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## Lab-on-a-tissue : optimization of on-tissue chemistry for improved mass spectrometry imaging

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### Citation

Heijs, B. P. A. M. (2018, February 1). *Lab-on-a-tissue : optimization of on-tissue chemistry for improved mass spectrometry imaging*. Retrieved from <https://hdl.handle.net/1887/60212>

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**Author:** Heijs, B.P.A.M.

**Title:** Lab-on-a-tissue : optimization of on-tissue chemistry for improved mass spectrometry imaging

**Issue Date:** 2018-02-01

# List of publications

- (i) Isabella Piga, **Bram Heijs**, Simone Nicolardi, Laura Giusti, Lorella Marselli, Piero Marchetti, Maria Rosa Mazzoni, Antonio Lucacchini, Liam A. McDonnell. "Ultra-high resolution MALDI-FTICR-MSI analysis of intact proteins in mouse and human pancreas tissue," *In press*, International Journal of Mass Spectrometry, 2017.
- (ii) **Bram Heijs\***, Stephanie Holst\*, Inge H. Briaire-de Bruijn, Gabi W. van Pelt, Arnoud H. de Ru, Peter A. van Veelen, Richard R. Drake, Anand S. Mehta, Wilma E. Mesker, Rob A. Tollenaar, Judith V.M.G. Bovée, Manfred Wuhrer, Liam A. McDonnell. "Multimodal Mass Spectrometry Imaging of N-Glycans and Proteins from the Same Tissue Section," *Analytical Chemistry*, vol. 88, no. 15, pp. 7745–7753, 2016.
- (iii) Stephanie Holst\*, **Bram Heijs\***, Noortje de Haan, René J.M. van Zeijl, Inge H. Briaire-de Bruijn, Gabi W. van Pelt, Anand S. Mehta, Peggi M. Angel, Wilma E. Mesker, Rob A. Tollenaar, Richard R. Drake, Judith V.M.G. Bovée, Liam A. McDonnell, Manfred Wuhrer, "Linkage-Specific in Situ Sialic Acid Derivatization for N-Glycan Mass Spectrometry Imaging of Formalin-Fixed Paraffin-Embedded Tissues," *Analytical Chemistry*, vol. 88, no. 11, pp. 5904-5913, 2016.
- (iv) **Bram Heijs\***, W.M. Abdelmoula\*, Sha Lou, Inge H. Briaire-de Bruijn, Jouke Dijkstra, Judith V.M. G. Bovée, and Liam A. McDonnell, "Histology-Guided High-Resolution Matrix-Assisted Laser Desorption Ionization Mass Spectrometry Imaging," *Analytical Chemistry*, vol. 87, no. 24, pp. 11978–11983, 2015.
- (v) **Bram Heijs**, Else A. Tolner, Judith V.M.G. Bovée, Arn M.J.M. van den Maagdenberg, Liam A. McDonnell, "Brain Region-Specific Dynamics of On-Tissue Protein Digestion Using MALDI-MSI," *Journal of Proteome Research*, vol. 14, no. 12, pp. 5348–5354, 2015.
- (vi) **Bram Heijs**, Ricardo J. Carreira, Else A. Tolner, Arnoud H. de Ru, Arn M.J.M. van den Maagdenberg, Peter A. van Veelen, Liam A. McDonnell, "Comprehensive Analysis of the Mouse Brain Proteome Sampled in Mass Spectrometry Imaging," *Analytical Chemistry*, vol. 87, no. 3, pp. 1867–1875, 2015.

# Curriculum Vitæ

Bram Petrus Antonius Maria Heijs was born on November 7th, 1986 in Tilburg, the Netherlands. In 2005 he graduated from Theresia Lyceum in Tilburg, and started his studies in Life Science & Technology at Leiden University and Delft University of Technology. Following the bachelor's degree in Life Science & Technology, he started his masters in Life Science & Technology at Leiden University in 2010. The master program focused on molecular biology and biochemistry and included two internships; the first being at the Leiden Institute of Chemistry (LIC) at Leiden University, under the supervision of dr. Claude Backendorf and prof. dr. Mathieu Noteborn, focusing on the purification of the PTD4-apoptin protein. The second internship was performed under the supervision of prof. dr. Per Andrén of the Medical Mass Spectrometry group at the Center for Biomedicine at Uppsala University in Uppsala, Sweden. The aim was to optimize methods to study the molecular alterations in human cerebrospinal fluid and mouse brain tissue caused by Parkinson's disease. After obtaining the title of Master of Science in Life Science & Technology in 2013, he started as a PhD candidate at the Mass Spectrometry Imaging group of the Center for Proteomics & Metabolomics (CPM) at the Leiden University Medical Center (LUMC). The project, under supervision of dr. Liam McDonnell, was in close collaboration with prof. dr. Judith Bovée at the Department of Pathology of the LUMC. His work at CPM, largely described in this thesis, focused on the development and improvement of *in-situ* (enzymatic) chemistry methods for improved mass spectrometry imaging and application of these methods in a clinical study on myxoid liposarcoma. Parts of this work were presented at a number of (inter)national conferences by the Dutch Society for Mass Spectrometry (NVMS, 2014, 2016), the American Society for Mass Spectrometry (ASMS, 2014), the European OurCon Mass Spectrometry Imaging Society (2014, 2015, 2016, 2017) and the International Mass Spectrometry Society (2016). In September 2017 during the OurCon conference, Bram was awarded with the ImaBiotech Mass Spectrometry Imaging Award for young and innovative scientists in the field of mass spectrometry imaging. Besides research activities, he also is involved in the CPM quality management team and the design committee for the new laboratories CPM will occupy in 2019. Since April 2017, Bram is working as a researcher at the CPM where he will continue the clinical study on the molecular alterations underlying the tumor progression of myxoid liposarcoma. After obtaining his PhD degree, he will continue his career at the CPM as group leader of the Mass Spectrometry Imaging group.

# Acknowledgements

Much like a summer vacation being reduced to a single photo album, my PhD journey was an incredible experience that has been reduced to the work presented in this thesis. Like a photo album, this thesis contains countless unwritten memories, shared and made possible by a large number of people who I am forever thankful! On this final page of my thesis I would like to acknowledge all of you who have, in any way, shape, or form, contributed to establishing this thesis!

First, I would like to express my sincerest gratitude to my promotor, professor Judith Bovée, and my co-promotor and supervisor, dr. Liam McDonnell, for giving me the opportunity to be a PhD candidate in the Mass Spectrometry Imaging group. Thank you for your support, guidance, and for being incredibly inspiring mentors!

Without a doubt science is a team effort, so I would also like to thank all current and past members of the Mass Spectrometry Imaging group. Benjamin, Clara, Fanny, Hans, Isabella, René, Ricardo, Ruben, Sha, Stephi, and Walid, without your help and support I couldn't have done this.

In this light I would also like to express my gratitude to all colleagues at the Center for Proteomics & Metabolomics, the Department of Pathology, and all the people I have collaborated with throughout the LUMC. I would like to give special thanks to: Prof. Manfred Wuhrer, thank you for your guidance and support and for the trust you put in me for the future; Sarantos, thank you for our nice discussions about science, music, and life in general; Hulda, Aswin, Gerda, and Tiziana, without you R6-26 wouldn't have been the great office that it was; Inge and Marieke, thank you for always taking the time to help me with sampling and clinical information, and having a nice chat; Anton, Bart, Dana, Dick-Paul, Frank, Guinevere, Isabelle, Linda, Peter, Robert, Simone, Tugçe, a wholehearted thank you for being great colleagues and friends.

Ik wil mijn bandmaatjes in Transient State, Hologram Earth en Mudguard, mijn LST-buddies, en Michiel bedanken voor hun oneindige support! Ik wil mijn familie en schoonfamilie bedanken omdat ze er altijd voor me zijn; pap en mam, Janne en Pieter, Jennie en Willem, zonder jullie steun en begrip was me dit niet gelukt! Ingeborg, mijn steun en toeverlaat, jouw relativerend vermogen brengt de dalen dicht bij de toppen! Dank je dat je altijd voor me klaar staat!



