Analysis of human gut microbiome samples collected in the context of autoimmune and autoinflammatory disorders

Description of the project
The i3 laboratory, located at the Hospital of the Pitié-Salpêtrière in Paris, aims to (i) advance the frontiers of knowledge in immunology and (ii) develop novel immunotherapies using systems biology approaches.

During the last years, our laboratory has secured, among others, 2 major grants in the field of systems immunology of autoimmune diseases:
• Transimmunom (Laboratory of Excellence program) aims at phenotyping of 1,000 patients with various AIDs (www.transimmunom.fr);
• iMAP (a Recherche Hospitalo-Universitaire program) aims at developing low dose IL-2 as a therapy of autoimmune diseases, and at studying the biology of IL-2 in humans.

The final aim of these research programs is to guide the development of novel therapeutic strategies and to redefine the nosography of autoimmune and autoinflammatory diseases.

Our strategy is to analyze and integrate multiple omics and clinical data to identify and understand the complexity of the immune responses underlying these immunopathologies. In particular, we are focusing our investigations on the process and analysis of microbiome (metagenomics), transcriptome (RNA-seq), TCR repertoire (Rep-seq), deep immunophenotyping (flow cytometry), cytokines (Luminex) and clinical data.

In this context, the collected intestinal microbiome data are of great importance as multiple studies have outlined its role in the context of autoimmune diseases. Currently, we processed samples from more than 300 patients and healthy donors. Raw data have been generated and are stored in dedicated servers.

<u>The project proposal for a 6-month Master 2 internship aims at interpreting patient gut microbiome data using systems immunology approaches</u>

We already have implemented an automated pipeline that addresses all the conventional steps of metagenomics microbiome data processing as well as the first-level analysis (quality control of sequences until OTU quantification, identification of bacterial communities impacted by diseases or treatments, diversity analyses). So far, we are able to interpret these data at different complexity levels (from phylum to species levels) which consist of thousands of variables for hundreds of patients. Especially, we aim now at developing functional profiling analyses of the collected microbiome samples.

The aim of the internships is to use and extend these analytical pipelines to decipher the complex host-microbiome interaction involved in the context of autoimmune and autoinflammatory diseases. Such analyses will allow the understanding of the symbiosis and dysbiosis mechanisms involved in autoimmune and autoinflammatory diseases.

Expected profile
The expected MSc candidate must have a strong interest in Systems Immunology and biomedical research and should justify training in Bioinformatics, Immunology, Computer Science or Biology.

Research environment
The candidate will benefit from a highly interdisciplinary environment, including biologists, immunologists, clinicians, computer scientists, and bioinformaticians. The internship should ideally start in January/February/March/April 2021. This project can be extended as part of a PhD thesis.

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