

connived in handing over the captaincy of our fate to the editors of these journals.

These editors are largely full-time professionals who, as Slack writes, are too sensitive to fashion and can be over-suspicious of really new work where the level of rigour cannot be as high as with investigations into familiar territory. The most original papers will be better sent to specialized journals where the editors are more often research scientists, the acceptance rate is higher and papers are more often reviewed. (In *Development*, which Slack names as a leading journal in his field, only 7% of submitted papers are sent back without review.)

But young scientists looking for a career in research may fail if they publish only in specialized journals. They cannot dare to be adventurous, knowing that it is safer to stay near where they started, restricting their project and manicuring their manuscript into whatever form is currently in vogue. Increasingly, many scientists believe that networking with colleagues (possible reviewers of their articles) and with the editors themselves are profitable investments of their time.

Slack ends by telling any would-be biologist to be adventurous, indeed, to fish "in some backwater thought hopelessly unfundable". He notes, "the fashionable stuff always involves lethal competition and is sure to be mined out within a few years". Choose something that interests you personally, "then if you don't get your paper into *Cell* ... you will at least have spent some time doing something ... you felt was really worthwhile". Very good advice, but why have we allowed our career structure to become so distorted that it may prove suicidal to follow it? □

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Darwinizing psychology

The Evolution of Mind

edited by Denise Dellarosa Cummins and Colen Allen

Oxford University Press: 1998. 264 pp.

£25, \$41.13

Andrew Whiten

One of the most significant achievements of evolutionary psychology has been to seriously question the traditional view that we possess a general-purpose intelligence that can analyse any aspect of human experience with equal aplomb. Humanity in the image of a divine being is perhaps the most extreme expression and source of this view. In contrast, an evolutionary perspective reveals human minds, like those of other species, to be imperfect, relatively jerry-built devices



Getting a head

The trebling of brain size in hominid evolution from *Australopithecus* to *Homo sapiens* is explored in this piece of "Brainart" by Evian Gordon, head of the Cognitive Neuroscience Unit at the University of Sydney, Australia. Entitled "Our shared evolutionary history", it comes from *Your Future Self: a Journey*

to the *Frontiers of Molecular Medicine* (Thames & Hudson, \$27.50) by the science popularizer and documentary-maker Hank Whittemore. The book presents images from molecular and cellular biology for non-scientists in an attempt to inspire awe in the unfolding revelation of our inner universe.

that are shaped by natural selection to deal with a specific set of problems in the species' ancestral environment. Minds are expected to have cognitive blind spots.

Recent studies summarized by Gerd Gigerenzer and by Denise Dellarosa Cummins in the two opening chapters of *The Evolution of Mind* show that our celebrated reasoning power works pathetically in some cases. Evolutionary theory can explain this. Gigerenzer's examples are relevant to most scientists who, even if they do not consider themselves divine, take a certain pride in their rationality and numeracy. For example, estimate the probability that a woman with a positive mammogram actually has breast cancer, given that: (1) the probability that a patient has breast cancer is 1%; (2) if the patient has breast cancer, the probability of correct diagnosis from the mammogram is 80%; and (3) if the patient has no cancer the probability of a positive test is 10%. The typical answer given by a large sample of physicians was around 75%. The correct answer is in fact one order of magnitude smaller.

Gigerenzer's explanation is that ancestral reasoning processes never received input in the form of such probabilities and so are not naturally adapted to interpret them. By contrast, a common ancestral form of information was the raw frequencies of different events. When the cancer problem is cast in simple frequencies, people are more likely to arrive at the correct answer. Imagine

answering the question again, having seen 10 cases out of 1,000 with both a positive mammogram and cancer, and 100 cases with a positive mammogram and no cancer.

Gigerenzer's beautifully executed opening chapter is exciting for at least two reasons. The first is the revolutionary implications for our view of the human mind: human reasoning may not be homogeneous but may run on both rational and non-rational tracks that only make sense from the perspective of evolutionary psychology. In Gigerenzer's own terms, we are moving towards an understanding of our "bounded rationality". The second reason for excitement is that these insights not only are relevant to academic disciplines, but also have serious practical implications, ranging from medicine to the legal system to the teaching of statistical reasoning.

The Evolution of Mind is therefore a timely collection. The authors of its 10 chapters are drawn from departments of psychology, philosophy, biology and anthropology, and the book covers both human and non-human minds. The substantial chapter by the primate ethologist Marc Hauser and the developmental psychologist Susan Carey is particularly important in this respect because it counters the dearth of truly comparative studies. They apply the same experimental techniques in probing the minds of both monkeys and pre-verbal human infants, to discriminate shared cognitive

primitive concepts (such as basic quantifiers as one/another) from mental operations emerging in only one of these species.

However, the book does not attempt to represent evolutionary psychology as a whole. There is no coverage of the burgeoning literature on mate-choice or altruism, for example. 'Mind' is interpreted as the 'higher' cognitive functions, with two chapters devoted to reasoning, two to numeracy and two to language. Even here, there is no attempt to be comprehensive; cognitive mapping, tool use or cultural learning, for example, are not included. Since the rationale for this selectivity is not explained, the book has the feel of being a whimsical sampling of current thought on the evolution of mind. Thus, although the well-written chapters could be read individually as introductions to their specific areas, the book is not an overview for students. That said, some contributions are original and merit the attention of advanced scholars in both evolutionary psychology and related disciplines.

Some of the philosophers' contributions are unusually refreshing, particularly since they engage the concerns of practising scientists, as in Elliot Sober's chapter on the appropriate interpretation of Lloyd Morgan's famous canon: "In no case may we interpret an action as the outcome of the exercise of a higher psychical faculty, if it can be interpreted as the outcome of the exercise of one which stands lower in the psychological scale."

Two chapters deal with the underlying rationale of evolutionary psychology more directly. Colin Allen and Eric Sidel build the case that although a certain cognitive structure may be uniquely human, the origins of at least some of its components may well be evolutionarily traceable. They illustrate this by examining the primate counterpart of language's ability to refer a listener to topics.

In the final chapter, Lawrence Shapiro identifies the core of evolutionary psychology: "what Darwin did for psychology is to license and ground the ascription of teleological functions to mental processes." Readers new to, or suspicious of, evolutionary psychology should perhaps read this chapter first. □

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More on the mind

Reaching into Thought: The Minds of the Great Apes

edited by Anne E. Russon, Kim A. Bard & Sue Taylor Parker
Cambridge University Press, £24.95

The Evolution of Consciousness
by Euan M. Macphail
Oxford University Press, £15.99, \$28

How the Mind Works
by Steven Pinker

Perigee, £9.99

Earth's internally generated motions

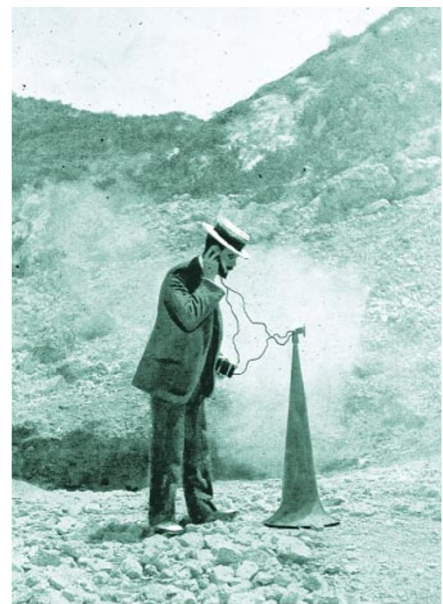
Theoretical Global Seismology

by F. A. Dahlen and Jeroen Tromp
Princeton University Press: 1998. 1,025 pp.
\$80, £60

Paul G. Richards

Global seismology began in the 1880s when the first teleseismic recording was made in Europe of an earthquake in Japan. For decades the subject developed as the study of the seismic body waves that propagate through Earth's deep interior, and the surface waves that are confined to the crust and upper mantle. Such waves can now be faithfully recorded across vast ranges of frequency, wavelength, distance and amplitude; and we study them for what they can tell us about the seismic source — perhaps an earthquake or an explosion — and about the Earth's structure through which they have travelled.

Since the underlying seismic motion can be quantified using linear wave equations, and since the Earth is a body of finite size, we know that all seismic motions of our planet can be expressed as a sum of the Earth's normal modes. Conceptually, every seismogram of every earthquake and explosion is a sum of the same set of decaying sinusoids, each of which begins its oscillation at every point of the planet when the earthquake begins. In practice, the set sums to zero until the first body wave arrives, and thereafter it is a representation of the ground motion at that recording station.



Communing with nature: a 1917 seismologist listens to the rumbling of Italy's Solfatara volcano.

Theoretical Global Seismology by F. A. Dahlen and Jeroen Tromp consists of more than 1,000 pages and 10,000 equations and is motivated by the simplicity and elegance of this idea of mode summation. It is the first book to pull together the necessary details to address the complications arising from the fact that our planet departs slightly from elastic behaviour and is far from homogeneous.

First, the authors present the continuum mechanics that are needed to quantify features exhibited by the Earth — anelasticity, heterogeneity, anisotropy, high internal stress, rotation and spontaneous failures of

New in paperback

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by Michael W. Friedlander
Westview Press, £11.95, \$17

The Call of Distant Mammoths: Why the Ice Age Mammals Disappeared

by Peter D. Ward
Springer, \$15, £11.50

Colonialism and its Force of Knowledge: The British India

by Bernard S. Cohn
Princeton University Press, \$17.95, £12.95

The Astronomer's Universe

by Herbert Friedman
W. W. Norton, \$14.95, £10.95

Sir Aurel Stein: Archaeological Explorer

by Jeannette Mirsky
University of Chicago Press, \$20, £15.95

Redeeming Culture: American Religion in an Age of Science

by James Gilbert
University of Chicago Press, \$19, £15.25

The Kindly Dr. Guillotin: And Other Essays on Science and Life

by Harold J. Morowitz
Counterpoint, £8.95, \$12.50

Linear Programming and Extensions

by George B. Dantzig
Princeton University Press, \$29.95, £23.95

From Savage to Negro: Anthropology and the Construction of Race, 1896–1954

by Lee D. Baker
University of California Press, \$17.95, £12.95

Fairweather Eden

by Michael Pitts & Mark Roberts
Arrow, £8.99