

# Quantum incoherence

Daniel C. Dennett

**Evolving the Mind: On the Nature of Matter and the Origin of Consciousness.** By A. G. Cairns-Smith. Cambridge University Press: 1996. Pp. 329. £16.95, \$24.95.

AFTER decades of persistent work by researchers in many fields, building foundations and patiently filling in details, the gigantic jigsaw puzzle of consciousness is beginning to come into focus. As large assemblies fall into place with a gratifying convergence of details drawn from different disciplines, the pace is quickening. Everybody wants to be in on the delicious task of describing what the Big Picture is going to look like, predicting the outlines before the mopping-up operations confirm them. Well, not quite everybody. There are also those who dislike what they see happening: consciousness is turning out to be 'just' a great big jigsaw puzzle. What? No cosmic revolutions in quantum (or meta-) physics? No Impenetrable Mysteries? Bummer!

What does a theory of consciousness look like to a chemist whose home base is molecular evolution, but who has educated himself strenuously if patchily in cognitive neuroscience and even philosophy of mind? A. G. Cairns-Smith is a brilliant explainer of difficult ideas, bringing to the task an imagination that is magnificently disciplined by detailed scientific understanding. He is also open-minded. His book will tantalize participants and onlookers of all persuasions, for after lucidly describing many of the best pieces of the puzzle, and showing how they could (almost?) complete the picture, he veers off to join forces with the quantum-physics-to-the-rescue squad. This is all the more thought-provoking because he appreciates, and indeed eloquently expresses, the well-known line of reasoning that persuades most of the puzzle-solvers that consciousness will prove to be like all the other dazzling phenomena of life (self-replication, self-transformation, self-repair, self-fuelling, self-protection): explicable in terms of molecular and cellular machinery (and higher-level assemblages of such machinery) without having to invoke any amplification of subatomic weirdness. Has Cairns-Smith seen the importance of something we others have underestimated?

No, I think it is he who has underestimated an opportunity staring him in the face: consciousness is not some further phenomenon occurring in the brain, but is constituted by all the phenomena that individually do not count as instances of consciousness — in the same way that life is not some mysterious phenomenon over



**"The Prince of Darkness: Dagol"** from a late-eighteenth-century German work on magical arts. It appears in "Abracadabra: The Magic of Medicine", an exhibition at the Wellcome Institute for the History of Medicine, London, from 21 June to 26 October.

and above the components listed above, but is constituted by their ensemble occurrence. What makes his swift dismissal of this prospect all the more tantalizing is that he himself sees the ominous parallel with vitalism — and rejects it: "Indeed, apart from its origin, life, it seems to me, is essentially explained as a phenomenon by a combination of conventional molecular biology and the neo-Darwinian theory of evolution. But consciousness is another matter altogether, one on which molecular biology has so far provided little illumination." One might suppose that Cairns-Smith, like many others, rejects this 'constitutive' option out of hand

because it is so initially counter-intuitive, but he knows better than to do that; he recognizes that a theory of consciousness "should seem crazy (anything evidently sensible would have been established ages ago)". Why, though, does he not heed his own principle and at least give this 'crazy' prospect a serious exploration?

We can mark the moments where the missteps take place. After a brilliant exposition of the tricky relationship between subatomic physics and the biochemists' 'ball-and-stick' models of macromolecules, he proceeds to show how these machines work together to compose greater machines. I have never encountered a clearer or more vivid account of the spectacular ingenuity of cellular design and operation, eventually focusing on the details of "the computers within the Computer" — neurons and their paracrine and endocrine signalling systems.

A crisp, no-nonsense primer then takes us up to the next level, where his analysis of specialized neural circuits (and how they probably evolved) lets his readers arrive, in good company, at the idea that, thanks to the many activities of these specialized subsystems, there is neither a localized destination for the 'inbound' traffic, nor a localized source for the 'outbound' traffic of consciousness. The work to be done by consciousness must be spread out "all over the place" in the brain. This almost perfectly sets the stage for the proposed wedding of neuroscience and phenomenology. What now has to be considered is the initially mind-boggling idea that both sides of consciousness (both the 'given' and the 'taking' of the 'given' with all its repercussions) have to be inextricably intertwined in all these distributed activities. If both the self and the feelings that the self finds nasty or nice are jointly constituted by

the relations and interactions of the neuronal networks, there is no further or left-over appreciation-phenomenon to be explained. So no further feelings have to be generated, somehow, by novel neuronal activities — no task remains for which quantum effects might possibly come in handy.

Cairns-Smith's stage-setting has discouraged this perspective, however, by postulating the need for a "system-3": "Chemical, neuronal, conscious, there are these three forms of control to be discerned." Why is conscious control an additional sort of control, not simply a function of the chemical and neuronal

competences he has already so brilliantly surveyed? Because, he says, "our multi-sensory experience of the world has a certain unity if only because it is so much simpler than the frantic computing that underlies it." He goes on, however, to see that this answer is too strong: "I think that our consciousness is highly but not completely integrated, and that it is more integrated at some times than others", but then he swings back the other way, asserting that "there should be one boss" and eventually concluding: "Our conscious selves seem to be quasi-independent agents which operate through feelings. And I think they are that."

Over and over again, Cairns-Smith asks himself the right questions and even gives the right answers (in my opinion): "Our consciousness has a certain unity and yet at the same time it has passive and active aspects to it: perception and volition. Anyway that is what it seems 'from the inside', and it is what is needed finally to short-circuit a regress at the level of consciousness. Consciousness must do something. Feelings must have effects." Precisely. But if we take that seriously, we should be able to see — however crazy it seems at first glance — why feelings are not anything over and above the patterns of activity of all those neural signalling processes. And again: "We should consider the possibility that feelings have their own inner workings too." Indeed, but why should those inner workings be postulated to involve quantum-level effects? Cairns-Smith follows Henry Stapp (author of *Mind, Matter, and Quantum Mechanics*, Springer, 1993)

in following William James, and quotes as decisive a passage from James, pointing out, correctly, that James's argument is "hardly conclusive.... But I do not think this spoils his general argument." Well, why not? "The kind of unity of brain which is achieved by assembling molecules together to make successively higher-order machines gives us no adequate insight into how conscious experience is so much of a piece." It all comes down to being very impressed with the much-of-a-pieceness of consciousness.

By his own account, then, he strikes only glancing blows — often retracted — against the constitutive option. Having done that, he goes on to give an illuminating survey of the quantum options, pointing out calmly and clearly the extravagances they variously involve. He is so sane, so honest in this undertaking that his book amounts to the best advertisement yet for this family of options. If anybody can wrest a coherent story out of this jumble of spookiness, Cairns-Smith can, but, for just that reason, many of us conservatives will take heart that we are on the right track after all, for although he succeeds handsomely in fending off brusque dismissal, his attempt to show that we need such measures falls well short. He closes with a dialogue between Advo and Krit, an attempt to give the other side its proper innings. How I ached to take over the controls of Krit! □

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## Out of the shadows

Sally Temple

**Neuroglia.** Edited by Helmut Kettenmann and Bruce R. Ransom. Oxford University Press: 1995. Pp. 1,079. £150, \$195.

DURING his defence of his thesis, a PhD student recently bemoaned the fact that a major neuroscience textbook devoted roughly two of its thousand pages to glial cells. When I was a PhD student, a favourite professor was touring with a lecture entitled "The Astrocyte: Unsung Star of the Nervous System". In keeping with this view of glial scientists as underdogs, the dedication of *Neuroglia* is: "To those who believed in glial cells during the long, dark period when the neuron concept dominated brain science".

Now the underdog definitely has its day. *Neuroglia* is a comprehensive text that covers the gamut, from morphology to physiology to pathology. It is a thorough, thoughtful assemblage of 69 chapters by prominent researchers in the glial field. In such a large book, differences in style are often apparent, and it is a credit to the editors and contributors that the flow is maintained so well. Overall it is readable, interesting and informative.

There is some patchiness, inevitable in a book of this breadth. Rather than pinpoint the relatively minor gaps, I would rather point out a few highlights such as the chapters on non-mammalian (largely invertebrate) glia, microglia (the under-



THE strong affinities between the developing sciences of linguistics and anthropology early this century are shown by the work of Frances Densmore of the Smithsonian Institution, here seen playing a phonographic record of native American utterances to Mountain Chief, a Blackfoot, who interpreted them. The picture is taken from the new paperback edition of *The Science of Words* by George A. Miller. "Lucid, interesting and original", wrote Paul Fletcher in a review in *Nature* 352, 30 (1991). W. H. Freeman/Scientific American Library, \$19.95, £14.95.