LABORATOIRE D'ELECTROCHIMIE MOLECULAIRE

CNRS – Univ. Paris Diderot UMR 7591, Paris France

Post-doctoral Fellowship

Funded by the ANR (National Agency for Research) – 2014

ANR *Project* : eVIRZYM

Functional Imaging of Enzymatic Nanosystems Reconstituted on a Virus Nano-Scaffold Using Atomic Force Microscopy coupled to Electrochemistry

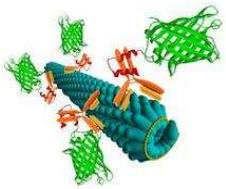
Keywords: AFM, SECM, Nanotechnology, (Bio)Electrochemistry

Salary : From 2100 € / month (net income) ***Duration*** : 1 year (renewable)

Starting date : ***From February 2017***

Host Laboratory : Laboratoire d'Electrochimie Moléculaire LEM – Paris Diderot University, 15 rue J.A. Antoine de Baïf, 75013 Paris, France – www.lemp7.cnrs.fr

eVIRZYM project : Coordinator Dr. Christophe Demaille (LEM) - *Research Team* **:** Biomacromolecular systems. Electron transport at the nanoscale.



The major scientific goal of this multidisciplinary project is to generate new insights into the way spatial organization modulates the efficiency of scaffolded multi-component enzymatic systems. To achieve this goal, experimental nanoscale enzymatic platforms need to be designed and their functional behavior interrogated at the individual nano-system scale. Beyond the formidable instrumental challenge this represents, being able to carry out such nanoscale catalytic measurements will open up potential applications in nanocatalysis, lab on a chip and biosensor devices, drug delivery vectors and nanometrology.

As an original nano-engineering approach for reconstituting functional multi-component enzymatic systems we propose to use bacteriophages (harmless viruses from bacteria) as scaffolds. These virus nano-carriers will be used as intermediate building blocks carrying correctly exposed proteins on their surface, and immobilized onto a solid substrate. Thanks to the expertise of the biologist Partner of the project (INRA, Bordeaux, France) [1] in virus and protein engineering a large toolbox of site-selective bio-conjugation strategies, some of them entirely original, will be available for organizing molecular components scaffold onto the virus.

Functional interrogation of the engineered multi-component systems will be carried out using a high resolution correlative local probe microscopy technique combining atomic force (AFM) and electrochemical microscopy (SECM) in a configuration invented by the electrochemist Partner of this project (Partner 1) [2,3], and uniquely enabling to: (i) resolve the position of the virus-based nano-systems on surfaces, (ii) probe selectively the catalytic and/or redox function of these nano-systems individually.

[1] Cardinale, D.; Carette, N.; Michon, T. Virus Scaffolds as Enzyme Nano-Carriers. *Trends in Biotechnol*. **2012**, *30*, 369-376.
[2] Huang, K.; Anne, A.; Bahri, M. A.; Demaille, C. Probing Individual Redox PEGylated Gold Nanoparticles by Electrochemical-Atomic Force Microscopy. *ACS Nano* **2013**, *7*, 4151-4163.
[3] Nault, L.; Taofifenua, C.; Anne, A.; Chovin, A.; Demaille, C.; Besong-Ndika, J.; Cardinale, D.; Carette, N.; Michon, T.; Walter, J. AFM-SECM Imaging of Redox-Immunomarked Proteins on Native Potyviruses: From Subparticle to Single-Protein Resolution. *ACS Nano* **2015**, *9*, 4911-4924.

Candidates profile :
The candidate must hold a doctoral degree in chemistry, physics, biology or biophysics. She/he should be a skilled experimentalist. Some experience in local probe microscopies (AFM,…) and in electrochemistry would be appreciated.

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