**Master 2 internship project**

**Year 2024-2025**

**Laboratory/Institute:** CEA/SyMMES **Director:** P. Delangle

**Team:** CIBEST **Head of the team:** M. Carriere

**Name and status of the scientist in charge of the project:** Marie Carriere, Research director and head of the CIBEST team.

 **HDR: yes ☐ 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: Physiological impact of micro- and nanoplastics on 2D and 3D human intestinal cells, in vitro**

Objectives:

The aim of this internship is to characterize the impact of micro- and nanoplastics (MNPLs) on advanced human intestinal models (2D and 3D), in vitro, using polyethylene terephthalate (PET) as a model MNPLs, which is the main polymer used to make plastic water bottles and some plastic food containers.

Abstract:

Because of their attractive properties and low cost, plastics are widely used in everyday products. This leads to a substantial accumulation of plastic waste in the environment, which remains for long periods in the ecosystems, where it degrades into micro- and nano-plastic particles (MNPL). Moreover, plastics food containers and bottles continuously release MNPLs in the food/beverage they contain, leading to direct exposure of human gastro-intestinal tract when ingested. Little is known about the impacts of MNPLs on humans physiology. Up to now, only very simple in vitro models have been used to study MNPL impact on human intestine. Within this internship, the objective is to compare the response of these simple cell models to that of more advanced models. The focus will be to characterize their impact on DNA and their potency to induce cell transformation, which is usually used as a hallmark of carcinogenicity. Then their potency to induce epigenetic modifications will be evaluated.

Methods:

-Cell culture and exposure to MNPLs: co-cultures of cell lines (Caco-2 and HT29-MTX), primary murine intestinal cells, and intestinal organoids (3D),

-Impact on DNA integrity and cell transformation potency: comet assay, 53BP1 immunostaining, micronucleus assay, Bhas42 assay

-Epigenetics modifications (DNA methylation): HPLC-MS/MS

Up to 3 relevant publications of the team:

- M. Fontaine, et al. Genotoxicity evaluation of nanobiomaterials using high throughput p53-binding protein 1 (53BP1) assay. PlosOne, 2023, 18(9):e0288737. doi: 10.1371/journal.pone.0288737

- O. Kose, et al. An AOP-oriented strategy to test the toxicity towards intestinal epithelial cells of Ag NPs digested in simulated gastrointestinal fluids. Toxics, 11, 199, 2023.

- M. Dorier, et al. The food additive E171 and titanium dioxide nanoparticles indirectly alter the homeostasis of the human intestinal epithelial cells, in vitro. Environmental Science: Nano, 6: 1549-1551, 2019.

Requested domains of expertise (up to 5 keywords):

Cell culture, DNA integrity, cell transformation, epigenetics, cancer