

**Master 2 internship project
Year 2025-2026**

Laboratory/Institute: Institute for Advanced Biosciences **Director:** Christophe Arnoult
Team: Physiology and Pathophysiology of Sperm cells **Head of the team:** Aminata Touré

Name and status of the scientist in charge of the project: Marjorie Whitfield - Chercheur INSERM

HDR: yes ☐ no ☒

Address: Bâtiment Jean Roget Place du commandant Nal 38700 LA TRONCHE

Phone: 0457041347

e-mail: marjorie.whitfield@inserm.fr

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: Characterization of the sperm annulus: its role in flagellum biogenesis

Objectives (up to 3 lines):

The objective of the internship will be to characterize the role of the annulus in the biogenesis of sperm flagellum and in particular its contribution to the formation of the mitochondrial sheath.

Abstract (up to 10 lines):

The annulus is a ring-shaped structure located at the junction of the two main flagellar compartments : the midpiece and the principal piece. While its role as a diffusion barrier in mature sperm is now well described, its function during flagellum biogenesis in the testis remains enigmatic. Furthermore, little information is currently available regarding its molecular composition. The laboratory has obtained two mutant mouse lines that are invalidated for proteins specifically localizing at the sperm annulus. Mice from these lines are infertile due to sperm motility defects and major morphological defects of the flagellum, indicating the importance of the annulus in the formation and/or maintenance of the flagellum. During the internship, we will study the annulus and characterize novel identified components of this structure during the different steps of flagellum formation within the testis; we will particularly focus on the physical/functional interaction of the annulus with mitochondria.

Methods (up to 3 lines):

Immunolabeling techniques coupled with optical clearing to visualize *in situ* the stages of flagellum assembly within the testis. Characterization of new proteins identified in the annulus by the laboratory (Western Blot, Immunofluorescence). Mouse sperm analysis.

Up to 3 relevant publications of the team:

[1] **Whitfield M.** The annulus: composition, role and importance in sperm flagellum biogenesis and male fertility. Basic Clin Androl 2024;34:25. <https://doi.org/10.1186/s12610-024-00241-2>.

- [2] Cavarocchi E, Sayou C, Lorès P, Cazin C, Stouvenel L, El Khouri E, (...) **Whitfield M**, et al. Identification of IQCH as a calmodulin-associated protein required for sperm motility in humans. iScience 2023;26:107354. <https://doi.org/10.1016/j.isci.2023.107354>.
- [3] **Whitfield M**, Thomas L, Bequignon E, Schmitt A, Stouvenel L, Montantin G, et al. Mutations in DNAH17, Encoding a Sperm-Specific Axonemal Outer Dynein Arm Heavy Chain, Cause Isolated Male Infertility Due to Asthenozoospermia. Am J Hum Genet 2019;105:198–212. <https://doi.org/10.1016/j.ajhg.2019.04.015>.

Requested domains of expertise (up to 5 keywords):

Knowledge of general physiology, cell biology, theoretical knowledge of basic techniques in biochemistry.