

INTERNSHIP PROPOSAL

Institute and Group: IBS, Viral Infection and Cancer group, Mass spectrometry laboratory

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Research project title:

Investigation of post- translational modifications of proteins using a MALDI-TOF/TOF mass spectrometry

Keywords to describe the project: mass spectrometry (MS), Matrix Assisted Laser Desorption Ionisation (MALDI), proteins, post-translational modifications (PTMs)

Description of the project (aims, experimental techniques, recommended background):

Context

The primary sequence and post-translational modifications (PTMs) of proteins influence their structure and function, tuning their actions in key cellular processes. The IBS MS laboratory aims to characterise proteins and their PTMs using mass spectrometry (MS). MS can assess the mass of biomolecules with high accuracy, sensitivity and rapidity. In 2018 we acquired a new mass spectrometer, which allows us to sequence intact proteins and to determine type, number and position of their PTMs using the so-called “top-down approach”.

Aims and recommended background

This project aims to set up the use of the novel mass spectrometer to perform top-down investigation of proteins. It should appeal to students with a background in biology, nanoscience or physics, who are interested in innovative approaches.

Experimental techniques

Using a MALDI time-of-flight (TOF)/TOF, the student will optimise sample preparation conditions to sequence proteins and localise their PTMs. She/he will assess different types of matrices, sample deposition and matrix crystallisation. She/he tests distinct types and concentration of samples (both soluble and membrane proteins) and laser intensity. Overall, she/he will aim to maximise mass resolution, accuracy, sensitivity and sequence coverage.

Justification that the internship’s subject fits with the general theme of GRAL:

A sensitive and accurate method to characterise PTMs represents an asset for many GRAL projects that study structures of proteins and their function being exercised in the context of host-pathogen interactions and regulation of the chloroplast biogenesis (current ANR grant with Prof. Thomas Pfannschmidt).

Relevant publications of the laboratory:

1) **Boeri Erba E**, Klein PA, Signor L.

Combining a NHS ester and glutaraldehyde improves crosslinking prior to MALDI MS analysis of intact protein complexes. *J Mass Spectrom.* 2015, 50(10):1114-9. doi: 10.1002/jms.3626

2) **Boeri Erba E.** et al. Characterizing Intact Macromolecular Complexes Using Native Mass Spectrometry. *Methods Mol Biol* 2018, 10.1007/978-1-4939-7759-8_9

3) Signor L, **Boeri Erba E.** Matrix-assisted laser desorption/ionization time of flight (MALDI-TOF) mass spectrometric analysis of intact proteins larger than 100 kDa. *J Vis Exp.* 2013, (79). doi: 10.3791/50635