Molecular mass spectrometry imaging (MSI) combines the chemical specificity and parallel detection possibility of mass spectrometry (MS) with microscopic imaging capabilities. Molecular MSI is therefore an emerging research field to detect intact molecules (analyte profiling) and visualize their spatial distribution (analyte imaging).

Protein and peptide MALDI imaging data will be presented from different tissue types to highlight the power of MSI. Additionally, novel strategies to use MALDI MSI together with micro X-ray fluorescence (µ-XRF) or laser ablation inductive coupled plasma MS (LA-ICP-MS) for combined molecular and elemental imaging in biological tissues will be presented. MALDI MS provides localized information on intact molecules, LA-ICP-MS gives quantitative elemental distribution information and µ-XRF imaging is successfully used to examine the spatial context of elements without destroying the sample.

Combining either of these approaches to gather information from one tissue section will allow unbiased, novel insight into molecule/element co-localization providing data not accessible by any other method. Moreover, the application of LA-ICP-MS, MALDI MSI in combination with FT-IR analysis is presented that allowed to better understand different inflammation events occurring in lung tissue after inhaling different types of inorganic nanoparticles.