**Master 2 internship project**

**Year 2023-2024**

**Laboratory/Institute:** Institute for Advanced Biosciences **Director:** Dr Hainaut

**Team:** Targeted therapies, early diagnosis and cancer imaging **Head of the team:** Dr Coll

**Name and status of the scientist in charge of the project:** Dr Xavier Le Guevel, Research Director DR2 CNRs.

**HDR: yes X no ☐**

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**Program of the Master’s degree in Biology:**

**☐** Microbiology, Infectious Diseases and Immunology **☐** Structural Biology of Pathogens

**X** Physiology, Epigenetics, Differentiation, Cancer **☐** Neurosciences and Neurobiology

**Title of the project: Innovative Nanoparticles for Overcoming Thermoresistance in Cancer Cells during Photothermal Therapy**

Objectives (up to 3 lines):

The project aims to test a novel nanotherapeutic system for phototherapy to effectively eliminate tumor cells. Additionally, it aims to introduce gene silencing techniques that target the cellular defense mechanism known as heat shock response in cancer cells, with the goal of minimizing cellular thermoresistance.

Abstract (up to 10 lines):

Photothermal therapy (PTT) uses photothermal conversion agents that convert NIR light to hyperthermia which can kill cancer cells. However, PTT often suffers from the fundamental cellular defense mechanism of heat shock response which leads to therapeutic resistance of cancer cells and reduces the therapeutic efficacy. Recently our laboratory has developed promising photothermal ultra-small gold nano-therapeutic platform able to deliver siRNA and protect it against degradation. These carriers demonstrated strong photoluminescence, excellent photostability, and good biocompatibility.

The M2 project will focus on 3 axes:

1- Characterization of the nanotherapeutic system

2- Evaluation of siRNA delivery and efficiency targeting the heat shock response

3- Investigation of the photothermal effect following accumulation of nanotherapeutic system in cancer cells.

Methods (up to 3 lines):

Cell culture, fluorescence microscopy, cellular transfection, FACS, electrophoresis gel, spectrophotometry, western blot.

Up to 3 relevant publications of the team:

- Porret E, Fleury JB, Sancey L, Pezet M, Coll JL, Le Guével X., Augmented interaction of multivalent arginine coated gold nanoclusters with lipid membranes and cells., RSC Adv. 2020 Feb 11;10(11):6436-6443. doi: 10.1039/c9ra10047d.

- Porret E, Le Guével X, Coll JL., Gold nanoclusters for biomedical applications: toward in vivo studies,

J Mater Chem B. 2020 Mar 18;8(11):2216-2232. doi: 10.1039/c9tb02767j.

- Koskas S, Decottignies A, Dufour S, Pezet M, Verdel A, Vourc'h C, Faure V. Heat shock factor 1 promotes TERRA transcription and telomere protection upon heat stress. Nucleic Acids Res. 2017 Jun 20;45(11):6321-6333. doi: 10.1093/nar/gkx208

Requested domains of expertise (up to 5 keywords):

Cellular and molecular biology / RNA-targeted therapies/ Nanomedicine/ tumoral thermoresistance