

IMAGE
UNAVAILABLE
FOR
COPYRIGHT
REASONS

Wallace, aged 30 . . .

IMAGE
UNAVAILABLE
FOR
COPYRIGHT
REASONS

. . . and at 46.

measure of security for the remainder of his natural life was an act of expiation". It is a dramatic language: "Darwin understandably panicked". And the reader might understandably panic, too: "Both letters exhibit guile, glibness, and guilt mixed with integrity and honor".

Darwin was distressed when Wallace's 1858 article reached him but distress does not prove guilt. There is no evidence that Darwin plundered Wallace's paper for ideas and wrote them into his own manuscript. Darwin had been brooding on his theory for years and had not written his book and I find his outcry about loss of priority entirely natural. Darwin did not seize on Wallace's idea of divergence and make it his own in the supposed two-week interval between receipt and admission of receipt of Wallace's 1858 article. In 1855, Wallace had written in a paper appearing in the *Annals and Magazine of Natural History* (16, 184-196): "But if two or more species have been independently formed

. . . then the series of affinities will be compound and can only be represented by a forked or many branched line". As for the mechanism, Darwin had written to Asa Gray in 1857 (and the letter is not a fake) of: "an unerring power at work in *natural selection* (the title of my book)" and of a principle of divergence "which shows that organic beings seem to branch out into all the places available".

I find no case against Darwin. I think that the explanation for Wallace's partial eclipse from the evolution-by-natural-selection debate is less dramatic. Darwin's fame came not from the appreciation of a new biological theory by a few members of the Linnean Society but from the intelligent reading public. Evolution by natural selection was a revolutionary theory but the public of Victorian England did not read the proceedings of the Linnean Society. It read books. And the readers, shattered by the convincing mechanism for a process which was already a subject of conversation, were troubled by the implications of the theory for the status of man.

Wallace did not write an *Origin* (it was Darwin who provided a detailed account of the process of organic evolution which was accessible to the reading public) and Wallace developed unacceptable ideas about the evolution of man. Finally, Wallace, the younger man by 14 years, insisted that their theory should be called Darwinism, summing up the situation himself when he wrote to Darwin in 1864:

Animal arms races

John R. Krebs

Tooth and Claw: Defensive Strategies in the Animal World. By J. L. Cloudsley-Thompson. Pp.252. (Dent/Biblio: 1980.) £9.95, \$22.50.

THIS is a popular book about the ways in which animals defend themselves against predators and the counter-adaptions of predators to overcome their prey. It covers similar ground to *Defence in Animals* by M. Edmunds (Longmans, 1974) and *The Ethology of Predation* by E. Curio (Springer-Verlag, 1976), but is aimed at a more general audience.

Most of the text consists of examples, many based on the author's own observations of different kinds of anti-predator adaptation and tricks used by predators to catch their prey. Examples of camouflage, mimicry, venoms, defensive spines, armour and so on are described in a charming and entertaining way. Most readers are certain to come away with at least one or two good coffee-time stories. My favourite is about the African water mongoose, which is alleged to catch birds by sticking its rear end in the air and distending its anus to make it look like a

You had worked it out in details I had never thought of, years before I had a ray of light on the subject, and my paper would never have convinced anybody or been noticed as more than an ingenious speculation, whereas your book has revolutionised the study of natural history.

But I am glad to see a book that publicizes Wallace's contribution to the theory of evolution by natural selection, a book that reprints both the 1855 and 1858 species papers — though it is a pity that Darwin's 1858 contributions were not included for the reader to make his own judgement — and a book that has some hilariously scabrous comments in the "Author's Notes". Wallace's name is heard today much more often than it was in the nineteenth century, partly because of the lessened obsession with the evolution of man and the increased interest in other implications of the theory, partly owing to the work of the historians of science and partly because of the return to fashion of evolutionary zoogeography founded by Wallace and stamped indelibly with his "line". But the more Wallace is linked with Darwin as a co-founder of the theory of evolution by natural selection, the more will historical accuracy be served. Thus, even a negative book like this contributes to the subject. □

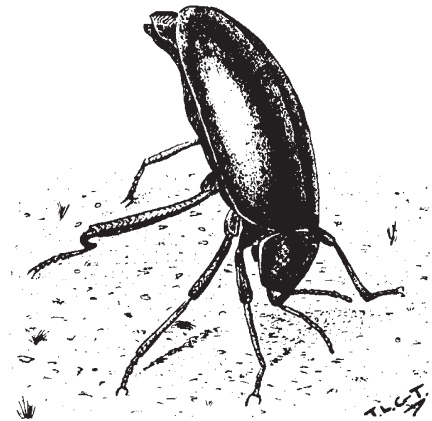
Wilma George is a Lecturer in Zoology at the University of Oxford, and the author of Biologist Philosopher: a Study of the Life and Writings of Alfred Russel Wallace (Abelard-Schuman, 1964).

ripe fruit. Along comes an unsuspecting bird to peck at the fruit and with a smart about turn the wily mongoose snaps it up! Second place goes to the story about frogs' legs and the genitalia of French soldiers in nineteenth century Algeria (without giving too much away, the British are right to stick to pie and chips), and a close third is the account of how large tropical scolopendromorph and scutigermorph centipedes escape from attackers. When attacked or frightened, they shed one of their back legs; the automatized leg leaps around making loud creaking or stridulating sounds to attract the attention of the predator while the nonagintanovipede slips silently away.

Cloudsley-Thompson also tries to extract some general principles about coevolution of predators and prey. He draws a parallel between military arms races and the coevolutionary race between predators and prey. In both military and coevolutionary races, adaptations or innovations by one party call forth counter-adaptations by the other. These counter-adaptations lead in turn to counter-counter-adaptations and so on. One general principle applicable to both kinds of race is the concept of a "trade off" between competing demands. Heavy armour may render a tank less vulnerable

to shell fire, but at the same time it reduces speed and mobility. In the same way animal defences may work well against one kind of attacker but be much less effective against others. The king cobra, for example, is venomous enough to kill an elephant, but is itself killed on occasions by the mongoose with its superior agility.

A closely related idea is that every defensive adaptation has a "cost" which might, for example, be measured in terms of energy that could otherwise be channelled into reproduction. One of the most convincing pieces of evidence for the cost of anti-predator adaptations comes



Chemical defence: when disturbed, *Eleodes* sprays a secretion at the attacker from its abdomen.

from the study of chemical defences in plants (and is therefore not discussed by Cloudsley-Thompson). R. G. Cates (*Ecology* 56, 391-400; 1975) has shown that wild ginger plants (*Asarum caudatum*) in places where slugs are common channel more energy into chemical defence (they taste nastier) at the expense of seed production and growth than do plants of the same species where there is little grazing pressure.

The book touches on some issues without trying to discuss them in their full complexity. For example, in the discussion of Müllerian mimicry (mimicry in which several unpalatable species share the same colour patterns) Cloudsley-Thompson presents the conventional argument that a shared colour pattern reduces the chances that an individual will be killed by a predator in the process of learning to associate colour with distastefulness; the larger the pool of similarly coloured prey

individuals, the smaller the chance that any one of them will be killed. While this argument seems to be correct, it leads one to expect that all unpalatable species living in the same habitat should share the same warning colour patterns. In fact it is known that neotropical butterflies, for example, form several different Müllerian mimicry complexes within the same habitat (C. Papageorgis *Am. Sci.* 73, 522-53; 1975).

The mechanism of evolution of warning coloration is also glossed over, with no mention of R. A. Fisher's suggestion that it might have arisen through kin selection.

However it would be churlish to criticize a popular book for not exploring recondite details. The main aim of Cloudsley-Thompson's book is to entertain and stimulate the reader. In this it succeeds. □

John R. Krebs is a Lecturer in the Edward Grey Institute of Field Ornithology, Department of Zoology, University of Oxford.

Animals for the coffee table and student

Bryan Turner

The Complete Encyclopedia of the Animal World. Edited by David M. Burn. Pp. 400. (Octopus: 1980.) £12.95, \$17.98.

THE diversity of animals, the sheer numbers of species, and the richness of their differing forms and functions has always fascinated people. It attracts the curious layman and for biologists begs answers to questions of "how?" and "why?". Although this book has been written and designed to adorn the coffee tables of the general public, students of zoology will find much to interest them. The book is of a higher intellectual standard than that customarily associated with this sort of glossy volume, in part due to the impressive list of contributors. Each section has been written by an acknowledged expert in that particular field. Skilful editing has successfully combined the many and varied styles of the contributors in a way that makes section to section differences unobtrusive.

The text is complemented by a beautiful series of colour photographs and novel illustrations. Although most of the illustrations are useful, some are confusing: for instance, in a figure of the distribution of the geological plates of the Earth's crust the key is absent so that the variously coloured boundaries are meaningless. Perhaps somewhat more important than minor irritants of this nature is the discussion on the links between the chordates and the non-chordates (essentially but not precisely equivalent to the vertebrates and invertebrates). Here the widely held ideas of a link involving the hemichordate acorn worms are dismissed and a new but little accepted theory involving the fossil calcichordates is

expounded. In a general text such as this the most widely accepted views of the experts should surely take precedence, and any new and highly controversial ideas take second place.

The main part of the book is a catalogue of the different groups of animals which is sandwiched between chapters on special aspects of animal life. There are introductory chapters on ecology, in which the biologists' "how?" and "why?" questions are briefly considered, and on taxonomy explaining the classificatory process. This latter section is introduced by a full colour photograph of the book's editor in the guise of a lepidopteran taxonomist supposedly illustrating the qualities of "Patience, experience and a good eye" — perhaps a book on brass instruments will be next! Other specialist chapters include such topics as locomotion, migration, senses, associations, endangered species and a useful section on the major zoos and national parks of the world. The foreword, curiously by David Bellamy, the "Botanic Man", is accompanied by a picture of him riding a tortoise. To ensure that we recognize him, the usually sufficient facial characteristics have been supplemented by those other well-aired taxonomic features — the hairy legs!

These asides apart, this book does represent a good, balanced and informative account of the immense variety of animal life. Although unable in 400 pages to live up to its title "Complete", it is none the less a very creditable contribution from the Octopus stables. □

Bryan Turner is a Lecturer in Zoology at King's College, London.



AMERICAN NUCLEAR SOCIETY'S PUBLICATIONS

*Complete Nuclear
Publications and
Services Worldwide.*

Inquire about specific
interests.

For Free Publications
and Services Catalog,
contact:

American Nuclear Society
555 N. Kensington Avenue
La Grange Park, IL 60525
U.S.A.

Circle No. 02 on Reader Enquiry Card.