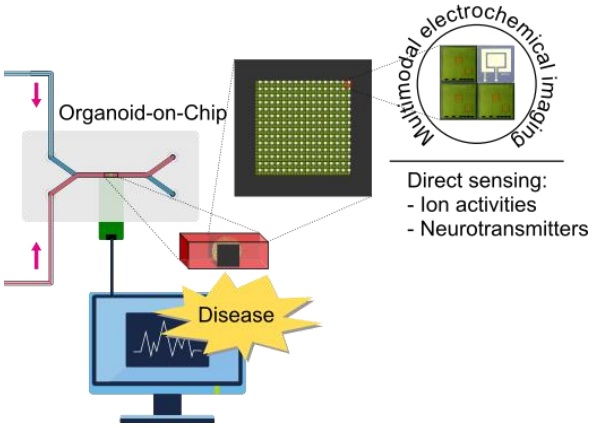
Open paid thesis position in Engineering (Master's/PhD)

CMOS Design of Neuromorphic Electrochemical Imagers for Advanced Organ Modeling and Medical Discovery on Chip

Description

"Organ-on-chip" (OoC) technology - understood as the microfabrication of cell culture devices to model functional units of human organs in vitro - has seen significant advancements in recent years. OoC is transforming biomedical research by replicating organ-level physiology within complex and controlled microenvironments. However, its progress is hindered by current knowledge gaps in the spatiotemporal dynamics involved in the development of organoids, which are three-dimensional cell tissue cultures with enormous potential to revolutionize the control over specific physiological and pathological responses of human organs in OoC.



In this project, you will collaborate with a multidisciplinary team with expertise in neuroscience, microelectronics, chemistry, and computational biology, incorporating the latest advances in CMOS biochemical sensors and neuromorphic engineering to develop the first smart biochip for precise interpretation of organoid biochemical activity in organ-on-chip platforms. You will investigate new ultra-low-power ICs for the readout of micron-sized sensor arrays for electrochemical imaging, which can be integrated to provide comprehensive electrochemical analyses in the miniaturized dimensions of organoids-on-chip. The readout circuits will be optimized to (i) deliver tunable compression of interfering components to enhance measuring resolution, and (ii) distributed event-based encoding to boost performance in posterior neuro-AI processing stages.

Background & skills

- Finishing a Master's degree in Electronics/IT Engineering (or similar);
- Competence with Cadence EDA tools for IC design;
- Experience with PCB design and FPGA/embedded systems programming;
- Research-oriented attitude, capable of taking initiatives and with a solid problem-solving attitude;
- Ability to work in an interdisciplinary team, w/ good spoken and written English.

Tasks

- Design of neuromorphic readout architectures for multimodal sensing. This includes developing sensor analog frontends, asynchronous A/D converters, and the digital communication stages. You will integrate your circuit proposals in sub-micron CMOS technologies.
- Tape-out of your own custom chips and electrochemical characterization.
- Integration into a lab-on-a-chip device and validation through biochemical assays carried on real organoids.

What we offer

- Paid thesis position, with an official go/no-go PhD assessment within 6 months.
- An excellent technical infrastructure in a stimulating, multidisciplinary, and dynamic environment;
- Extensive benefits package for work-life balance in line with Spanish Administration's and CSIC's regulations;
- International collaboration network with possibility to perform research stays among partners in related European and National projects;
- Personalized hands-on training on cutting-edge technology topics with links to industry;
- Opportunity to join an ongoing startup project as entrepreneur.

Contact To apply, please send your CV, references, and academic records with subject "OrgChip" to:
Dr. Josep Maria Margarit josepmaria.margarit@csic.es