**SCIENCE & TECHNOLOGY** 

Neuroscience

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## Sound and no fury

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## It may, in the future, be possible to treat brain diseases with ultrasound

THE idea of treating maladies of the mind by blasting the brain with noise sounds, to the layman, like kicking a television set in order to repair it. It is, however, on the cards.

The noise in question is ultrasound. This has been used for decades to scan human interiors—particularly wombs containing developing fetuses. The ultrasound is reflected from surfaces within the body (such as the skin of a fetus) in the way that audible sound echoes from a cliff face. William Tyler and his colleagues at Arizona State University, however, want to take things a stage further. They think that ultrasound might be used therapeutically as well.

The team knew from experiments done by other groups of researchers that ultrasound can have a physical effect on tissue. Unfortunately, that effect is generally a harmful one. When nerve cells were exposed to it at close range, for example, they heated up and died. Dr Tyler, however, realised that all of the studies he had examined used high-intensity ultrasound. He guessed that lowering the intensity might allow nerve cells to be manipulated without damage.

To test this idea, he and his colleagues placed slices of living mouse brain into an artificial version of cerebrospinal fluid, the liquid that cushions the brain. They then beamed different frequencies of low-intensity ultrasound at the slices and monitored the results using dye molecules that give off light in response to the activity of proteins called ion channels. (An ion channel is a molecule that allows the passage of electrically charged atoms of sodium, potassium, calcium and so on through the outer membrane of a cell.)

The purpose of all this was to coax the cells to release neurotransmitters. These are molecules that carry information from one nerve cell to another. When they arrive, they cause ion channels to open and thus trigger the electrical impulses that pass messages along nerve fibres. When those pulses arrive at the other end of a fibre they, in turn, trigger the release of more neurotransmitters.

Disruption of this system of communication is characteristic of several medical conditions, including Alzheimer's disease, Parkinson's disease, depression and epilepsy. Ways of boosting the release of neurotransmitters may thus have therapeutic value. And the ultrasound did indeed boost their release.

How that came about is not absolutely certain, but Dr Tyler thinks the shaking that his ultrasound gave to the cells in question opened up some of their ion channels. The cells were thus fooled into acting as though an impulse had arrived, and released neurotransmitters as a consequence.

Any medical application of the idea is a long way away. But ultrasound does now offer at least the possibility of manipulating the brains of people suffering from mental illnesses without resorting to drugs or electrodes. And that is certainly a path worth investigating.

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