

Interfacing with the brain: improving materials and devices for neural recording

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1. Why simultaneously monitor the activity of large number of neurons?

- Considerable progress is still necessary to reliably increase the number of neurons that are recorded and identified simultaneously during extracellular recordings.
- Extracellular recordings face a disagreement between the typical number of neurons observed and the number expected based on anatomical considerations.

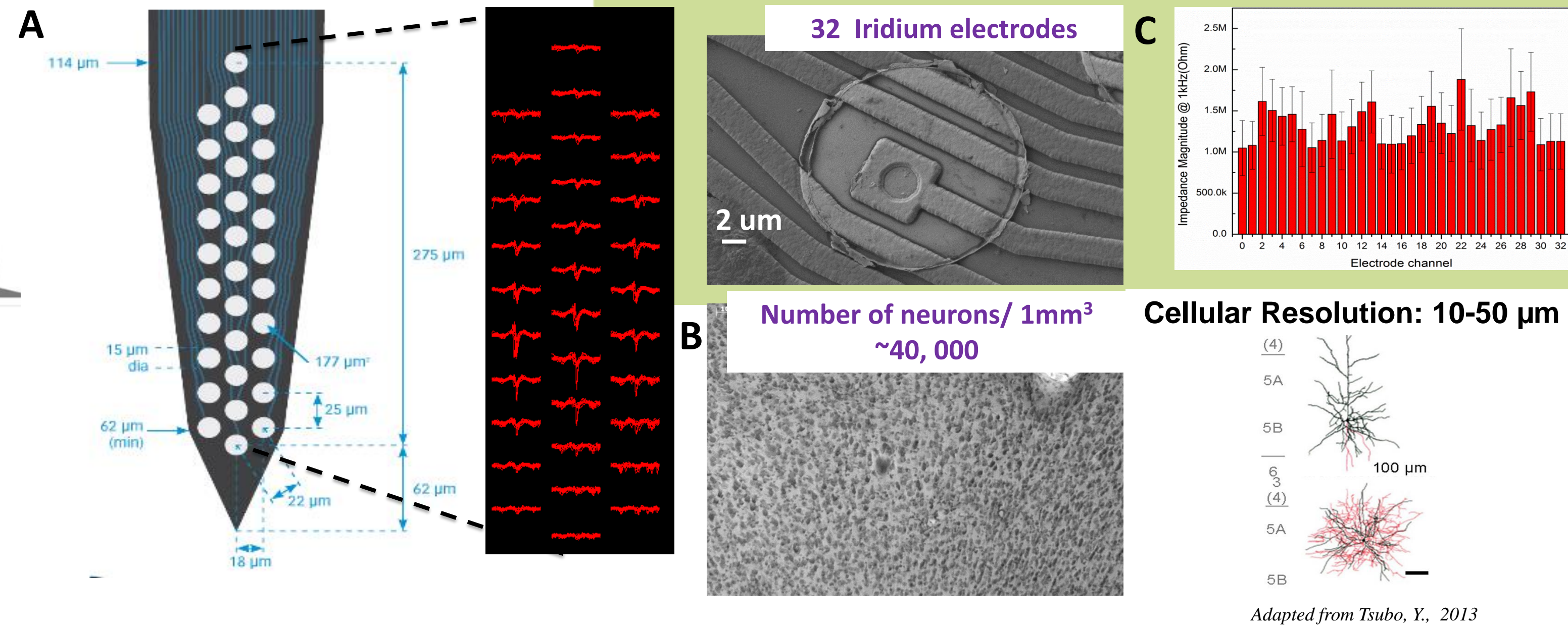
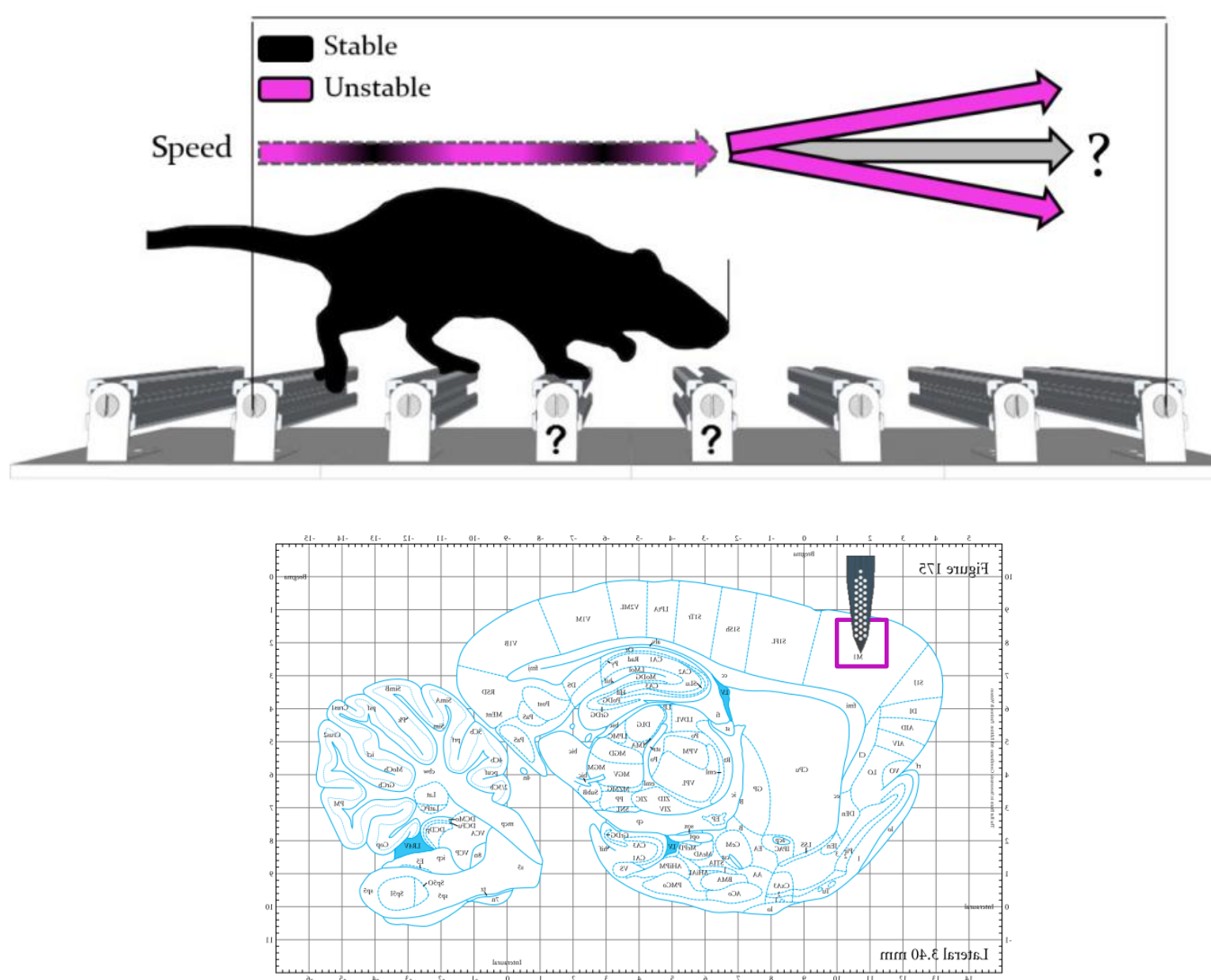


Figure1. a) Scheme of a silicon probe comprising a dense electrode array . Geometric visualization of spontaneous neural activity from motor cortex in layer 5; b) photograph of 100- μ m-thick section stained from M1 of the rat. The number of neurons in the detectable volume (within 50 μ m) of this probe should be around 89 cells and; c) the signal transference from the tissue to the electrode depends on its impedance.

2. Precision dual-probe setup for evaluating ultra-high density devices, new materials and spike sorting algorithms

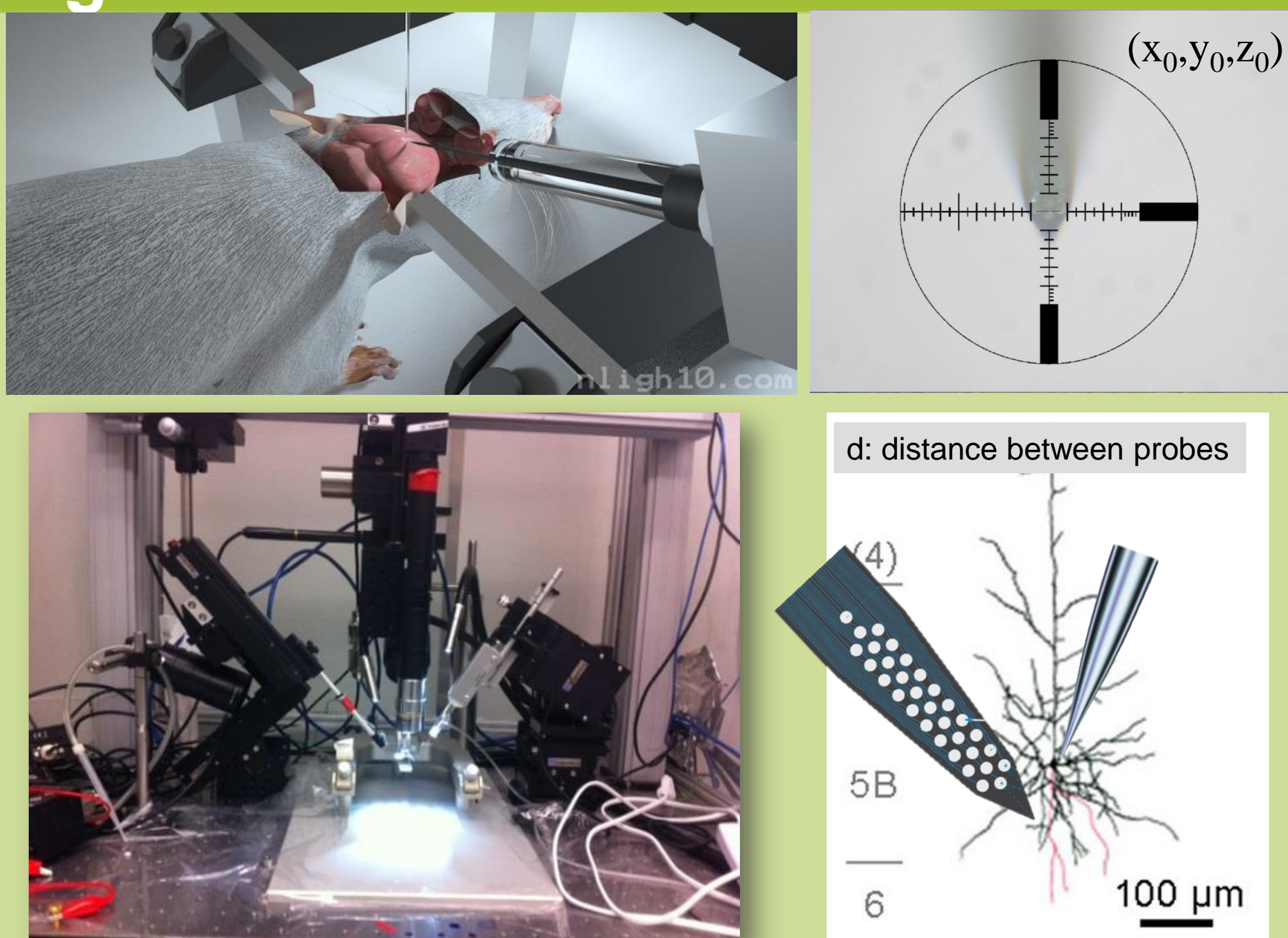
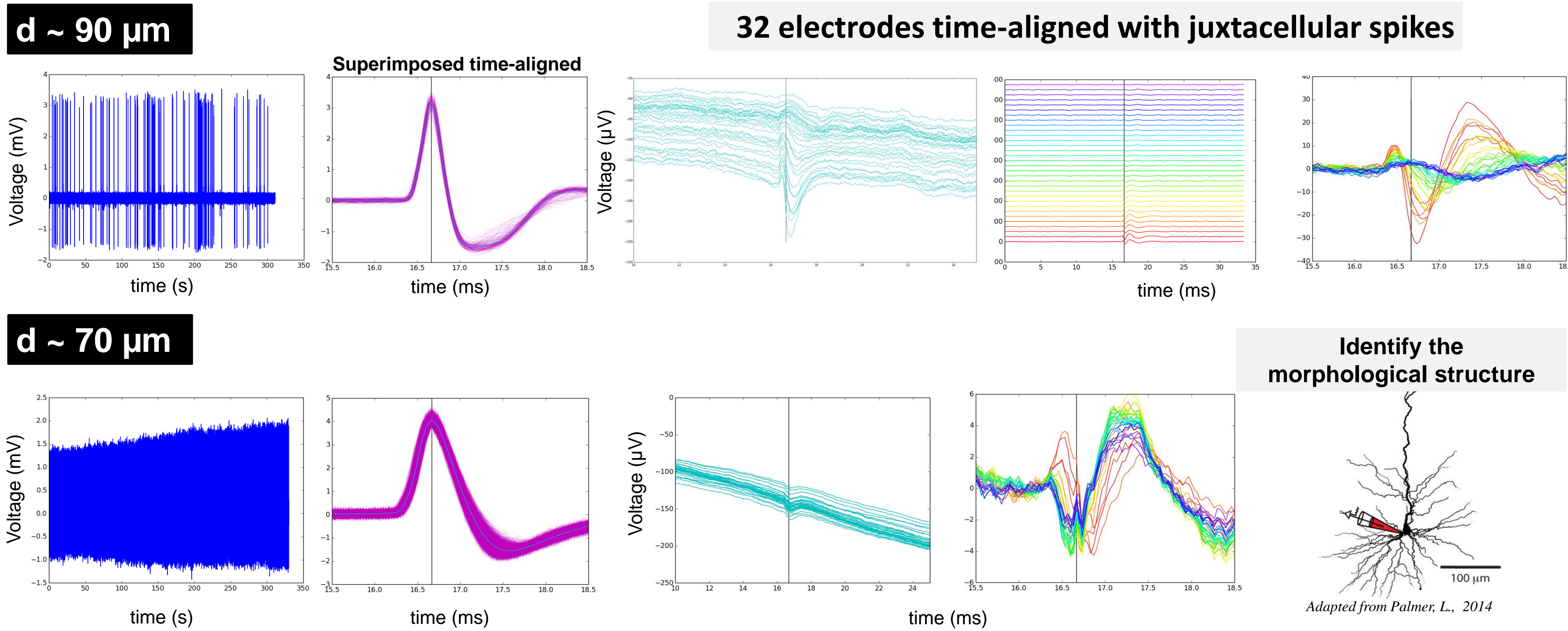
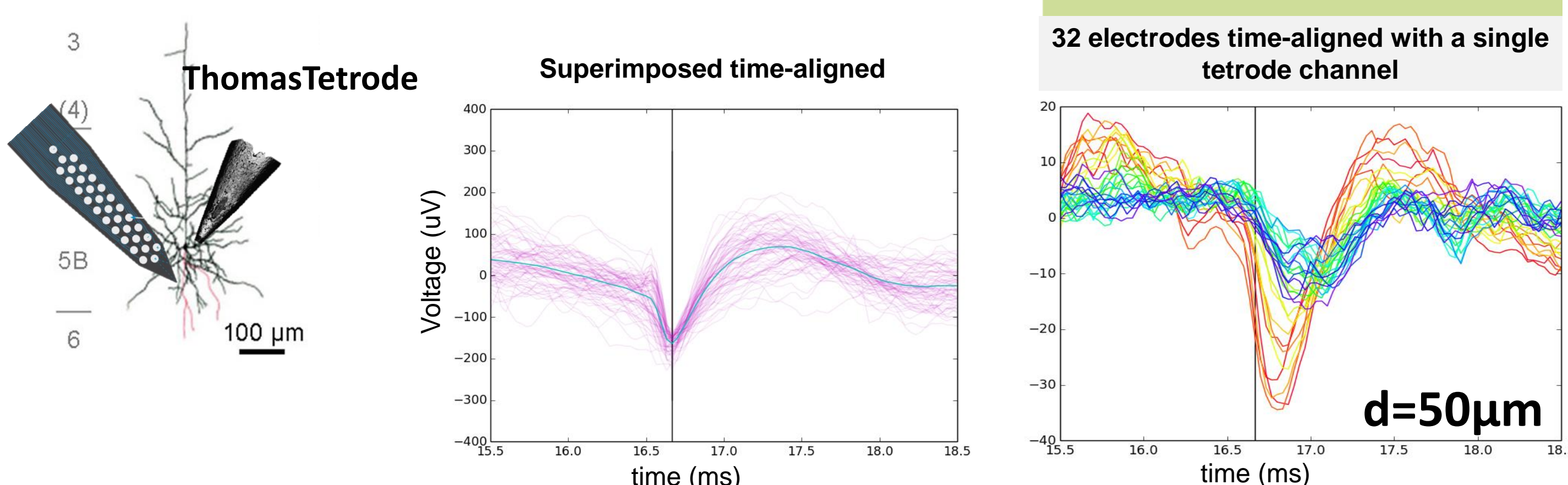


Figure2. Automated surgery-physiology setup composed by a microscope to align both electrodes and high precision motors.

- Simultaneous extracellular and juxtacellular recordings from the same neurons can provide the 'ground-truth' data required for the probe and materials evaluation. Juxtacellular signature provides unambiguous detection of single neuron.



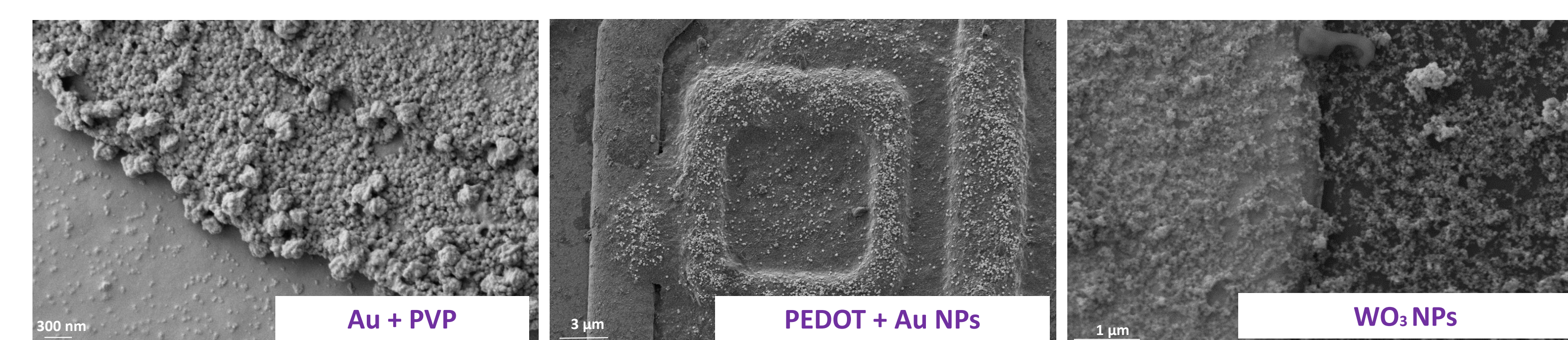
4. Material electrode-brain interface



Modified electrodes
Gold
PEDOT
Pristine

- Recordings from two extracellular probes within 100um were achieved by using a ThomasTetrode.

- More interfaces....



3. Electrode material

- We are evaluating different interfaces for improving recording and isolation methods, as well as the effect of electrode features on the signal transfer from tissue to electrode.

