

## **EpitopeMap Short Visit Grants**

### **Proponent**

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### **Short description of the purpose of the visit**

This Short Visit is connected to the ongoing EpitopeMap Exchange Project that involves the proponent's Ph.D. student Daniele Maiolo. Maiolo's project – entitled "A preliminary study of the nanomechanics of the nanoparticle-protein corona" – was conceived on the hypothesis that the proteins perform a nanomechanical surface work to enter and exit the nanoparticle-protein corona and was aimed at devising and performing the first experiments to quantify it. In that project the proponent committed to cover an advisory role with respect to the protein surface nanomechanics.

On this basis, the proposed Short Visit will coincide with the last weeks of the exchange period of Maiolo, tentatively the last week of January 2011, with the primary aim to workshop with Maiolo and his tutors at Centre for BioNano Interactions, Kenneth Dawson and Marco Monopoli (and possibly with the other researches involved in Daniele's activity), on his experiments. In particular, the proposed meetings will focus on (but not limited to):

- discussion and assessment the results Maiolo has achieved;
- discussion on the possibility of the application of biomolecule surface nanomechanical thinking to the widest possible range of nanoparticle-biological interfaces;
- planning of future activities, comprising follow-up activities at Brescia University, submission of joint research projects, other scientist exchanges, etc.

### **Report of the work carried out during the visit**

The visit was framed within the EpitopeMap Exchange Project that involves Paolo Bergese's Ph.D. student Daniele Maiolo. The visit therefore took place at the end of the third month of Maiolo's permanence at Kenneth Dawson's Centre of BioNano Interaction (CBNI) and consisted of two days of full-time work.

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In the morning of the first visit day an informal seminar, chaired by Marco Monopoli, was delivered to the whole research group of Dawson. This was the perfect occasion to share and workshop the basic principles and possible advantages of framing biomolecule surface transformations in a nanomechanical perspective, with a special focus on proteins adsorbed or in close proximity to inorganic nanoparticles (NPs).

The rest of the day was dedicated to review and assess Maiolo's results with Dawson, Monopoli and Maiolo. Maiolo's experiments were focused on challenging the long-lived ("hard") NP-protein corona [1] formed in plasma with different detergents, in the attempt to determine which proteins are strongly bound and which are loosely bound and eventual nanomechanical aspects involved in the binding/release mechanisms. The results looked very promising, pointing to a correlation between the critical micelle concentration (CMC) of the detergent and the stability of the plasma hard NP-protein corona. Also, protocols for the selective extraction of given proteins from the plasma hard NP-protein corona did emerge. In view of this, it was agreed to present these results in a research paper, that is at the moment under preparation. Furthermore, in order to perform novel and complementary

experiments, an application to the QNano Research Infrastructure (<http://www.qnano-ri.eu/access.html>) and a new application of Maiolo to an EpitopeMap Exchange Project were agreed.

The morning of the second visit day was spent in the CBNI labs and the routine experimental activity followed for half a day, allowing for a deeper understanding and evaluation of the experimental bench work involved in preparation and characterization of the NP-protein corona. The afternoon was dedicated to further workshop on experimental results and planning of future activities, comprising follow-up experiments at Brescia University (tensiometric and surface Plasmon resonance (SPR) spectroscopy experiments), submission of joint research projects and other scientist exchanges.

1. In a biological environment proteins spontaneously adsorb to inorganic NPs setting a corona that may be divided into two components named the “hard” and “soft” coronas, due to the “long” and “short” exchange times with the surroundings. See Monopoli M, Walczyk D, Campbell A, Elia G, Lynch I, Baldelli Bombelli F, Dawson K. *J. Am. Chem. Soc.* (2011) 133, 2525-2534.