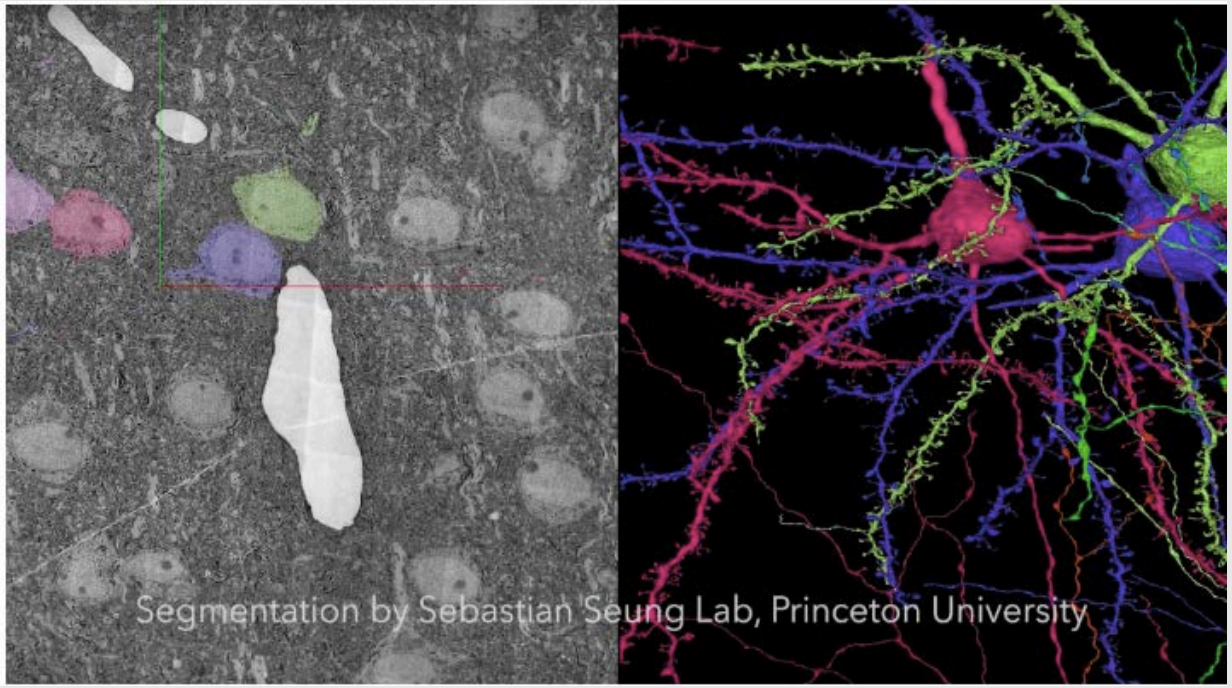
Allen Institute Showcase Symposium

November 11-12, 2019

Seattle, WA

Serial Reconstruction from Electron Microscopy

- Segment and reconstruct nanoscale structures
- Reveals morphologies and spatial features that are inaccessible with two-dimensional imaging
- 3D reconstructions from electron microscopy have been driven by the field of **connectomics**
  - Dense reconstructions necessary to view total connectivity of brain networks



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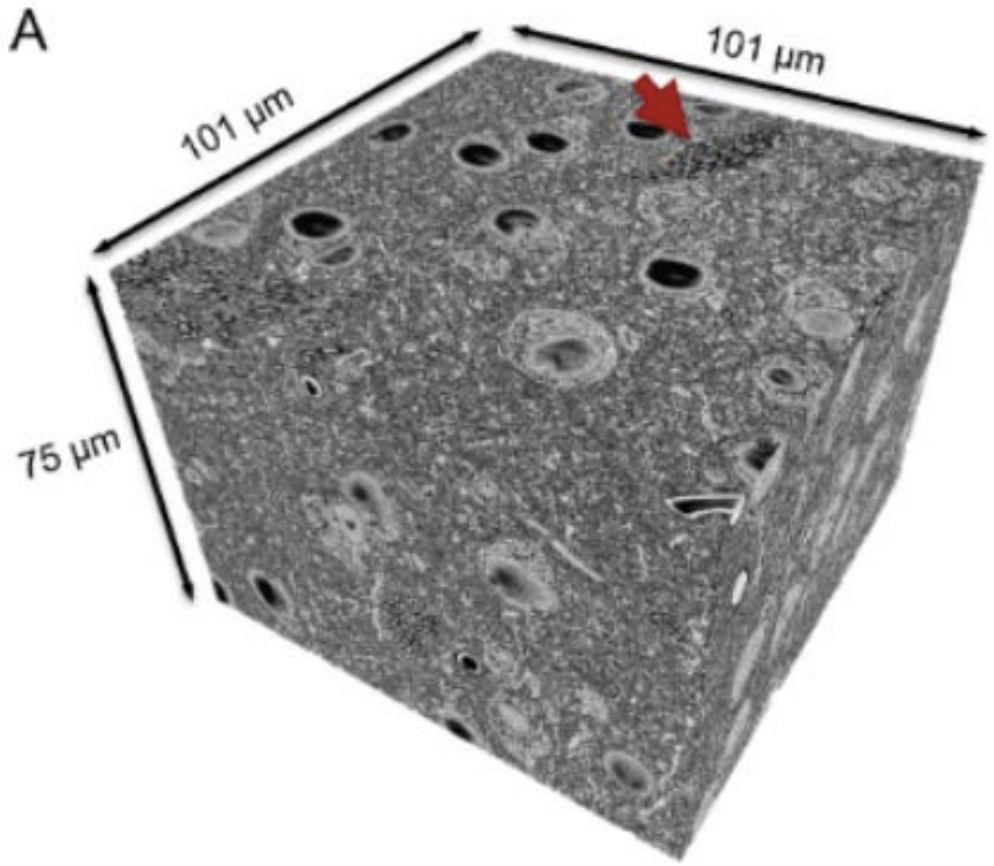

Cali et al. 2019; 3D cellular reconstruction of cortical glia and parenchymal morphometric analysis from Serial Block-Face Electron Microscopy of juvenile rat *Progress in Neurobiology*. https://doi.org/10.1016/j.pneurobio.2019.101696

Serial Reconstruction from Electron Microscopy

- In a cubic mm of brain tissue:
  - 100,000 neurons
  - 1 billion synapses
- Tissue preparation:
  - Brain sample must be sliced into 25,000 slices that are 40 nm wide
  - Imaged for 4-6 months
  - Utilized six electron microscopes

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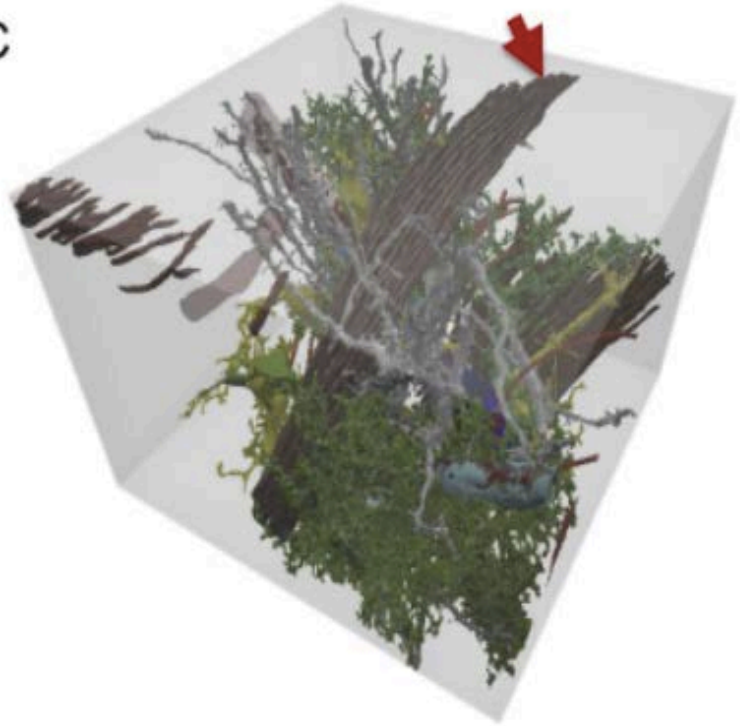

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Cell type	Reconstructed
Neurons	4
Astrocytes	4
Microglia	4
Pericytes	4
Blood vessels	2
Myelinated axons	213

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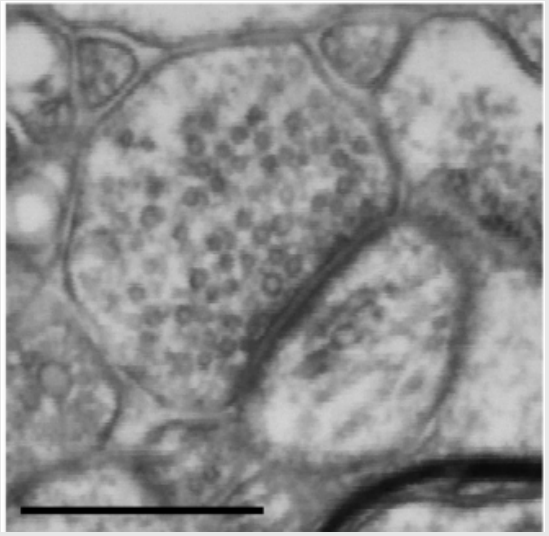
Serial Reconstruction of Glia



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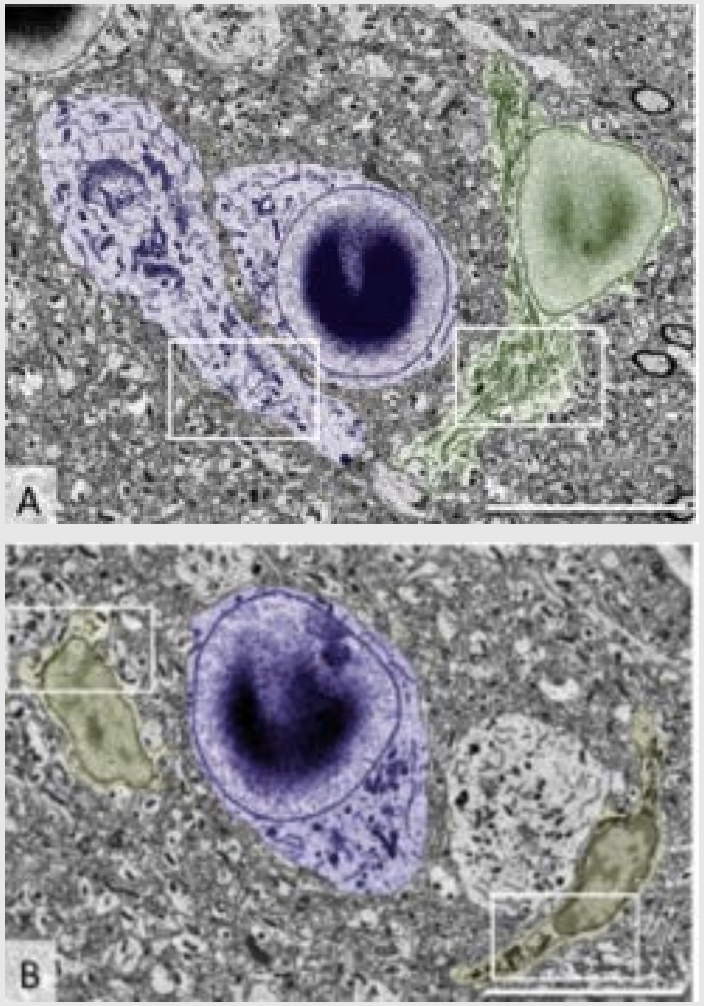
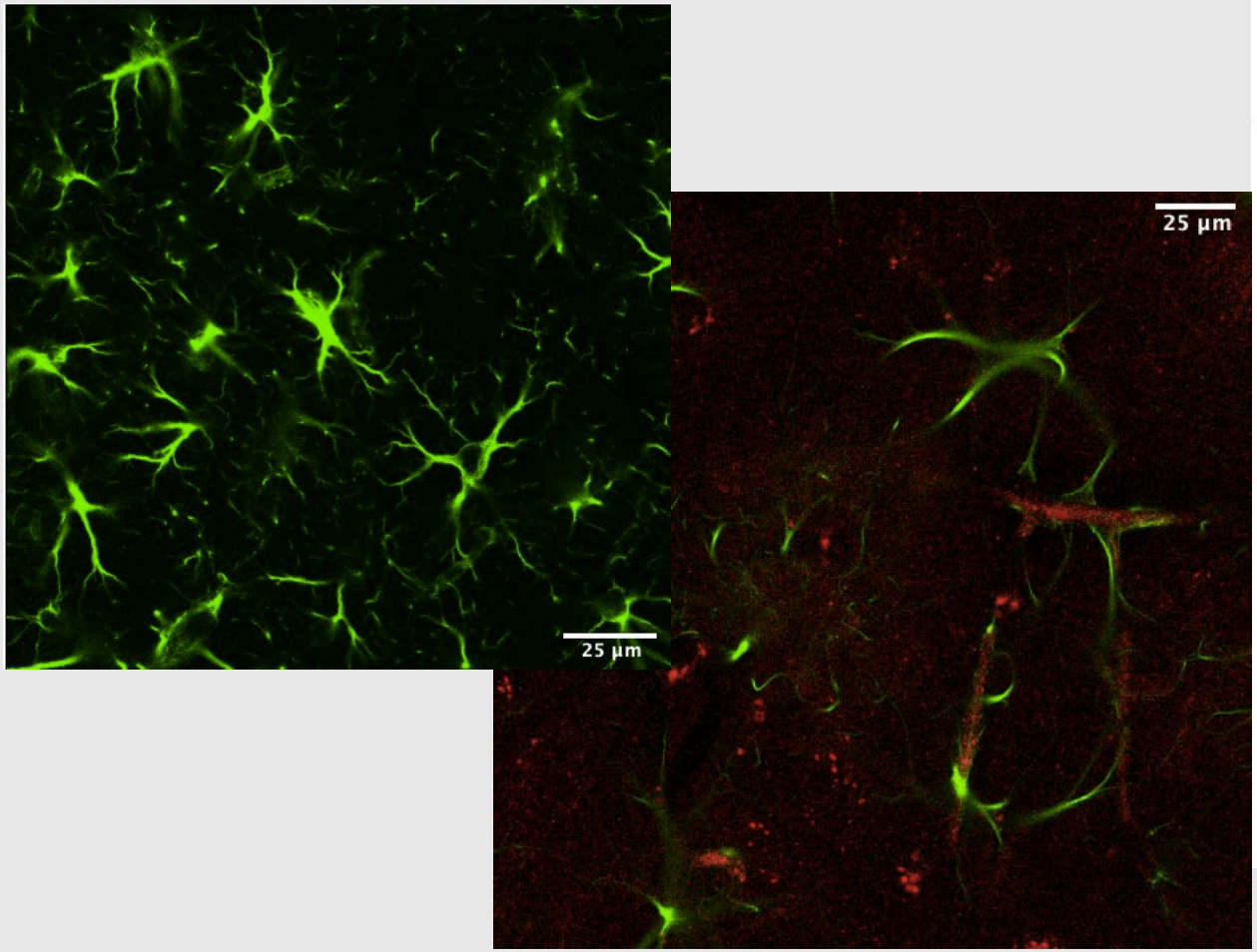
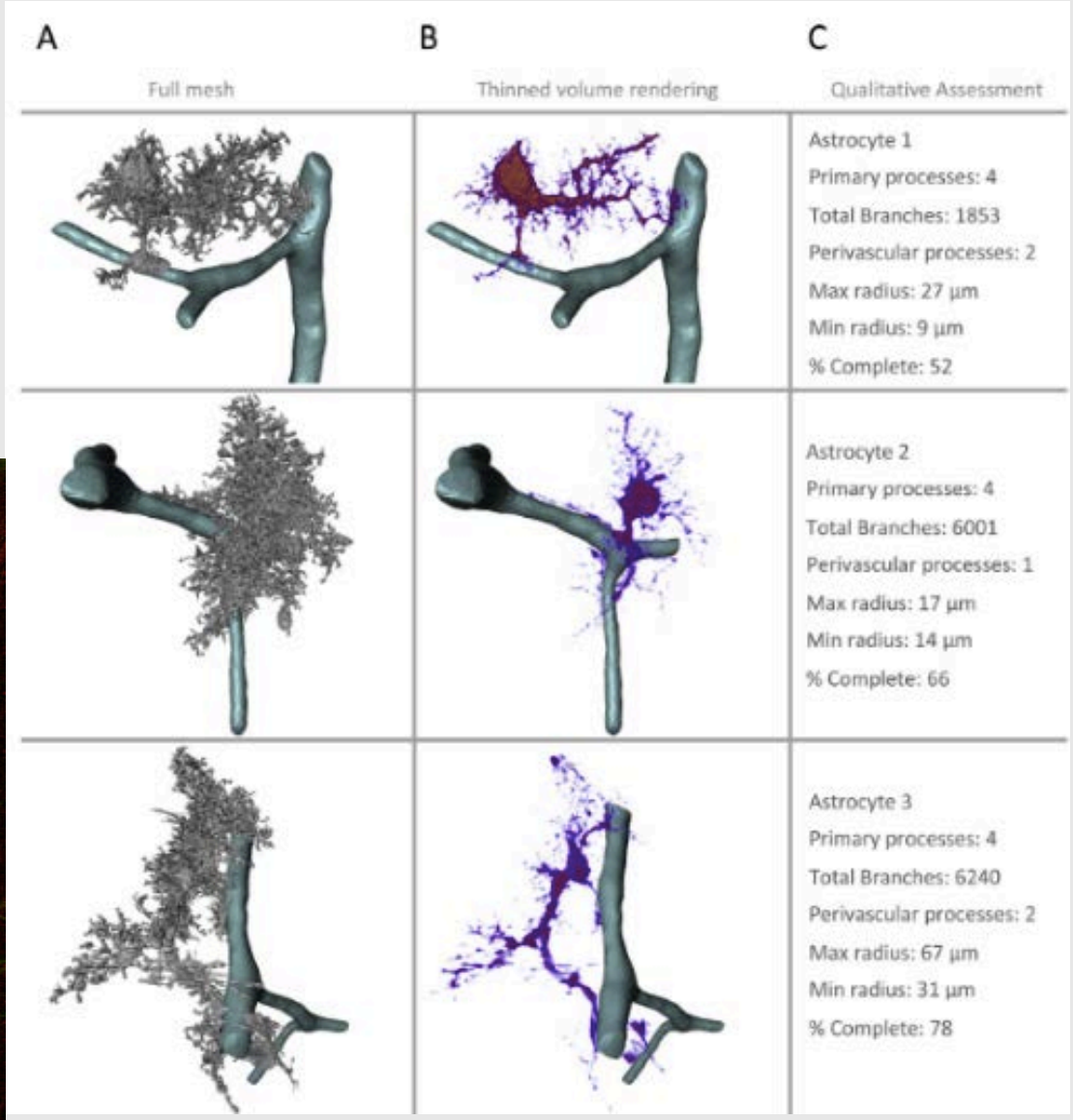


Interactions between microglia and neurons in V1 visual cortex using 3D serial section electron microscopy

Cali et al. 2019; https://doi.org/10.1016/j.pneurobio.2019.101696

Serial Reconstruction of Astrocytes





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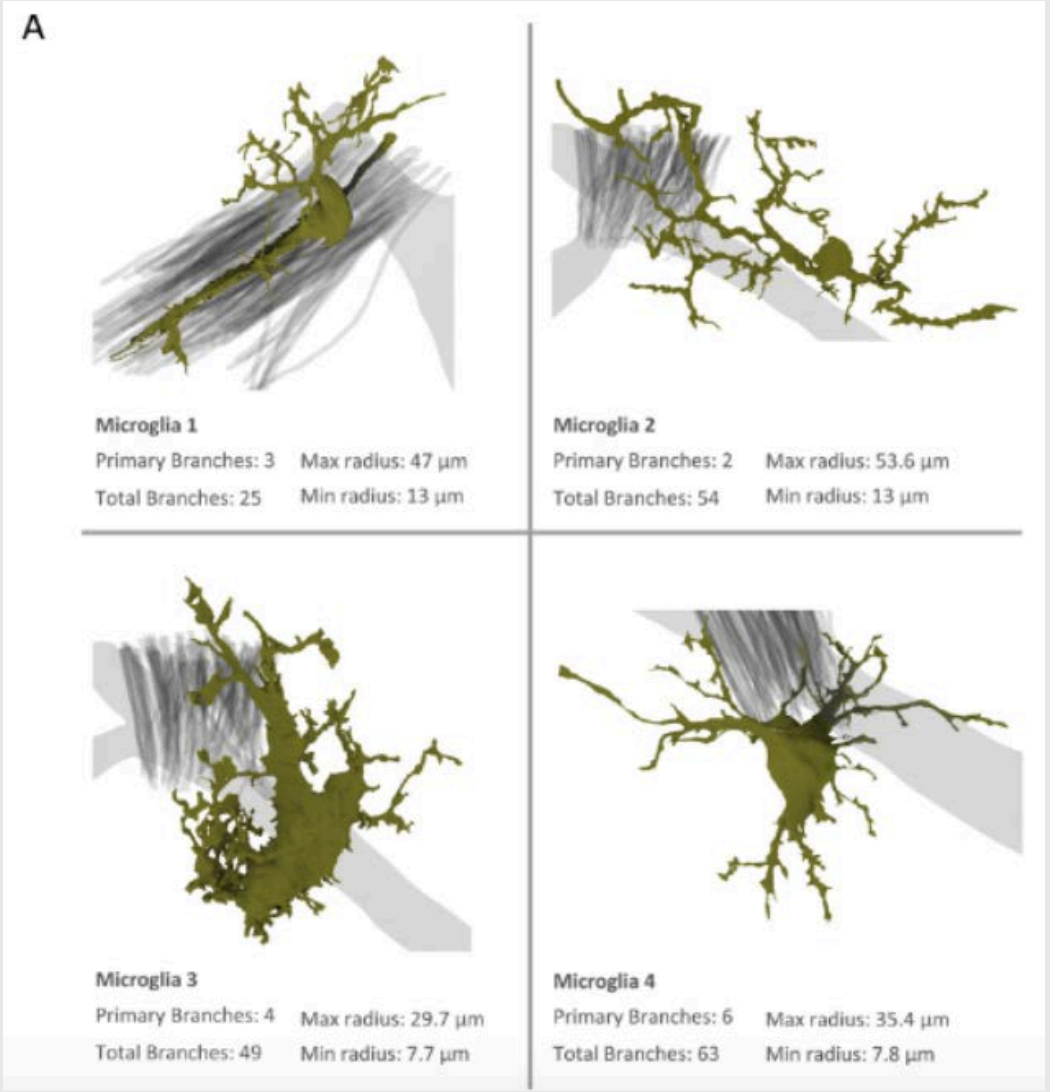
Serial Reconstruction of Microglia

- ~15% of microglia have a 'host' neuron
  - There are no synapses wherever the microglia is 'stuck' to a neuron
- Microglia can connect to neurons ~50um away from their soma
  - Unclear why they connect to some neurons and not others
- Found that up to 8 microglia can be contacting the same neuron



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