Project 3.8 Electrochemical analysis of neurobiologically relevant analytes.

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Unit: Charge transfer processes in hydrodynamic systems
WWW: https://www.charge-transfer.pl/

Background:

Sensors proposed in this project are based on ion-transfer voltammetry. Traditional voltammetric techniques quantify exchange of electrons between the molecule of interest and the electrode but in case of ion-transfer voltammetry the molecule does not have to be electroactive. The prerequisite for the detection is the charge of the molecule. Because of this ion-transfer voltammetry became an interesting means to electrochemically analyze non-electroactive molecules such as proteins, and could potentially serve as a method of constant detection of MMP-9 in neuronal cultures or simultaneous detection of neurotransmitters.

The main hurdle in simultaneous analysis of dopamine and serotonin is not only their similar detection potential, which requires employment of electrode modification strategies but also polymerization of dopamine at physiological pH, which causes inactivation of the sensor. Given the huge effort of the scientific community to solve this problem the proposed strategy will be twofold. First, sensors will be fabricated from double barrel capillaries in a way allowing both modes of detection, at one side by means of ion-transfer voltammetry, at the other using well established methods of voltammetric analysis of dopamine on carbon. Secondly, machine learning methods will be applied to quantify both compound based on multivariate curve resolution or multivariate regression.

Aim:

The main scientific goal of this project is to develop electrochemical microsensors that allow analysis of neurobiologically relevant analytes such as matrix metallopeptidase 9 (MMP-9) and neurotransmitters. Although dopamine is the first and most often analyzed till this day neurotransmitter detected by electrochemical means regardless the effort made for simultaneous detection of dopamine and serotonin no reliable method was proposed. In the case of MMP-9 the main problem of the available electrochemical sensors is their mode of action based on peptide cleavage which does not allow constant detection. After the peptide is cleaved the sensor is considered consumed.

Requirements:

- MSc in Chemistry, Physics, Biology, Biotechnology, Medicine, Biomedical Engineering (or related fields).
- Creativity measured by the quality and number of projects, the course of studies, internships, authorship in peer-reviewed publications and patents in which the Candidate participated and contributed
- Ability to work independently as well as in a group.
- Analytical thinking and problem solving
- Fluency in spoken and written English
- Experience in electrochemistry especially regarding detection of neurotransmitters and fabrication of microelectrodes will be a plus.