UFR de Chimie et de Biologie
UNIVERSITÉ Grenoble Alpes

Master's degree in Biology – Chemistry-Biology Department

Master 2 internship project
Year 2019-2020

Laboratory/Institute: IBS
Team: Metalloproteins unit

Director: W. Weissenhorn
Head of the team: Y. Nicolet

Name and status of the scientist in charge of the project: M. Cherrier **HDR: yes** ☑ **no** ☐
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Program of the Master's degree in Biology:

☐ Immunology, Microbiology, Infectious Diseases ☑ Integrative Structural Biology
☐ Physiology, Epigenetics, Differentiation, Cancer ☐ Neurosciences and Neurobiology
☐ Planta International

Title of the project: Structural study of the metal cluster maturation of Nitrogenase.

Objectives (up to 3 lines):

The goal of this M2 proposal is to decipher the mechanism of nitrogenase active site metallocofactor biosynthesis. Using complementary structural biology techniques, we will focus on the different catalytic steps the assembly and on the essential cofactor transfer steps occurring during this process.

Abstract (up to 10 lines):

Nitrogen is one of the main components of proteins and nucleic acids, but the majority of living organisms are unable to use the most abundant source of nitrogen: the atmospheric dinitrogen. Only few microorganisms, named diazotrophs, are able to catalyze the difficult reaction of dinitrogen reduction into ammonia under ambient conditions. An enzymatic complex called nitrogenase, which contains one of the most complex metal clusters, is responsible for this conversion. In addition to its fundamental interest, the study of nitrogenase also aims at bioengineering plants to make them capable of using atmospheric nitrogen instead of supplying nitrates, which are responsible for water and soil contamination. In addition, nitrogenase can be used for hydrogen or hydrocarbon production. The M2 student will be involved in the protein sample preparation as wel as the structural analyses. Because the metalloclusters are sensitive to oxygen degradation, these systems must be studied under a strict anaerobic environment inside the different glove boxes of the laboratory.

Methods (up to 3 lines):

The studied protein complexes will be purified and characterized under anaerobic conditions. Samples will be prepared thus be prepared inside our glove boxes. X-ray crystallography, and when possible cryo-electron microscopy techniques will be used as main techniques.

Up to 3 relevant publications of the team:

- Cherrier, M.V., *et al*. (2018). "Crystallographic evidence for unexpected selective tyrosine hydroxylations in an aerated achiral Ru-papain conjugate." Met. Integr. Biometal Sci. **10**, 1452–1459.
- Rohac, R., *et al.* (2016). "Carbon-sulfur bond-forming reaction catalysed by the radical SAM enzyme HydE." Nat. Chem. **8**, 491–500.
- Sicoli, G., *et al.* (2016). "Fine-tuning of a radical-based reaction by radical S-adenosyl-L-methionine tryptophan lyase." Science **351**, 1320–1323.

Requested domains of expertise (up to 5 keywords):

Biochemistry ; Structural Biology ; Bioinformatic