

## PhD fellow in Microscale neuroelectronic devices (microBots)

IIT invites excellent candidates to apply to its PhD program organized in collaboration with the Open University; this international PhD program confers Doctorates in *Health, Sustainable and Human Technologies*.

In order to be admitted into the ARC program, the minimum requirements are

- i. a Masters-level degree, which broadly corresponds to a 4/5-year undergraduate MSc/MChem/Meng-style degree or to a postgraduate Masters in the British system, or to a second level University degree in Italy;
- ii. a grade corresponding to an upper second class (2.1) or a merit in the UK system or 100/110 in the Italian system. Candidates with lower grades but redeeming features (publications, specific expertise) are requested to contact the potential supervisors before applying;
- iii. where English is not the applicant's first language, a valid IELTS (International English Language Testing System) certificate. The minimum acceptable score is an overall 6.5, with no less than 6.0 in any of the four categories

One PhD fellow position **will be available from October 1<sup>st</sup> 2023** in the Microtechnology for Neuroelectronics research line led by Dr. Luca Berdondini.

The position will be funded by the European Commission within the HORIZON-EIC-2021-PATHFINDERCHALLENGES project "CROSSBRAIN" – Grant Agreement n° 101070908.

### **Title of the project: Distributed and federated cross-modality actuation through advanced nanomaterials and neuromorphic learning**

*Background:* A vast number of pathological brain conditions (such as epilepsy or neurodegenerative diseases) directly involve aberrant electrical activity of the brain. The immediate recognition of such activity and reaction is imperative to trigger periodical and adaptive treatments. However, available neurotechnologies to detect and modulate brain activity precisely and selectively for therapeutic purposes are severely limited and require new solutions to drastically reduce invasiveness while enabling distributed brain stimulation with high spatiotemporal precision.

*Description:* In the EIC funded project "Crossbrain" we target to unlock access to completely novel neuromodulation paradigms based on the challenging development of wireless, implantable, MRI-compatible "microbots" devices (100x100x100  $\mu\text{m}^3$ ). Specifically, we will study and develop such micro-scale, fully-integrated devices to provide monitoring and modulation functionalities of neural activity with an unprecedented level of reduced invasiveness. Based on our original expertise on microscale neuro-devices for neural interfaces, the student will contribute to this development by studying and characterizing different CMOS circuit solutions for front-end recording and stimulation, as well as by developing micro-structuring processes to realize and demonstrate such neuro-devices. Research activities will be carried out within the laboratory in tight collaboration with experienced researchers in CMOS circuit design, micro-/nano-structuring and in-vivo electrophysiology, as well as in tight collaboration with researchers of the Crossbrain EIC project..

#### *External References:*

[1] Angotzi G.N, et al. (2022) "Integrated Micro-Devices for a Lab-in-Organoid Technology Platform: Current Status and Future Perspectives", *Frontiers in neuroscience*. 16.

doi: 10.3389/fnins.2022.842265.

[2] Angotzi G.N, et al. (2019) "SiNAPS: An implantable active pixel sensor CMOS-probe for simultaneous large-scale neural recordings",

*Biosens Bioelectron*. 2019 Feb 1;126:355-364.

doi: 10.1016/j.bios.2018.10.032 .

[3] Angotzi G.N, et al. (2018) "A  $\mu\text{Radio}$  CMOS Device for Real-Time In-Tissue Monitoring of Human Organoids," 2018 IEEE Biomedical Circuits and Systems Conference (BioCAS), pp. 1-4.

doi: 10.1109/BIOCAS.2018.8584695.

**Main Supervisor:** Luca Berdondini. (Microtechnology for Neuroelectronics)

*Essential expertise:*

- i. MSc or equivalent degree in Electronic/Electrical Engineering, Bioengineering or in Physics.
- ii. Background in microelectronics or microstructuring technologies
- iii. Skills in programming with Matlab/Python/C++/C# or similar environments for data analysis
- iv. Experience in electronic circuit simulations

*Desirable expertise:*

- i. Background in neuroscience
- ii. Desirable expertise in biosensors and bioelectronics
- iii. Background in neural interfaces
- iv. Desirable expertise in (bio-)electrochemical sensors and electrochemistry

**How to apply.** Prospective students must submit using the [online form](#) the following documents

- 1) 2-page CV, which includes studies, expertise and achievements.
- 2) 1-page research statement, which includes the choice of a project from the list above and a justification of the choice. Only if robustly justified, the student may signal their interest also for a second project, but there is no guarantee that this will be taken into account by the selection panel.
- 3) A transcript of undergraduate and postgraduate studies.
- 4) A valid IELTS certificate, obtained no more than two years before the proposed registration date.
- 5) Contact details of two referees.

**For this position, ARC accepts candidatures on an ongoing basis (first-come, first-served).**

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Please note that the data that you provide will be used exclusively for the purpose of professional profiles' evaluation and selection, and in order to meet the requirements of Istituto Italiano di Tecnologia. Your data will be processed by Istituto Italiano di Tecnologia, based in Genoa, Via Morego 30, acting as Data Controller, in compliance with the rules on protection of personal data, including those related to data security.