

Sujet de stage de Master 2

Laboratoire : Institut de Biologie Structurale

Directeur : Winfried Weissenhorn

Intitulé de l'équipe : SIGNAL

Responsable : Malene R. Jensen

Nom et Qualité du Responsable du Stage : Malene R. Jensen, DR1 CNRS HDR oui

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Parcours de Master 2 : Chemistry for Life Sciences (CLS)

Titre du sujet : Molecular effects of Hofmeister ions on intrinsically disordered proteins studied by nuclear magnetic resonance (NMR) spectroscopy

Objectifs visés du stage :

The aim of this internship is to investigate how different inorganic ions influence the structure, dynamics and local electrostatic environment of an intrinsically disordered protein. The student will systematically explore ions spanning the Hofmeister series and determine how their chemical nature and solvation properties shape the protein's conformational ensemble. Using solution NMR spectroscopy and charged gadolinium complexes as paramagnetic probes, the project will map ion-induced changes in the local electrostatic potential of the protein and identify sequence segments with different sensitivities to specific ions.

Intérêts pédagogiques et compétences visées :

This internship will provide hands-on training in the study of biomolecular systems using solution-state NMR spectroscopy. The student will learn to express recombinant proteins in bacteria and purify them using affinity and size-exclusion chromatography. He/she will acquire and analyze multidimensional NMR data to obtain residue-specific information on protein structure and dynamics. The student will also develop skills in protein structure visualization.

Résumé :

Proteins in living cells are continuously exposed to a complex mixture of inorganic ions that can influence their structure and dynamics in an ion-specific manner. This is particularly relevant for intrinsically disordered proteins (IDPs), whose highly dynamic conformational ensembles are sensitive to changes in their chemical environment. In this project, we will systematically investigate how ions with different chemical and solvation properties affect an IDP. Charged gadolinium complexes will be used as paramagnetic probes to monitor changes in the local electrostatic environment along the protein sequence. The project will provide a molecular understanding of how specific ions influence IDPs and how local sequence properties shape their response to changes in the ionic environment.

Approches & matériels utilisés : The project will combine recombinant protein expression and purification with solution-state NMR spectroscopy. The student will investigate the structure and dynamics of the protein in the presence of mono- and multivalent inorganic ions spanning the Hofmeister series. Charged gadolinium complexes will be used as paramagnetic probes to characterize local electrostatic environments along the protein sequence. NMR diffusion measurements will be used to monitor changes in the overall hydrodynamic dimensions of the protein under different ionic conditions.

Domaines de compétences souhaitées du candidat : The project is aimed at a Master's student in chemistry, biophysics, biochemistry or a related field, with an interest in physical chemistry and biomolecular systems. Previous experience with NMR spectroscopy is an advantage, but not essential.

Dates du stage : January-June 2027