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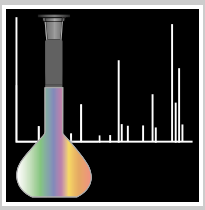

Highlights of Analytical Sciences in Switzerland

Division of Analytical Sciences
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Mass Spectrometric Imaging Applied to Biomedical Research

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Mass spectrometric imaging (MSI) stands out from the available molecular imaging technologies due to its ability to simultaneously map multiple analytes without the need for labeling. This makes it the method of choice for applications where labeling is not amenable, or where many (up to hundreds) analytes are to be monitored in one sample. Since the technology is based on the identification of the analyte molecules by their exact mass and/or fragmentation pattern, it also allows the imaging of a wide mass range without the need to know the analytes *a priori* to the measurement. While the potential of this technology was recognized early on, it was not till recently that new technological advances made it routinely applicable to biomedical research.

In our laboratory, the optimized mass spectrometric imaging process starts with whole-body tissue sections which are mounted on metal plates and coated with matrix which is required for the subsequent matrix-assisted laser desorption/ionization (MALDI) process. A reproducible matrix layer is achieved by spray-deposition using an in-house developed coater. The prepared samples are transferred to a temperature and humidity controlled store holding up to 110 plates. A robot distributes these plates to two MALDI mass spectrometers (FlashQuant, AB SCIEX) which acquire the image data from pre-defined regions, either for multiple analytes or whole mass ranges.

A typical experiment where compound and metabolite distributions are analyzed in rodents after administration involves five time points, with analysis of twelve sections per animal (triplicates from four positions). The resulting data shows the time-dependent distribution of the compound and its metabolites from one experiment, delivering mechanistic information in early drug discovery.

We proved the value of MS imaging for compound and metabolite distribution studies and demonstrated it to be an alternative to existing technology in cases where micromolar tissue concentrations are achieved. By applying a normalization strategy with internal standards, quantification accuracy of better than thirty percent was achieved.

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References

The authors maintain a website at *http://maldi.ms* with information related to MSI and free software.
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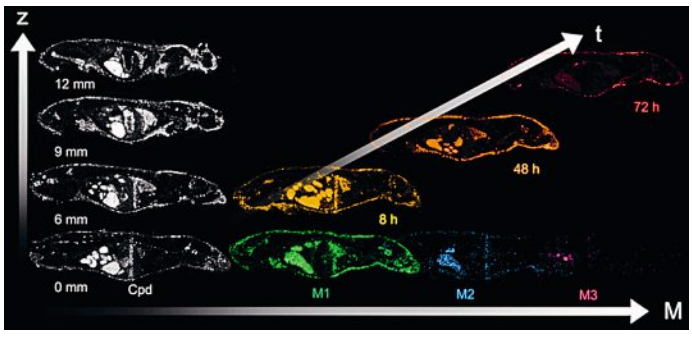
Mass spectrometric imaging platform at the Novartis campus. Tissue sections are prepared in a wet-lab and transferred to the mass spec lab using an elevator (right side). Two high sensitive mass spectrometers with a robotic system analyze the samples in automatic mode. Due to the novelty of this technology, it is on display in the Novartis showcase lab on the Novartis campus in Basel where visitors can learn about the process and see the system in action.



Mass spectrometric imaging data depicting the compound and metabolite distributions in rat after dosage. Higher intensity in the picture correlates to higher analyte concentration. From one animal, up to four sections are analyzed, covering the 50 organs of interest (z-axis). From one section, the compound (Cpd) and multiple metabolites (M1 to M3) are analyzed simultaneously. The time (t) dependent distribution information is acquired from different animals.

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