LABORATOIRE D'ELECTROCHIMIE MOLECULAIRE
Université Paris Diderot – Paris 7
Unité Mixte de Recherche CNRS / Paris 7 N°7591

'Biomacromolecular systems, electron transport at the nanoscale '

Post-doctoral position available

Funding: ANR (National agency for research) – PIRIBIO program (Interdisciplinary research program on molecular and cellular systems) – "CASCADE" project

Salary 2000 € (net income). Duration: 1 year, renewable each year for a maximum of 3 years.

Host laboratory :
Laboratory of Molecular Electrochemistry (LEM) –University Paris Diderot - Paris 7, CNRS UMR 7591, Paris, France

Starting date : From January 2010.

Laboratories involved in the project:

- Laboratory of Molecular Electrochemistry (LEM) – The Biomacromolecular Systems-Electron Transport at the Nanoscale group. University Paris Diderot - Paris 7, CNRS UMR 7591, Paris.
- Molecular Plant Biology Institute – The Plant-Virus Interaction group (IPV) - INRA UMR 1090, Bordeaux.
- Molecular Physics Center (CPMOH) – Nanophysics on Soft Materials and Biological Systems group –CNRS UMR 5798, Bordeaux.

Profile and requirements:

The candidate should:

- Hold a doctoral degree in chemistry or physics.
- Have some experience in nanoscience and local probe microscopies (AFM,…)
- Have some experience of, or a strong interest for reconstituted biomolecular systems.

Having notions in electrochemistry will be considered a plus.

It is important that the candidate is open for team work and collaborations with researchers of different fields (chemistry, physics, biology). Proficiency of French language is not mandatory.

Description of the ANR “CASCADE” project:

Scanning atomic force - electrochemical nanoreactor microscopy for functional probing of organized bio-catalytic enzyme cascades.

The aim of this project is to develop new experimental tools to both (*i*) Assemble artificial enzymatic complexes (cascades), in a way spatially controlled at the nanoscale (this part of the work will be carried out by the INRA partner) (*ii*) Probe their functional behavior, at the scale of a few, or even individual, enzyme molecules. To this aim a new local probe electrochemical technique will be designed allowing the functional probing of enzyme clusters at the nanoscale. Within this project the main task of the candidate will be to participate in the development and use of this innovative nanoelectrochemical technique which will allow a small patch of the enzyme-bearing surface to be confined under a “hollow” microlectrode (collaborative work involving the LEM and CPMOH partners). This “nanocavity “ microlectrode will be fabricated at the apex of an AFM probe. The resulting combined nanocavity AFM-SECM probe will allow the enzyme clusters to be located on the surface *and* the electrochemical currents associated to the enzymatic redox catalysis to be measured. Using nanocavity microelectrodes ~ 100-500 nm in size it will be possible to “cap” a selected population of enzymes and to probe their collective functional behavior. The local probe configuration will allow the enzyme populations to be selected based on their spatial position i.e based on their degree of diffusive coupling with neighboring enzyme clusters. Using even smaller nanocavity microelectrodes, ~ a few 10 nm in size, will make the functional behavior of *individual* enzyme molecules experimentally accessible. Addressing the catalytic behavior of single enzyme molecules is, in itself, a biologically relevant question, since in classical enzymology, insight into the dynamic behavior of enzymatic processes is typically derived from ensemble measurements. The kinetic behavior observed is the mean of the contribution of individual enzymes fluctuating between more or less active conformations. Observing a single enzyme removes the usual ensemble average, allowing the exploration of hidden heterogeneity in complex condensed phases as well as direct observation of dynamic changes, without synchronization. Such an approach should reveal itself extremely valuable for an in depth understanding of *in vivo* complex enzymatic mechanisms.

If you are interested, please send your application containing a CV, a motivation letter to Dr. Christophe Demaille , demaille@univ-paris-diderot.fr.

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