# PhD in Nano-bio-electrochemistry

## Single-impact electrochemistry coupled to luminescence for detecting soft entities

- Workplace: CEISAM Laboratory, Electrochemistry group, Nantes, France
- Profile: Master degree in Analytical/Physical Chemistry and/or Nano-biomaterials with a training in Electrochemistry
- Keywords: Electrochemistry, single impacts, bacteria, liposomes, ultramicroelectrode, membrane, luminescence
- Public funding: French Ministry for Higher Education and Research
- Salary: 1 600 € per month
- Dates: From 2024-10-01 to 2027-09-30
- Application deadline: 2024-05-31
- Contact for application: Estelle Lebègue
  (CV + cover letter) estelle.lebegue@univ-nantes.fr

### Topic description

The goal of the project is to develop a methodology for coupling single-impact electrochemistry experiments to luminescence measurements in order to detect soft entities (bacteria and liposomes) in real time. Several strategies will be tested such as fluorescence and electrochemiluminescence by using appropriate compounds (such as Green Fluorescence Protein, $[Ru(bpy)_3]^{2+}$ and tripropylamine) for detecting single impacts of bacteria or liposomes on the ultramicroelectrode surface. The Electrochemistry group in CEISAM has a strong expertise in single-impacts electrochemistry for the detection and analysis of bacteria (*Shewanella oneidensis*) [1,2] and synthetic liposomes based on DMPC phospholipids [3,4]. Because of the increasing need to couple electrochemical impact experiments to other analytical techniques able to give an accurate response in real time, the luminescence method seems to be appropriate for single-entity imaging [5,6].
The first task of the PhD student will be devoted to the adaptation to luminescence measurements of the electrochemical cell currently used for coupling electrochemistry and atomic force microscopy measurements. Then the setup of the coupling of electrochemical measurements with luminescence for single-entity analysis will be achieved with the detection of bacteria and liposomes impacts. The two main objectives of this project will be to couple single-impact electrochemistry and luminescence for the two soft entities studied in our lab: electroactive bacteria (micrometer-sized) and DMPC liposomes (nanometer-sized). This project will lead to new collaborations, especially with experts of fluorescence and electrochemiluminescence, therefore the PhD student should be open to opportunities to work in other labs and with other research groups during her/his thesis. Furthermore, the applicant should have had a training in Electrochemistry during her/his Master years.

estelle.lebegue@univ-nantes.fr Phone: (+33) 2 76 64 51 82
CEISAM UMR 6230, Faculté des Sciences et Techniques, 2 Rue de la Houssinière, BP 92208,
44322 NANTES CEDEX 3, France