

Research Topic for the ParisTech/CSC PhD Program

Subfield: Chemistry, Physical Chemistry

ParisTech School: Chimie ParisTech (<http://www.chimie-paristech.fr/>), Paris, France

Title: Bioactive surfaces

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Short description of possible research topics for a PhD: (10-15 lines in English + optional figure)

Implantable medical devices are increasingly important in the practice of modern medicine. Unfortunately, almost all medical devices suffer to a different extent from adverse reactions, including inflammation, fibrosis, thrombosis and infection due to protein adsorption or cell adhesion. Here we propose to design new biofunctional polymers and engineer innovative smart surfaces with controlled surface property (physical and chemical characteristics) to kill bacteria or reduce protein adsorption and cell interactions and subsequently improve implant biocompatibility.

Our main interest is the synthesis of new polymers obtained by radical polymerization through both rational design and combinatorial chemistry using several moieties (e.g. quaternary ammonium salts, zwitterionic or oligoethylene glycol derivatives, N-Isopropylacrylamide...). Different polymeric architectures will be investigated for their ability to modify surface properties (plastics, metals). We will as well take advantage of two-photon photopolymerisation to generate 3D microtopographies to obtain responsive materials.

This work will be done in collaboration with Institut Curie for the biological evaluation of the generated materials.

Required background of the student: (Which should be the main field of study of the applicant before applying)

Chemistry, Chemical Engineering, ideally with good knowledge and skill in organic and polymer chemistry or some knowledge in biochemistry.

A list of 5 (max.) representative publications of the group: (Related to the research topic)

- [1] Mussard W., Kebir N., Kriegel I., Estève M., Semetey V., *Angewandte Chemie Int. Ed. Engl.* **2011**, *50*, 10871-10874.
- [2] Oberleitner B., Dellinger A., Déforet M., Galtayries A., Castanet A.-S., Semetey V. *Chemical Communications* **2013**, *49*, 1615-1617.
- [3] Chauhan A., Bernardin A., Mussard W., Kriegel I., Estève M., Ghigo J. M., Beloin C., Semetey V. *The Journal of Infectious Diseases.* **2014**, *210*, 1347-56.
- [4] Kebir N., Kriegel I., Esteve M., Semetey V. *Applied Surface Science* **2016**, *360*, 866-874.
- [5] Coscoy S., Baiz S., Octon J., Rhoné B., Perquis L., Tseng Q., Amblard F., Semetey V. *Biointerphases.* **2018**, *13*, doi: 10.1116/1.5024601.