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Neuroscience

Magnetic personalities

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How brain disease might be diagnosed quickly and easily

MAGNETOENCEPHALOGRAPHY is a big word for a technique that measures tiny changes. It detects magnetic signals that are produced by the electrical activity of brain cells—and which have about a billionth of the strength of the Earth's magnetic field.

At the moment, it is used mainly as a research tool. But Apostolos Georgopoulos and his colleagues at the University of Minnesota, in Minneapolis, think it could be adapted for medical use. If they are right, the diagnosis of brain diseases such as Alzheimer's and schizophrenia is about to be revolutionised.

Magnetoencephalography does already have one medical use. It is employed to identify the focal points of epileptic seizures. That, however, homes in on specific parts of the brain. Dr Georgopoulos's insight was to wonder if the general hum of brain activity contains diagnostic information. And in a paper just published in the *Journal of Neural Engineering*, he reports that it might.

Last year, in work leading up to this paper, Dr Georgopoulos found a characteristic pattern in the magnetic fluctuations of healthy people's brains. He asked ten volunteers to stare at a point of light for 45 seconds as they lay under his machine. Each run of the experiment used 248 sensors and every sensor took 45,000 readings over the course of a run. Out of that plethora of data fell the human brain's synchronous background hum.

On its own, this discovery meant little. But Dr Georgopoulos wondered whether the brains of people with neurological diseases might have different yet equally distinctive magnetic patterns. To find out, he invited patients with a clear diagnosis of one of six afflictions—Alzheimer's and schizophrenia among them—to lie in his machine and concentrate on the light. Then he recorded the magnetic fluctuations of their brains.

He analysed the results using a technique called discriminant function analysis. This is a statistical trick that allows complicated data such as those from magnetoencephalography to be reduced to a small number of components whose co-ordinates can then be plotted on a standard graph. The hope is that the points on the graph will fall into clusters that correspond to something observable in the real world. And that is what happened. Each of the diseases produced a distinct cluster. Healthy brains produced a cluster that did not overlap with any of the diseases.

The question, which Dr Georgopoulos is now trying to answer, is whether the same clarity applies to people with mild symptoms that may or may not develop into something worse. If he sped up diagnosis by showing reliably who was going to become truly ill, treatment could start much earlier. He and his colleagues are therefore about to start regular tests on two groups of people suffering from mildly abnormal mental symptoms. One group is elderly and one is young.

About half of elderly people with mild cognitive impairments go on to develop Alzheimer's disease; the rest revert to the normal pattern of non-pathological decline that is the near-inevitable consequence of

growing old. At the moment it is impossible to predict who will fall into which group. However, since the progress of Alzheimer's disease can be slowed by early treatment, early diagnosis would help those at risk. It would also let those who were not at risk stop worrying.

Schizophrenia, meanwhile, normally manifests itself in a person's teens but, as with Alzheimer's disease, only about half of those who show early signs go on to develop the illness. Again, treatment is possible and early treatment is best. But the drugs used have nasty side-effects and can be addictive, so it is undesirable to prescribe them unless they are likely to do some good.

Whether Dr Georgopoulos's technique can distinguish those who will become seriously ill from those who will not remains to be seen. But if his magnets do pick the right patients, neurology will have made an important step forward.