Old companions who learn new tricks

Hunting dogs take to the water with their Micmac owners in nineteenth-century Canada. In *A History of Dogs in the Early Americas* (Yale University Press, $27.50, £21), Marion Schwartz tells how these versatile companions have coexisted with humans for 12,000 years, whether reared for food, used in hunting, sent to war or revered as guides to the afterlife.

So what is Cromer's solution? We must, he says, agree on what high-school graduates should know about science and then develop a coherent curriculum to produce students who have this knowledge. Cromer criticizes the US National Science Education Standards for not accomplishing this task and being laden with educational gobbledegook. A *de facto* set of ideas and skills already exists, he says, in the 'General Educational Development' test, or GED, a rigorous seven-hour high-school equivalency test of language skills, social studies science and mathematics given to adults. A pass in GED or a high-school diploma is required in the United States to attend college or technical school or to apply for most jobs. A novel idea is to have all ninth-graders take GED before they can go on to the final three years of high school — or leave school or go into a training programme. "It is vitally important that there be a meaningful intermediate certificate to provide young people with an honorable way to leave school after ninth or tenth grade. The drive to push everyone through twelve years of academic study has made 'drop outs' of those who are unable or unwilling to do so."

To ensure all students get at least to the GED level will require another unfashionable idea — ability grouping, in which students are grouped by their ability to perform certain tasks. Cromer does not intend this to be 'tracking', where students are permanently assigned to high, medium or low IQ groups, but a looser, less-permanent grouping that students can move in and out of as their skills and knowledge improve. He believes ability grouping is especially important if low-achieving students are to meet the minimal GED-type standards, because these students need special attention to develop even the most basic understanding.

Cromer enjoys the role of curmudgeon, and the forceful way in which he writes cannot help but engage the reader. (Speaking of criticisms of intelligence testing, he growls: "There are few educators who know enough arithmetic to balance a checkbook, let alone understand a multivariant logistic regression analysis".) But this leads to the occasional overstatement that frustrates or annoys. His physics is better than his social science and history. A chapter explaining why the uncertainty and indeterminacy of quantum mechanics makes the visible world in which we live certain and determined is an excellent antidote to postmodernists' claims about the lack of objective reality and the supposed inability of science to explain it. His discussion of intelligence is better than his discussion of race: as a physical anthropologist, I was dismayed by his confusion of the concept of equality with that of identicalness (the former social and legal construct is independent of the latter biological one). He combines the principles of natural selection with observations of animal and human behaviour to produce a new theory of human social organization. Here the yin of hierarchy and loyalty was selected with the yang of individualism and rebelliousness as adaptive traits in early human social environments. Although I am generally sympathetic to sociobiological and evolutionary approaches, I did not find the discussion fully persuasive.

But these are minor glitches in what is certainly a stimulating and thought-provoking book. Although the hats on the good guys and the bad guys are perhaps both whiter and blacker than in reality, one should definitely consider Cromer's analysis. There is a lot to be said for systematically teaching science from the part to the whole. □

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Fins, legs, fins

Ancient Marine Reptiles
edited by Jack M. Callaway and Elizabeth L. Nicholls
Academic: 1997. Pp. 501. $64.95, £49.95

Michael W. Caldwell

This book hails itself as the long overdue revision of Samuel Williston's *Water Reptiles of the Past and Present* (1914). The claim invites comparison. Williston wrote his book by himself; 28 authors, contributing 17 chapters and 6 introductions, have produced *Ancient Marine Reptiles*. Williston's book was devoted to a taxonomic and biological review of marine reptiles, and not one page described or named a new taxon; four chapters in *Ancient Marine Reptiles* are purely descriptive, serving only to give names to, or to revise, a single genus or species.

If there is a critical flaw in this edited volume, if there is one feature where it drifts from the tradition of Williston's book, this is it. Simply put, these four chapters should have been published as journal contributions, leaving more space for the remaining 13 synthetic chapters. To my mind, an up-to-date assessment of a particular field should focus on the contrast between observation and theory; innovation is found in the distillation and synthesis of disparate data points and the resulting generation of new questions. It is a pity that there was not more room in this volume to address these contrasts in depth.

Nevertheless, I applaud this volume. Most chapters are well written and pertinent. The figures are informative and the references accurate. Highlights include the chapters by McGowan and by Motani, which provide excellent reviews and interpretations of new faunas and data sets; Rieppel's chapter on Triassic sauropterygians, even though it barely reviews his recent mountain of revisionary publications; and Bell's chapter on mosasaur phylogeny, which unfortunately only scratches the surface of his PhD thesis, with no discussion of the implications of his character analysis.

The last four chapters, with a lengthy introduction by Massare, reveal the main

palaeobiological issues underlying the study of ancient marine reptiles. Did fins evolve to legs and back to fins again? And what was more important, homoplasy or homology? Selection or constraint? Unique morphologies or modifications of the old? Marine reptiles are a model system for posing a broad range of questions about the evolution of tetrapods in aquatic environments. We often consider cetaceans or pinnipeds in this light, yet forget that ichthyosaurs were 'dolphin-like' about 190 million years before the first proto-dolphin even thought of going for a swim. □

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Axioms for biology

Foundations of Biophilosophy
by Martin Mahner and Mario Bunge
Springer: 1997. Pp. 423. $54, £36.50

Paul E. Griffiths

The logical empiricist consensus that existed in the philosophy of science until the 1960s held that the ideal statement of a scientific theory would be a formal axiom system of the kind found in mathematics. The biologist J. H. Woodger is remembered for his attempts to make biology live up to this ideal. For reasons too complex and varied to explore here, few philosophers of science now try to make scientific theories axiomatic.

It is therefore surprising to find the biologist Martin Mahner and the philosopher Mario Bunge formulating their general account of biology using the logical apparatus of predicate calculus and set theory, complete with axioms, definitions and corollaries. Their aim appears twofold: to ensure consistency between their views on diverse topics and to ensure that their biological views are as tightly constrained as possible by the metaphysics that occupies the first third of their book. This introductory section takes a stand on most of the basic questions of metaphysics and epistemology. Topics covered include basic ontology (the nature of events, properties and things), the interpretation of the probability calculus and the nature of truth and evidence. Philosophers will be frustrated at the speed with which Mahner and Bunge dismiss alternative positions, and biologists should beware of taking their often strongly stated views to represent a philosophical consensus. However, it is hard to see how these problems could be avoided without turning this into a book on metaphysics and epistemology, rather than biology. Bunge has argued at length for his views in many other works.

Perhaps the biggest surprise is that there is no discussion of the reduction of Mendelian to molecular genetics. This is the topic in the philosophy of biology most influenced by the axiomatic method. The original idea of 'theory reduction' was that the axioms of one, formalized theory should be derived logically from those of another, thus showing that nothing is lost when the former is replaced by the latter. This omission is more surprising because the coverage of the book is otherwise excellent.

There are two further surprises in Mahner and Bunge's biophilosophy. First, they reject 'population thinking': evolution is not about ensembles of individuals but about types of organism. They argue that these types, which include species, are in some sense 'natural kinds'. They strongly reject the consensus view, deriving from David L. Hull and Michael Ghiselin, that taxa are ontologically akin to individual objects such as nations rather than to natural kinds such as gold. The second surprise is the authors' radical approach to developmental biology: development is not guided by a genetic program. Instead, Mahner and Bunge call for a synthesis between the 'structuralist' approach to development, which seeks emergent laws of complex biological systems, and the 'constructionist' view that the control of development cannot be localized in one material cause.

Having adopted this radical perspective, Mahner and Bunge attack existing structuralists and constructionists in a manner worthy of Trotskyite splinter politics. The structuralism of Brian Goodwin must be rescued from "holism, (crypto)idealism and subjectivism" by the adoption of Mahner and Bunge's metaphysical scheme. My own advocacy of constructionism with the biologist Russell Gray "must be judged as an utter failure" because of a "severely flawed ontology" which I share with A. N. Whitehead and Hull.

Mahner and Bunge convict most existing biological theorists of basic metaphysical errors, something they hope to avoid through their formal, axiomatic method. For example, Theodosius Dobzhansky characterized evolution as change in the genetic composition of populations owing to "altered interactions with their environment". The authors may be right that it is strictly organisms rather than populations that interact with the environment, but I remain unconvinced that Dobzhansky's slip shows "how easily habits of speech may obfuscate clarity and proper theorising".

This tendency to over-diagnose fundamental metaphysical confusions and to deduce absurd apparent consequences reduces the usefulness of this book as a text for students, despite its admirably wide coverage of the subject. The axiomatic framework and use of logical symbolism will also be unattractive to students, especially those in biology. □

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When the rains come

Climates of South Asia
by G. B. Pant and K. Rupa Kumar
Wiley: 1997. Pp. 320. £75, $130

Julia Slingo

The climate of South Asia is dominated by the monsoon, which returns with remarkable regularity each summer and provides the rainfall needed to sustain more than 60 per cent of the world's population. The vastness of the Asian continent and the unique configuration of the East African Highlands and the Tibetan Plateau mean that the Indian summer monsoon is the most vigorous and influential of all the monsoon circulations. Increasingly, the monsoon is being seen as an important player in the global climate.

It is fortuitous that the first book detailing the climatology of South Asia should be published on the fiftieth anniversary of India's independence. Without the influence of the British Raj and scientists such as Blanford, who in 1886 recognized "the paramount importance of knowledge of distribution of rainfall in space and time", the comprehensive database that provides the core of this book might not have been realized.

The book brings together the vast literature and data resources of India and its neighbours (Pakistan, Bangladesh, Nepal and Sri Lanka), providing a comprehensive description of a wide range of topics, from extreme weather events to the environmental impact of climate change. It is generally well written, although unfortunately the authors had not updated much of the material to include the most recent observations. For those seeking an understanding of the physical mechanisms involved in the climatology of South Asia, its weather systems and its year-to-year variability, this book provides little in the way of answers. That said, it is a valuable teaching aid, is likely to appeal to the more casual reader and is an excellent reference book for dipping into. □

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