3D View of the Brain

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(PhysOrg.com) -- A completely new view of the brains of mice has been achieved by a team headed by R. Graham Cooks at Purdue University (West Lafayette, Indiana, USA). By using mass-spectrometric techniques and imaging processes, they were able to produce three-dimensional images that reflect the spatial distribution of certain biomolecules within substructures of mouse brains, the scientists report in the journal *Angewandte Chemie*.

Mass spectrometry (MS) is a method by which molecules can be separated and identified by means of their mass. Combination with imaging techniques makes it possible to very specifically represent the two-dimensional distribution of molecules such as drugs, proteins, or lipids on the surface of a biological sample.

Tissue samples need only be prepared following simplified standard histological protocols. For MS analysis, the molecules must then be carried off of the surface, ionized, and converted to the gas phase. For this, the researchers used desorption electrospray ionization (DESI), an ionization technique developed by Cooks' team a few years ago. Says Cooks: "The particular advantage is that the samples can be examined in the open atmosphere, whereas previous MS imaging techniques required special surface treatment and ionization under vacuum."

The researchers prepared series of thin sections of mouse brains and analyzed their lipid composition. Two different mass-spectrometric patterns were observed. These could be assigned to the gray and white masses in the brain, which differ in their lipid composition.

By using a set of the 2D data, the researchers constructed 3D images, which each map a specific primary lipid component. By overlaying these 3D data sets, they produced a model of the mouse brain in which anatomical details could be recognized. Other biomolecules could then also be charted and their 3D images also laid over the model, which makes it possible to determine in which areas of the brain the corresponding substances are primarily found. “We hope to use this to obtain a better understanding of the biochemical processes in the brain,” says Cooks. “In addition to the brain, we would also like to map other organs in this way.”

More information: R. Graham Cooks, Purdue University, Three-Dimensional Vizualization of Mouse Brain by Lipid Analysis Using Ambient Ionization Mass Spectrometry, *Angewandte Chemie International Edition*, Permalink: dx.doi.org/10.1002/anie.200906283