A matter of delivery: nanocarriers and the engineering of protective immunity in tuberculosis vaccination

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CURRICULUM VITAE

Mikołaj Mieczysław Szachniewicz was born on January 9, 1992, in Łódź, Poland. His passion for science began at the age of five, sparked by a fascination with astronomy – an interest that continues to this day. Over time, his scientific curiosity expanded into other disciplines and was nurtured during his education at the General Education High School of the Lodz University of Technology, where he developed a particular interest in chemistry.

In 2011, he enrolled in the Nanotechnology Engineering Program at the Faculty of Chemistry, Lodz University of Technology, drawn by the promise and interdisciplinary nature of the emerging field of nanotechnology. During his first year, he began his research journey as a volunteer at the Division of Applied Radiation Chemistry under the supervision of Dr. Radosław Wach, contributing to an international IAEA research project focused on the synthesis and characterization of biomaterials.

His academic interests gradually shifted toward the biomedical applications of nanotechnology. For his BSc/Eng. thesis, he worked on the chemical modification of surgical implants in collaboration with a local medical device manufacturer. He completed his undergraduate studies in the top 5 % of students of the university.

Continuing in the Nanotechnology MSc program at Lodz University of Technology, Mikołaj was selected for a double diploma degree program with the University of Twente (Netherlands). His research focused increasingly on biomedical applications. Under the supervision of Prof. Ruchi Bansal, he completed his master's thesis on "Nanotechnology-based targeted drug delivery systems for the treatment of liver fibrosis" at the Biomaterials Science and Technology Group, Faculty of Science and Technology.

To further expand his expertise, he completed an internship at RWTH Aachen University Hospital (Germany) in the Department of Medicine III, where he conducted *in vitro* studies on nanoparticle-based drug delivery systems. He earned dual MSc degrees in Nanotechnology, graduating in the top 1 % of students at Lodz University of Technology.

In 2017, Mikołaj began his PhD at Leiden University Medical Center in the Department of Infectious Diseases (now Leiden University Center for Infectious Diseases, LUCID), under the supervision of Prof. Tom Ottenhoff (LUCID) and Prof. Joke Bouwstra (Leiden Academic Centre for Drug Research, LACDR). In this research, he was also guided by Prof. Annemieke Geluk (LUCID) and Prof. Wim Jiskoot (LACDR). The results of his doctoral studies are presented in this thesis.

LIST OF PUBLICATIONS

1. **M.M. Szachniewicz**, M.A. Neustrup, K.E. van Meijgaarden, W. Jiskoot, J.A. Bouwstra, M.C. Haks, A. Geluk, T.H.M. Ottenhoff, Intrinsic immunogenicity of liposomes for tuberculosis vaccines: Effect of cationic lipid and cholesterol, *European Journal of Pharmaceutical Sciences* 195 (2024) 106730.

2. **M.M. Szachniewicz**, K.E. van Meijgaarden, E. Kavrik, W. Jiskoot, J.A. Bouwstra, M.C. Haks, A. Geluk, T.H.M. Ottenhoff, Cationic pH-sensitive liposomes as tuberculosis subunit vaccine delivery systems: Effect of liposome composition on cellular innate immune responses, *International Immunopharmacology* 145 (2025) 113782.

3. **M.M. Szachniewicz**, S.J.F. van den Eeden, K.E. van Meijgaarden, K.L.M.C. Franken, S. van Veen, A. Geluk, J.A. Bouwstra, T.H.M. Ottenhoff, Cationic pH-sensitive liposome-based subunit tuberculosis vaccine induces protection in mice challenged with Mycobacterium tuberculosis, *European Journal of Pharmaceutics and Biopharmaceutics* 203 (2024) 114437.

4. **M.M. Szachniewicz**, S.J.F. van den Eeden, K.E. van Meijgaarden, K.L.M.C. Franken, S. van Veen, A. Geluk, J.A. Bouwstra, T.H.M. Ottenhoff, Intradermal versus subcutaneous immunization: Effects of administration route using a lipid-PLGA hybrid nanoparticle tuberculosis vaccine, *European Journal of Pharmaceutical Sciences* 205 (2025) 106995.

5. **M.M. Szachniewicz**, M.A. Neustrup, S.J.F. van den Eeden, K.E. van Meijgaarden, K.L.M.C. Franken, S. van Veen, R.I. Koning, R.W.A.L. Limpens, A. Geluk, J.A. Bouwstra, T.H.M. Ottenhoff, Evaluation of PLGA, lipid-PLGA hybrid nanoparticles, and cationic pH-sensitive liposomes as tuberculosis vaccine delivery systems in a Mycobacterium tuberculosis challenge mouse model – A comparison, *International Journal of Pharmaceutics* 666 (2024) 124842.

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