PhD in Nanobioelectrochemistry

Electrochemistry of redox liposome nano-impacts for bacterial toxins sensing

- Workplace: CEISAM Laboratory, IMF team, Nantes, France
- Profile: Master degree in Analytical/Physical Chemistry and/or Nanomaterials
- Keywords: Electrochemistry, single impacts, redox liposomes, toxins, ultramicroelectrode, pathogenic bacteria, lipids, membrane
- Public funding: French National Agency (ANR) ELIPOX (ANR-21-CE42-0007-01)
- Dates: From 2022-10-01 to 2025-09-30
- Application deadline: 2022-06-30
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Topic description

The goal of the project is to design and develop a highly sensitive and specific electrochemical sensor device for the detection of virulence factors secreted by pathogenic bacteria. Electrochemistry of single redox liposome nano-impacts will be applied to the detection of toxins from two bacteria responsible for nosocomial infections: the δ-Hemolysin from *Staphylococcus aureus* and the Rhamnolipid from *Pseudomonas aeruginosa*. The electrochemical sensing principle is based on the weakening of the liposomes lipid membrane upon interaction with destructive bacterial virulence factors which leads upon impact at an ultramicroelectrode to the breakdown of the liposomes and the release/electrolysis of its encapsulated redox probe.
The project is mainly supported by the coordinator's previous results on electrochemical single collisions of redox liposomes (https://doi.org/10.1002/anie.202111416; https://doi.org/10.1021/acs.analchem.9b02809; https://doi.org/10.1021/acs.langmuir.5b03123) with the objective to extend this strategy for sensing two target toxins (produced by two pathogenic bacteria), known for interacting with the lipid membrane of liposomes. The main challenge of the project will be to optimize and adapt the liposomes lipid membrane composition in order to specifically detect the two target toxins and to reach high sensing selectivity, which is of critical importance for biosensor applications.
The expected results of the project are the most sensitive electrochemical detection toward the target toxins (sub-micromolar) in a short time analysis (30 minutes maximum) with an easy handling and cheap technique.

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