatomical specimens from the Gross Anatomy Lab.

taste of science Philadelphia (11,12)

Students from our department volunteered with *taste of science*, a nationwide non-profit science outreach initiative, to share research with a wider audience. Scientists from the Philadelphia area, including Dr. Jessica Barson and recent graduate Dr. Andrew Matamoros, were invited to present short talks on their research at local venues. This year, the team also partnered with Two Photon Art by offering "Science is for everyone" enamel pins at their events. Proceeds from these pins were donated to the Massive Science Consortium's program for journalism training for underrepresented minorities.

GED to Health Care

On October 18, Neurobiology and Anatomy faculty and students provided interactive presentations in the anatomy lab for non-traditional students from a program called GED to Health Care. The program is sponsored by 1199C, an affiliate of the National Union of Hospital and Health Care Employees, to enable learners to earn their GED while training for careers in the health professions.

Johns Hopkins Underrepresented in Medicine Program (JUMP)

In conjunction with the Office of Diversity, Equity & Inclusion, Neurobiology and Anatomy faculty and students conducted gross anatomy and neuroscience labs for visitors from Johns Hopkins Underrepresented in Medicine Program (JUMP) this August. JUMP's mission is to promote the success of students from underrepresented populations that are interested in pursuing careers in medicine and other health professions.

Activities

At the Gordon Research Conference on Catecholamines

The Annual American Society for Cell Biology (ASCB) Meeting in Washington D.C.

España lab beer garden outing

Our Department was featured in Atlas Obscura!

Holi celebrations at Queen Lane!

ATV ride up a volcano after the EMBO Neuronal Cytoskeleton workshop in Chile

Publications

Ilse Alonso (Graduate Student – Espana Lab)

Alonso IP. (In press). Inferior. How science got women wrong-and the new research that's rewriting the story. {Review in Spanish of the Book Inferior, by Angela Saini]. De este lado: revista feminista de divulgacion cientifica.

Peter Baas, PhD – Professor

Dong Z, Wu S, Zhu C, Wang X, Li Y, Chen X, Liu D, Qiang L, Baas PW, Liu M. 2019. Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)/ Cas9-mediated kif15 mutations accelerate axonal outgrowth during neuronal development and regeneration in zebrafish. Traffic 20: 71-81.

Qiang L, Piermarini E, Muralidharan H, Yu W, Leo L, Hennessy LE, Fernandes S, Connors T, Yates PL, Swift M, Zholudeva LV, Lane MA, Morfini G, Alexander GM, Heiman-Patterson TD, Baas PW. 2019. Hereditary Spastic Paraplegia: gain-of-function mechanisms revealed by new transgenic mouse. Human Molecular Genetics. 28: 1136-1152.

Matamoros, A.J., V.J. Tom, D. Wu, Y. Rao, D.J. Sharp, and P.W. Baas. 2019. Knockdown of fidgetin improves regeneration of injured axons by a microtubule-based mechanism. Journal of Neuroscience. 39: 2011-2024.

Muralidharan, H, and P.W. Baas. 2019. Mitotic motor KIFC1 is an organizer of microtubules in the axon. Journal of Neuroscience 39: 3792-3811.

Baas, P.W., and L. Qiang. 2019. Tau: It's not what you think. Trends in Cell Biology. 29: 452-461.

Qiang, L., E. Piermarini, and P.W. Baas. 2019. New hypothesis for the Etiology of SPAST-based hereditary spastic paraplegia. Cytoskeleton 76: 289-297.

Jessica Barson, PhD – Assistant Professor

Curtis GR, Coudriet JM, Sanzalone L, Mack NR, Stein LM, Hayes MR, Barson JR. Short- and long-access palatable food self-administration results in different phenotypes of binge-type eating. Physiol Behav. 2019 [Epub ahead of print]

Tatiana Bezdudnaya, PhD - Instructor

Shevtsova, N. A., Marchenko, V., Bezdudnaya, T. (2019) Modulation of respiratory system by limb muscle afferents in intact and injured spinal cord. Front Neurosci. 13:289. PMCID: PMC6443963

Manuel Castro, PhD – Professor

Hormigo S, Vega-Flores G, Rovira V, Castro-Alamancos MA. (2019) Circuits That Mediate Expression of Signaled Active Avoidance Converge in the Pedunculopontine Tegmentum. J. Neurosci. 39(23):4576-4594.

Marie-Pascale Côté, PhD – Assistant Professor

Beverungen H, Choyke S., Klasky M, Côté M-P (2019) Rehabilitation decreases spasticity by restoring chloride homeostasis through the BDNF-KCC2 pathway after SCI. J Neurotrauma 36:1-14.

Simon Danner, PhD – Research Instructor

Danner, S. M., Zhang, H., Shevtsova, N. A., Borowska-Fielding, J., Deska-Gauthier, D., Rybak, I. A. and Zhang, Y. (2019). Spinal V3 interneurons and left-right coordination in mammalian locomotion. Front. Cellular Neurosci 13, 516. 1-23.

Fujiki, S., Aoi, S., Tsuchiya, K., Danner, S. M., Rybak, I. A. and Yanagihara, D. (2019). Phase- dependent response to afferent stimulation during fictive locomotion: a computational modeling study. Front. Neurosci [accepted] DOI: 10.3389/fnins.2019.01288

Hofstoetter US, Freundl B, Danner SM, Krenn MJ, Mayr W, Binder H, Minassian K (2019) Transcutaneous Spinal Cord Stimulation Induces Temporary Attenuation of Spasticity in Individuals with Spinal Cord Injury. J Neurotrauma. doi: 10.1089/neu.2019.6588.

Ausborn, J., Shevtsova, N. A., Caggiano, V., Danner, S. M., and Rybak, I. A. (2019) Computational modeling of brainstem circuits controlling locomotor frequency and gait. eLife. 8. pii: e43587.

Megan Detloff, PhD – Assistant Professor

*Chhaya SJ, Schmidt KA, Gistzer SF, Detloff MR. Diverse immune response in the dorsal root ganglia acutely after spinal cord injury. Scientific Reports. Accepted.

Kimberly Dougherty, PhD – Associate Professor

Li EZ, Garcia-Ramirez DL, Dougherty KJ. 2019. Flexor and Extensor Ankle Afferents Broadly Innervate Locomotor Spinal Shox2 Neurons and Induce Similar Effects in Neonatal Mice. Front Cell Neurosci. 13:452.

Dougherty KJ, Ha NT. 2019. The rhythm section: An update on spinal interneurons setting the beat for mammalian locomotion. Curr Opin Physiol. 8:84-93.

Ha NT, Dougherty KJ. 2018. Spinal Shox2 interneuron interconnectivity related to function and development. Elife. 7. pii: e42519.

Rodrigo España, PhD – Associate Professor

Brodnik ZD, Black EM, España RA. Accelerated development of cocaine-associated dopamine transients and cocaine use vulnerability following traumatic stress. Neuropsychopharmacology. 2019 Sep 20. doi: 10.1038/ s41386-019-0526-1. [Epub ahead of print] PMID:31539899

Aggarwal S, Liu X, Rice C, Menell P, Clark PJ, Paparoidamis N, Xiao YC, Salvino JM, Fontana ACK, España RA, Kortagere S, Mortensen OV. Identification of a Novel Allosteric Modulator of the Human Dopamine Transporter. ACS Chem Neurosci. 2019 Aug 21;10(8):3718-3730. doi: 10.1021/acschemneuro.9b00262. Epub 2019 Jun 24. PMID:31184115

Itzhak Fischer, PhD – Professor and Chair

Partyka PP, Jin Y, Bouyer J, DaSilva A, GodseyGA, Nagele RG, Fischer I, Galie PA (2019) Harnessing neurovascular interaction to guide axon growth. Scientific Reports DOI:10.1038/s41598-019-38558-y.

Fischer I, Dulin J, Lane M (2019) Transplanting neural progenitor cells in spinal cord injury: past, present, future. Invited by Nature Reviews.

Wen-Jun Gao, PhD – Professor

Dan-Dan Hong1, Wen-Qiang Huang1, Ai-Ai Ji1, Sha-Sha Yang1, Hui Xu2, Ke-Yi Sun1, Aihua Cao3, Wen-Jun Gao4, Ning Zhou5*, Ping Yu1* (2019) Neurons in rat orbitofrontal cortex and medial prefrontal cortex exhibit distinct responses in reward and strategy-update in a risk-based decision-making task. Metabolic Brain Disease 2018 Dec 8. doi: 10.1007/s11011-018-0360-x. [Epub ahead of print] PMID: 30535618

Eric Prouty, Dan Chandler, Wen-Jun Gao, Barry Waterhouse (2019) Selective vulnerability of dorsal raphe-medial prefrontal cortex projection neurons to corticosterone-induced hypofunction. Eur. J. Neurosci. 2019 Jan 28. doi: 10.1111/ejn.14355. [Epub ahead of print] PMID: 30687960

Melissa A. Snyder and Wen-Jun Gao* (invited review, 2019): NMDA receptor hypofunction for schizophrenia revisited: perspectives from epigenetic mechanisms. Schizophrenia Research (2019 Apr 9. pii: S0920-9964(19)30104-5. doi: 10.1016/j.schres.2019.03.010. [Epub ahead of print])

Steven Hill1,§, Andrew Blaeser1,§, Austin A. Coley2, Katherine A. Shepard1, Corey Harwell3, Wen-Jun Gao2, A. Denise R. Garcia1,2* (2019) Sonic hedgehog signaling in astrocytes mediates cell-type specific synaptic organization. eLife 2019;8:e45545 doi: 10.7554/eLife.45545 https://elifesciences.org/articles/45545

Austin Coley and Wen-Jun Gao: PSD-95 deficiency alters the development of glutamatergic transmission in the prefrontal cortex and impairs PFC-associated cognition. Scientific Reports, Article number: 9486 (https://www.nature.com/articles/s41598-019-45971-w)

Yan-Chun Li1*, Priyalakshmi Panikker2, Bo Xing1, Sha-Sha Yang1, Cassandra Alexandropoulos1, Erin P McEachern1, Rita Akumuo1, Elise Zhao1, Yelena Gulchina1, Mikhail V. Pletnikov3, Nikhil M. Urs4, Marc G. Caron5, Felice Elefant2, and Wen-Jun Gao1* (2019) Deletion of GSK-3β in D2R-expressing neurons ameliorates cognitive impairment via NMDAR-dependent synaptic plasticity. Biological Psychiatry. https://doi.org/10.1016/j.biopsych.2019.10.025 (in print-proof).

John Houle, PhD – Professor

Farrell K and Houle JD (2019) Systemic Inhibition of Soluble Tumor Necrosis Factor with XPro1595 Exacerbates a Post-Spinal Cord Injury Depressive Phenotype in Female Rats. J Neurotrauma 36(21):2964-2976.

Farrell K, Detloff MR and Houle JD (2019) Plastic changes after spinal cord injury. Oxford Research Encyclopedia of Neuroscience. DOI:10.1093/acrefore/9780190264086.013.241

Caitlin Howe, PhD – Assistant Professor

Howe CA, Ruane BM, Latham SE, Sahu N. Promotion of Cadaver-Based Military Trauma Education: Integration of Civilian and Military Trauma Systems. Military Medicine. [Epub ahead of print], June 2019.

Clyburn C, Howe CA, Arnold A, Lang C, Travagli RA, Browning KN. Perinatal High Fat Diet Alters Development of GABAA Receptor Subunits in the Dorsal Motor Nucleus of the Vagus. Am J Physiol Gastrointest Liver Physiol. 317: G40–G50, May 2019.

Tae Gyo Kim, PhD – Research Associate

Kim, T., Schmidt, K.A., Deemie, C.W, Wycech, J., Liang, H., Giszter, S.F., Highly flexible precisely braided multielectrode probes and combinatorics for future neuroprostheses, Frontiers in Neuroscience – Neuroprosthetics, Jun. 2019.

Kim, T., Zhong, Y., Giszter, S.F., Precise tubular braid structures of ultrafine microwires as neural probes: significantly less immune response and greater local neural survival in rat brains, IEEE TNSRE, May 2019.

Todorov, D., Capps, R., Barnett, W.H., Latash, E.M., Kim, T., Hamade, K.C., Markin, S.N., Rybak, I.A., Molkov, Y.I. The interplay between cerebellum and basal ganglia in motor adaptation: a modeling study, PLoS ONE, Apr. 2019.

Kim, T., Capps, R.A., Hamade, K.C., Markin, S.N., Barnett, W.H., Todorov, D., Latash, E.M., Rybak, I.A., Molkov, Y.I., The functional role of striatal cholinergic interneurons in reinforcement learning from computational perspective, Frontiers in Neural Circuits, Feb. 2019.

Michael A. Lane, PhD – Associate Professor

Qiang L, Piermarini E, Muralidharan H, Yu W, Leo L, Hennessy LE, Fernandes S, Connors T, Yates PL, Swift M, Zholudeva LV, Lane MA, Morfini G, Alexander GM, Heiman-Patterson TD, Baas PW. Hereditary spastic paraplegia: gain-of-function mechanisms revealed by new transgenic mouse. Hum Mol Gen. 28(7): 1136-1152. [PMID: 30520996]

Zholudeva LV, Lane MA (2019). Transplanting Cells for Spinal Cord Repair: Who, What, When, Where and Why? Invited Review. Cell Transplant, online [PMID: 30654638]

Zholudeva LV, Lane MA (2019). Choosing the right cell for spinal cord repair. Invited Commentary and Featured Cover Image. J. Neurosci Res., 97(2): 109-111 [PMID: 30383302]

Liang Qiang, PhD – Research Assistant Professor

Qiang L*, Piermarini E, Baas PW. New hypothesis for the etiology of SPAST-based hereditary spastic paraplegia. Cytoskeleton (Hoboken). 2019 Apr;76(4):289-297.(* corresponding author)

Baas PW, Qiang L. Tau: It's Not What You Think. Trends Cell Biol. 2019 Jun;29(6):452-461.

Qiang L, Piermarini E, Muralidharan H, Yu W, Leo L, Hennessy LE, Fernandes S, Connors T, Yates PL, Swift M, Zholudeva LV, Lane MA, Morfini G, Alexander GM, Heiman-Patterson TD, Baas PW. Hereditary spastic paraplegia: gain-of-function mechanisms revealed by new transgenic mouse. Hum Mol Gen. 28(7): 1136-1152. [PMID: 30520996]

Dong Z, Wu S, Zhu C, Wang X, Li Y, Chen X, Liu D, Qiang L, Baas PW, Liu M. Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)/Cas9-mediated kif15 mutations accelerate axonal outgrowth during neuronal development and regeneration in zebrafish. Traffic. 2019 Jan;20(1):71-81.

Ramesh Raghupathi, PhD - Professor

Huh JW and Raghupathi R. Therapeutic strategies to target acute and long-term sequelae of pediatric traumatic brain injury. Neuropharmacol. 145:153-159, 2019.

Hanlon LA, Raghupathi R, Huh JW. Depletion of microglia immediately following traumatic brain injury in the pediatric rat: Implications for cellular and behavioral pathology. Exp Neurol. 316:39-51, 2019.

Hanlon L.A., Huh J.W. and Raghupathi R. Pediatric TBI models: Lessons learned, in Neurotrauma: A Comprehensive Book on Traumatic brain injury and Spinal Cord injury (Wang K.K.W., ed.) Oxford University Press, 2018.

Ilya Rybak, PhD – Professor

Fujiki, S., Aol, S., Tsuchiya, K., Danner, S.M., Rybak, I.A. and Yanagihara, D. (2019). Phase-dependent response to afferent stimulation during fictive locomotion: a computational modeling study. Front. Neurosci [accepted] DOI: 10.3389/fnins. 2019.01288

Danner, S.M., Zhang, H., Shevtsova, N.A., Borowska-Field, J., Deska-Gauthier, D., Rybak, I.A. and Zhang, Y. (2019) Spinal V3 interneurons and left-right coordination in mammalian locomotion. Front. Cellular Neurosci 13, 516. 1-23.

Ausbornm J., Shevtsova, N.A., Caggiano, V., Danner, S.M., and Rybak, I.A. (2019) Computational modeling of brainstem circuits controlling locomotor frequency and gait. eLife. 8.pii: e43587.

Shevtsova, N.A., Marchenko, V., and Bezdudnaya, T. (2019) Modulation of respiratory system by limb muscle afferents in intact and injured spinal cord. Front. Neurosci. 13:289.

Kim, T., Capps, R.A., Hamade, K.C., Barnett, W.H., Todorov, D.I., Latash, E.M., Markin, S.N., Rybak, I.A., and Molkov, Y.I. (2019) The functional role of striatal cholinergic interneurons in reinforcement learning from computational perspective. Front. Neural Circuits 13:10.

Todorov, D.I., Capps, R.A., Barnett, W.H., Latash, E.M., Hamade, K.C., Markin, S.N., Rybak, I..A., and Molkov, Y.I. (2019) The interplay between cerebellum and basal ganglia in motor adaptation: A modeling study. PLoS One 14(4):e0214926.

Veronica Tom, PhD – Professor

Mironets, E., Fischer, R., Bracchi-Ricard, V., Saltos, T.M., Truglio, T.S., O'Reilly, M.L., Swanson, K.A., Bethea, J.R., Tom, V.J. (2019). Attenuating neurogenic sympathetic hyperreflexia robustly improves antibacterial immunity after chronic spinal cord injury. Journal of Neuroscience (In Press). PMID: 31754014.

Kazuhito Toyooka, PhD – Assistant Professor

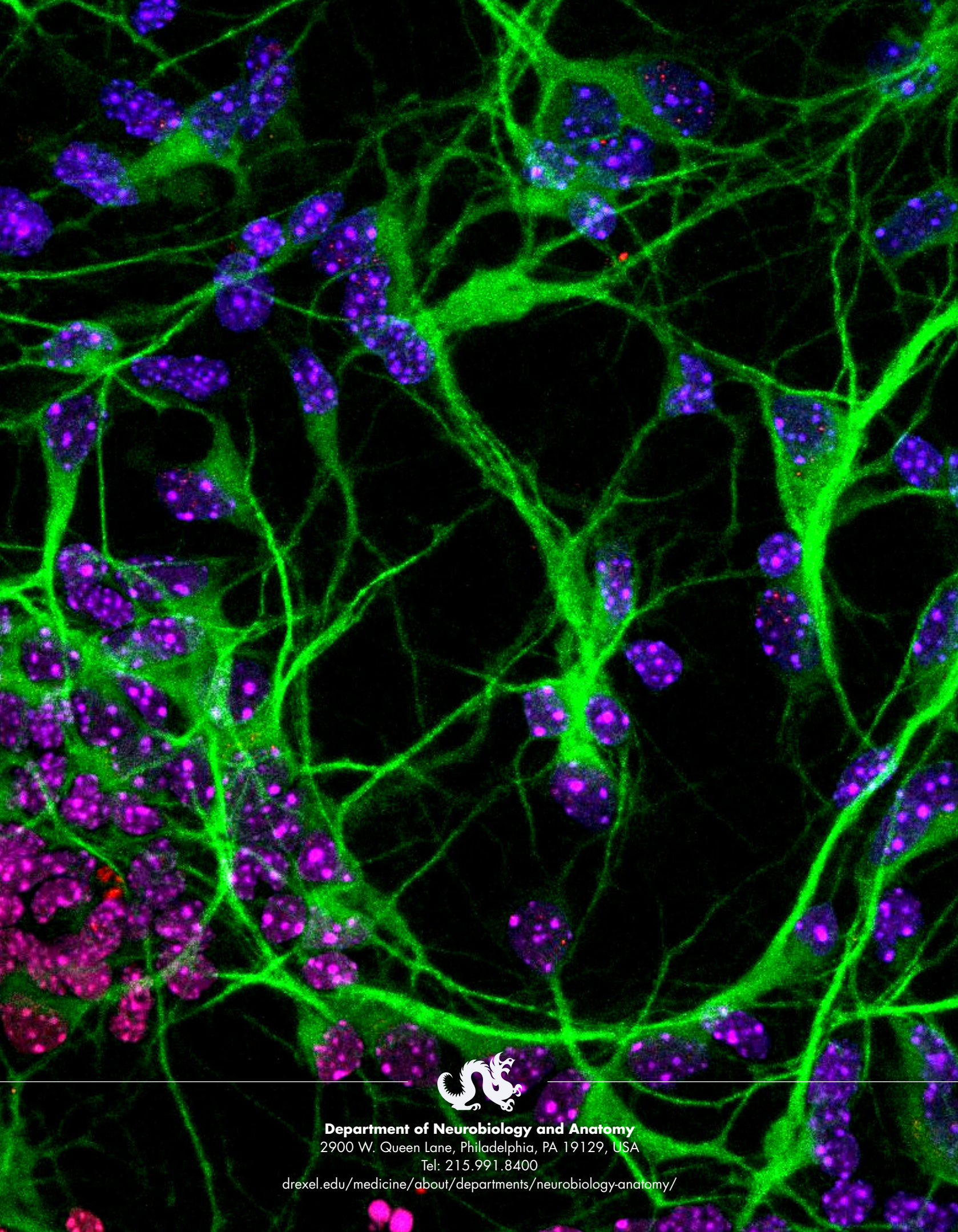
Sarah A Bennison, Sara M Blazejewski, Trevor H Smith , Kazuhito Toyo-Oka, Protein Kinases: Master Regulators of Neuritogenesis and Therapeutic Targets for Axon Regeneration, Cell Mol Life Sci, 2019 Oct 28, DOI: 10.1007/s00018-019-03336-6, PMID: 31659414

Dong Wang, PhD – Assistant Professor

Opalka A, Huang W-Q, Liu J, Liang H, Wang, D. Hippocampal ripple coordinates retrosplenial inhibitory neurons during slow-wave sleep. Cell Reports accepted

Wenqian Yu, MD – Research Instructor

Qiang L, Piermarini E, Muralidharan H, Yu W, Leo L, Hennessy LE, Fernandes S, Connors T, Yates PL, Swift M, Zholudeva LV, Lane MA, Morfini G, Alexander GM, Heiman-Patterson TD, Baas PW. 2019. Hereditary Spastic Paraplegia: gain-of-function mechanisms revealed by new transgenic mouse. Hum Mol Genet. 28: 1136-1152.



Department of Neurobiology and Anatomy
2900 W. Queen Lane, Philadelphia, PA 19129, USA
Tel: 215.991.8400
drexel.edu/medicine/about/departments/neurobiology-anatomy/