

## MRI for tracing living cells

**Researchers from the Mannheim Medical Faculty, which is part of Heidelberg University, and the Max Planck Institute (MPI) for Biological Cybernetics in Tübingen have achieved a world first in the use of magnetic resonance imaging (MRI) for the simultaneous visualisation of sodium and potassium ions, which are important for proper cell function, in the living cell. The scientists from the Mannheim Medical Faculty have thus achieved an important milestone in the development of a method that enables them to visualise the vitality of cells without having to expose patients to dangerous radiation.**

The sodium-potassium pump is one of the most important physiological mechanisms for maintaining the vital function of human cells. The pump moves sodium and potassium in opposite directions across the cell membrane and ensures that the unequal concentrations of these ions are maintained. If the cell function is impeded by a disease, for example stroke or tumours, then the sodium-potassium pump breaks down, resulting in a breakdown of the vital concentration gradient of these ions in the cells concerned.

The researchers are using this knowledge in the hope that the distribution of sodium and potassium ions will provide them with information on the vitality of cells. Previously, there was no harmless method to enable the visualisation of sodium and potassium ions in the living cell simultaneously. Prof. Dr. Lothar Schad, Dr. Stefan Kirsch and Patrick Heiler of the Mannheim Medical Faculty and Mark Augath of the MPI in Tübingen have now succeeded in visualising these ions by using a high-resolution 9.4 Tesla MRI device.

MRI is a non-invasive medical imaging method that does not require patients to be exposed to radiation. In medical diagnostics, MRI is mainly used for the visualisation of the structure and function of tissues and organs in the body. MRI uses a magnetic field to align the nuclear magnetisation of atoms – in conventional MRI this is usually hydrogen atoms in water in the body. When they return to their original state, the hydrogen nuclei produce signals that can be measured. Different tissues send out signals of different strengths, resulting in the visualisation of tissue and organ structures.

For some years now it has been possible to use other atomic nuclei in the body, sodium for example, for the production of MR images. The Mannheim researchers have now succeeded in producing MR images on the basis of potassium nuclei. And this is not all. They have also developed a 'triple-resonance' receiver coil that simultaneously produces proton, sodium and potassium images in the living organism.

Professor Dr. Lothar Schad, Director of the Institute for Computer-Assisted Clinical Medicine, is pleased with the results: "Despite the still coarse resolution of the sodium and potassium images, they can still be used to visualise the function of the sodium-potassium pump. The visualisation of cell activity opens up completely new possibilities in the diagnosis and therapy of stroke and tumour diseases."

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### Press release

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