The scan's the limit

The MRI scanner is opening up all sorts of new possibilities for food scientists. It can be used to measure liver fat, for example, or to monitor the effect of vitamin B on memory.

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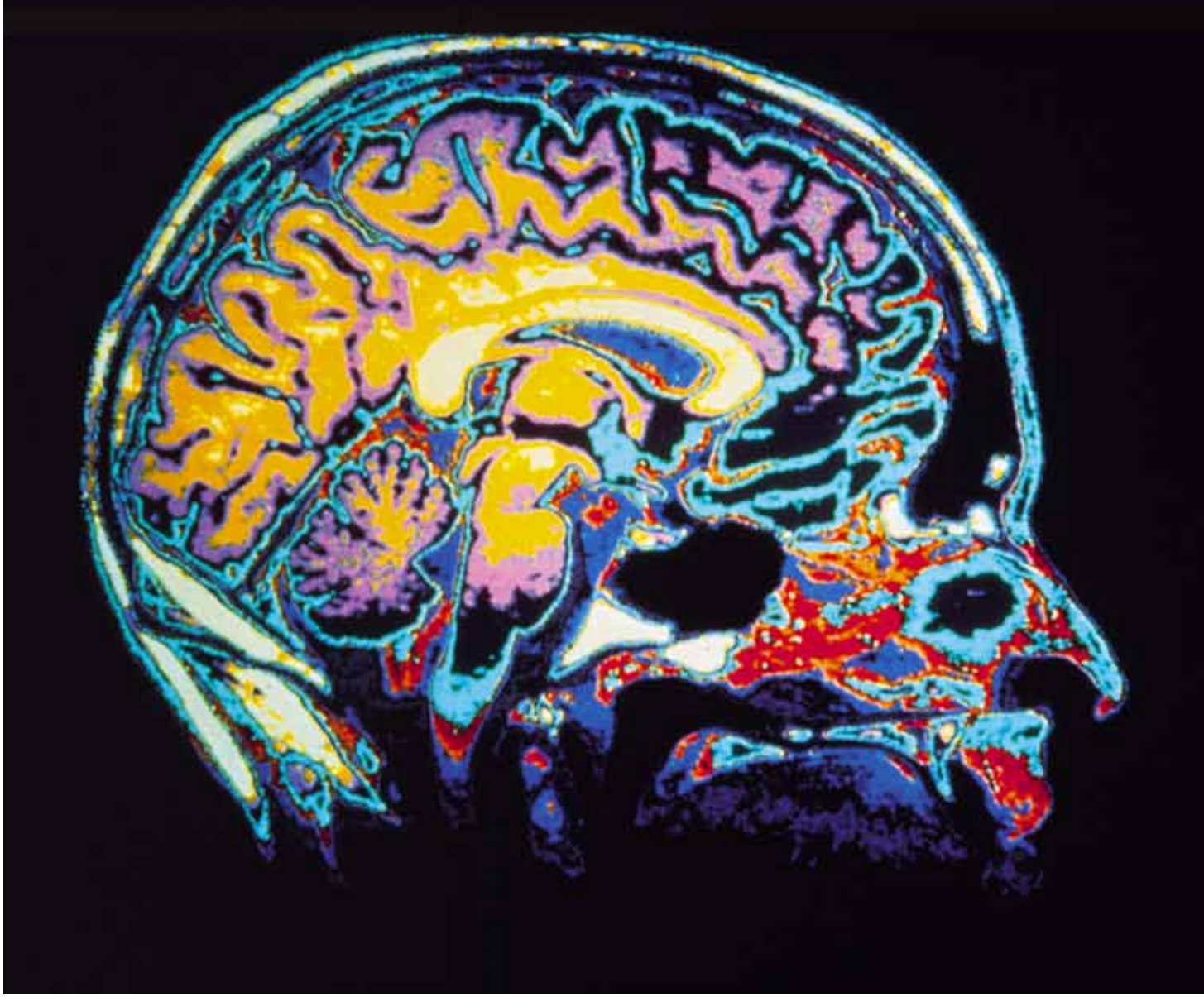
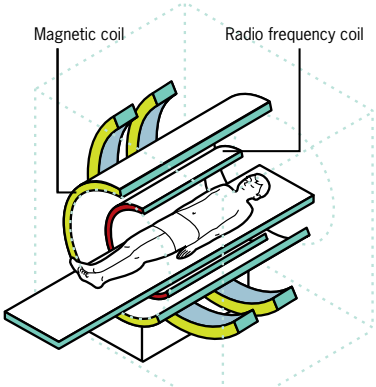


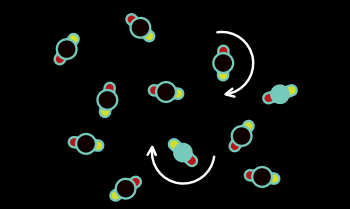
‘If I were starting at university now I would study neuroscience’, says Frans Kok, head of the department of Human Nutrition at Wageningen University, part of Wageningen UR. With great enthusiasm, Kok describes the scope offered by the MRI scanner purchased last year by CAT-AgroFood, a technology fund jointly established by Wageningen UR, the province of Gelderland and the Dutch central government. The 2.5 million-euro machine – housed at the Gelderse Vallei hospital, which also makes use of it – offers researchers all sorts of new possibilities. Not only can it track a person’s brain activity, but it effectively gives researchers a window into the body. It does not render blood tests, weight measurements and questionnaires redundant but it does provide an additional source of information. When a test subject or patient slides into an MRI scanner, he or she enters into a strong magnetic field. This causes all the hydrogen nuclei in the body to line up in the same direction, like iron filings around a strong magnet. Then a radio wave goes through the body, causing the nuclei to change direction. The speed at which they then return to their original position is different for each part of the body. With the help of smart software you can use these differences to obtain images of organs and other soft tissues.

ABDOMINAL FAT

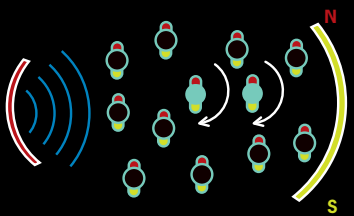
The Wageningen Belly Fat Study is one of the projects that have gained a new dimension thanks to the MRI scanner. ‘We can now zoom in on excess fat in the abdominal cavity and measure it’, says Kok. Previously you could only arrive at an approximation through blood tests. A specialized scanning technique now makes it possible to establish the exact amount of fat in the liver, for example. Researchers look for suitable participants for an intervention study among people with a lot of this ‘visceral fat’. In the study, the test subjects are prescribed a healthier diet and in some cases more exercise. Excess abdominal fat is of particular interest because it is bad for the health. It can become chronically inflamed, releasing toxic cytokines into the system. These substances seem to be to blame for the diseases of affluence such as diabetes and cardiovascular disease. ‘This does not mean we imagine that we are going to solve the obesity problem’, says Kok. ‘But even for very overweight people, losing a few kilos can make a big difference to their health.’



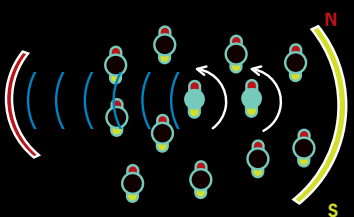
The MRI scanner uses a magnetic field and radio waves to produce signals in the body which are processed into images by a computer.



1 The hydrogen atoms in the body are aligned in random directions.



2 A strong magnetic field ensures that hydrogen atoms align themselves in the same direction. A radio wave that is then sent through the body causes these atoms to ‘turn around’.



3 The atoms turn back to their original direction of their own accord. This releases energy, which can be measured. The tempo at which the atoms return to their original position varies per tissue type. Using the computer you can create images of the tissues based on this information.

Besides providing images of the body, the scanner can also be used to observe brain activity using a technique known as functional MRI (fMRI). This makes use of the relative proportions of oxygen-poor and oxygen-rich haemoglobin, the protein complex that transports oxygen through the bloodstream. In order to meet an increased demand for energy, more blood flows through the active regions of the brain, keeping the proportion of oxygen-rich haemoglobin in the blood there relatively high. This makes it possible to relate stimuli to the brain regions that process them.

BETTER PERFORMANCE

The Human Nutrition researchers will use fMRI to look at such questions as the effect of nutrients on cognitive functions such as memory and attention spans. For example, they plan to give elderly people either vitamin B pills or a placebo. After two years the two groups will be compared using both fMRI and neuropsychological tests. The question then will be whether the elderly people on vitamin B perform better than the others on tests for memory, attention span and speed.

But for Kok these are by no means the only advantages of an MRI scanner. The Human Nutrition department is also studying the effect of sensory perception on appetite and satiety. Kok: ‘We are looking at how the smell and taste of foods affect the pleasure centres in the brain. The mechanism may be disrupted in seriously overweight people and patients with particular conditions. This is a whole new field in which we have a lot to learn. That is another reason why we bought the scanner.’ ■