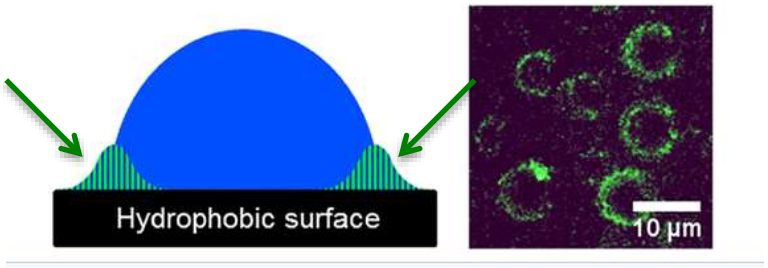
2019-2020

Internship proposal at LMGP Lab.

Effect of dehydration on protein conformation and protein-protein interactions at material surfaces

Abstract

Biological molecules (proteins and others) represent an increasing part of today's therapeutics. Proteins are complex macromolecules that are inherently unstable and have a tendency to adsorb on surfaces and air interfaces. During preparation, storage and administration, proteins adsorbed on material surfaces may be transiently exposed to air. Partial dehydration favors the formation of intermolecular interactions associated to collective conformational changes. We demonstrated the existence of such a phenomenon in the case of insulin adsorbed on hydrophobic surfaces [Frachon et al. *Langmuir* 2016, 32, 13009−19]. In the side figure, protein aggregates revealed by green fluorescence have formed around droplets remaining on a hydrophobic surface after the protein solution has been withdrawn.



Project description

Fourier Transform InfraRed spectroscopy (FTIR) is a sensitive technique commonly used to reveal protein conformational changes. We previously used this technique to characterize insulin accumulating from the solution onto hydrophobic surfaces [Nault et al. *Acta Biomaterialia,* 2012, 9, 5070-9]. In this project, we will use this technique to characterize conformational changes of insulin adsorbed on hydrophobic surfaces during a controlled dehydration process. In addition, infrared spectroscopy will be used to characterize the amount and structure of remaining water associated to proteins.

Methodology: We will develop a new experimental setup allowing to pass dry air or water vapor-saturated air on hydrophobic surface where insulin has been adsorbed. Infrared spectra will be recorded using a Fourier Transform InfraRed spectrophotometer equipped with Attenuated Total Reflection (ATR-FTIR). Protein solutions will be prepared in H_2O and D_2O. Spectra will be analyzed to separate the contribution of water and protein molecules to the spectra.

Objectives: The outcome will be to characterize the changes associated to protein dehydration on materials surfaces. The next goal will be to study several therapeutical of interest and study how the presence of surfactants affect these changes.

Scientific environment:

The candidate will work within the LMGP, Materials and Physical Engineering Laboratory, in the IMBM team, in connection with the technical staff of the laboratory for the design of the physical instrumentation. Industrial collaborations are possible in the near future.

Located in the heart of an exceptional scientific environment, the LMGP offers the applicant a rewarding place to work.
LMGP Web Site: http://www.lmgp.grenoble-inp.fr/

Profile & requested skills:

We look for a student with a strong knowledge in biophysics and/or in material science with an interest in protein biochemistry, The student should be able to work in a team, have good writing skills (report, presentation…) and a good knowledge of spoken and written English.
The internship will be from February 2020 for a duration of 6 months.

Subject could be continued with a PhD thesis: Possibly

Allowance: Internship allowance will be provided

CONTACT

Send a *C.V.* and a cover letter to Franz Bruckert and Carmen Jimenez: franz.bruckert@grenoble-inp.fr
carmen.jimenez@grenoble-inp.fr