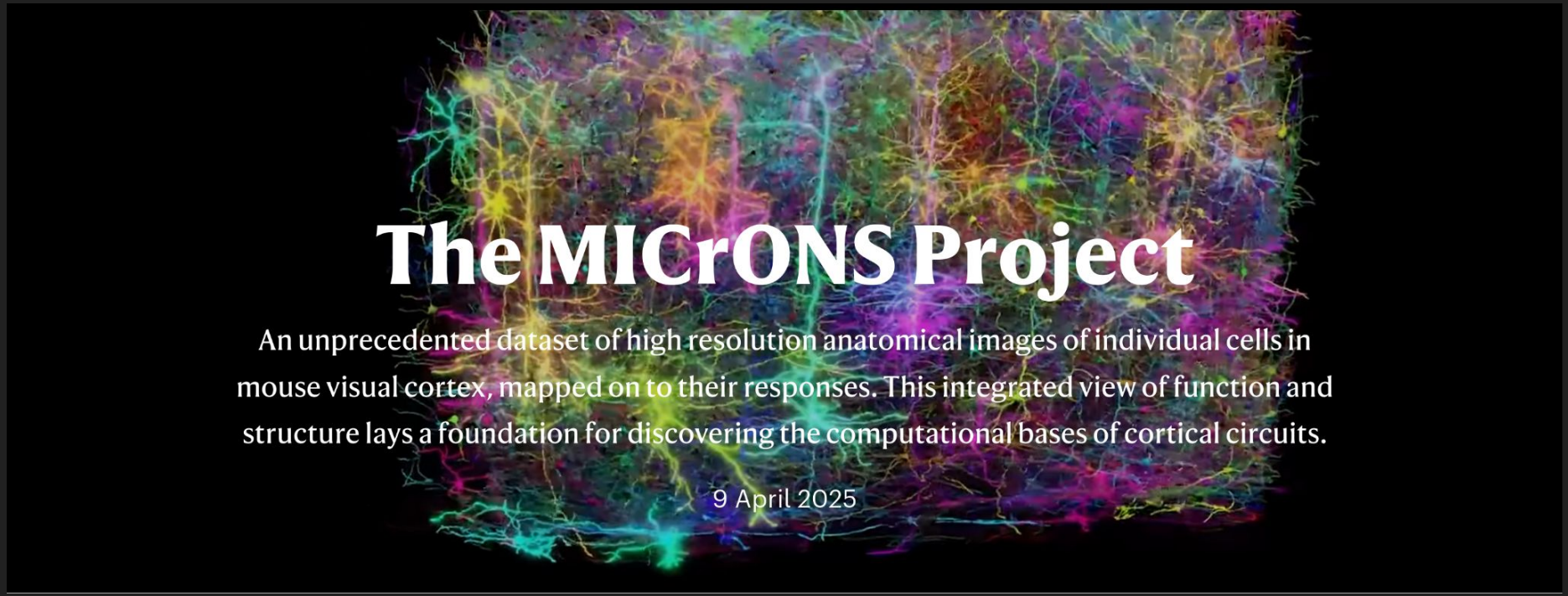
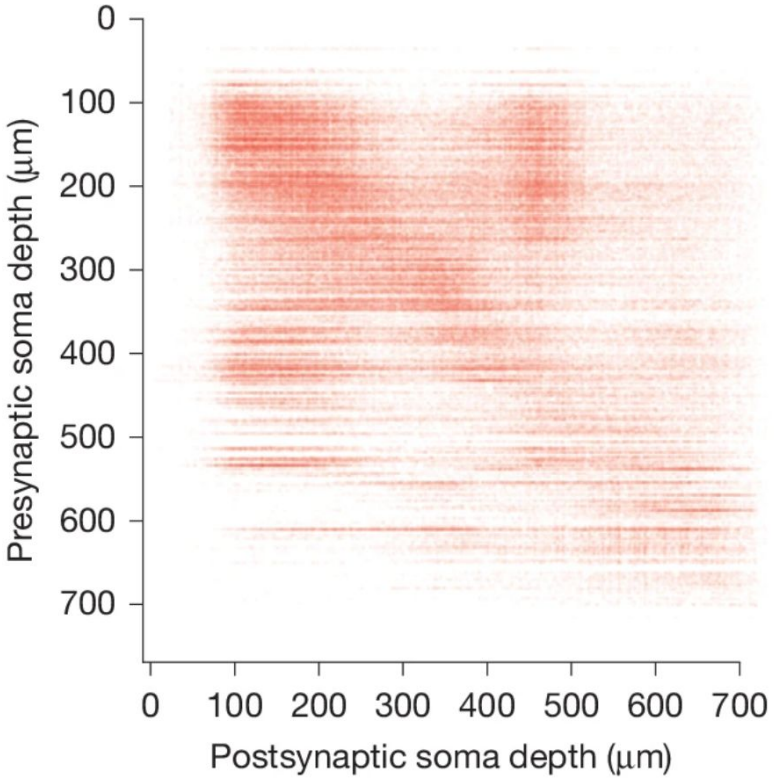


The MICrONS Project

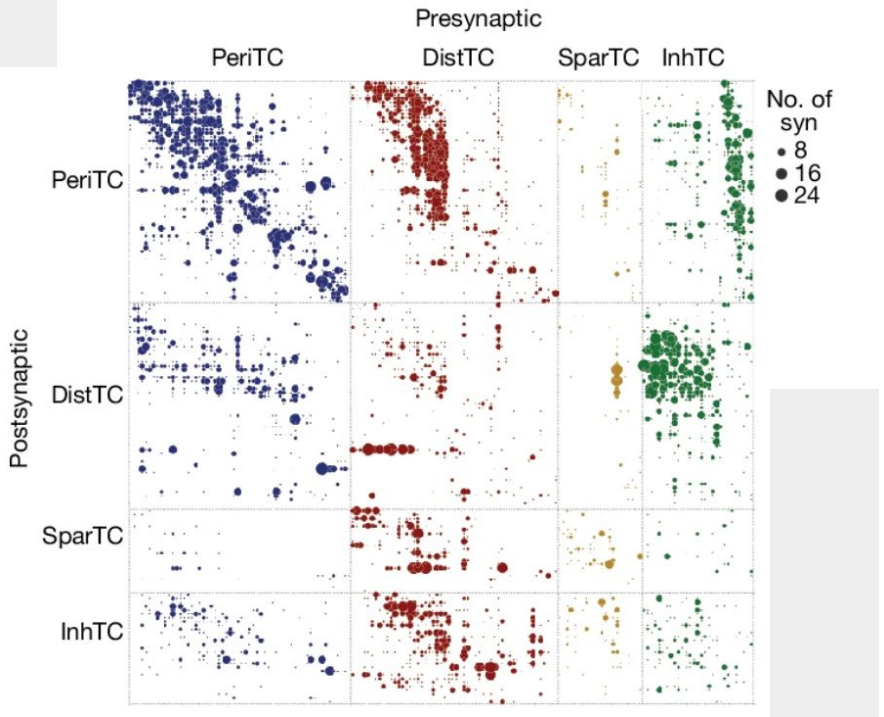
An unprecedented dataset of high resolution anatomical images of individual cells in mouse visual cortex, mapped on to their responses. This integrated view of function and structure lays a foundation for discovering the computational bases of cortical circuits.

9 April 2025

E to E



I to I



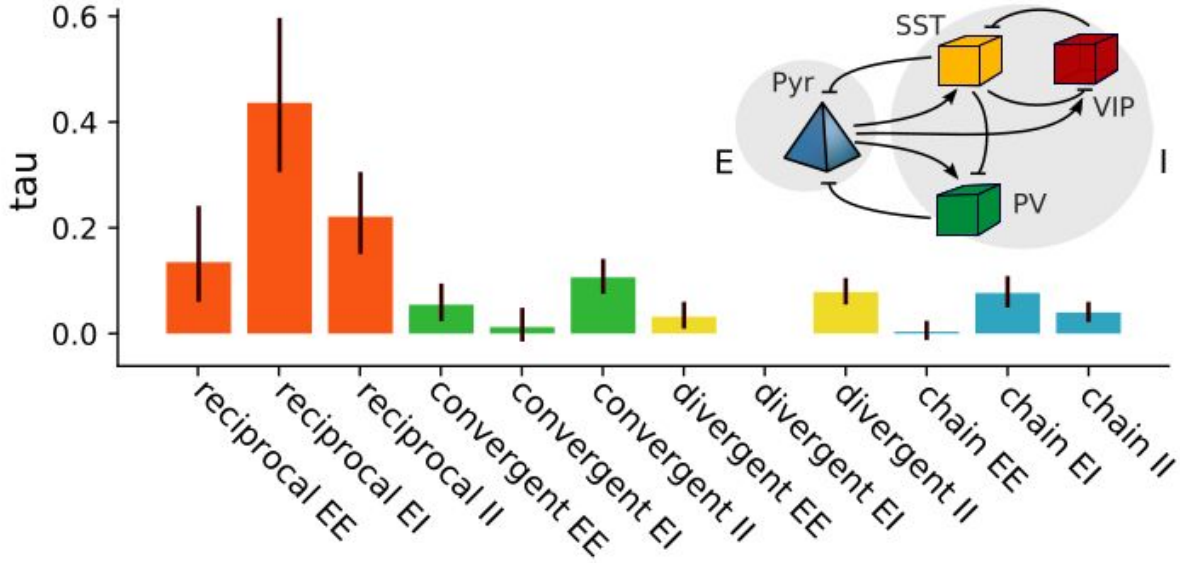
MICrONS dataset, *Nature* 2025

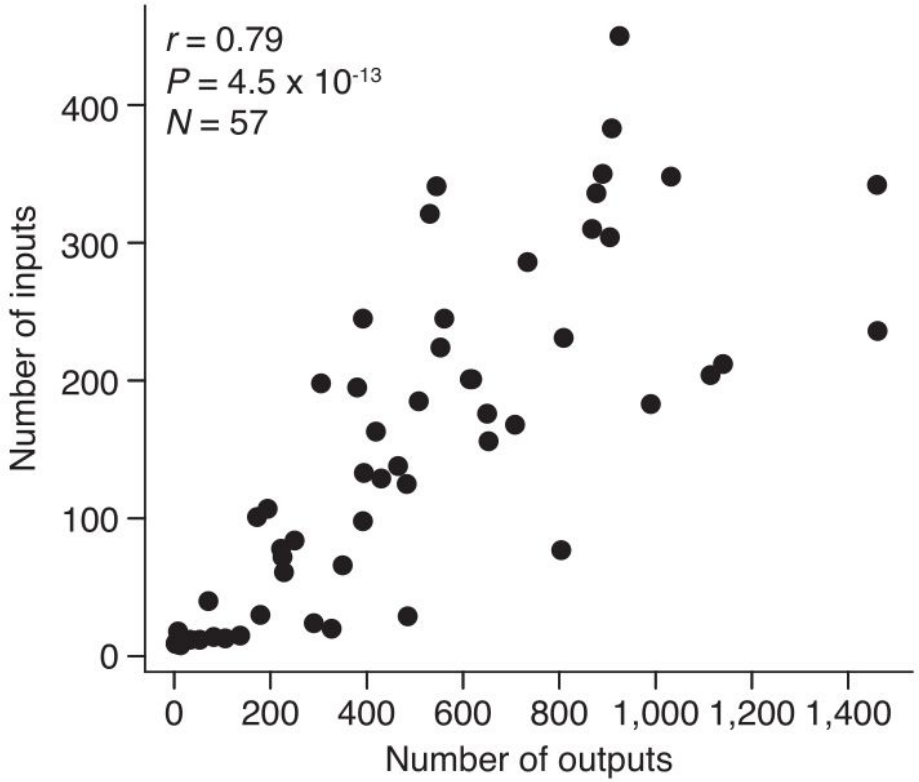
$$w_{ij} \overset{\text{i.i.d.}}{\sim} P(w)$$

How do we go beyond the random i.i.d. scenario?

Sompolinsky et al. 1988
Van Vreeswijk & Sompolinsky, 1996
Brunel 2000

…


0.6
0.4
0.2
0.0
tau
reciprocal EE
reciprocal EI
reciprocal II
convergent EE
convergent EI
convergent II
divergent EE
divergent EI
divergent II
chain EE
chain EI
chain II
SST
Pyr
VIP
E
I
PV



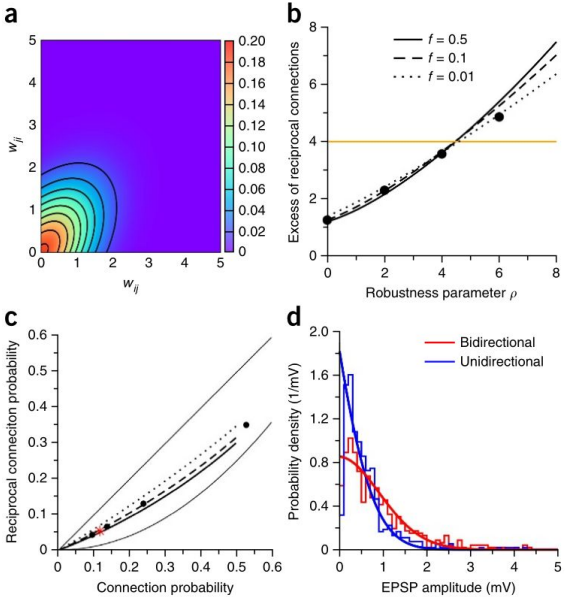
Data from *MICrONS*

Motifs in networks that do stuff

What is the motif’s origin?

Is cortical connectivity optimized for storing information?

Nicolas Brunel[1,2]

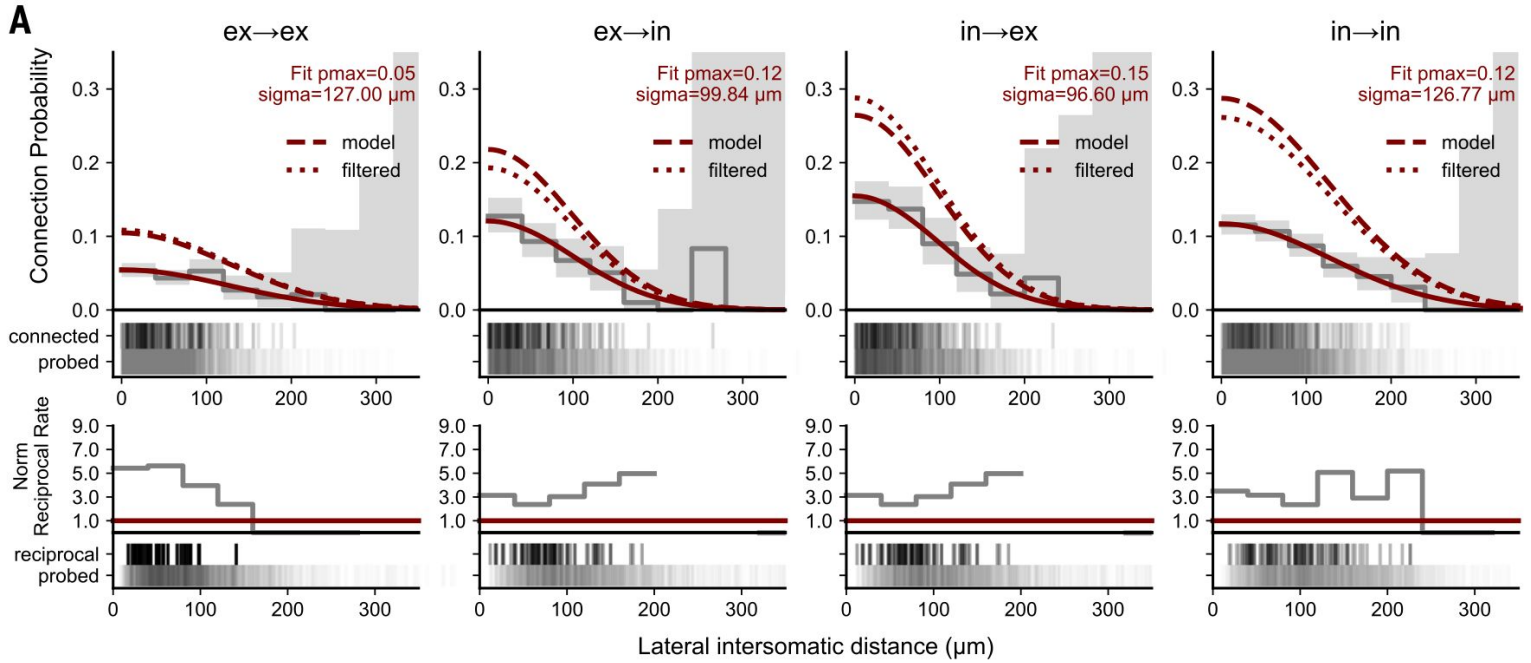


Brunel, Nat. Neuro. 2016

Plasticity and motifs

- **Ocker et al. PLOS CB 2015:** self-consistent evolution of motifs under STDP
- **Montangie et al. PLOS CB 2020 ; Festa et al. BiorXiv 2024:** extensions of this idea to triplet STDP and inhibitory STDP
- Also:
  - Tannenbaum & Burak 2016
  - Trousdale et al 2012
  - Richardson 2008

Could there be other causes for motifs?



Campagnola et al. 2022

Today: from motifs to dynamics

- Hu, … , Shea-Brown, PRE 2018
- Shao, …, Ostojic, ArXiv 2024

Effect of motifs on network dynamics

- Recanatesi, …, Shea-Brown 2019 (motifs on dimensionality)
- Dahmen, …, Shea-Brown 2020 (motifs, dimensionality in models and data)
- Marti, …, Ostojic 2018 (effect of reciprocal connectivity on chaos)