Grenoble Alliance for Integrated Structural & Cell Biology

INTERNSHIP PROPOSAL

Institute and Group: **Institut Laue Langevin, groupe Spectroscopie**

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Research project title:

Study of the sporulation of spores

5 Keywords to describe the project:

bacterial spore resistance, hydration , food preservation, neutron scattering, high hydrostatic pressure,

Description of the project (aims, experimental techniques, recommended background): 10 to 15 lines:

Food spoilage is caused by a variety of factors, but the most important process involves the development of microorganisms in the food itself. Among these microorganisms, some bacteria are able to form specific structures called spores that show remarkable resistance properties to decontamination processes. The bacterial spore is a dormant state that germinate and come back to vegetative life when environment conditions become favourable. It is highly resistant to extreme chemical or physical conditions such as high temperature or high pressure. Evidence suggests that this resistance is due to a partial dehydration of the core, coupled to a compartmentalization of water within the organism, an immobilization of core components essential to their future outgrowth, and some repair mechanisms. Measuring the physical properties of water and core macromolecules as function of temperature and high pressure is therefore mandatory to better understand the physical mechanism underlying this exceptional resistance, and to further improve food conservation techniques. During the internship, neutron scattering data will be analysed and compared to other complementary studies as Dynamic light scattering or Calorimetry. The candidate should have a background in physics, basic knowledge in biology and chemistry is an advantage.

Justification that the internship's subject fits with the general theme of GRAL (3 lines):

The internship fits perfectly with the topics treated within the M2 “Complex Matter, Living Matter” and is in relation with molecular biology, biochemistry, biophysics, structural biology and biochemistry of signal transduction.

Relevant publications of the team (3 max):

A. C. de la Noue, J. Peters, P. Gervais, N. Martinez, J.-M. Perrier-Cornet, and F. Natali, “Proton dynamics in bacterial spores, a neutron scattering investigation," in EPJ Web of Conferences, vol. 83, p. 02003, EDP Sciences, 2015.

J. Peters et al., “High hydrostatic pressure equipment for neutron scattering studies of samples in solutions”, High Pressure Research 32 (2012), 97 – 102.

N. Martinez, G. Michoud, A. Cario, J. Ollivier, B. Franzetti, M. Jebbar, P. Oger, and J. Peters, “High protein flexibility and reduced hydration water dynamics are key pressure adaptive strategies in prokaryotes," Scientific Reports, vol. 6, 2016.