LABORATOIRE D'ELECTROCHIMIE MOLECULAIRE

CNRS – Univ. Paris Diderot UMR 7591, Paris France

Post-doctoral Fellowship

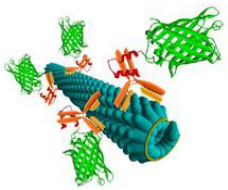
Funded by the ANR (National Agency for Research) – 2014

ANR *Project* : eVIRZYM

Probing the Catalytic Activity of Functional Enzymatic Nanosystems Reconstituted on a Virus Nano-Scaffold Using Atomic Force – Scanning Electrochemical Microscopy

Keywords: AFM, SECM, Nano Bioelectrochemistry, Active Nanometric Devices, Viral Nanotechnology, Functional Imaging

Salary : 2100 € / month (net income) ***Duration*** : 1 year (renewable)
Starting date : ***From September 2015***
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 scientific goal of the ANR eVIRZYM project is to generate new insights into the way spatial organization modulates the efficiency of scaffolded multi-component redox/enzymatic systems. To achieve this goal, experimental nanoscale systems are to be designed and their functional behavior interrogated.

- We propose an original strategy for designing such systems, which consists in coupling enzymes and redox macromolecules of interest with a compatible highly ordered protein scaffold: Virus particles. Following this bio-inspired "bottom up" viral nano-technology approach, pioneered by the biologist partner of the project (INRA, Bordeaux, France) [1], two types of nanosystems will be designed, namely a redox nano-transducer and a two enzyme catalytic cascade.
- Another particularly advanced aspect of this interdisciplinary project is that 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, coordinator of the project (LEM-CNRS) [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.

Beyond the formidable fundamental and instrumental challenges the eVIRZYM project 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.

[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, preferably familiar with surface biofunctionalization. Some experience in electrochemistry and in local probe microscopies (AFM,…) would also be appreciated.

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A covering letter, CV and the contact details of two referees should also be sent by e-mail to Dr. C. Demaille.