

PhD opportunity in Sorbonne University, Paris, France

"Encapsulation of photoactive proteins in inorganic mesoporous materials".

Laboratory for Surface Reactivity, Sorbonne University, Paris, France.

Several photoactive proteins are nowadays used in various fields, ranging from optogenetics to biosensors. Recently, several research groups, including ours, have explored the encapsulation of photoactive protein in mesoporous silica matrices.

In our laboratory, the photoactive Orange Carotenoid Protein OCP [1], involved in photoprotection of cyanobacteria, has been successfully encapsulated in raw and surface-functionalized SBA-15 matrices (PhD thesis Ms S. Leccese, defense foreseen in September 2022).

Interestingly, OCP retains its photoactivity when bound to the matrix [2,3]. The choice of OCP has been prompted by its simplicity (being constituted by a ~300 amino acid and a single carotenoid) and by its strong anti-oxidant properties.

In this project, we plan to extend the investigation to a recently-discovered new form of OCP, with higher quantum yield of conversion. In addition, we aim to encapsulate another photoactive protein, the Water-Soluble Chlorophyll Protein (WSCP), which have interesting emitting properties and can act as a singlet oxygen generator [4]. The encapsulated proteins will be characterized by a multidisciplinary approach combining optical spectroscopy techniques (UV-Vis, fluorescence, and especially time-resolved FTIR, a technique well-established in LRS - Dr Mezzetti is a well-known expert in its application to photoreactions and proteins, including OCP [5] and chlorophyll-containing proteins [6]) with usual mesoporous materials characterization techniques. Transient EPR experiments will also be possible through an on-going collaboration with the University of Padova, Italy.

[1] Muzzopappa, Kirilovsky, Trends in Plant Sciences 2020, 25, 92

[2] S. Leccese Tesi di Laurea (M2 report) Univ. Bari & LRS, Italy, 2019.

[3] Leccese, Onfroy, Wilson, Kirilovsky, Casale, Guira, Selmane, Mezzetti, submitted to Microporous Macroporous Materials.

[4] Renger, Pieper, Theiss, Trostmann. Paulsen, Renger, Eichler, Schmitt, J. Plant Physiology 2011, 168, 1462

[5] Mezzetti, Alexandre, Thurotte, Wilson, Gwizdala, Kirilovsky J Phys Chem B 2019, 123, 3259

[6] Carbonera, Di Valentin, Spezia, Mezzetti, Current Protein and Peptide Science 2014, 15, 332

Salary is roughly 1450 euro net/month, and it can be complemented (~150 euro month) by some teaching.

The pre-selected candidate will have to pass an interview in front of the board of the doctoral school around middle of may.

The person should obtain his Master degree before October 2022.

The ideal candidate has a overall good background in chemistry or material science and a special interest in interactions between proteins and inorganic surfaces.

This is a very interdisciplinary project, which includes nanoparticle synthesis, surface functionalisation, optica spectroscopy (including time-resolved techniques), molecular biology, photochemistry/photobiology. Sorbonne Université is n. 35 in the planet according to Shangai ranking (2nd in France, and 6th in Europe, including UK).

The lab is located in Place Jussieu, in the Pierre etMarie Curie Campus, in the center of Paris.

Any interested candidate should contact before April 7 Dr Alberto Mezzetti at

alberto.mezzetti@sorbonne-universite.fr