Technische Universität Braunschweig

Bioinformatik & Biochemie

Exploring Pathway-Specific Metabolic Adaptations in Macrophages: A Focus on TLR4 and STING

Who are we?

The immuno-metabolism group (head: Prof. Karsten Hiller), located at the Braunschweig Integrated Centre of Systems Biology (BRICS), investigates cellular and mitochondrial metabolism of immune cells during bacterial infection, cancer, metabolic complications and neuro-degeneration. The team has developed a strong expertise in stable-isotope assisted metabolomics and metabolic flux analysis both on a whole cell as well as on a mitochondrial sub-compartment level.

Project background

Macrophages are essential sentinel cells of the innate immune system, serving as the first line of defense against invading pathogens such as bacteria, viruses, and fungi. Upon detection of pathogens, macrophages initiate a tightly regulated inflammatory response to recruit other immune cells and neutralize the threat. Dysregulation of these processes can result in either increased susceptibility to infections or excessive inflammation, leading to tissue damage or autoimmunity. Understanding how macrophages modulate their immune responses and metabolism during pathogen encounters is critical for developing more precise therapeutic strategies.

Thesis content

This project focuses on comparing the immune and metabolic responses of macrophages stimulated through two key pathways: Toll-like receptor 4 (TLR4), a receptor that recognizes bacterial components such as lipopolysaccharides, and the stimulator of interferon genes (STING), which detects cytosolic DNA from viruses or bacteria. By identifying specific signatures and vulnerabilities associated with these pathways, the research aims to uncover novel targets for modulating macrophage responses in infections and inflammatory diseases.

Methodology:

- Cell Culture
- Metabolic Analysis with GC-MS (including Flux Analysis)
- Seahorse Analysis
- YSI
- qPCR

Interested?

Please send your application via Email with your preferred starting date.

- English or German

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