the author points out, 150 years later, over half of Americans continue to believe that God has either created species or directs evolution in some way. It seems that science and the human condition will always need a beautiful idea. ■

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With the future in mind

The 21st-Century Brain: Explaining, Mending and Manipulating the Mind
by Steven Rose
Jonathan Cape: 2005. 352 pp. £20
Published in the US as The Future of the Brain *(Oxford University Press, $28)*

John C. Marshall

Steven Rose is both a distinguished neuroscientist and a conscientious citizen who has long been active in left-wing causes. Reflecting this duality, *The 21st-Century Brain* is surely the only book on neuroscience in which the index entry for 'consciousness' includes both 'class' and 'feminist' as subheadings. It is also the only one that the author says "is definitely not about offering some dramatic new 'theory of consciousness'". The omens, then, are good.

Rose offers a fairly comprehensive, albeit simple, account of our current understanding of the brain, of where research might lead us next, and of the ethical issues that already arise from the application of neuroscience and that will multiply rapidly in the near future.

He takes us on the evolutionary journey from the metabolic soup of protocells in sea water to the 100 billion richly interconnected nerve cells that make up the human brain. Yet all the while he insists that the physical brain enables, but does not determine, mental life. The locution allows Rose to stress how individual life histories are "shaped by culture, society and technology", although this observation, however true, does little to bridge the gap between brain and mind.

Indeed, when the chips are down, Rose's position is indistinguishable from one form of dualism: "In the lab we can all aspire to objectivity, examining the workings of other brains — or even imagining our own — yet we go home in the evening to our subjective, autobiographical world, and aspire to make personal sense of our lives and loves." Neuroscientists, he declares, "must learn to live with this contradiction". He is even prepared to believe that the natural sciences are perhaps intrinsically incomplete and must be complemented by the kinds of knowledge we gain from the arts and humanities. Certainly, he sees no reason to believe E. O. Wilson's claim that art, literature and music arose as evolutionary strategies for attracting mates.

I have every sympathy for Rose's position here, but I wonder whether neodarwinism can survive in its present form if we are allowed to pick and choose which behaviours (or their underlying genes) have been subject to natural selection. For example, Rose is convinced that "language evolves to fit comfortably with pre-existing brain mechanisms, and the brain evolves to accommodate these new linguistic potentials". But there is no more hard evidence for these claims than there is for the notion, roundly dismissed by Rose, that human nature was fixed in the Pleistocene 600,000 to a million years ago. At some point we may understand how the roughly 1% genetic difference between chimpanzees and humans is responsible for such a cognitive gulf between the two species, including the capacity for language; at present we are in the realm of 'just so' stories.

Even with respect to Rose's own area of research — learning and memory — the lack of detail in *The 21st-Century Brain* makes the line of argument confusing to the outsider. Rose notes that "because non-human animal brains work very much in the same way as do our own, I am able to work with experimental animals to analyse the molecular and cellular processes that occur when they learn some new skill or task". A little later, however, we discover that "different species have widely differing skills" in what they can and cannot learn. No doubt the two claims are compatible, but it would have been helpful to have the reconciliation spelled out. The section on autobiographical memory only confuses the issue further. Rose reports the position of the psychologist Endel Tulving that memories are not permanently stored in the brain, but rather "actively called into being, in the process of recall". I suspect that Rose would disagree, but sadly he fails to comment.

In the concluding chapters, Rose moves into the controversial realms of mental illness, psychopharmacology, thought control, neurogenetics and biocybernetics. These pages are appropriately sceptical of the motives of drug companies, politicians and generals. Rose argues convincingly that the distinctions between mad, bad and justified violence depend less on the supposedly diseased or normal structure and activity of the brain than on who wields the power. The main issues for "ethics in a neurocentric world", the title of Rose's concluding chapter, seem to have more to do with politics than neuroscience. This chapter is a welcome reminder that we should keep our eyes and ears open, and make our voices heard. ■

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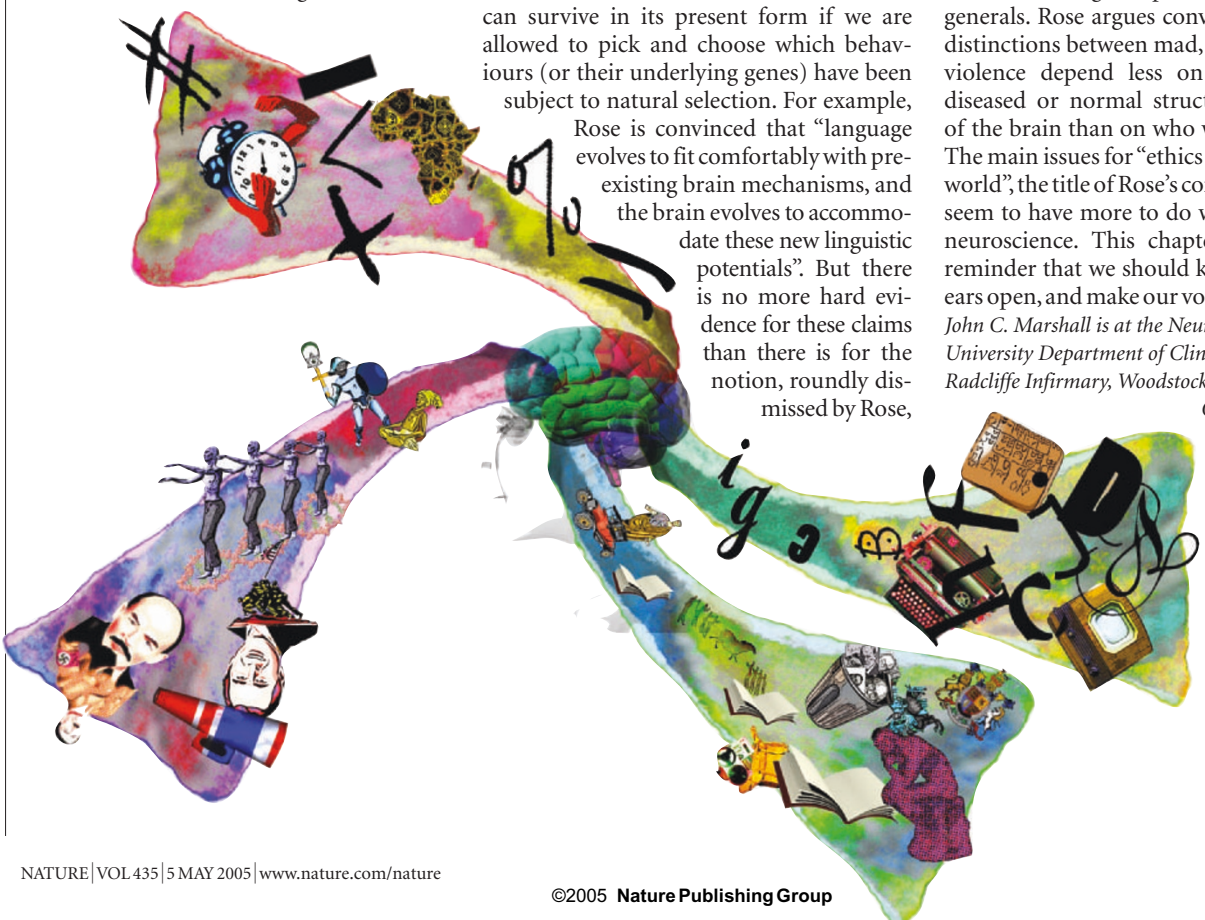

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