

**Master 2 internship project
Year 2026-2027**

Laboratory/Institute: Institut de Biologie Structurale
Team: Equipe Legal

Director: Winfried Weissenhorn
Head of the team: Thibault Legal

Name and status of the scientist in charge of the project: Thibault Legal, Chaire de Professeur Junior

HDR: yes ☐ no ☒

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Program of the Master's degree in Biology:

- ☒ Microbiology, Infectious Diseases and Immunology ☒ Biochemistry & Structure
☐ Physiology, Epigenetics, Differentiation, Cancer ☐ Neurosciences and Neurobiology

Title of the project:

Structural analysis of the *Leishmania* cytoskeleton by cryo-electron microscopy

Objectives (up to 3 lines):

Characterise the molecular architecture of the microtubule-based cytoskeleton of *Leishmania* parasites using cryo-electron microscopy and cryo-electron tomography. Identify structural features and associated proteins underlying parasite shape and stability to inform future therapeutic strategies.

Abstract (up to 10 lines):

Leishmaniasis is a severe parasitic disease caused by *Leishmania* parasites affecting millions of people worldwide, including in southern France. This M2 internship will focus on understanding how *Leishmania* parasites build and organise their cytoskeleton, which is mainly composed of microtubules and associated proteins. The student will mainly be using cryo-electron microscopy and cryo-electron tomography. The student will take part in parasite culture and sample preparation, optimisation of sample preparation protocols for electron microscopy and data acquisition. The student will also process data using specialised software such as Cryosparc and Relion as well as artificial-intelligence-based tools. Working with state-of-the-art microscopy facilities, the student will contribute to an exciting research project at the interface of structural biology, cell biology and parasitology, while gaining valuable skills for a future PhD or career in biomedical research.

Methods (up to 3 lines):

Parasite cell culture and sample preparation; cryo-electron microscopy and cryo-electron tomography; single particle analysis and subtomogram averaging; computational image processing; 3D reconstruction; AI-assisted methods to identify proteins.

Up to 3 relevant publications of the team:

Legal, T.*, Joachimiak, E.*, Parra, M., Peng, W., Tam, A., Black, C., Valente-Paterno, M., Brouhard, G., Gaertig, J., Wloga, D., Bui, K. H. (2025) Structure of the Ciliary Tip Central Pair Reveals the Unique Role of the Microtubule-Seam Binding Protein SPEF1. *Current Biology*. 35: 3404-17.

Master's degree in Biology – Chemistry-Biology Department

Gao, J.*, Tong., M.*, Lee, C., Gaertig, J., **Legal, T.#**, Bui, K.H.# (2024) DomainFit: Identification of Protein Domains in cryo-EM Maps at Intermediate Resolution using AlphaFold2-predicted Models. *Structure*. 32: 1248-1279.

Legal, T., Parra, M., Tong, M., Black, C.S., Joachimiak, E., Valente-Paterno, M., Lechtreck, K., Gaertig, J., Bui, K.H. (2023) CEP104/FAP256 and associated cap complex maintain stability of the ciliary tip. *Journal of Cell Biology*. 222: e202301129.

Requested domains of expertise (up to 5 keywords):

Cell biology; structural biology; biochemistry; electron microscopy; parasitology