Jana Neirinck

Publications

J. Neirinck, A. Emmaneel, M. Buysse et al., The EuroFlow PID Orientation Tube (PIDOT) in the diagnostic work-up of primary immunodeficiency: daily practice performance in a tertiary University Hospital. Frontiers in Immunology (2022)

J. Neirinck, M. Buysse, N. Brdickova et al., The EuroFlow PIDOT external quality assurance scheme: enhancing laboratory performance evalution in immunophenotyping of rare lymphoid immunodeficiencies. Clinical Chemistry and Laboratory Medicine (2024)

J. Neirinck, M. Buysse, C. De Vriendt et al., The role of immunophenotyping in common variable immunodeficiency: a narrative review. Critical Reviews in Laboratory Medicine Sciences (2024)

J. Neirinck*, T. D'hamers*, M. Buysse et al., Different cell stimulation conditions result in distinct transcriptomic profiles within the systemic B cell compartment of healthy donors. Manuscript in preparation. *Equally contributed

A. Emmaneel*, **J. Neirinck***, A. Torres et al., PIDgeon: An explainable AI model for improved flow cytometry-based screening of primary immunodeficiencies. Manuscript in preparation. *Equally contributed

E. Linskens, A. M. Diks, **J. Neirinck** et al., Improved Standardization of Flow Cytometry Diagnostic Screening of Primary Immunodeficiency by Software-Based Automated Gating. Frontiers in immunology (2020)

Additional publications can be viewed on
https://biblio.ugent.be/publication?text=jana+neirinck

Curriculum Vitae

2024 - …	Master of Science in Clinical Biology, Ghent University, Belgium
2019 - …	PhD student in Health Sciences, Ghent University, Belgium
2017 - 2019	Master of Science in Drug Development, Ghent University, Belgium
2014 - 2017	Bachelor of Science in Pharmaceutical Sciences, Ghent University, Belgium

GHENT UNIVERSITY

FACULTY OF MEDICINE AND HEALTH SCIENCES

Promotors

Prof. Dr. Carolien Bonroy
Department of Biomolecular Medicine
Ghent University, Belgium

Prof. Dr. Filomeen Haerynck
Department of Internal Medicine and Pediatrics
Ghent University, Belgium

Prof. Dr. Celine Everaert
Department of Biomolecular Medicine
Ghent University, Belgium

Examination committee

Prof. Dr. Peter Van Eenoo - Chair
Department of Diagnostic Sciences
Ghent University, Belgium

Prof. Dr. Ana Espada de Sousa
Institute of Molecular Medicine
Faculty of Medicine, University of Lisbon, Portugal

Prof. Dr. Stefan Nierkens
Center for Translational Immunology
University Medical Center Utrecht, The Netherlands

Prof. Dr. Sander De Bruyne
Department of Diagnostic Sciences
Ghent University, Belgium

Prof. Dr. Katrien Devreese
Department of Diagnostic Sciences
Ghent University, Belgium

Dr. Heidi Schaballie
Department of Internal Medicine and Pediatrics
Ghent University, Belgium

Dr. Simon Tavernier - Secretary
Department of Biomedical Molecular Biology
Ghent University, Belgium

Doctoral guidance committee

Dr. Mattias Hofmans
Department of Diagnostic Sciences
Ghent University, Belgium

Expanding diagnostics in primary immunodeficiency

Integrating innovations in clinical laboratory practice

Jana Neirinck

2024 - 2025

Dissertation submitted to obtain the degree
Doctor of Health Sciences

Summary

Primary immune deficiencies (PID) are rare disorders caused by inborn defects in the immune system and show great heterogeneity in clinical presentation. PID diagnosis is complex and requires a variety of laboratory tests, making the process challenging for clinicians and laboratory experts. Multiparameter flow cytometry is a crucial tool for screening, diagnosis and classification of PID. Recent efforts have focused on standardization of this technique to ensure reproducible results across clinical laboratories and to increase its clinical applicability.

The first part of this project addressed some of the remaining standardization challenges in the context of PID diagnostics. Firstly, we validated the EuroFlow PID Orientation tube (PIDOT) as well as its accompanying automated analysis tool to establish its precise place in the diagnostic work-up of suspected (lymphoid) PID. In addition, we developed PIDgeon, a fully automated cytometry data analysis pipeline tailored to the diagnostic needs, enabling rapid and reproducible data analysis as well as disease prediction. Finally, we set-up the PIDOT external quality program (PIDOT-EQAS). Such programs are essential to monitor the quality of flow analysis. Moreover, PIDOT-EQAS also allows for the training of laboratory experts to recognize immunological abnormalities in PID. Thus, all these innovations introduced guarantee that PIDOT can be accurately performed by the laboratories and it is expected that the results of this thesis will lower the threshold for laboratories to perform flow in the context of PID screening/diagnosis and thus contribute to earlier detection of PID.

The second part of this project involved the first steps in investigating the heterogeneity of “common variable immunodeficiencies” (CVID), an important subtype of PID. First, we conducted a comprehensive literature review on the role of flow cytometry in diagnosis and classification of CVID as a function of clinical phenotype. We concluded that inconsistencies on the use of flow cytometry in the context of CVID characterization exist and that flowcytometry alone is insufficient to explain the full spectrum of the disease. Based on that, we suggested that multicenter collaboration, standardized flow cytometry, computational tools and epigenetics may contribute in unraveling the pathophysiology of CVID and improving its classification. Subsequently, we investigated the impact of in vitro B-cell stimulators on the peripheral B-cell compartment using an innovative and cost-effective multiplex workflow for single-cell CITE-seq analysis. This study provides a valuable reference for B cell activation at the single-cell level, and supports refinement of the future experimental approaches when examining (epigenetic) patterns of B-cell dysregulation in CVID

Samenvatting

Primaire immuundeficiënties (PID) zijn zeldzame, aangeboren aandoeningen van het immuunsysteem. De diagnose is complex en vereist geavanceerde technieken zoals multiparameter flowcytometrie. Dit project richtte zich op het verbeteren en standaardiseren van de diagnostiek.

In het eerste deel valideerden we de EuroFlow PID Orientation Tube (PIDOT) en de bijbehorende geautomatiseerde analysetool. We ontwikkelden PIDgeon voor snelle, reproduceerbare data-analyse. Daarnaast werd een extern kwaliteitsprogramma (PIDOT-EQAS) opgezet om laboratoria te ondersteunen bij kwaliteitscontrole en training in het herkennen van immunologische afwijkingen. Deze innovaties maken vroege en betrouwbare PID-detectie toegankelijker.

Het tweede deel richtte zich op “common variable immunodeficiencies” (CVID), een belangrijk PID-subtype. We voerden eerst een uitgebreide literatuurstudie uit naar de rol van flowcytometrie in de diagnose en classificatie van CVID op basis van het klinische fenotype. Samenwerking tussen centra, standaardisatie, computertools en epigenetica werden geïdentificeerd als cruciale elementen. Daarnaast onderzochten we met single-cell CITE-seq analyse het effect van in vitro B-cel stimulators, wat nieuwe inzichten biedt voor toekomstige onderzoek in epigenetische patronen van B-cel dysregulatie bij CVID.

Contact

Department of Diagnostic Sciences
Research group Prof. Dr. Carolien Bonroy

Jana.Neirinck@ugent.be
T +32 9 332 39 04
www.ugent.be

An electronic version of this doctoral thesis can be requested by email.

WITH THANKS TO

Research Foundation Flanders
Opening new horizons

UZ GENT

UNIVERSITEIT GENT

VIB

EuroFlow

This work was supported by Research Foundation Flanders (FWO) under Grant 11L2822N; FWO under Grant T000119N.