SIMS-24
24th International Conference on Secondary Ion Mass Spectrometry
8-13 September 2024
La Rochelle, France
www.sims-24.com

Revealing trace element and stable isotope subcellular distributions in biological materials with high resolution SIMS

Katie MOORE

K. Moore [1], S. Sheraz [2], J. Dinsley [1], M. Turner [1], M. Burkitt-Gray [2], K. Else [1], J. Balk [3]
[1] University of Manchester - Manchester (Royaume-Uni)
[2] Kings College London - London (Royaume-Uni)
[3] John Innes Centre - Norwich (Royaume-Uni)

Mapping the distribution of trace elements at the subcellular scale is analytically challenging but necessary to understand the mechanisms of uptake of toxic and beneficial elements into cells and organisms. For example, the uptake of both toxic and beneficial elements in plants and crops can affect the human diet [1]. Through the subcellular localisation of trace elements, it is possible to infer the pathways by which important elements are taken up, and how they are stored and accumulated. The use of isotopically labelled compounds allows for the possibility of pulse-chase experiments which can provide temporal information about uptake, mechanisms and mobilisation within cells and tissues [1].

This presentation will focus on the use of high lateral resolution SIMS imaging (NanoSIMS) and the sample preparation methodology required to preserve the distribution of diffusible and easily mobilised elements stored in water-based cell contents.

This presentation will show how the NanoSIMS has been used to localize a range of important trace elements in many different plant tissues including the uptake of trace levels of iron into wheat grain using 57Fe stable isotope labelling [2] and the localisation of uranium in plant roots colonised with arbuscular mycorrhizal fungi. This presentation will also show how the NanoSIMS has been used to map nanoparticle distributions in plant roots and how isotopically labelled compounds can infer mechanisms of uptake in parasites.

Throughout this presentation, complementary and correlative imaging will be emphasised to show how it has been used to gain a deeper understanding of the samples than could be obtained from one technique alone.

References

[1] PM Kopittke, E Lombi, A Van Der Ent, P Wang, JS Laird, KL Moore, DP Persson, S Husted, Plant Physiology, 82 (2020) p.1869 doi:10.1104/pp.19.01306

[2] S Sheraz, Y Wan, E Venter, SK Verma, Q Xiong, J Waites, JM Connorton, PR Shewry, KL Moore and J Balk, New Phytologist 231 (2021), p. 1644 doi:10.1111/nph.17440