Webs of intrigue

J.L. Cloudsley-Thompson

Spiders: Webs, Behavior, and Evolution. Edited by William A. Shear. *Stanford University Press: 1986. Pp.492. $55.*

WHEN, in his arbitrary way, Callimachus the Alexandrian announced that a big book is a big nuisance, he cannot have had in mind books like this one. It is, indeed, fairly large — nearly 500 pages in length — but far from being a nuisance and a bore it is an intellectual delight. Twenty-five years ago, worthwhile publications on the webs of spiders, their construction and functions, numbered a few dozen at the most. The bibliography of the present volume occupies over 38 pages, and the books and papers listed in it have mostly appeared in recent years.

The 13 chapters have been written by internationally recognized arachnologists, and it is no coincidence that they are either American or have done a lot of work in the United States — no longer is the study of spider behaviour confined to European naturalists and amateur zoologists. Four of the authors are ecologists who look at problems of web-building from the viewpoint of the interactions of spiders with the environment and with one another; eight are interested in behavioural biology (although half of them began as taxonomists); three others adopt a highly technical approach, focusing a laser beam on a single, vibrating silk thread; and one has found computers useful in monitoring the activities of a social species of spider. There are contributions on the selection of web sites, webs as sensory transducers, and the effects of the geometry of webs on their efficiency in catching prey: surprisingly, many orb-web spiders have reduced or even lost their web, so that they use up less rather than more silk.

By the secretion of chemical mimics of the sex-pheromones of Lepidoptera, certain spiders are able to attract male moths to a bolas of silk whirled by one of the legs. Other species construct narrow ladder-webs which attract large numbers of moths: as the prey slides down the elongated web, it sheds its scales until it has lost so many that its body is held firmly in place by the viscid threads. One nocturnal spider has acquired the anomalous behaviour of preying, not on flying insects, but on pedestrian arthropods. Its asterisk-shaped web has no sticky elements, and serves only to signal the presence of prey which is then wrapped with a swathe of silk so that the spider can administer a poisonous bite. Yet other species actively net prey in diminutive webs held between their legs.

Some spiders are kleptoparasites, living in the webs of larger species and stealing prey from them. More than a few attack their hosts as well. There is even a small parasitic spider that crawls over the bodies of larger species, feeding on the fluids that ooze from the prey of their hosts. Other of the more interesting topics developed in the various chapters are the monophyletic origin of the orb-web, and the evolution of web-building behaviour. It may surprise some readers to learn that jumping spiders (Salticidae), the quintessential visual predators of all land invertebrates, and equipped as they are with large and highly specialized eyes, have nevertheless evolved from web-building ancestors.

This is a book of puzzles, problems and paradoxes in spider behaviour, a synthesis of much recent work carried out, often in extremely uncomfortable tropical conditions, by a number of young and enthusiastic research workers. It is not difficult to understand the reasons for their motivation. □

J.L. Cloudsley-Thompson, Department of Zoology, University College London, Gower Street, London WC1E 6BT, UK, is Emeritus Professor of Zoology in the University of London.

Debatable physics

Michael Redhead

The Ghost in the Atom: A Discussion of the Mysteries of Quantum Physics. Edited by P.C.W. Davies and J.R. Brown. *Cambridge University Press: 1986. Pp.157. Hbk £17.50, $29.95; pbk £6.50, $9.95.*

HISTORICALLY, arguments about the interpretation of quantum mechanics divide into three periods. First, from 1927 to 1935, there was the famous debate between Bohr and Einstein over Bohr's complementarity interpretation. Bohr considered that quantum mechanics had led him to a profound metaphysical discovery about the physical world and our epistemological relationship to it; roughly, he argued that a complete understanding of microphysical reality requires us to recognize the existence of incompatible (complementary) descriptions, couched in the language of classical physics, but relativized to the specification of the whole experimental context in which that particular aspect of reality is being displayed. This is the so-called Copenhagen interpretation. Einstein argued that such relativization signalled a limitation in the completeness of the quantum-mechanical description, a fact which he sought finally to demonstrate in the famous paper he wrote with Podolsky and Rosen in 1935.

Bohr refused to accept the reasoning in that paper, and such was his charismatic authority that the scientific community in effect declared him the winner and for the next 30 years Copenhagen orthodoxy reigned supreme. However there were some dissenters, notably David Bohm, who in the early 1950s produced a "completed" interpretation of quantum mechanics along the lines envisaged by Einstein. However, Bohm's interpretation involved violently nonlocal features, whereas Einstein's 1935 paper had been predicated on the assumption of no-action-at-a-distance.

The third period of lively debate stems from the mid-1960s, when John Bell showed that any "completed" version of quantum mechanics must exhibit nonlocality as a result of violating the now famous Bell inequality. Two matters have been the centre of recent interest. First, are there any hidden assumptions in Bell's argument in addition to locality which could be impugned if the inequality is violated? And second, is the inequality actually violated experimentally? A succession of positive answers to the second question (after some initial indecisiveness) has culminated in the recent work of Aspect and his collaborators in Paris. With regard to the first question it is now largely accepted that "completed" versions of quantum mechanics do involve some feature of nonlocality, but of a rather subtle kind that does not for example allow the construction of "Bell" telephones for superluminal transmission of information!

The present book originated in a programme for BBC Radio 3 in which Paul Davies interviewed eight physicists with widely differing views on the interpretation of quantum mechanics. The most diehard defender of the orthodox position is Sir Rudolf Peierls. He announces: "there is only one way in which you can understand quantum mechanics". Such dogmatism (which is also factually incorrect) is what a number of other contributors are reacting against. In particular, Bohm and Hiley each explain how the traditional view of an external reality, possessing all its attributes independently of observation, can be accommodated in their quantum potential approach. They fully recognize the holistic or nonlocal features arising in their interpretation, but argue that this does not contradict the special theory of relativity, understood as applying to statistical effects.

Aspect lucidly describes the special features of his own experiments, while John Bell explains how he arrived at his inequality by "thinking intensely all around these questions". Bell usefully emphasizes that Aspect's experiment is not directly concerned with settling questions about indeterminism, of God's playing dice with the Universe, but bears directly on the distinct issue of non-locality. It is true, however, that one's understanding of this