LITHUANIAN UNIVERSITY OF HEALTH SCIENCES

International Summer School Practice

Exploring Host–Microbe Interactions: Cellular and Molecular Mechanisms of Inflammation and Immune Regulation

Host–microbe interactions play a pivotal role in maintaining tissue homeostasis and regulating inflammatory and immune responses. Alterations in microbial composition and activity can profoundly influence epithelial cell functions, immune signaling, and the tissue microenvironment, contributing to chronic inflammatory diseases and cancer.

Previous research has demonstrated the impact of microbiota alterations on intestinal inflammation (Strati et al., 2021) and highlighted the role of microbial factors in shaping antitumor immune responses. In particular, our previous work demonstrated that Fusobacterium nucleatum, a bacterium associated with colorectal cancer, can modulate invariant natural killer T (iNKT) cell functions, promoting inflammatory cytokine production and interactions with immunosuppressive neutrophils (Lattanzi, Strati et al., 2023). Subsequent investigations further highlighted the complex relationship between the intestinal microbiome and antitumor immunity (Lattanzi et al., 2024).

Building upon these scientific foundations, this summer research internship offers students the opportunity to actively contribute to an ongoing biomedical research program investigating the cellular and molecular mechanisms underlying host–microbe interactions.

Students will be integrated into a competitive, internationally connected, and cutting-edge research environment, gaining direct exposure to experimental approaches addressing relevant questions in microbiology, cellular biology, and immunology.

The experimental activities will focus on investigating how microbial stimuli and microbial-derived products influence mammalian cell behavior, with particular attention to epithelial responses, inflammatory signaling, and cellular homeostasis.

Research activities will include:

I Mammalian cell culture: Maintenance, expansion, and experimental manipulation of established cellular models to investigate cellular responses under controlled experimental conditions.

II Host–microbe interaction models: Implementation of cell stimulation and co-culture experiments using selected microorganisms, microbial components, or microbial-derived metabolites to investigate their effects on cellular physiology and inflammatory responses.

III Cellular phenotypic characterization: Assessment of cell morphology, viability, and responses to experimental treatments through microscopy and quantitative cellular assays.

IV Molecular characterization: Investigation of selected genes involved in inflammatory signaling and cellular stress through RNA extraction and RT-qPCR, according to the experimental objectives.

The internship will be embedded within ongoing investigations exploring how microbiota-associated signals contribute to epithelial dysfunction, inflammatory processes, and immune regulation. Experimental activities will be selected according to the duration of the internship (1–2 months), ensuring that students can contribute meaningfully to a defined scientific question.

Students will also participate in experimental planning, scientific discussions, laboratory meetings, and data interpretation, gaining insight into the research process within an internationally collaborative scientific environment.

Expected outcomes: By the end of the internship, students will have gained practical experience in cellular and molecular biology techniques, strengthened their experimental and analytical skills, and contributed to ongoing research addressing the molecular mechanisms of host–microbe communication and inflammation.