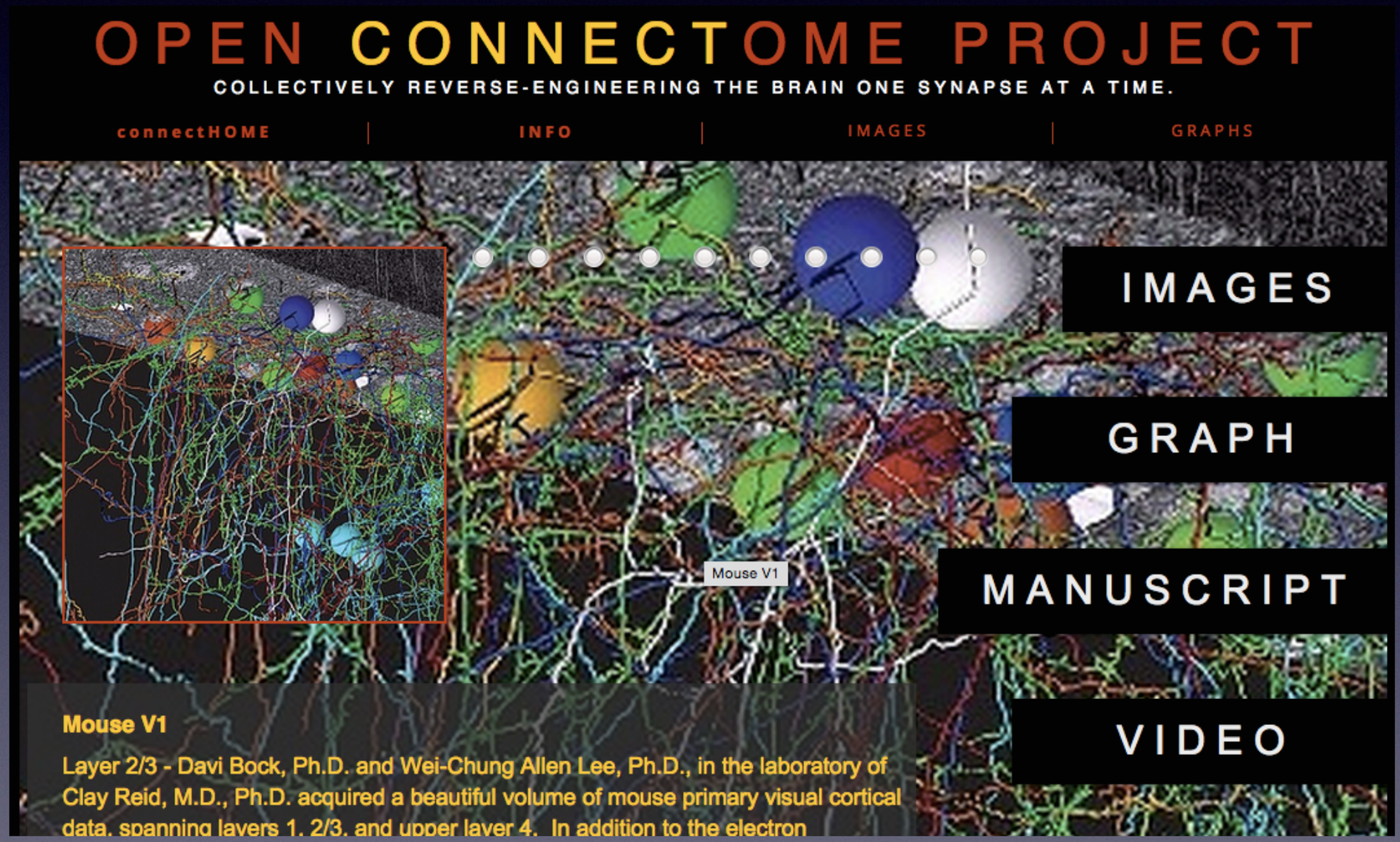
# “Network anatomy and in vivo physiology of visual cortical neurons”

Davi Bock, et. al, 2015

Presented by Joshua Vogelstein

# Outline

- Opportunity
- Challenge
- Action
- Resolution
- Discussion

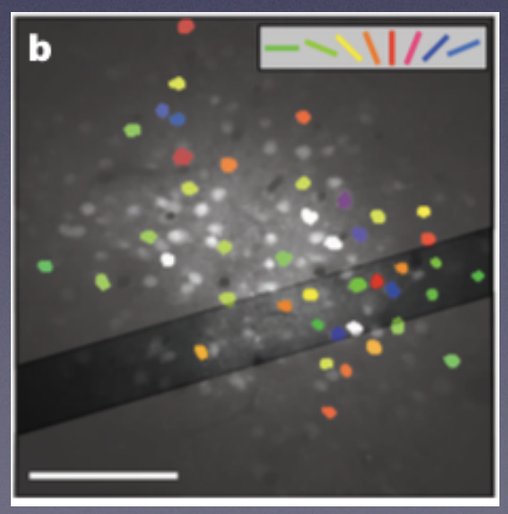


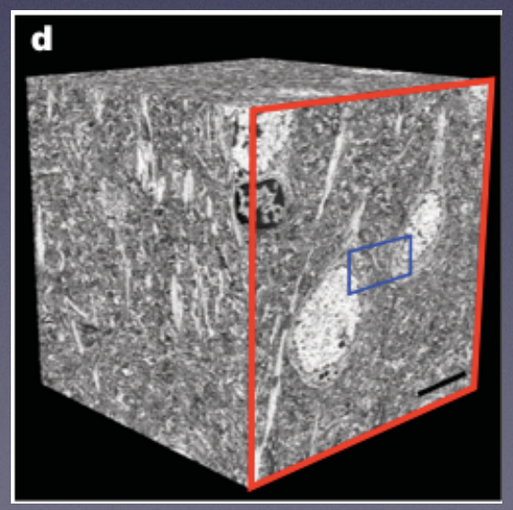
# Opportunity

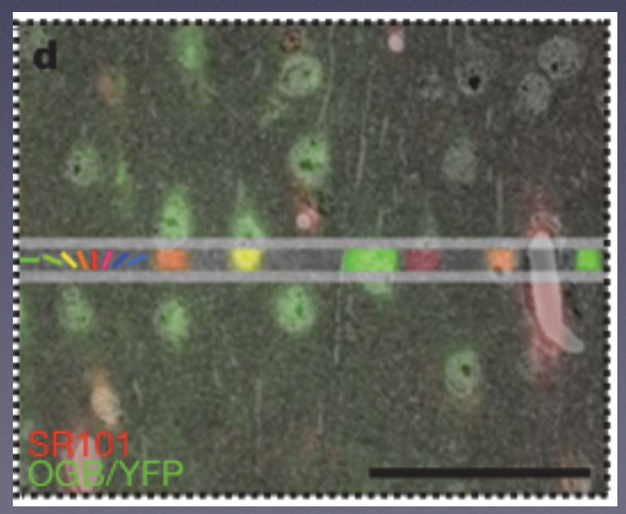
- Serial Section Electron Microscopy (SSEM) is enabling relatively high-throughput anatomy
- Two-photon microscopy of calcium physiology imaging (2P CaI) is enabling relatively high-throughput physiology
- We can better understand the brain by understanding structure in terms of function and vice versa
- We don’t understand the relationship between connectivity and tuning properties in V1 of mouse
- Previous hypothesis: that inhibitory interneurons in the mouse primary visual cortex receive dense, convergent input from nearby excitatory (pyramidal) neurons with widely varying preferred stimulus orientations

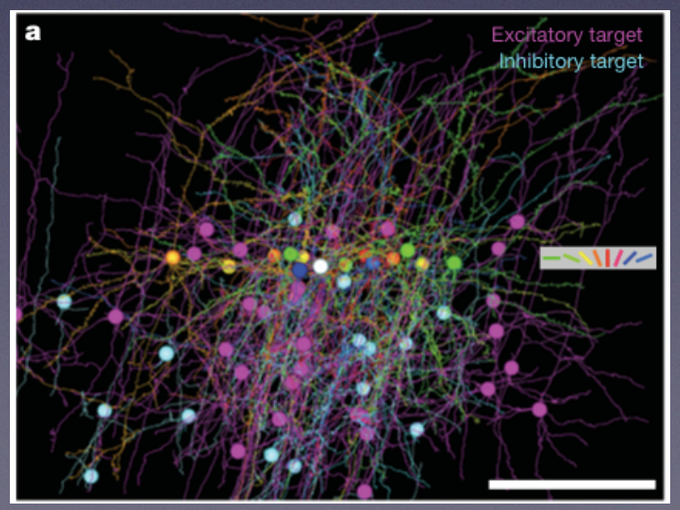
# Challenge

- SSEM is relatively slow
- 2PCaI might degrade EM data
- Not clear how to register EM and 2P data
- Tracing EM data is hard



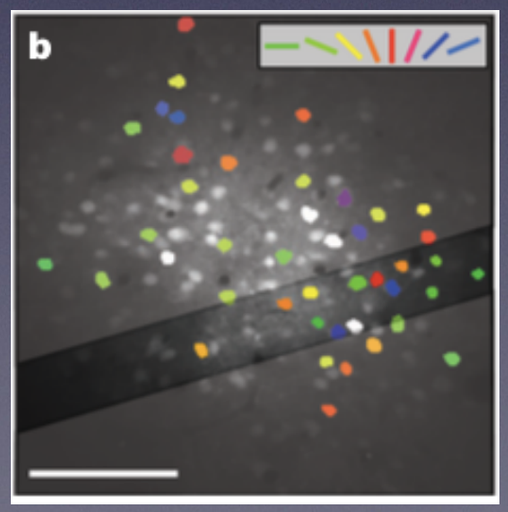



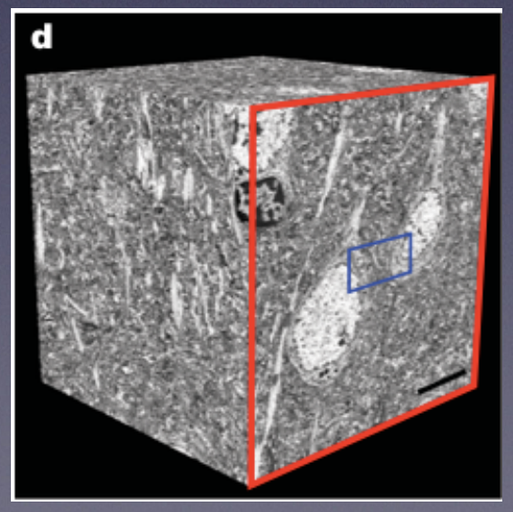



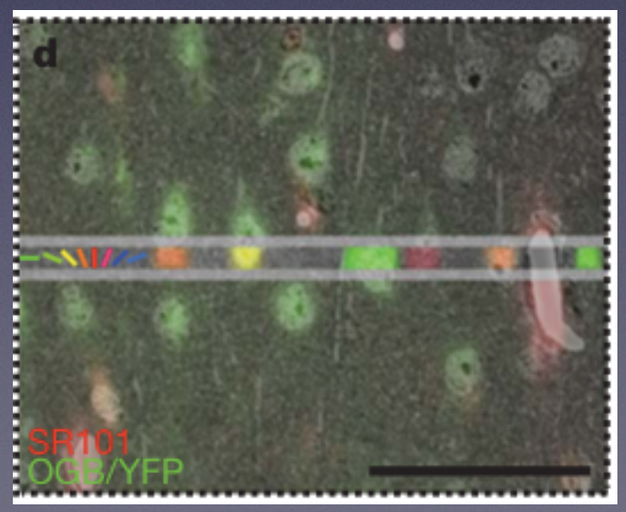
# Action

- Build TEMCA
- Collect “pilot” 2P data
- Register and trace manually

- Analyze relationship between connectivity and tuning



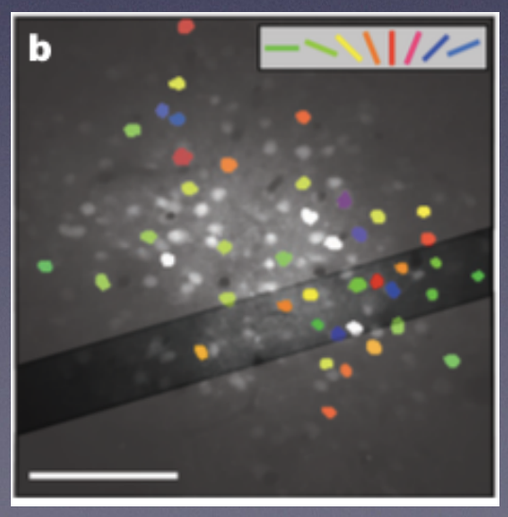



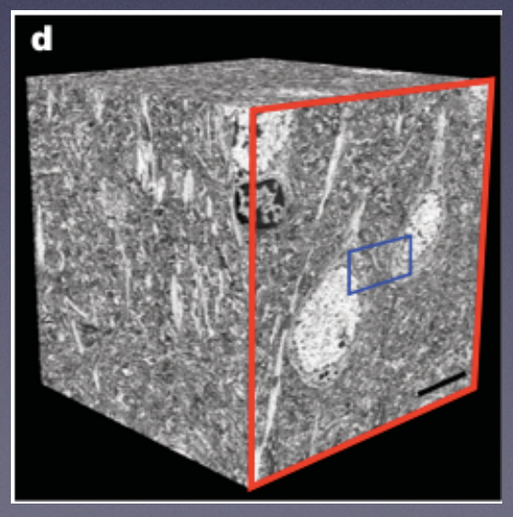



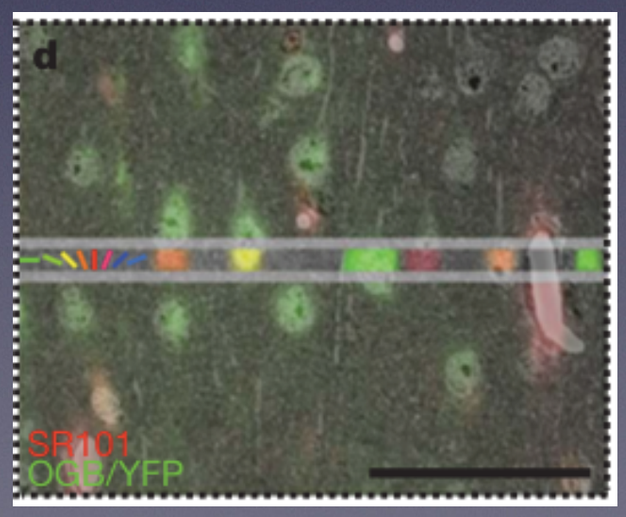

# Resolution

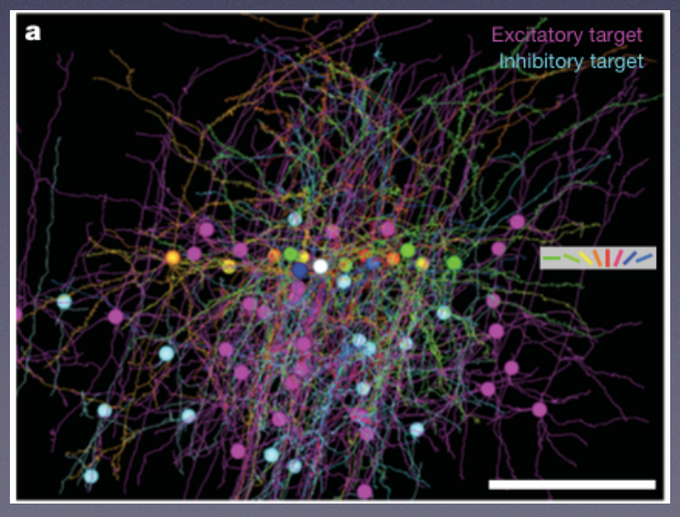
- 2P does not seem to significantly degrade EM quality
- EM data can be manually traced
- EM & 2P data can be manually co-registered

- Convergent inhibitory connections are independent of tuning properties



# Discussion

- 2P doesn’t degrade EM too much
- Don’t fret aligning 2P & EM
- Scalable EM and manual sparse tracing is totally doable
- Seems like convergence onto inhibitory neurons is independent of tuning, now can confirm that and check other stuff
- We need automatic tools for graph inference from EM data

# Thank you. Questions?

| | |
|---|---|
| Stats | C. Priebe, M Maggioni, D Dunson, G Sapiro, B Caffo, M Miller |
| Code | Randal Burns, OPEN CONNECTOME PROJECT<br>COLLECTIVELY REVERSE-ENGINEERING THE BRAIN ONE SYNAPSE AT A TIME. |
| Data | C Reid, M Milham, K Deisseroth, J Lichtman, S Smith, M Ahrens |
| Funds | TRA (NIH), XDATA & GRAPHS (DARPA),<br>BIGDATA & CRCNS (NIH/NSF) |
| Love | yummy, family, friends, earth, universe, multiverse!? |

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