

**T**he human brain releases its secrets slowly, almost reluctantly. As the dominant organ of our bodies, it controls our perception, consciousness, unconscious thought processes, and our metabolism. But even though it is so vital to us, its inner mysteries remain as obscure and as tantalising as those of outer space – and the journey to unravel them is as exciting as the exploration of the cosmos.

One of the scientists who has embarked on that journey is Alan Crockard, a consultant neurosurgeon at the National Hospital for Nervous Diseases.

It is a subject for which he has an evident sense of wonder. 'The brain is a quite remarkable structure,' he says, in his cramped office at the homely Maida Vale Hospital in West London. 'For example, you can put a patient to sleep, open up his head, and after the operation he'll have little or no headache. The brain is the guardian of our senses, it protects us by registering pain – yet it feels no pain itself.'

Crockard spends three days a week as a brain surgeon, the rest of his time as part of a team that is researching the brain. Their greatest current preoccupation is the problem of oedema, or tissue swelling – and he makes it sound like a riveting subject. When the body receives an injury, such as a blow to the eye, the surrounding tissues become swollen and bruised several days later. In some mysterious way, the cells which were initially damaged cause neighbouring cells to suffer as well. But no one knows why. The same process, Crockard explains, occurs in brain strokes – 'and if we knew why, we might be able to find a remedy'.

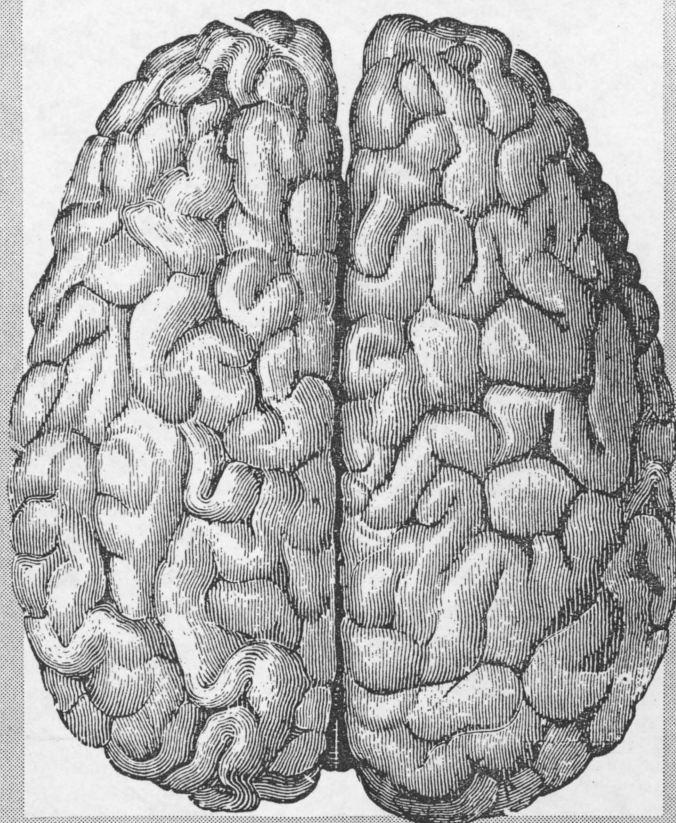
Strokes interest Crockard in another way: 'A lot of people have them without realising, because they occur in an area of their brain concerned with their thinking. In an older person, people say, "Granny is just not as well as she was".' Crockard believes, in fact, that multiple small strokes may contribute to the onset of senility.

One of the brain's most fascinating attributes is its remarkable capacity to accommodate change. Crockard tells of a man who had a tumour on his

## Human Brain, Monday 9.25 BBC2

Beginning on Monday, seven films will explore the human brain – its biological make-up and all the areas of its activity. Below, brain surgeon Alan Crockard talks to Leni Gillman about the wonders of the body's dominant organ, followed by a dissertation on 'mind and brain' by philosopher Daniel Dennett

# Grey matter and mind



pituitary gland, deep inside his brain, that grew for seven years. It had reached the size of a billiard ball before the man began to suffer headaches and impaired eyesight. Meanwhile he worked and played normally. From X-rays, Crockard found that the cells surrounding the tumour had simply compressed themselves to make room. When he removed the tumour, the brain re-established its territory. Provided that change occurs gradually, says Crockard, the brain adapts. 'It's when it happens very quickly that the brain can't cope.'

A clue to the brain's extraordinary adaptability comes

from the fact that it consists of no fewer than 100 billion cells – and even though a million of them become defunct every day from the age of 25, this occurs without any apparent loss of intellectual or physical capacity. It adds up to a very tough and resilient organ that can often make dramatic recovery from serious injury, even one resulting in a coma. There are, however, certain crucial areas of the brain where damage appears irreparable, such as the one that can cause a profound loss of muscular co-ordination on the left side of the body – Crockard refers to it respectfully as 'Crewe Junction'.

Crockard also talks of the brain's 'light-bulb effect', whereby the brain also appears to be able to sustain a series of minor injuries up to a certain fail-safe level. Once that level is passed – Crockard says that occurs when more than 60 per cent of the cells in a particular area are damaged – then the remaining cells suffer a dramatic collapse, like a light-bulb that suddenly blows out. It is this phenomenon, Crockard believes, that accounts for the sudden deterioration of boxers who become punch-drunk.

As a brain surgeon, Crockard considers that some of the most vital unanswered questions concern what happens in the event of strokes or heart attacks. 'We have about four minutes to do something before the person's brain is irreparably damaged owing to oxygen deprivation. If only we could give ourselves more time, or find some drug to protect the brain from this.' He is sure that such a protective device or measure would also reduce the effects of later tissue damage, or oedema.

Even so, the brain is gradually yielding its secrets. Ten years ago, researchers in Aberdeen discovered endorphins, the chemical signals emitted by the brain to control the body's tolerance of pain. It is now also known that if one nerve pathway to the brain is stimulated, the body's ability to sense pain via another pathway is blocked – processes that could help explain the mysteries of the ancient Chinese practice of acupuncture, now being increasingly accepted by Western society. It marks a further advance in our understanding and provides another enticing glimpse of the inner world of the brain. ●

**D**o we really need the traditional distinction between the mind and the brain?

Now that the human brain is believed to be the physical seat of all human mental activity, why do we persist in talking and thinking about our minds? No doubt in part because no matter how much we may learn about our brains, there seems to be something else we know much more intimately – our minds.





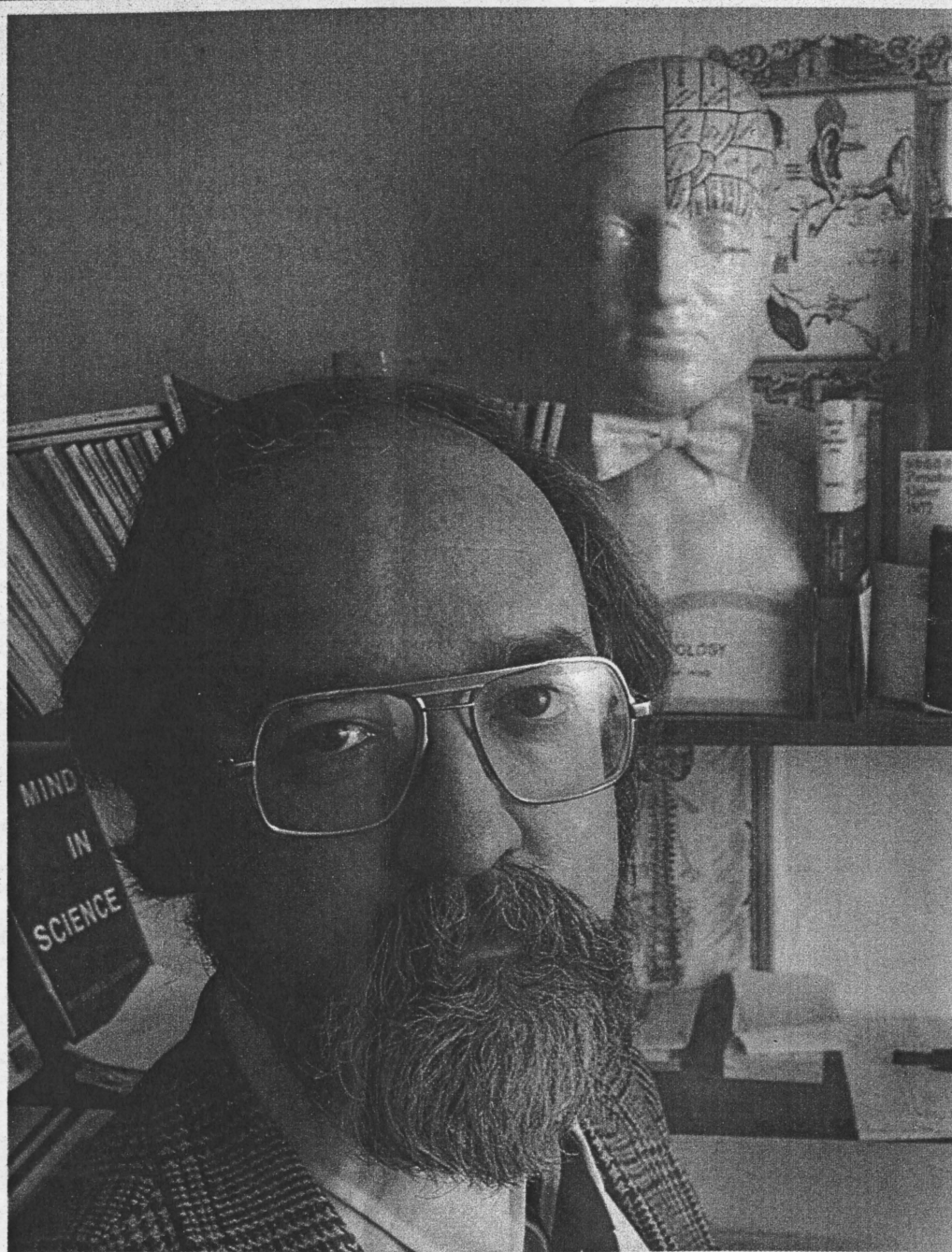
← myriad microscopic details make the situation worse. The brain no longer seems a mysterious pulsing lump; now it seems like an unimaginably complicated system of relays and interactions — a teeming metropolis of mindless, faceless, sub-cellular agents, working through a tangle of plumbing and wiring that makes the inside of a computer look simple. Whatever else it is, the brain reveals itself through the microscope to be utterly impersonal in its massive blind complexity.

How could any amount of that frantic electro-chemical activity, however orchestrated, add up to a secret thought, a luscious remembered aroma, a private vision? The question appears at first to be unanswerable, and many who confront it are content to declare that the conscious mind must be forever impenetrable by science. But it is not scientific ignorance that stands in the way so much as a failure of imagination. For, even if you permit yourself to *make up* whatever biological facts you like, you will still be hard-pressed to knit them into a coherent story that could possibly explain how our minds are lodged in the same world with our brains.

Somehow we must find a sideways step or two to take in our thinking about the mind. The hope of such a purely conceptual breakthrough has inspired centuries of armchair musings by philosophers — including the amateur philosophisings of brain scientists. Only recently, however, has there been much to fuel these speculations beyond common sense and the unreliable deliverances of 'introspection'.

Now at last the brain sciences themselves appear to be uncovering the telling data, and developing the concepts, that will lead to a new vision of the mind. The discoveries that promise to help the most are not about the microscopic workings of brain cells, but about person-sized phenomena: the bizarre and fascinating problems people have when their brains are damaged in one way or another, and the difficulties normal people encounter when they are placed in strange and taxing environments, their brains tricked by illusions, overloaded and provoked into error.

The new concepts arise from attempts to understand the



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organisation of brains — and computers — at the abstract level of 'information processing' and 'cognitive operations'. While nothing approaching a complete solution to the mysteries of the mind has been uncovered, tantalising suggestions are emerging about how to reconceive our minds and ourselves as products of the activity of our brains.

As philosophers and scientists enrich their thinking with new concepts and discoveries, the traditional 'mind-body problem' is dissolving into an array of more interesting and soluble problems to challenge our imaginations. ●