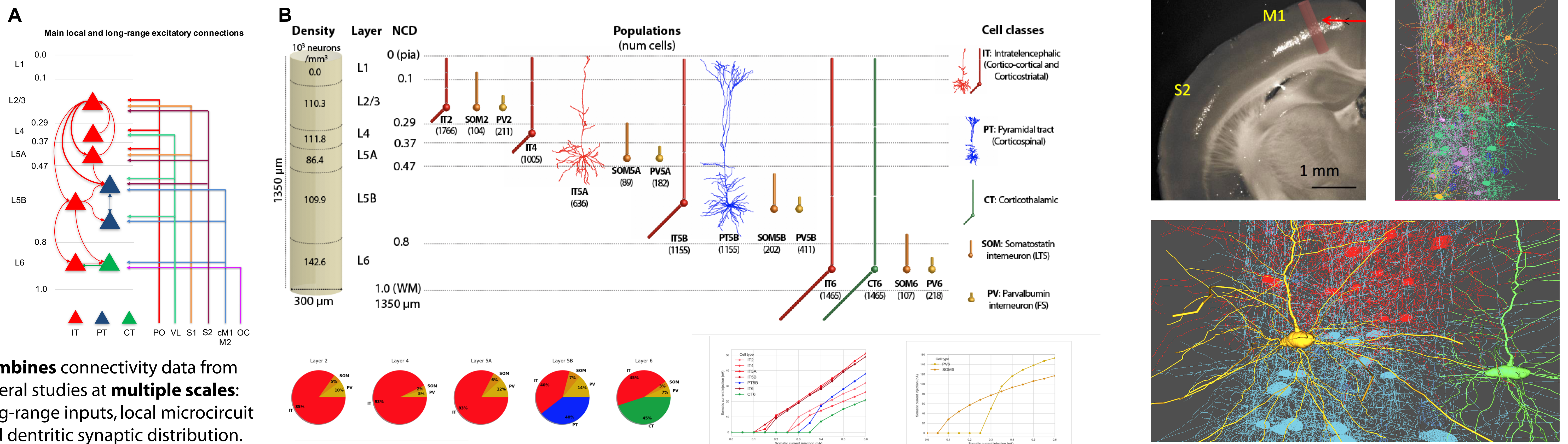


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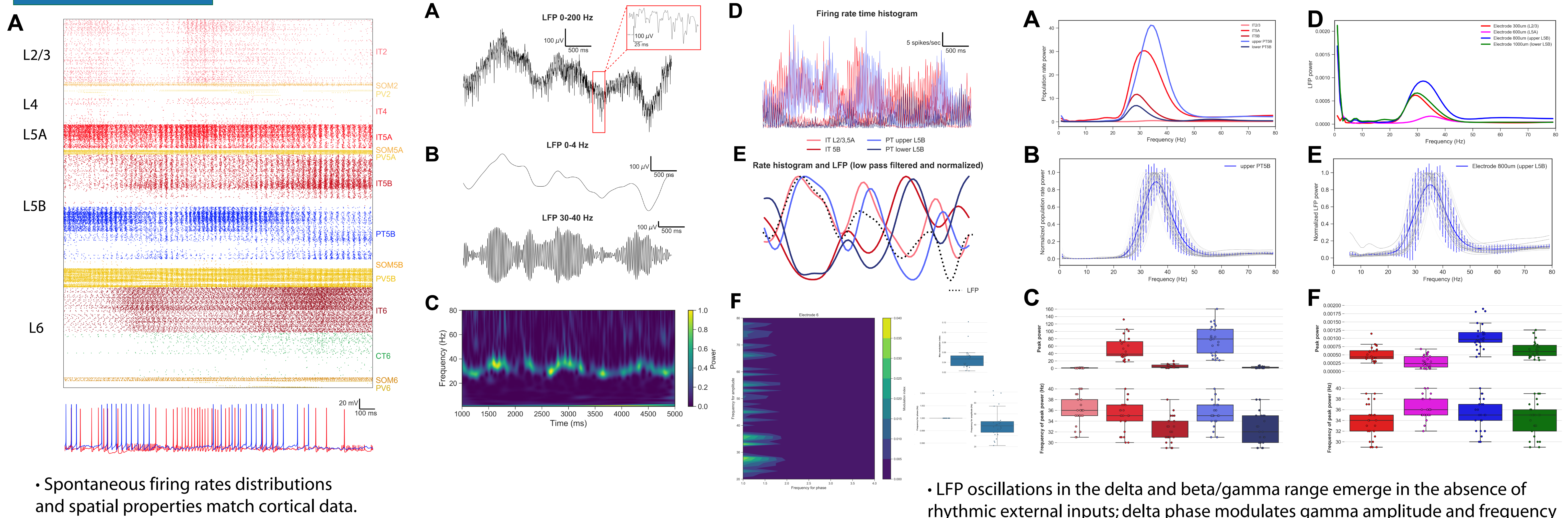
## Model description

Mouse 6-layer M1 with **10,171 neurons** of 5 classes distributed in 15 populations  
 Full scale cylindrical volume of **300 μm** (diameter) x **1350 μm** (cortical depth) with realistic cell densities and ratios



Combines connectivity data from several studies at **multiple scales**: long-range inputs, local microcircuit and dendritic synaptic distribution.

## Oscillations



Spontaneous firing rates distributions and spatial properties match cortical data.

LFP oscillations in the delta and beta/gamma range emerge in the absence of rhythmic external inputs; delta phase modulates gamma amplitude and frequency

## Information flow



Strongest information flow consistent with connectivity e.g. IT2/3 -> IT5A and upper PT5B  
 Peak information flow frequencies match peak oscillation frequency of target populations  
 Reveals subnetworks involving interneurons, e.g. strong influence from L2 SOM -> IT5A and upperPT5B

## Publications

Dura-Bernal S, ..., Shepherd GMG, Lytton WW (2016) **Long-range inputs and H-current regulate different modes of operation in a multiscale model of mouse M1 microcircuits.** bioRxiv 201707  
 Neymotin SA, Suter BA, Dura-Bernal S, Shepherd GMG, Migliore M, Lytton WW (2016) **Optimizing computer models of corticospinal neurons to replicate in vitro dynamics.** J. Neurophysiol 117  
 Dura-Bernal S, Suter B, Gleeson, Cantarelli M, ..., McDougal R, Hines M, Shepherd GMG, Lytton WW. (2018) **NetPyNE: a tool for data-driven multiscale modeling of brain circuits.** eLife 44494  
 Lytton WW, Seidenstein AH, Dura-Bernal S, ..., Hines ML. (2016) **Simulation neurotechnologies for advancing brain research: Parallelizing large networks in NEURON.** Neu Comp 28:2063-2090

## Funding

NIBIB U01EB017695: "Microconnectomics of primary motor cortex: a multiscale computer model"  
 NSF Internet2 E-CAS 190444 1042C: "Deciphering the brain's neural code through large-scale simulation of motor cortex circuits"  
 NYS DOH C32250GG "Institutional Support for Spinal Cord Injury Research"

Lab and publications: [neurosimlab.org](http://neurosimlab.org)  
 NetPyNE tool: [www.netpyne.org](http://www.netpyne.org)