(Oct. 21, 2011) Researchers at Lund University can now study molecules which are normally only found in very small concentrations, directly in organs and tissue. After several years of work, researchers in Lund have managed to construct an instrument that 'hyperpolarises' the molecules and thus makes it possible to track them using MRI. The technology opens up new possibilities to study what really happens on molecular level in organs such as the brain.

Magnetic resonance imaging (MRI) is an established technique which over the years has made it possible for researchers and healthcare professionals to study biological phenomena in the body without using ionising radiation, for example X-rays.

The images produced by normal MRI are, to put it simply, pictures of water in the body, since the body is largely made up of water. MRI produces images of the hydrogen nuclei in water molecules. It can also be used to study other types of nuclei in many other interesting molecules. The only problem is that the concentration of molecules that are interesting to track is so low that they are not visible on a normal MRI scan. It is this problem that the researchers have now solved by constructing a 'polariser'.

In the polariser, the researchers make these molecules visible to the MRI scanner by hyperpolarising them. The molecules are then injected into their natural body tissue.

"Then we can follow the specific molecule and see the reactions in which it is involved. This gives us a unique opportunity to see and measure enzymatic reactions directly in the living tissue," explains Professor Deniz Kirik.

The technology could be used to study molecules in many different types of tissue in the body. Deniz Kirik, who is a Professor of Neuroscience, will focus on developing this technology to study the brain -- something which has not been done before.

"The brain is not an easy target!" he observes. "When we look inside the brain today using MRI, we see the molecules that are most numerous. However, it is rarely these common molecules we want to study. We want to study how molecules that have a low concentration in the tissue behave, for example how signal substances are produced, used and broken down. It is when

these processes don't work that we become ill.

"This technology has the potential to help us do just that. If we can make it work, it will be a breakthrough not only for neuroscience but also for other research fields such as diabetes, cancer and inflammation, where similar obstacles limit our understanding of the basic molecular processes which lead to disease."

Professor Hindrik Mulder is one of the co-applicants for the project and he will develop and use the technology in diabetes research. Dr Vladimir Denisov from the Lund University Bioimaging Centre is leading the technical development within the project.

At present there are only a few polarisers in the world and Lund's newly built device is the only one in Scandinavia to be fully available for academic research. "All the other equivalent instruments are purchased commercially and come with restrictions placed by the manufacturer. We therefore chose to take the longer and more complicated route of building the instrument ourselves," explains a pleased and proud Deniz Kirik.

Now that the instrument has become operational, the researchers have started on the first experiments.

"This is the first of two steps," says Deniz Kirik. "The next step in this frontline research is to develop the unique technology by constructing an even more sophisticated polariser which will enable advanced experiments on animal models for various diseases."

The project has been made possible through a grant from the Swedish Research Council and earlier grants from the Swedish Foundation for Strategic Research.

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