

words in the debate, such as emergence, constraints and contingency. With such a tangle of terminology, is it any wonder that outsiders are reluctant to enter the fray? What's more, that the uncertain terminology was (or appeared to be) used to obfuscate the debate has made it easy for many to dismiss the ideas altogether.

Eldredge claims, for instance, that his perspective of selection is different in an important respect from that of Williams and Dawkins. Organisms have, he argues, both "economic" and "reproductive" activities and this, he suggests, is missed by evolutionary genetics. But in its mathematical form, this view of selection seems to be no different from that of conventional population genetics.

Perhaps this is the great stumbling-block: the debate has been dominated by metaphor, not by mathematics. Contrast this with the equally acrimonious debate between selectionists and neutralists. Here the issues at stake are more transparent because the mathematics makes the assumptions clearer, the conclusions more robust and the disagreements open to experimental resolution.

Yet Eldredge makes, I think, an acceptable case that there really were (and are)

issues at stake as well — not great issues as the author insists, but issues nonetheless. Constructive things have come out of the slanging matches. As he discusses, the criticism that phylogeny was not taken into account in the testing of adaptive explanations provided the stimulus behind the comparative method.

Perhaps more importantly, the interventions of palaeontologists hint at difficulties to be faced by mainstream evolutionary biology. Some things have changed. Most notably, the tempo and mode of evolution are back on the agenda. Although stasis in the fossil record is still an open issue, there is a growing acceptance that other kinds of stasis constitute a real problem. Why, Williams has asked, do all eutherian mammals, whether Arctic or Saharan, have more or less the same body temperature? Differences would have been expected and, were they to be found, would be just another example of adaptation. Instead of a heated debate, is it not about time that we had a debate about heat? □

Laurence D. Hurst is in the Department of Genetics, University of Cambridge, Downing Street, Cambridge CB2 3EH, UK.

Karube argues that "in the developed countries where materialism has reached saturation point, the future of electronics depends on the problem of what sort of approach to take towards the brain, the neurons and the mind". On this subject, two different answers are given, even in this short book. Kazuhiro Fuchi suggests that most human intellectual activities will gradually turn into sports, whereas Shun-Ichi Amari speculates that the human brain processes an object not in terms of symbols but intuitively and unconsciously as form. He thus proposes that increasingly machines will perform symbol processing.

With such a spread of opinion, it is hardly surprising that MITI has difficulties in identifying the industries of the future. What is surprising is that of the two leading Japanese technologies, optoelectronics and production technologies, the book all but ignores the second. This is part of Japan's problem. Some 75 per cent of its exports is production equipment for components and materials. The development of these products takes a long time and, with increasing financial difficulties in Japan, their future is unclear. Yasuhuru Suematsu illustrates the malaise with the comment that "the head of a securities firm said that it didn't matter if Japanese technology worked out provided Japan keeps control of finance and information. I was shocked."

This shows that Japan's problems are becoming progressively similar to those of the West and that its academics may have to follow the example of their colleagues in the United States where "you have to shout and publish often, otherwise you don't survive", as Makoto Nagao puts it. For those with a general interest and background knowledge in technology, many clues about how their colleagues in Japan think, especially those at Tokyo University, can be gained from this book. □

Anders Hansson is at 20 Leyborne Avenue, London W13 9RB, UK.

Speaking for themselves

Anders Hansson

Technology's New Horizons: Conversations with Japanese Scientists. Edited by Hiroaki Yanagida. *Oxford University Press: 1995. £19.99, \$35.*

ACADEMIC historians dislike simple models. But for those who lack historical memory, simple models provide a starting point for an understanding of the past, present and future. They are particularly useful for Japan, and can go some way to explain the pessimistic mood prevalent there today. Beginning with the Meiji restoration, Japan's history can be divided into 40-year cycles: 1865–1905, from the restoration to victory over Russia; 1905–45, from increasing militaristic expansion to defeat; and 1945–85, with the rebirth of economic power.

If the trend continues, then the present cycle, lasting to 2025, will be one of decline. True, export-led reinvestment following the 1973 oil-price crisis did result in an annual growth of 6 per cent in the late 1980s. But many economists, industrialists and politicians during that period, including Nakasone Yasuhiro, the prime minister from 1982 to 1987, were in fact principally preoccupied with trying to avert the beginning of the fourth cycle of economic decline. As it turned out, 1986 was the high point of Yasuhiro's time in office, and in 1990 the bubble

burst. The effects continue to undermine the economy today. Again, the reason is largely historical: for many senior executives it is vital to avoid what happened in the Showa depression (1927–32), which resulted in the active militarism that still tarnishes Japan's international reputation.

So an industrial revival without an economic crisis like that of Anglo-American capitalism is the aim of most Japanese leaders. The Ministry of International Trade and Industry (MITI) assumes that this can be achieved along with an annual economic growth of 1 per cent, which gives time for change. Industrial horizons are closer than that. Within the next five years, new industries must be developed to maintain employment and social stability, leading industrialists claim.

Against this general background, *Technology's New Horizons* gives an interesting insight into the views of senior scientists in Japan. As usual, it is often the contributors' off-beat comments that reveal the most important things. The editor, Hiroyuki Yoshikawa, wonders "if capitalism has the power to resolve the contradiction between these infinite desires and finite resources". He even talks about an "infinity cult" in the natural sciences: "biology may have more of a flavour of what is finite, but molecular biology, I think, has no interest in it at all". Isao

Corrections

In this year's New Journals supplement (21 September), the caption on p.265 refers to a book by Christopher Langton as *Artificial Intelligence*. It is in fact entitled *Artificial Life: An Overview*. MIT Press, \$42, £24.95.

The wrong publisher was given for three books recently listed as new in paperback. *Science on Trial* by Douglas J. Futuyma, *A Primer in Ecology* by Nicholas J. Gotelli and *Exploring Evolutionary Biology* edited by M. Slatkin are published by Sinauer and distributed in Europe by W. H. Freeman.