SENTINEL

European Training Network in Single-Entity NanoElectrochemistry

2 early stage researcher opportunities available based at the

University of Twente

Bioelectronics Research Group

Project Descriptions

ESR13: Single-Polymer Detection

This post will be co-supervised by the Pollard Institute at the University of Leeds.

Objectives: To investigate the amperometric detection of water-soluble conducting polymers as transduction mechanism in bioelectronics. Arrays of independently addressable microfabricated electrodes with a sub-50 nm spacing will be employed.

Expected Results: Trapping of individual polymer molecules will be electrically monitored in real time, with the aim of achieving the detection of single polymer coils that remain fully solvated. This represents an important building block for an all-electrical transduction mechanism for single-molecule biochemical assays.

Planned Secondments:

- University of Leeds - single cell and single molecule analysis using nanopipettes. The ESR will be trained on nanoelectrochemical methods for the manipulation of single-cells with single molecule resolution.
- East China University of Science &Technology - functional probe design for chemical sensing. The ESR will have the opprtunity to become familiar with methods for imparting chemical functionally to nanopipettes/nanopores for single molecule sensing.
- Aarhus University - surface charge mapping of single-cells. This secondment will expose the ESR to a recently developed technique capable of mapping surface charge density of living cells to understand neurological function.

ESR14: CMOS-Based Nanocapacitor Arrays

This post will be co-supervised by Elements SRL.

Objectives: We will explore single-entity detection using high-frequency CMOS-based nanocapacitor arrays.

Expected Results: The ultimate goal of this research is to provide a new fingerprinting method based on the frequency-dependent response of individual synthetic or biological entities. A proof-of-concept application is the detection of short RNA oligomers as genomic markers for a number of diseases and medical conditions.

Planned Secondments:

- Elements - Development of CMOS potentiostats. The ESR will learn fabrication of portable potentiostats using microchips (ASICs) and standard CMOS processes.
- Nippon Telegraph and Telephone (NTT) - Nanodevices for single-entity measurements. The ESR will learn about advanced nanofabrication techniques for the development of functional nanofluidics devices with single-entity sensitivity.
- ETH Zurich - force controlled single cell analysis. This secondment will rely on the FluidFM technology. The ESR will employ an atomic force microscope (AFM) based on hollow cantilevers for local liquid dispensing and stimulation of single living cells under physiological conditions.

About the Employer

The University of Twente is a leading Dutch technical research university with a strong track record in connecting technology and engineering to businesses, organisations and real-world needs. The research will be embedded in the MESA+ Institute for Nanotechnology, one of the world's largest nanoscience institutes (525 researchers) working on key enabling nanotechnologies: photonics, micro- and nano-electronics, biomolecular and polymer science, advanced materials, lab-on-chip and nanofluidics.

The Bioelectronics Research Group has access to a wide range of instruments for sensitive electrical measurements, including commercial potentiostats and AC instrumentation as well as custom-built setups for multichannel ultralow current measurements. This equipment, together with a range of characterisation tools, will be fully available to the project. The group also has convenient access to NanoLabNL, a world-class 1250 sqm cleanroom facility with particular emphasis on fluidic device fabrication.

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