Internship Proposition
(one page max)
Master 2 GP Immunology & ImmunoIntervention (I^3)
2025-2026

Lab: CR2TI

Team: 4

Name and position of the supervisor: Sophie Brouard DRCE / Nicolas Degauque CRCN

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Candidate (if internship filled):

Title of the internship: Metabolic Regulation of Regulatory B Cell Function

Summary of the internship proposal:

Scientific Context. B cells are traditionally known for their role in humoral immunity through antibody production. However, a subset of B cells with regulatory properties, termed regulatory B cells (Bregs), can suppress immune responses and contribute to immune tolerance. These cells play a critical role in autoimmune diseases, cancer, and transplantation. Notably, our previous work has shown that an increased frequency of B cell, particularly those expressing granzyme B (GZMb), is closely associated with the very low immunological risk of rejection of kidney transplant. The acquisition of a regulatory phenotype is influenced by environmental cues, activation signals, and cellular metabolism. Emerging evidence suggests that metabolic pathways such as glycolysis, oxidative phosphorylation, and redox balance shape B cell fate and function. However, how specific metabolic programs drive the expression of regulatory molecules like IL-10 and granzyme B (GZMb) remains poorly understood.

Objectives: This internship aims to investigate how metabolism controls the acquisition of regulatory function in human B cells, using biological samples from healthy volunteers and kidney transplant with low to high immunological risk of rejection. The project will: (1) Characterize the metabolic profile (glycolysis, mitochondrial respiration, redox state) of GZMb Bregs vs. non-regulatory B cell subsets; (2) Test metabolic modulators (e.g., glucose availability, ROS scavengers, metabolic inhibitors) on regulatory; (3) Explore signaling pathways linking metabolism to B cell regulatory differentiation (e.g., mTOR, AMPK, HIF-1α).

Methods: Isolation and culture of human B cells from peripheral blood; Flow cytometry to assess phenotype and cytokine expression; Assays for glucose uptake, ROS levels, and mitochondrial activity; Pharmacological modulation of metabolic pathways. Clinical samples from healthy volunteers and kidney transplant recipients from the DIVAT biocollection will be used.

Expected Outcomes. Using in vitro assays and spectral flow cytometry, this project will clarify how metabolic reprogramming support regulatory B cell function, with potential implications for tolerance induction in transplantation and immune tolerance.

Option(s) linked to the project:

☐ Clinical Research Profile (Recherche Clinique)
☐ Data Analyst Profile (Recherche et Analyse de Données Biologiques)
☒ Experimental Biology Profile (Recherche Expérimentale)

Form to be sent by email to : gpi3@univ-nantes.fr