UFR de Chimie et de Biologie
UNIVERSITÉ Grenoble Alpes

Master's degree in Biology – Chemistry-Biology Department

Master 2 internship project
Year 2022-2023

Laboratory/Institute: ISTCT UMR 6030 CNRS Université de Caen-Normandie

Director: Myriam Bernaudin

Name and status of the scientist in charge of the project:

Nathalie Colloc'h, CRHC CNRS **HDR:** yes

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Laboratory/Institute: Univ. Grenoble Alpes, CEA, CNRS, Institut de Biologie Structurale

Director: Winfried Weissenhorn

Team: DYNAMOP/SNaX

Head of the team: Jacques-Philippe Colletier

Name and status of the scientist in charge of the project:

Elke De Zitter **HDR**: no

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Program of the Master's degree in Biology:

☐ Microbiology, Infectious Diseases and Immunology X Structural Biology of Pathogens
☐ Physiology, Epigenetics, Differentiation, Cancer ☐ Neurosciences and Neurobiology

Title of the project:

Analysis of the effect of carbon ion beam irradiation on protein structure

Objectives (up to 3 lines):

X-ray induced damage to proteins have been often described, but those induced by carbon ions have never been investigated. This project aims at analyzing these through an innovative way of structure refinement that allows to reveal low populated conformers.

Abstract (up to 10 lines):

The effects of irradiation by a carbon ion beam on healthy tissue is a major concern in the frame of the development of hadrontherapy for cancer treatment. In order to investigate these effects, Nathalie Colloc'h has already irradiated protein crystals of urate oxidase and neuroglobin with carbon ions at various doses, followed by X-ray data collections.
The goal of the project will be to determine and analyze the structures of the irradiated proteins, using an innovative program, called Xtrapol8, which has been developed by Jacques-Philippe Colletier and Elke De Zitter. This program aims at elucidating low occupancy states in crystallography, and will therefore be perfectly suited to reveal the small structural modifications induced by carbon ions at a dose where the crystals still diffract.

During the internship, protein crystals will also be irradiated with carbon ions, followed by a X-ray data collection, and subsequent refinement and analysis.
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Methods (up to 3 lines):

Data processing and structure refinement will be performed with Phenix and Xtrapol8, comparative analysis of data and structures will be performed using different visualization analysis tools. The internship will take in place at ISTCT in Caen, with a few stays at the IBS in Grenoble. Crystals will be irradiated in Ganil in Caen, and X-ray data collection will be performed at ESRF in Grenoble.

Up to 3 relevant publications of the team:

De Zitter,E., Coquelle, N., Oeser, P., Barends, T., Colletier, J.-P.Xtrapol8 enables automatic elucidation of low-occupancy intermediate-states in crystallographic studies. Comm. Biol. **5**, 640 (2022)

Requested domains of expertise (up to 5 keywords):

Structural biology, protein crystallography, X-ray data collection, refinement of crystallographic data, carbon ion irradiation