

# GRADUATE PROGRAM IN NEUROSCIENCE

## CELLULAR NEUROSCIENCE, NEURODEVELOPMENT AND NEURODEGENERATION GROUP



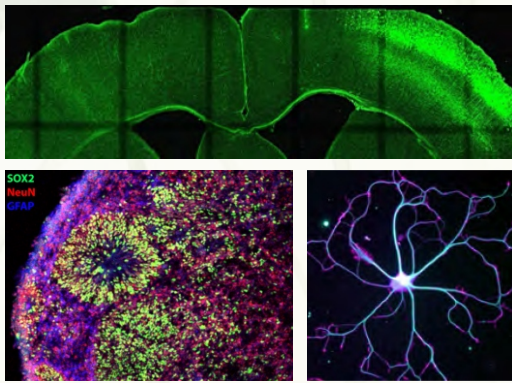
DREXEL UNIVERSITY  
Graduate School of  
**Biomedical Sciences  
and Professional Studies**  
*College of Medicine*

**OUR MISSION** To boldly move the field of cellular neuroscience forward in transformational ways that change the course of basic science while dramatically shifting paradigms for disease treatment strategies. Rather than following the crowd, our approach is to think out of the box, innovate and forge new directions.

### WHO WE ARE

We have a robust multidisciplinary sub-focus on cellular neuroscience, neurodevelopment and neurodegeneration. This research group starts with basic cellular and developmental neuroscience, with cutting-edge mechanistic studies on questions such as:

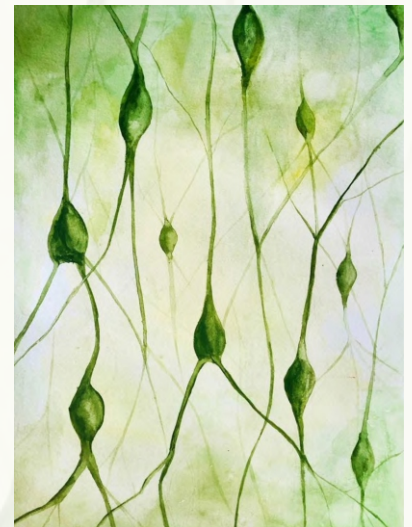
- How axons and dendrites grow
- How neurons migrate
- How growth cones find their targets
- How organelles are trafficked in the neuron



Clockwise from top: cortical section, hippocampal neuron, cerebral organoid

Other studies delve into signaling pathways, genetics and epigenetics. Model systems include human induced pluripotent stem cells, mouse models for neurological disorders, as well as rodent primary cell cultures.

Building on the basic science themes that are strong among the faculty, an ever-growing level of attention in the group is devoted to neurodevelopmental disorders and neurodegenerative diseases.



Artwork by  
Hemalatha  
Muralidharan

### UNDERSTANDING MECHANISMS

Our approach combines mechanistic basic science and disease-oriented research so that entirely new insights can drive our efforts toward novel therapies.

We have a highly collaborative atmosphere wherein the expertise and insights of multiple teams in three departments (Neurobiology & Anatomy, Pharmacology & Physiology, and Biology) combine to drive projects forward:

#### Methodologies

- Rodent models, various rodent primary neuronal cultures
- Human induced pluripotent stem cell derived CNS neurons and brain organoids
- Microscopy – in vitro, ex vivo, time-lapse
- Molecular and cellular biology and biochemistry
- Multi-electrode in vitro, ex vivo electrophysiology
- Drug development
- Single cell RNA sequencing
- LC-MS/MS proteomics

#### Current research areas

##### Neuronal cytoskeleton

- Microtubule organization (Baas, Toyooka, Qiang)
- Axonal and dendritic transport (Baas, Spiliotis)
- Microtubules and axon regeneration (Baas, Qiang, Fischer, Tom)

##### Neuronal development

- Neurogenesis and migration (Baas, Toyooka, Qiang)
- Neurite formation (Baas, Toyooka)

##### Neurodegeneration

- Mutant protein toxicity (Qiang, Baas, Cunningham)
- Defective axonal transport (Baas, Qiang, Spiliotis, Raghupathi)
- Autophagy deficits (Qiang)
- Cellular vulnerability in distinct neurodegenerative disorders (Qiang, Baas)



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### ■ DISEASE ETIOLOGY AND TREATMENT

#### ***Tauopathies***

A group of disorders involving aberrations to the microtubule-associated protein tau. (Baas, Fischer, Qiang, Raghupathi)

#### ***Gulf War Illness***

A chronic disorder suffered by veterans of the first Gulf War exposed to pesticides and nerve agents. (Baas, Qiang)

#### ***Neuro-AIDS***

HIV-AIDS adversely affects every system of the body and has profound negative effects on the nervous system. (Meucci, others)

#### ***Hereditary Spastic Paraplegia***

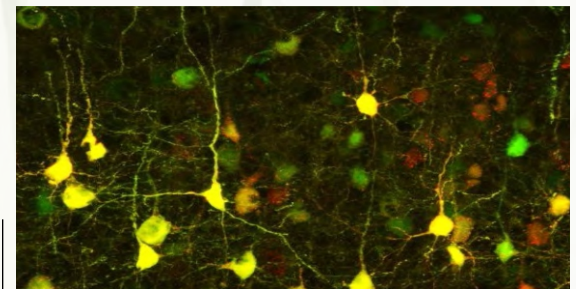
Corticospinal degeneration leading to gait impairment, caused by mutations to the microtubule-severing protein spastin. (Baas, Qiang, collaboration with Marion Murray Spinal Cord Research Center)

#### ***Autism Spectrum Disorders***

Genetic mutations affecting early developmental timepoints such as neuronal morphogenesis, migration and cortical connectivity. (Toyooka, collaboration with Gao and the AJ Drexel Autism Institute)

#### ***CNS Injuries***

Spinal cord injury (SCI) and traumatic brain injury (TBI) are poorly understood mechanistically, and hence effective therapies remain elusive. (Baas, Qiang, Tom, Fischer, Raghupathi)



Neurons in the cortex

### ■ OUR TRAINEES

Graduate students are the centerpiece of the process, the hub of the collaborative efforts and the spark for new ideas.

There are many opportunities for our trainees to attend conferences and meet with leaders in the fields of science, medicine, government and industry.

Students in our program successfully publish in premier journals such as *Cell Reports*, *Journal of Neuroscience*, *Journal of Cell Biology* and *Current Biology*.



Queen Lane Campus

#### **Get in Touch**

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