The problems of a dinosaur

Dale A. Russell

Dynamics of Dinosaurs and Other Extinct Giants. By R. McNeill Alexander. *Columbia University Press: 1989. Pp. 167. $30.*

IT IS not easy to write simply, clearly and concisely. R. McNeill Alexander is a master of the art, as he shows in this charmingly quantitative volume which deals primarily with the biology of dinosaurs.

Many of those interested in dinosaurs (including myself) lack an adequate background in the principles of physics and engineering as they apply to vertebrate morphology. Those principles are demonstrated in a sampling of topics including assessments of the weights of dinosaurs, their motion as revealed by trackways, their 'athletic' ability, the structure and function of the backbone, reproductive competition and metabolism. Flight in pterosaurs and swimming in giant marine reptiles are also considered, as is the controversy surrounding the extinction of the dinosaurs and subsequent giantism in mammals and birds. The text is all the more valuable for its open-minded and non-polemical tone.

Many stimulating insights emerge from the book. Among those I particularly appreciated are the comments on the ability of sand and wet clay soils to support weight; the apparent lack of athleticism in brontosaurs and in *Tyrannosaurus*; the use of the tail in kangaroos to offset angular momentum generated by the legs in hopping; the small size of the horns in *Triceratops* relative to horn–body-weight trends in antelopes (were *Triceratops* jousts correspondingly less energetic?); the prediction of a neck 'crumple zone' to absorb the shock of head-to-head impact between two colliding dome-headed dinosaurs; the suggestion that duck-billed dinosaur females (like human females?) tended to prefer mates with deeper voices; and the physical reasons for the importance of aspect ratio to fluid dynamics.

There are, however, points to disagree with. For example, the vertebrae in the brontosaur neck are extraordinarily pneumatic, and the specific gravity of the neck may well have been less than that of the body, contrary to what Alexander implies. Indeed, the neck was often partly or completely separated from the body upon burial, possibly because of its relative buoyancy (and, perhaps, because of the absence of a single, powerful neck tendon). In the book, no conclusions are drawn with respect to 'hot-bloodedness' in dinosaurs; among the various kinds of evidence cited, however, predator–prey ratios as preserved in the fossil record are said to be probably the most significant. In the Cretaceous assemblage from Canada (Oldman Formation) that Pierre Béland and I have examined, the ratio happens to suggest that dinosaurian carnivores had metabolic levels less than those of mammals. I would agree, though, with the suggestion that, in the case of the 'cold-blooded' alternative, the standing crop of large dinosaurian herbivores might well have been spectacular.

Many fascinating problems suggest themselves from a thoughtful perusal of this book. Specialists should read it, reflect on it and let Professer Alexander have their ideas for further research. Those disparate disciplines, physics and palaeontology, have much to offer each other. □

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Stan Ulam

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From Cardinals to Chaos: Reflections on the Life and Legacy of Stanislaw Ulam. Edited by Necia Grant Cooper. *Cambridge University Press: 1989. Pp.320. Hbk £40, $75; pbk £15, $24.95.*

I SUSPECT that, like me, most mathematicians have heard of Stanislaw Ulam but have come across his name in connection with no more than one or two mathematical disciplines. With this prejudice, I felt that Ulam's contributions to mathematics were not great enough to warrant such a weighty, large-format book as this. I was wrong — the number of areas in which Ulam produced original work is quite surprising, and it would take a person with very wide interests fully to appreciate the range of his endeavours.

There are three parts to the book. In the introductory section, Ulam is known to everyone as Stan and the reader gets on first-name terms with him too — appropriately so, for it is always good to know what drives the leaders and visionaries in any academic subject and how they go about their lives away from the formality of the written paper. Fellow mathematician Gian-Carlo Rota, Ulam's close friend, is responsible for much intimate insight and sets the informal tone with an anecdotal article which gives an appreciation of Ulam's personal and scientific qualities. After several other revealing and fond tributes, part two gives an appreciation of his scientific legacy. The layout is attractive and the articles are littered with sketches and pictures as well as reproductions of letters from von Neumann to Ulam, his colleague. The unpredictable, even chaotic, bitty format makes for enjoyable reading.

The scientific articles are well written in accessible style. They testify to Ulam's crucial and often early intervention in many key research areas, after which he generally left others to flesh out the ideas. Several papers contain beautiful colour plates. Together with the book's great bulk, these suggest that *From Cardinals to Chaos* should be put out for browsing alongside other large-format, glossy volumes. Yet a glance at the index shows that it contains plenty of mathematical detail and the contents are much more demanding than the initial appearance suggests.

The overwhelming scientific impression is of a strong cross-fertilization between the various strands of Ulam's interests in science, particularly physics, and mathematics. Some of the titles of the papers — "Strange Attractors and Number Theory", "Ergodicity and Biomathematics", "Nonlinear Sciences", "Molecular Genetics" and "Turbulence" — testify to his wide-ranging vistas.

The last part, entitled "The Ulam Touch", is short but highly entertaining, and consists of hitherto unpublished items. It says much about Ulam the man. We should be grateful that Rota has transcribed some of his conversations with Ulam on general philosophical points as well as discussions about some of his most famous acquaintances such as von Neumann, Erdös, Teller and Gamow. There are also touches of hilarity, with a "memorable memo", and a "Trialogue" written by Ulam which parodies the arguments of both the pro- and anti-nuclear lobbies around him during his time at Los Alamos. The "Trialogue" was described by Ulam as a "top-secret skit", not meant for public consumption, and that "posterity should decide".

Anyone who reads this attractive and highly informative book is likely to conclude that Ulam was a scientist of great originality, and that posterity will acknowledge his many seminal contributions. □

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