DC6: Charting Host Immunity Against Lung Organ Transplants

Host institution: Omniscope Espana SL

Country: Spain

Supervisory team: Dr. Holger Heyn (PhD promoter, Omniscope), Prof. Sandra Lindstedt (Co-supervisor, Lund University)

Project Description:

This project, part of the broader LifeLUNG initiative, focuses on understanding and predicting immune responses in lung transplantation. The project will involve analyzing human clinical samples from existing biobanks, collected from transplant recipients at various time points, including pre-transplant, early post-transplant, and during episodes of acute rejection or PGD. It will leverage advanced machine learning and the latest immune repertoire sequencing technologies. A successful project will result in a detailed single-cell atlas of immune cells in lung transplant patients, blood-based liquid biopsy methods for non-invasive monitoring of immune responses, and precision medicine tools for predicting and managing PGD and chronic rejection. The main objectives are:

1. **Develop a single-cell atlas of immune cells in dysfunctional and rejected lungs:** This involves characterizing tissue-resident and circulating immune cells in lungs affected by Primary Graft Dysfunction (PGD) and chronic rejection, utilizing advanced single-cell RNA sequencing (scRNA-seq) and Omniscope's proprietary T cell receptor (TCR) sequencing technologies.
2. **Characterize immune mechanisms underlying PGD and chronic rejection:** The project will aim to understand the intricate interplay of immune cells and their roles in driving these complications.
3. **Identify T cells and genes for drug design and therapy strategies:** By exploring TCR specificity and immune cell interaction networks, the goal is to pinpoint pathogenic immune activity and related targets for therapeutic intervention.
4. **Build computational models for predicting PGD and chronic rejection risk:** The DC will develop computational models and classifiers to forecast the risk of these complications, enabling personalized monitoring and treatment strategies.

Enrolment in Doctoral School:

UB Doctoral School, Biomedicine programme, Universitat de Barcelona, Spain

Planned Secondments:

- KU Leuven, Belgium: scRNAseq data analysis from clinical LTx IRI and rejection (months 7-8)
- Lund University, Sweden: Integration of multimodal data for understanding rejection mechanisms (months 40-41)

Essential Requirements of a Successful Candidate:

- You hold a Master's degree in Computer Science, Bioinformatics, Computational Biology or similar.
- You have advanced programming skills.
- You are ambitious, well organized and have excellent communication skills.
- You are proficient in English both spoken and written.
- You have a solutions-oriented mindset that thrives in a multidisciplinary team.
- You have the ability to work independently and have a critical mindset.

- Willingness to travel.

Skills and Expertise that are Viewed as an Asset:

- Prior exposure to or interest in Immunology.
- Familiarity with transcriptomic and immune repertoire analysis techniques (e.g., RNAseq).
- Basic understanding of machine learning and AI concepts, particularly in their application to biological data analysis.
- Experience with data analysis and statistical software.
- Proficiency in scientific programming languages (e.g., Python, R) for data processing and visualization.
- Knowledge of database management for scientific datasets.
- Experience with version control systems like Git.
- Ability to work effectively in an interdisciplinary team, collaborating with biologists, engineers, and clinicians.
- A proactive and self-starter mindset, with an eagerness to learn new technologies and scientific methodologies.
- Strong presentation skills for disseminating research findings.