University of Colorado **Anschutz Medical Campus**

Insights into Oligodendrocyte Research, Lab Techniques, and Cultural Exchange

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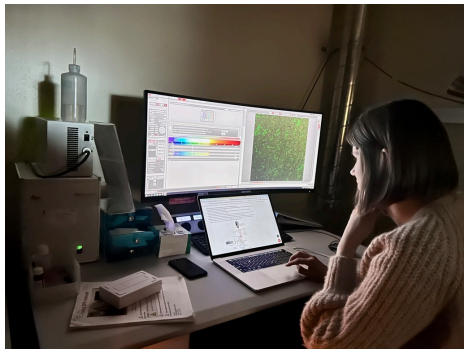
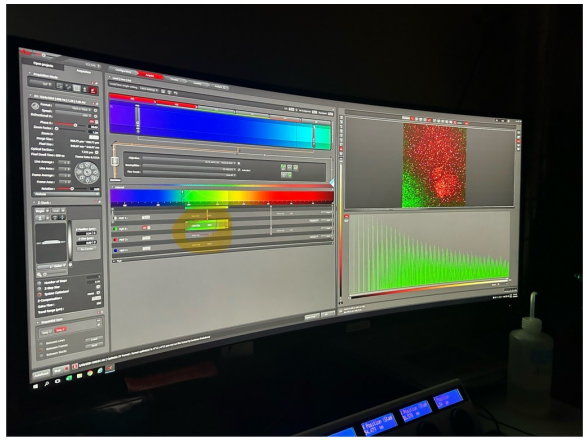
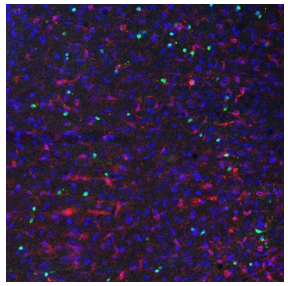
HUGHES LAB
Cellular Neuroscience

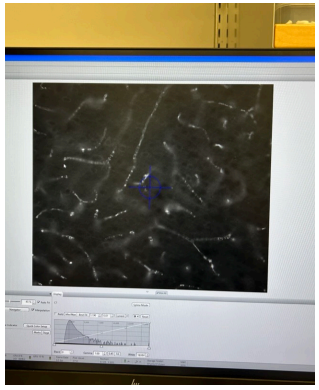
Overview

- Hughes Lab
  - Cellular neuroscience lab
- The Learning Experience
  - Cranial Window Surgery
  - Two-Photon Microscopy
  - Learned techniques
    - Brain IHC
    - Confocal Microscopy
- Cultural Exchange
- Conclusion



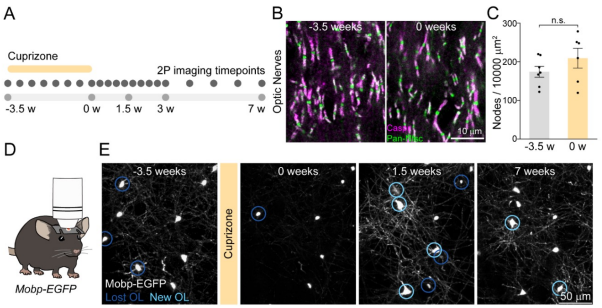




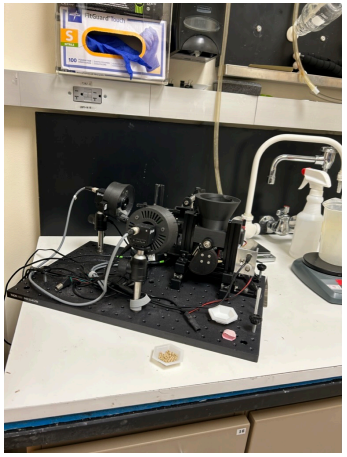


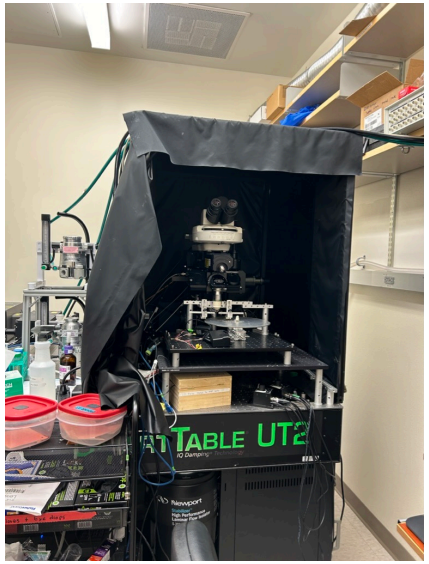
Lab Introduction & Background

- Hughes Lab
  - Cell dynamics in adult brain
    - Oligodendrocytes, OPC differentiation in CNS
    - Remyelination in Mobp-EGFP mice
- Study Techniques
  - Long term two-photon in-vivo imaging
  - Cranial window surgery
  - Behavioral Tests – motor reach task



Della-Flora Nunes, G., et al. (2024). BioRxiv.





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What are Oligodendrocytes?

Oligodendrocytes are a type of support cell in the CNS

- Provides myelin sheaths around axons of neurons.

  in the CNS

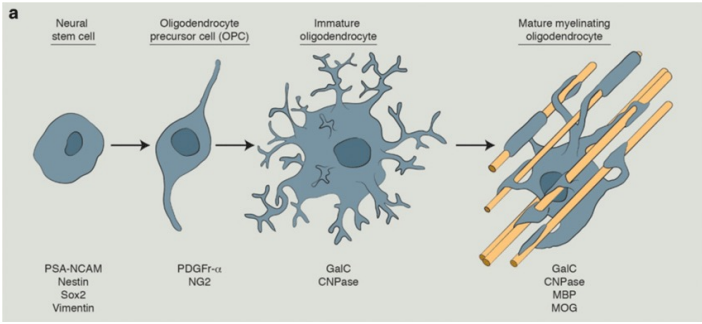
  - Allows for the rapid conduction of neural

    impulses/messages

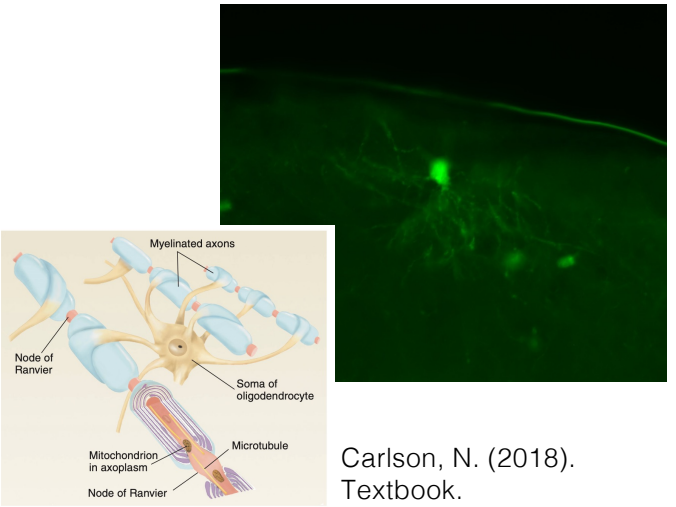
  - Demyelination: disrupts neural communication

  - Remyelination: natural process to rebuild myelin

  - Results in several pathologies – MS, Alzheimer's, etc.



Wooliscroft, L. et al. (2019). Curr Treat Options Neurol.



Carlson, N. (2018). Textbook.

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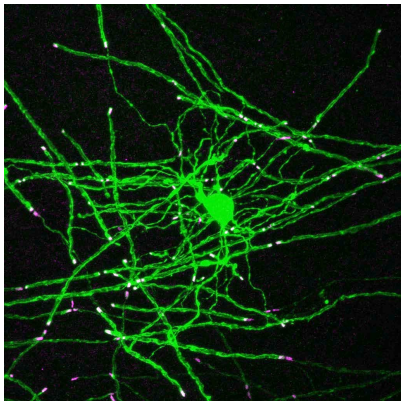
Cellular Neuroscience

Two-photon microscopy & Cranial Window

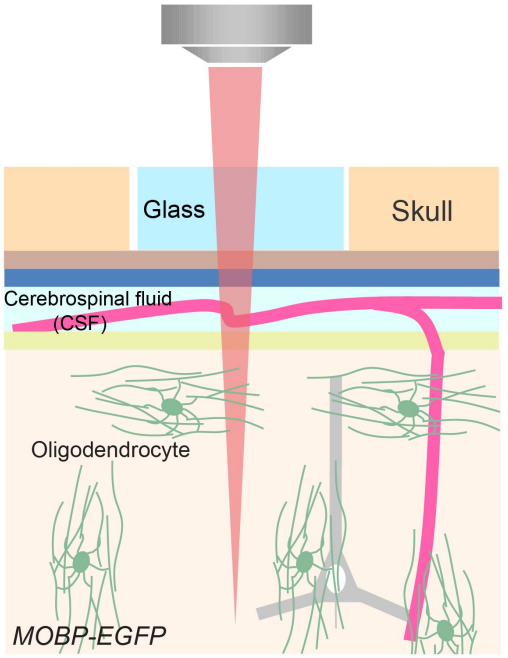
MOBP-EGFP transgenic mice



Fluorescent oligodendrocytes and myelin sheaths

Implantation of a cranial window over primary visual cortex (V1)

Two-photon imaging



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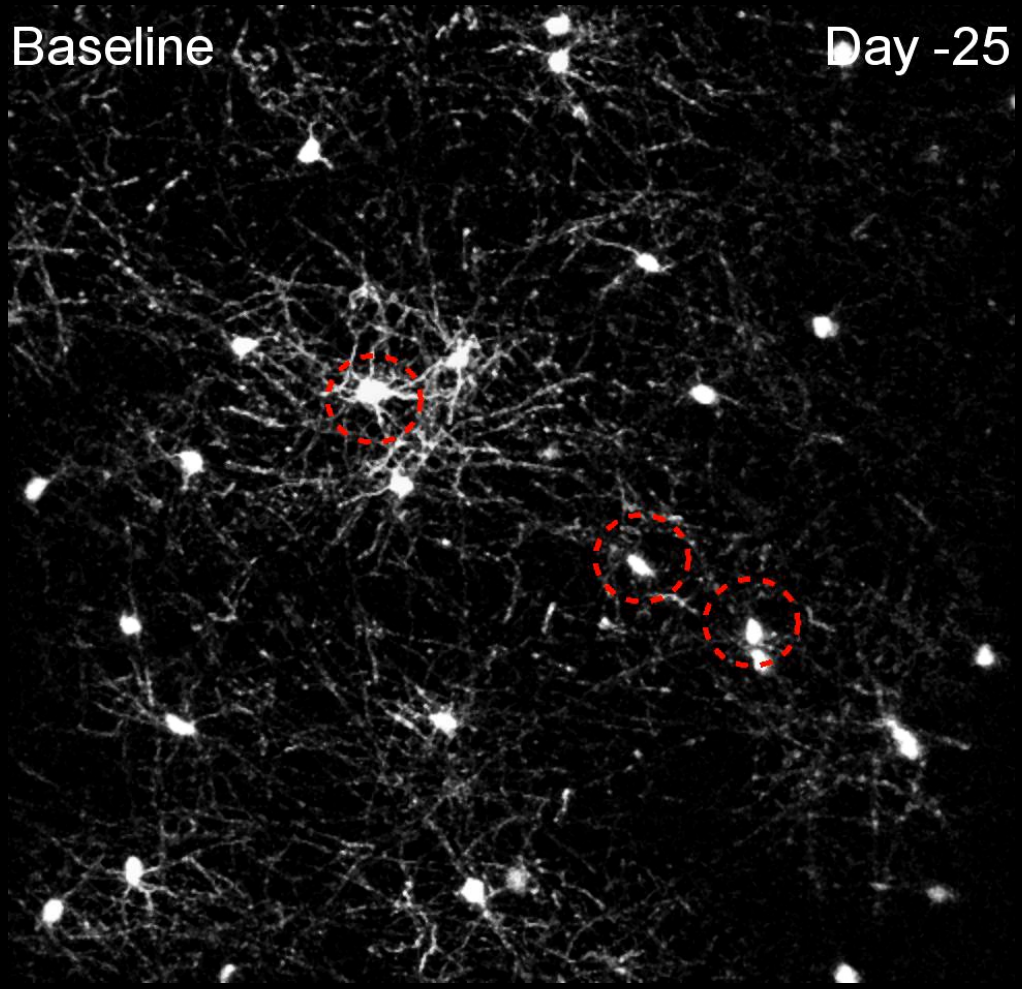
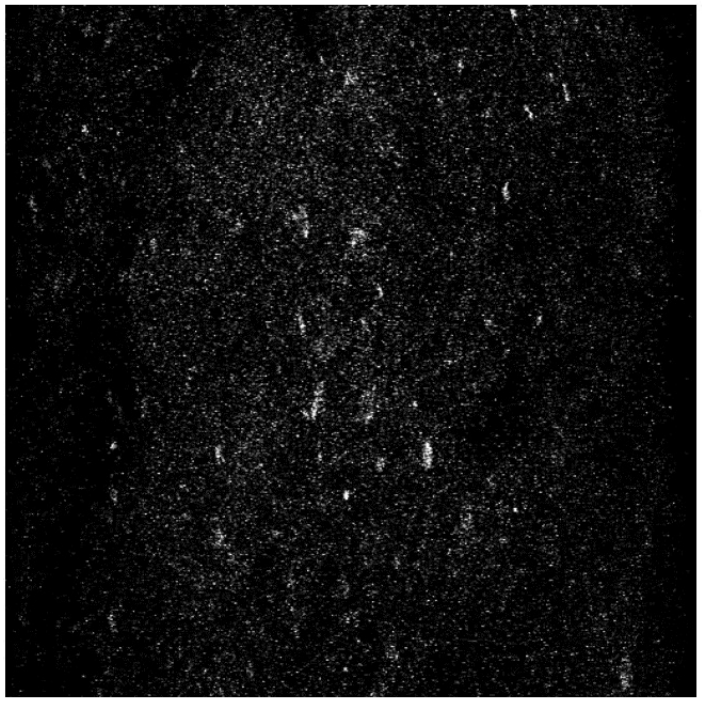
Oligodendrocyte loss and replacement



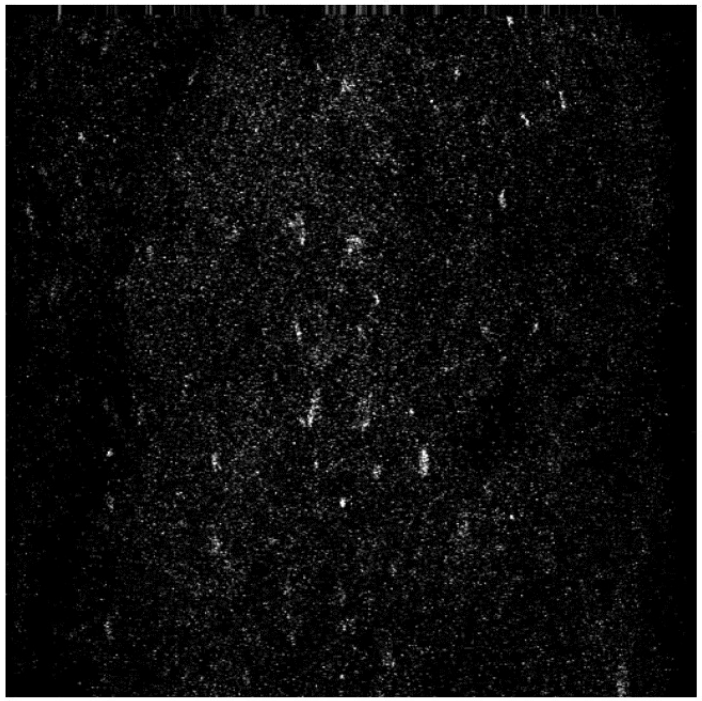
Lost cells

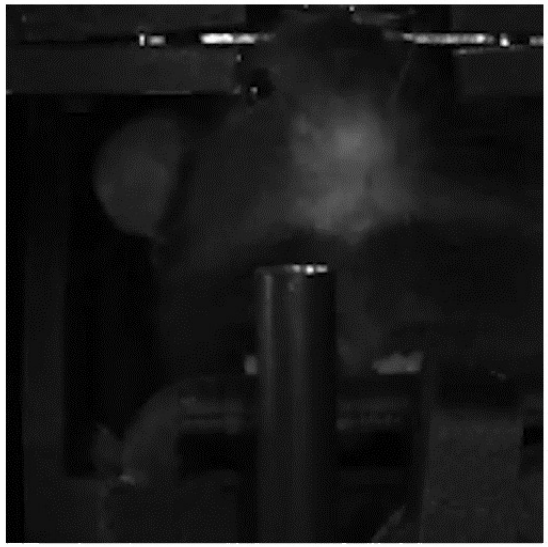
New cells

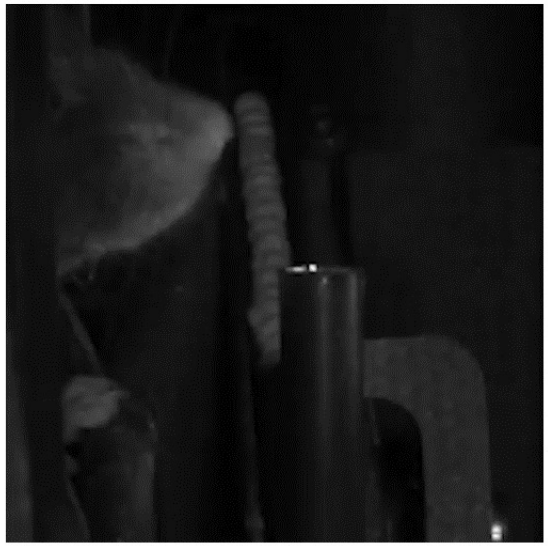
Raw image



Motion corrected

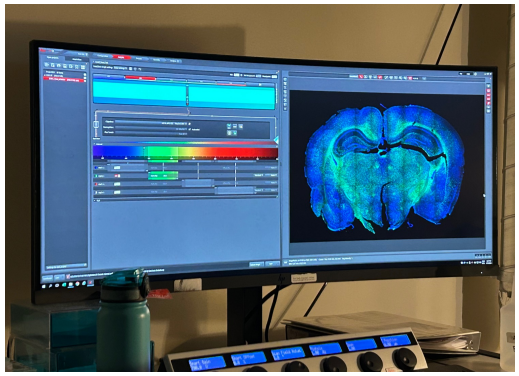






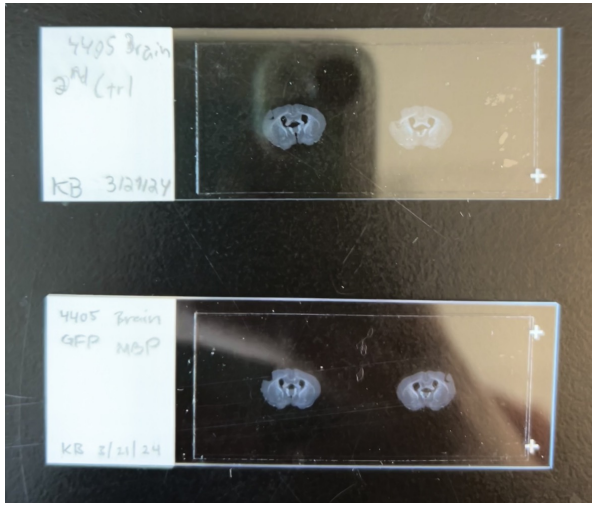
Brain Immunohistochemistry (IHC)

IHC is a staining technique that targets antigens within a sample and labels them with fluorescent markers, allowing for the visualization of a specific substance under a microscope



Day 1

- Washed tissue samples, blocked, & incubated with primary antibodies overnight



Day 2

- Washed samples, incubated with secondary antibodies, washed & incubated with DAPI, washed then mounted samples on slides

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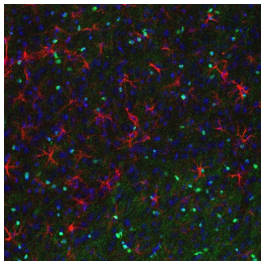
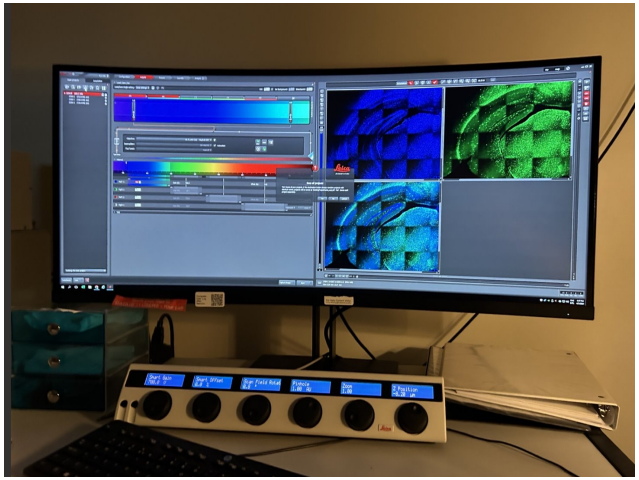
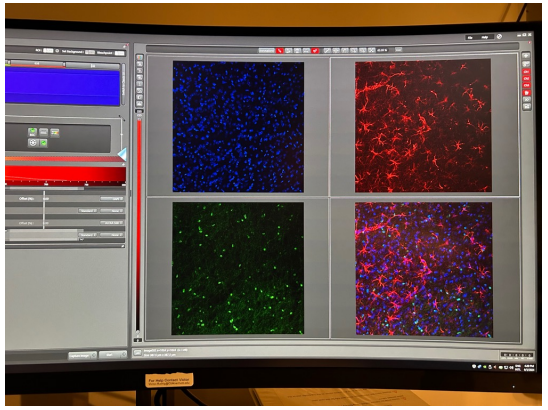
Confocal Microscopy

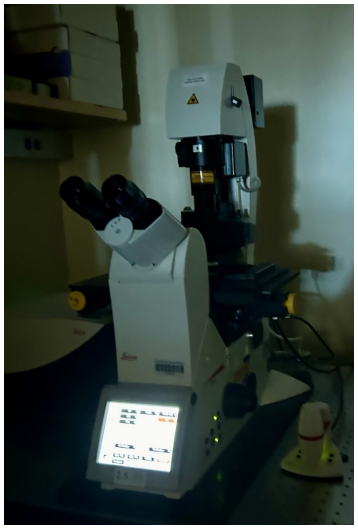
Advantages

- Offers enhanced clarity by removing out-of-focus light, reducing background noise
- Laser scans sample point by point to generate detailed images
- Creates mosaic merged images that provide detailed full image of sample









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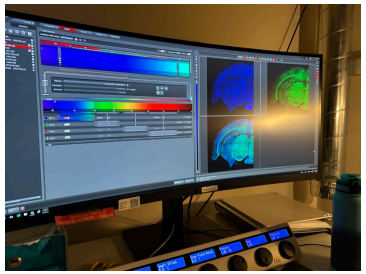
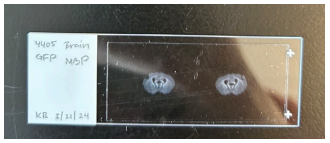
Cultural Exchange

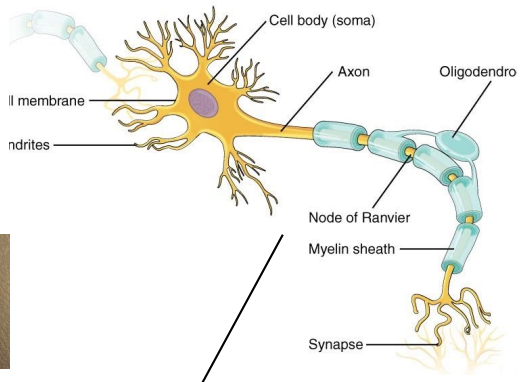
- Educational Systems
  - Brazil: Final exams are returned for review
  - U.S.: Students typically receive final grades without the ability to view finals unless requested
- Food and Cuisine
  - Brazilian food in Denver is acceptable
  - Tried Brazilian snacks/desserts for first time
- Language
  - Portuguese is the official language of Brazil
- Japanese Brazilians (日系)
  - Largest Japanese population outside of Japan (1.5 million)

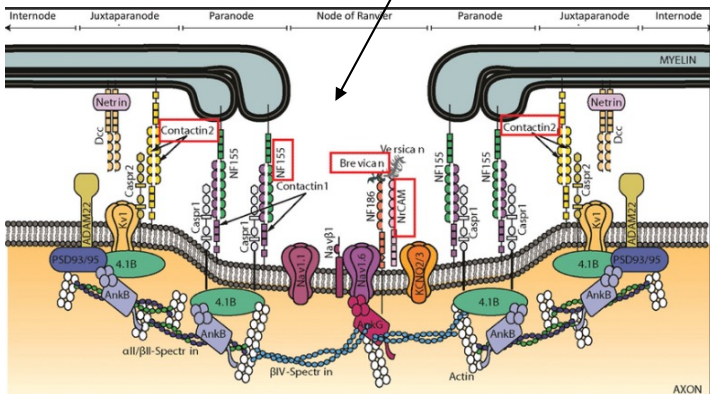
Conclusion

- What I learned
  - Real labs VERY different from school labs
  - Repeatedly reminded that it can always get smaller – systems are so much more complex than we're taught
  - Gained valuable skills in the lab and received guidance from a wonderful mentor









Lumen Learning Biology for Majors II. (2017). Neurons.
Arancibia-Carcamo, I.L. et al. (2014) Acta Neuropathol.

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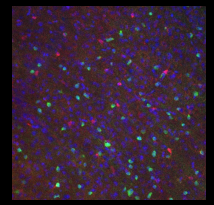

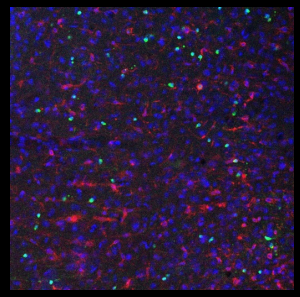

THANK YOU

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