

food remains that Brain describes — are not fully digested, but they will provide a rich resource for the depredations of other scientific scavengers. It would be useful for some of these to be of a more statistical inclination. There are, admittedly, methodological difficulties with the analysis of the kind of numerical information that Brain has collected; conventional statistical manipulations are always possible, but it is not always clear that the answers mean much in palaeoecological terms. Certainly his tentative approach, drawing essentially qualitative and specific conclusions through closely argued reasoning, yet presenting the original numerical data in full detail, is better than making more suspicious assertions based on operations only superficially possessing greater mathematical rigour. However, a statistical attack on the problem might be beneficial, for I feel that the data contain more information than the author has at present extracted from them; not that his conclusions are slight.

Brain's meticulous reappraisal seems conclusively to show little evidence of early hominids flailing at each other and at other animals with bone clubs or other weapons. Most of the assemblages are postulated to be the product of hyaenas and large felids such as leopards and the extinct *Dinofelis* that controlled the caves, probably a result of opportunistic predation at hominid sleeping sites. But between Sterkfontein Members 4 and 5 came a change, corresponding to that crucial step in human evolution when man put the cat out for the first time. The later bone collection has an exclusively human character, showing that we had at last attained some dominance

over other predators. Brain's work, however, supports the idea that initially the hominids relied heavily upon scavenging before increasing intelligence and the beginning of technology permitted the greater development of hunting abilities.

It is gratifying to see these very early hominids regarded as animals on their own terms, as species which are extinct and, no doubt, ones which had their own appropriate mode of life and behaviours. Identifying them too simply with models founded either on modern technologically undeveloped peoples or on modern pongids sometimes masks this fact, and it can be avoided by dealing with the matter from a more fundamental ecological basis, as Brain does here.

The Hunters or the Hunted? is a very important book for palaeoanthropology. It presents the first thorough analysis of the Sterkfontein Valley assemblages, contributes significantly to the resolution of lingering controversies and, by placing the

old information in a fresh perspective, enables new and more sophisticated questions to be asked not only of the South African material but of similar assemblages elsewhere. Another contribution is that it reinforces the recent change in feelings as to what constitutes data, for the value of looking at fossil and contemporary bones as closely as this is clear. Brain urges the necessity of recovering fossils with a high regard for subtle detail. I hope that excavators of any vertebrate fossil site will be persuaded to follow his advice and pay more attention to these features of bone accumulations that have been previously neglected; for taphonomy can be a powerful tool in elucidating the problems of fossil assemblages, especially when handled with the care and caution that Brain brings to the subject. □

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Structure in (and of) the neurosciences

Margaret Boden

Meaning and Purpose in the Intact Brain: A Philosophical, Psychological, and Biological Account of Conscious Processes. By Robert Miller. Pp.239. ISBN 0-19-857579-3. (Clarendon/Oxford University Press: 1982.) £20, \$34.50.

ROBERT Miller is a neuroscientist dissatisfied with neuroscience. It has not produced a general theory of consciousness, nor does it regard questions about consciousness, purpose, meaning, understanding or cognition as central. It has contributed little to our understanding of the behaviour of the whole organism, the overall patterns and strategies of living. Instead of "it" one should perhaps put "they", for there are a bewilderingly diverse and narrowly specialized set of neurosciences. In general, neuroscientists ignore psychology and deliberately eschew philosophical speculation.

One cannot but agree with Miller's criticisms of neuroscience. One may even applaud his aim of synthesizing brain research, psychology and philosophy in the search for a theory of consciousness. Nevertheless, despite its laudable intentions, this book is a failure. It does not help us progress significantly towards a theoretical understanding of meaning, purpose, cognition or consciousness.

This failure is grounded in Miller's reliance on an outmoded method of argument, and — ironically, given his critique of professional specialism — in his ignoring recent concepts and forms of argument which offer much greater promise of bringing neuroscience closer to

psychology (and philosophy).

Characteristically, Miller argues from structure to function or vice versa. So he gives an account of consciousness in terms of "omniconnected networks", sets of neurones showing synaptic plasticity and influenced by transmitter substances of various kinds. Doubtless such networks are involved. But, as computer science has helped to show, the notion that specific cognitive functions can be attributed to specific cerebral mechanisms on structural grounds alone is mistaken.

Moreover, computational models of psychological processes provide concepts better suited to express specific cognitive functions than the vague psychological terminology used by Miller. Marr's physiologically-informed work on the visual system, for instance, is nowhere mentioned (though his earlier work on the neocortex is cited). Marr argued that neuroscientists will need to specify the computational tasks that the brain must (or might) be performing, before discovering which physiological mechanisms are performing them. Whether or not one regards this claim as overly sweeping, it is effecting radical changes in our view of physiological psychology. Miller's book is gravely flawed by its failure to consider the usefulness of computational ideas in neuroscience. □

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Journals' review issue 1982

On October 7th *Nature* will publish a second review supplement devoted to science journals. Last year's supplement, covering journals first published between January 1978 and May 1980, appeared in *Nature* 293, 341-369; see p.343 of that issue for details.

Criteria for inclusion of a journal in the 1982 issue are that:

- the first number appeared, or the journal was re-titled, between June 1980 and May 1981;
- it is published at least three times a year;
- the main language used is English.

Broadly, periodicals of professional interest to scientists will be considered for review, with the exception of abstracts' journals.

In addition it is hoped to cover publicly available newsletters, first published between January 1978 and May 1981, in that issue.

Publishers and societies are invited to submit four sample issues of periodicals satisfying the above criteria, including the first and most recent numbers, to the Review Editor, *Nature*, 4 Little Essex St, London WC2R 3LF, England (London 836 6633 ext 2570) as soon as possible.