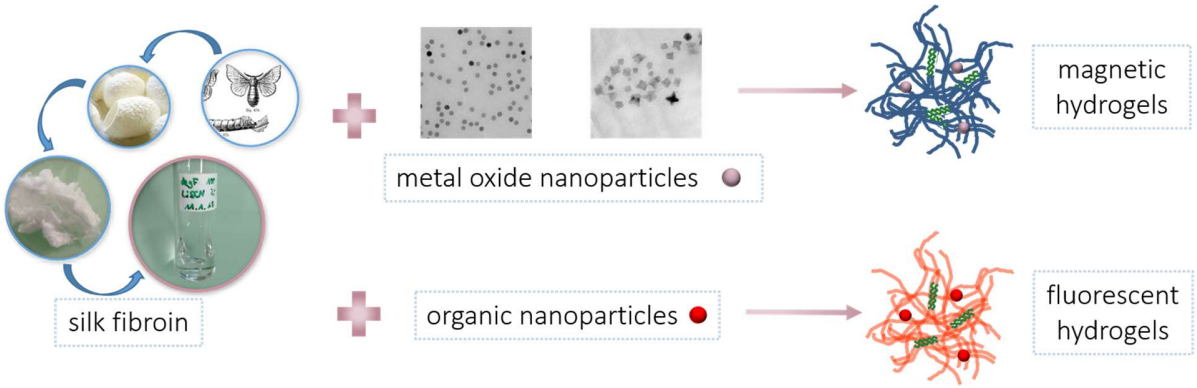
Master thesis at the Institut Laue-Langevin
Grenoble, France
Start: February 2019, 5 months

NEUTRONS FOR SOCIETY

Silk meets nanoparticles

Functional Silk fibroin Nanoparticle composite hydrogels for biomedical applications



The protein silk fibroin (SF), produced by the *B. mori* silkworm, has been used for biomedical applications for its exceptional mechanical properties paired with inherent biocompatibility and biodegradability. SF is constituted of a heavy chain (FibH, ~390 kDa), that has repetitive Glycine and Alanine rich domains, and a light chain (FibL, ~26 kDA), held together by a disulfide bond. For biomedical applications the SF is regenerated from the cocoons in a degumming and dissolution process. SF gels spontaneously in a slow process via a conformational change of the heavy chain from α-helix to β-sheet. The gelation process can be influenced and accelerated by addition of MeOH and salts, pH, temperature and mechanical shear to form hydrogels with various mechanic properties. We recently found that the gelation can be tuned by the addition of superparamagnetic core-shell iron oxide nanoparticles (SPION). Moreover, the SPION introduce the possibility to manipulate the gels by an external stimulus (i.e. alternating magnetic field) which can be used to further tune the gelling properties but also the structure of the hydrogels. The hydrogels can be applied as injectable wound dressings or wound dressings with sustained drug release. The aim of this research project is the synthesis and characterization of such composite hydrogels. The mechanism behind the accelerated gelation is of central interest in this project and will be investigated with a combination of methods (SANS, IR and UV-Vis spectroscopy, CD spectroscopy). The relation between degree of gelation, type and concentration of SPION and the mechanical properties will be investigated with rheometry.

Activities and profile of the student: Extraction of silk fibroin from cocoons and preparation of hydrogels thereof, surface modification of iron oxide nanoparticles, preparation and characterization of composite hydrogels. Ideally, the intern will have experience in organic and physical chemistry.

Contact: Andrea Lassenberger, Institut Laue-Langevin, 71 Avenue des Martyrs, 38042 Grenoble
Email: lassenberger@ill.fr
Phone: +33-(0) 4 76 20 7609