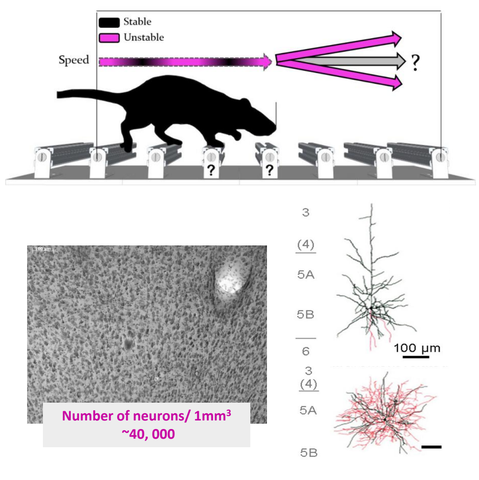
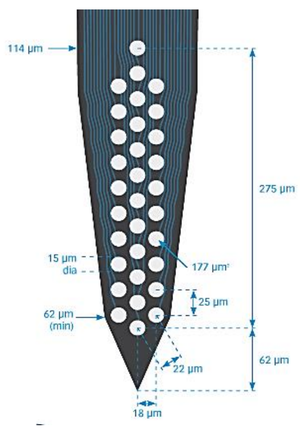
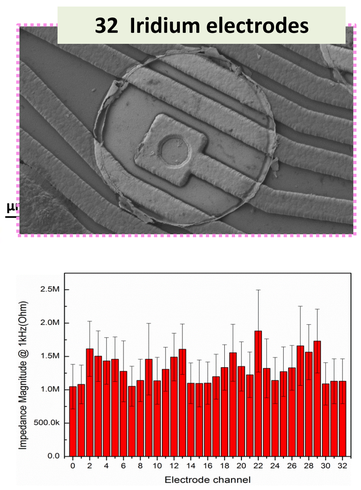
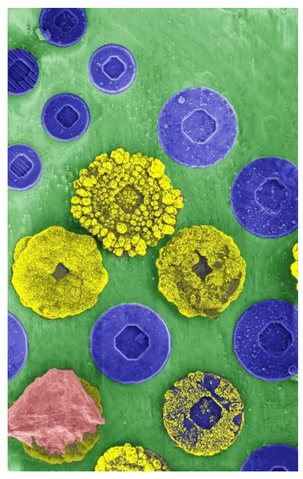
CENIMAT – Materials Research Centre, New University of Lisbon

Developing high-performance microfabricated devices for recording neural activity









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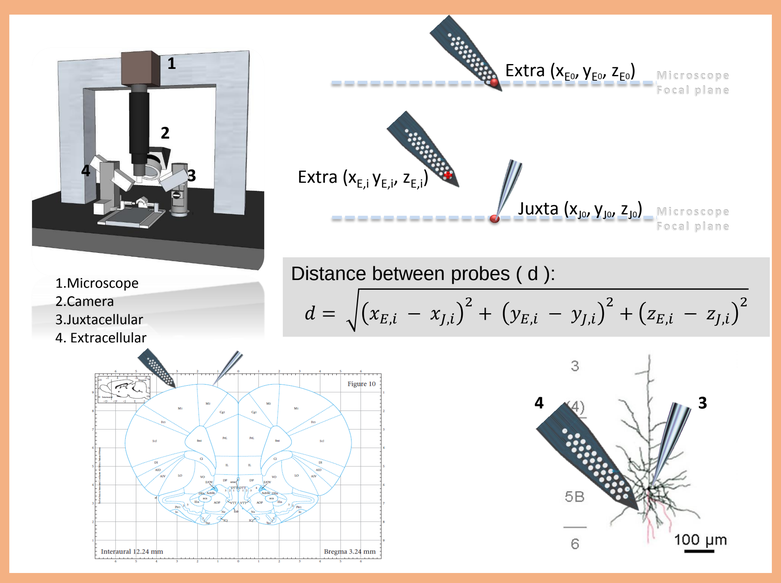
Objectives

Considerable progress is still necessary to reliably increase the number of neurons that are recorded and identified simultaneously during extracellular recordings.

This project aims to deliver 'ground truth' data in the field of high-spatial resolution of neural recording and on the effect of electrode features on the signal transfer from neural tissue to the electrode.

This collaborative project involves developing an experimental methodology to accurately quantify how different electrodes materials and morphologies can help increase the number of detectable neurons around the probe.



Methods and techniques

Acute, simultaneous extracellular and juxtacellular recordings from the same neurons will be acquired. This dual recording method will provide the 'ground-truth' data required for characterizing the performance of materials and validating spike-sorting algorithms.

- Develop the experimental methodology for evaluating neural probes: construct a stable, low-noise experimental platform for in vitro characterization and in vivo recordings from anesthetized rodents.

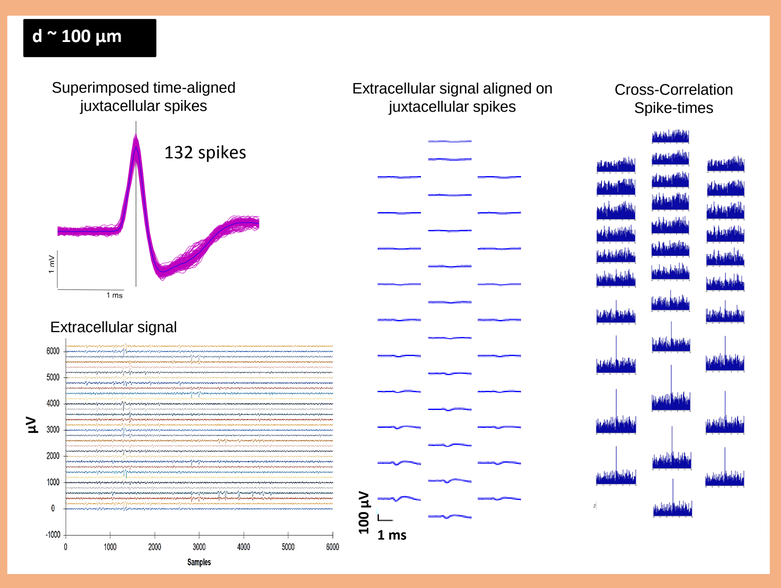
- Design novel coatings for microelectrode to improve the ability to isolate activity from individual neurons. Morphological and electrochemical characterization are performed.

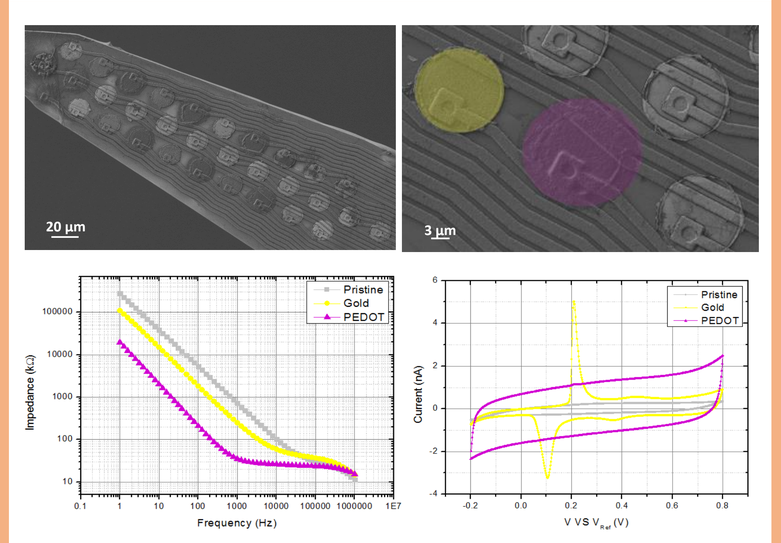
Results

- We developed a precision dual-recording setup that is capable of automatically positioning an extracellular and juxtacellular recording probe with micron resolution, without direct optical feedback, throughout the rodent brain. Juxtacellular signature provides unambiguous detection of single neurons. Moreover, it's possible to validate spike-sorting algorithms with the dataset. A paper is being prepared concerning the obtained results.

- It is expected that smaller electrodes, organized in dense arrays, will become available in the near future. Consequently, appropriate materials and designs must be employed to sustain appropriate transduction of the signal.

PEDOT-coated electrodes is a promising approach to mitigate the challenges of new electrode-tissue interfaces.





Publications

-Gonçalo Lopes, Niccolò Bonacchi, João Frazão, **Joana Neto**, Bassam V. Atallah, Sofia Soares, Luís Moreira, Sara Matias, Pavel M. Itskov, Patrícia A. Correia, Roberto Medina, Lorenza Calcaterra, Elena Dreosti, Joseph J. Paton, Adam R. Kampff, "Bonsai: An event-based framework for processing and controlling data streams" , **Nature Methods** (submitted)

-Santos, Lídia; **Neto, Joana**; Crespo, Ana; Nunes, Daniela; Costa, Nuno; Fonseca, Isabel; Barquinha, Pedro; Pereira, Luis; Silva, Jorge; Martins, Rodrigo; Fortunato, Elvira, "WO_3 nanoparticles-based conformable pH sensor", **ACS Applied Materials & Interfaces**

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