

## Doctoral fellowship for international students

University funding application for a 3-year PhD – Fall 2024

### Probing bioenergetics at single mitochondria by AFM-SECM microscopy

#### Summary

The goal of this project is to study bioenergetics activities at the scale of single organelles, the mitochondria, by using an ultra-sensitive electrochemical nano-imaging technique.

Mitochondria are the "energy powerhouses" of living cells, synthesizing the chemical

bioenergy fuel, ATP, under coupling with the activity of the enzymatic respiratory chain. Studying the efficiency of electron transport within the chain, *via* the oxidation of various coenzymes (NADH, quinone, cytochrome-c) with O<sub>2</sub> as the final acceptor, provides information about the bioenergetics functioning of mitochondria in physio and pathological conditions. In this project, individual mitochondria will be functionally imaged, under different respiratory, redox and metabolic states, using the ultra-resolved and dual atomic force-electrochemical nanoscopy (AFM-SECM). This imaging technique is currently the only one capable of constructing a topographical image of a single living mitochondrion while simultaneously mapping its redox reactivity, at an unprecedented sub-particle scale.

**Keywords.** Nano-bioelectrochemistry, AFM-SECM imaging, mitochondria, respiratory chain

#### Host laboratory

Laboratory of Molecular Electrochemistry, UMR 7591 CNRS, Université Paris Cité. BIONANO team (<https://lem-uparis.cnrs.fr/recherche/bionano/>). Thesis supervisor: Dr. Arnaud Chovin. Co supervisor: Dr. Stéphane Arbault, Institute of Chemistry and Biology of Membranes and Nano-objects (CBMN), UMR 5248 CNRS, University of Bordeaux.

#### PhD funding

Application to IdEx ("Initiative d'Excellence") international doctoral grants at University Paris Cité. Exclusively available to Master 2 foreign students enrolled in universities outside of France.

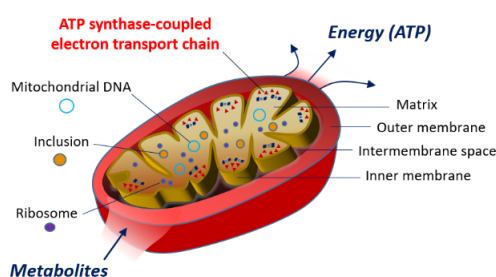
#### Candidate Profile

Master 2 degree in analytical or biological chemistry, biophysics or bioengineering. The candidate will have an affinity for interdisciplinary research, experimental work, and qualities of rigor, care and organization. Experience in electrochemistry, microscopy or instrumentation is a plus.

#### Contact

Candidates should send a CV and a letter of motivation by e-mail to Arnaud Chovin and Stéphane Arbault ([arnaud.chovin@u-paris.fr](mailto:arnaud.chovin@u-paris.fr) ; [stephane.arbault@u-bordeaux.fr](mailto:stephane.arbault@u-bordeaux.fr)). Deadline : 13/07/2024

#### Inner organisation of mitochondria



#### AFM-SECM nano-imaging

