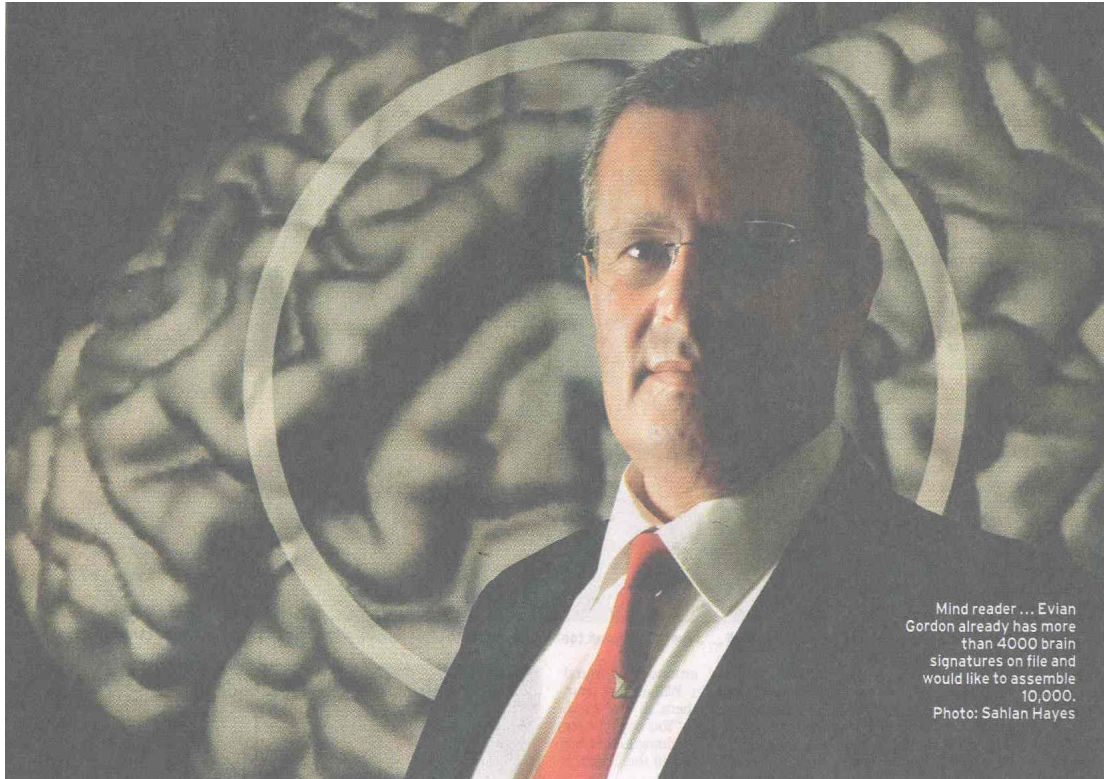


Matter over mind

Understanding of the human brain has hit the fast lane, and the questions being answered could solve some of our biggest mysteries. **Julie Robotham** reports.



Mind reader ... Evian Gordon already has more than 4000 brain signatures on file and would like to assemble 10,000.
Photo: Sahlan Hayes

USING THEIR BRAINS

The Brain Resource Company is a spin-off from Westmead Hospital and University of Sydney research, and was floated on the sharemarket in 2001.

Many of the 4000 individuals, aged from six to 90, whose brain profiles are held in the database, have undergone three hours of psychological tests on aspects of memory, attention, language, planning and sensory perception. At the same time, the biological responses of their brains have been recorded using electroencephalogram (EEG), magnetic resonance imaging (MRI) and functional magnetic resonance imaging (fMRI) - each of which yields different information about the swiftness and magnitude of the person's reaction and where in the brain it occurs. Gene tests are also performed.

In a canny piece of scientific franchising, the company's chief executive, Dr Evian Gordon - a former cardiologist who abandoned the well-documented structures of the heart for the "dirt road" of neurobiology, has signed up 70 laboratories in Australia and overseas to identically perform the same physical tests and psychological questionnaires.

Independent researchers get free access to the database, and at the same time they contribute new subjects. Drug companies - the most avid potential users - must pay to test their hypotheses about who will respond best to new medications. Julie Robotham

IN A utilitarian suite of offices in Ultimo, Dr Evian Gordon is collecting brains. The physical organs remain with their original owners; Gordon's interest is in their size and configuration, and how these correspond to the person's age, sex, medical history, social background and response to a range of stimuli.

Timed, measured, then blasted with computing power unthinkable even a decade ago, the profiles characterise for the first time normal brain activity.

But the brain is only the means. The Holy Grail is to solve the ultimate human mystery: the nature of the **mind**, which has occupied philosophers for millenniums and psychiatrists for a century, and may now be on the point of being revealed.

It is a pugnacious challenge to traditional psychiatry, which is at least as much art as science. But then Gordon's project is on a scale to warrant it.

He already has more than 4000 brain signatures on file, of the 10,000 he would like eventually to assemble. In medical science terms, that is a massive database. With so many specimens, it is almost impossible that any characteristic could be **over-**represented by chance. So if a research hypothesis stands up statistically when it is number-crunched through the brain samples, it is effectively proven.

Charting brain response could be a great leveller. The prospect of mapping people's temperaments and preferences to electrical impulse patterns first inherited, then modified in childhood and through life, makes humanity more knowable. And if we are all just points along a brain-function continuum, then some must inevitably fall at its extremes.

"Are psychiatric illnesses magnified variants of normality?" asks Gordon, the chief executive of the Brain Resource Company.

Human brain size has trebled in 2million years - the evolutionary equivalent of a nanosecond. That has propelled humans to the top of the Darwinian heap as they outwit potential predators. But the trade-off may be an inherent instability - new brain attributes that are not always helpful but have not yet been weeded out by natural selection. Perhaps the current version of the human brain - with its tendencies towards misery and misbehaviour - is just a prototype.

It is a seductive theory and one that has pulled in Professor Sandy McFarlane. Now head of the University of Adelaide's department of psychiatry, McFarlane became a world expert on post-traumatic stress disorder when he conducted exhaustive follow-up studies of people affected by the 1983 Ash Wednesday bushfires.

These days, McFarlane says: "I find myself thinking about psychiatric disorders as information processing disorders." A fractional deviation from the standard brain response to, say, a loud noise or an angry facial expression, may produce a behavioural ripple-effect problematic enough to be classified as illness.

McFarlane has begun his own investigations through the Brain Resource Company database. By analysing a subset of 740 participants without a mental illness, he was able to determine that those who had suffered stressful events such as abuse or domestic violence in early childhood demonstrated less pronounced brain responses to some stimuli.

That might eventually inform new theories or sub-classifications of post-traumatic stress disorder - in which one of the mysteries is why some people are vulnerable while others who experience the same events remain unaffected.

McFarlane anticipates the techniques will be particularly valuable in understanding mental disorders in children, such as attention deficit hyperactivity disorder (ADHD) and childhood depression.

"Children are not good at being able to use language to describe how they are feeling," he says. "Because they don't have a sophisticated language for emotion, people tend to notice their distractability. In some children with behaviour problems we'd associate with ADHD, it may really be about stress ... stress isn't just the content of your thoughts but also the mechanisms of how you think."

McFarlane's occasional colleague Professor Richard Clark, director of the cognitive neuroscience laboratory at Flinders University and a member of the Brain Resource Company's scientific advisory committee, says emerging brain scanning techniques make it possible "to measure the brain working in its own right, rather than measuring behaviour" as a proxy.

Vastly more efficient computer processing makes immediate sense of the results, and scientists can run all the tests they want without adding significantly to their costs.

Clark is using the database to tease out different ADHD sub-types based on brain activity - as opposed to asking teachers and parents about a child's behaviour, which is the present standard for diagnosis. "Pediatricians are starting to use these methods in the assessment process," says Clark, who has also been called as an expert witness in legal cases where a defendant's mental state is in question. Juries are sceptical about the mitigating role of mental illness, he says, except if you can show measures of brain function that are seriously abnormal.

If McFarlane and Clark's work seems gung-ho, Associate Professor Lea Williams goes further. Williams, who oversees the scientific division of the Brain Resource Company and also runs the Brain Dynamics Centre at Westmead Hospital, believes science is poised to deconstruct human emotion.

Subjective feelings may be a nexus of brain responses that can be described and measured, she says. Williams believes the very notion of human consciousness - why we are aware of ourselves as individuals rather than just blithely reproducing - may in time be cracked open.

It is Big Science in action: another grand unifying theory built on computer muscle in the wake of the Human Genome Project. But not everyone is convinced.

"You have to wonder whether it's profound or pseudo-profound," says Gordon Parker, Scientia professor of psychiatry at the University of NSW and executive director of the Black Dog Institute. For all their veneer of scientific robustness, brain databases still have to be taken on faith, he says, because those tackling the topic have yet to map emotions to specific groups of neurons or link them definitively to particular genes.

Parker, who suspects that codifying the human condition into patterns of brainwaves may turn out to be an elaborate nominal fallacy, believes the pendulum has swung too far towards a biological model of mental illness.

New-era psychiatry has "swept away all the previous frameworks as if they were irrelevant", he says. But the problem with defining mental disturbance only as biological illness is that that is inconsistent with human experience. "Depression can be a disease, but it can also be a disorder, normal, a predicament, and so on," Parker says.

Despite convincing evidence psychotherapy is at least as effective as medication for many patients, Parker believes the pendulum will take another decade to start swinging back. "The brightest young people are attracted to neuroscience and biological models," he says.

In Perth, Professor Assen Jablensky is running his first multi-disciplinary course on neuropsychiatry. Psychiatrists, neuroscientists and neurologists - many of them senior specialists - have signed up.

Jablensky, the director of the University of Western Australia's Centre for Clinical Research in Neuropsychiatry, is attempting to characterise different sub-types of schizophrenia through his own specialised brain database of 600 patients and family members affected by the devastating disorder.

There is practical value, he says, in moving beyond metaphysical versions of mental illness. "It relieves a bit of the inevitable guilt and responsibility that families feel, especially parents," says Jablensky, as the research direction coincides with families' own construction of their loved one's illness as a brain disorder distinct from the person's true self.

If psychiatric illness can be shown to be a simple misfiring of neurons, a condition as morally neutral as asthma or a broken bone, then that will remove the stigma for patients more effectively than a thousand anti-discrimination campaigns, he says.

Jablensky sees the coming together of brain science and psychiatry as the happy reunification of two lines of investigation that should never have become separated. Sigmund Freud founded modern psychiatry, he says, only as a stopgap because the tools were not then available to get down and dirty with brain function: "Many practitioners forget that Freud himself was a neurologist."