

PhD Position in Biomedical Mass Spectrometry Imaging

About the position

A fully funded PhD studentship is available in the research group of Dr. Sebastiaan Van Nuffel at the Maastricht University in the field of biomedical mass spectrometry imaging. The position is funded by the Faculty of Science and Engineering (FSE) and will be based at the Maastricht MultiModal Molecular Imaging (M4i) Institute, embedded in the Faculty of Health, Medicine and Life Sciences (FHML) at Maastricht University.

Over the past couple of years, mass spectrometry imaging (MSI) has arisen as a powerful tool to answer research questions in the biomedical field¹. MSI is an imaging technique that allows the visualization of molecules. In biological tissue, it can locate biochemical compounds such as proteins, lipids and metabolites, which provides mechanistic insight into biological processes and helps us understand diseases such as cancer. The MSI technique best positioned for tissue analysis is time-of-flight secondary ion mass spectrometry (ToF-SIMS) because it has the highest spatial resolution of all the molecular MSI techniques and can detect many biochemical species with high sensitivity². Thus far, ToF-SIMS has been extensively used in research involving relatively low-mass molecules such as lipidomics³ and metabolomics⁴. Unfortunately, it is still difficult to detect large molecules such as intact proteins with a typical ToF-SIMS instrument so label-free SIMS imaging of proteins in biological materials is not currently feasible. However, it is possible to conduct MSI-based immunohistochemistry (IHC) using metal labeled antibodies and then detect the metals instead⁵. Combining labeled protein imaging with the label-free detection of lipids and metabolites in the same tissue section would be extremely powerful as it will finally be possible to link the expression of a protein to other spatial omics.

This PhD project aims to develop a methodology for MSI-based immunohistochemistry (IHC) using our state-of-the-art ToF-SIMS instrument in order to obtain correlative multi-omic image data of biological samples. In particular, you will develop new sample preparation protocols, experimental procedures and data analysis methods. You will then apply this methodology to answer biomedical research questions in cooperation with internal and external collaborators. You are expected to present your work in scientific journals and at scientific conferences. In addition, you will be able to gain experience teaching and mentoring bachelor and master students.

The PhD position will be supervised by Dr. Sebastiaan Van Nuffel and Prof. Ron Heeren. The position is a 4-year long (full-time) paid position. The terms of employment are set out in the Collective Labour Agreement of Dutch Universities (caoNU) and supplemented by local Maastricht University provisions. The anticipated start date is the summer of 2021 or sooner.

- 1 R. M. A. Heeren, D. F. Smith, J. Stauber, B. Kükrer-Kaletas and L. MacAleese, *J. Am. Soc. Mass Spectrom.*, 2009, **20**, 1006–1014.
- 2 M. Tuck, L. Blanc, R. Touti, N. H. Patterson, S. Van Nuffel, S. Villette, J.-C. Taveau, A. Römpf, A. Brunelle, S. Lecomte and N. Desbenoit, *Anal. Chem.*, 2021, **93**, 445–477.
- 3 S. Van Nuffel, M. Quatredeniens, A. Pirkl, J. Zakel, J.-P. Le Caer, N. Elie, Q. P. Vanbellingen, S. J. Dumas, M. K. Nakhleh, M.-R. Ghigna, E. Fadel, M. Humbert, P. Chaurand, D. Touboul, S. Cohen-Kaminsky and A. Brunelle, *Anal. Chem.*, 2020, **53**, 19.
- 4 S. Van Nuffel, K. C. Ang, A. Y. Lin and K. C. Cheng, *J. Am. Soc. Mass Spectrom.*, 2021, **32**, 255–261.
- 5 M. Angelo, S. C. Bendall, R. Finck, M. B. Hale, C. Hitzman, A. D. Borowsky, R. M. Levenson, J. B. Lowe, S. D. Liu, S. Zhao, Y. Natkunam and G. P. Nolan, *Nat. Med.*, 2014, **20**, 436–442.

Skills and qualifications

Required:

- A Master degree in Chemistry, Physics, Biochemistry, Materials Science, Chemical Engineering or a related subject;
- Proficiency in English;
- Interest in both hands-on research activities and data analysis;
- Problem solving skills and creativity;
- Ability to work independently and as a member of a research team;

Preferred (if you have a couple of these, you are more likely to be selected):

- Experience with or knowledge of histological techniques;
- Experience with or knowledge of immunohistochemistry;
- Experience with or knowledge of analytical instrumentation;
- Experience with or knowledge of imaging mass spectrometry;
- Knowledge of or an interest in chemometrics.

Desired (not vital, but highly appreciated):

- Programming skills;
- Willingness to learn Dutch.

How to Apply

Interested candidates are invited to submit an up-to-date CV, a cover letter and the contact details of at least two references. Candidates should submit an application by April 11, 2021, through Academic Transfer or by contacting Dr. Sebastiaan Van Nuffel (s.vannuffel@maastrichtuniversity.nl) directly.