the basic assumptions in what one feels at times is a crusade to purge the literature of half-truths. Some detailed proofs and alternative derivations are left as (well-hinted) exercises for the reader. The approach works well for maser theory, which occupies the first two-thirds of the book. This part is not always easy going, but the reward for the hard climb is a broad overview of the subject, from the theoreticians' perspective.

In the last third of the book, Elitzur reviews the observed masers and their use as astronomical tools. This material will not submit readily to textbook treatment, so here the author's style changes to that of a monograph or review. The coverage is broad and comprehensive, but necessarily more superficial than the treatment of maser theory. Researchers will want to consult the observational review articles that are cited, where they will also get a stronger taste of the excitement of current research and the glamour and spectacle of masers. Masers are not only intellectually challenging, they are also fun, and this is one ingredient that I missed in this otherwise clear and excellent introduction. The book is an essential purchase for workers in the field, and will also interest other astrophysicists and researchers in related areas of physics. □

R. J. Cohen is at the Nuffield Radio Astronomy Laboratories, Jodrell Bank, Macclesfield, Cheshire SK11 9DL, UK.

Crab canon

F. A. Huntingford

Assessments and Decisions: A Study of Information Gathering by Hermit Crabs. By R. W. Elwood and S. J. Neil. *Chapman and Hall: 1991. Pp. 192. £29.95.*

How does natural selection act on behavioural traits? Or more specifically, what are the effects of animals' behaviour on their fitness? In recent years (some might say not before time), behavioural ecologists have recognized that to answer these questions it is often necessary to understand the mechanisms that generate adaptive behavioural responses — in other words, to study what causes animals to behave as they do. But integrating studies of the causes and consequences of behaviour is not at all easy. In *Assessments and Decisions*, Elwood and Neil address this task, using data from an elegant body of experimental research conducted over the past decade or so on decisions made by hermit crabs as they seek out and fight over the shells in which they live.

Hermit crabs in general (and in particular the small species such as *Pagurus bernhardus*) are well suited for such studies. Their shell is a precious resource, the species and size of which can make the difference between life and death. Encounters between crabs and shells, and between crabs and crabs, can easily be set up in the laboratory, and the responses that the crabs use to assess shells and opponents are clearly visible and easy to record. These encounters are illustrated by the many exquisite photographs in the book.

Elwood and Neil begin by defining and discussing the basic concepts. The term 'assessment' is mainly used to describe situations in which "some aspect of the environment is perceived and the information [is] used as a factor in decision making"; 'decision-making' is used to refer to "a process by which behavioural change is non-random". The authors next describe the behavioural ecology of hermit crabs and the biology of their study population of *P. bernhardus*. The scene is then set for the two main sections of the book in which motivational models are developed to explain the crabs' shell-related behaviour.

Elwood and Neil describe how crabs assess the quality of an unoccupied shell, presenting a single-factor motivational model of the behavioural mechanisms involved. They then provide an account of the shell fights, explaining in the context of games theory the role of shell value and opponent size in decision-making. The single-factor model for unoccupied shells is then expanded into a two-factor graphical model. Here, a crab's assessment of the value of the contested shell and of the probable costs of continuing a fight determine its choice of responses. The authors scrutinize how well their models explain the crab's behaviour and describe experimental tests of the models' predictions. They conclude by explaining how their models go beyond others, expressing the hope that this "will result in advances in our appreciation of how animals make assessments and decisions".

This is a very good and enjoyable book, and the experiments are described in a clear, concise and accessible way. Elwood and Neil address an important question of general interest to behavioural ecologists and "those interested in motivational analyses" (the intended audience of the book). Nevertheless, I have mixed views about whether the hope expressed at the end is realistic. Although the experiments described in the book contribute greatly to our understanding of how animals make decisions, I do not feel that the models (in the graphical form in which they are presented) add much to a simple verbal statement of the hypotheses they embody. This may well be just a personal quirk, though — it certainly does not detract much from the book's considerable value. □

F. A. Huntingford is in the Department of Zoology, University of Glasgow, Glasgow G12 8QQ, UK.

Wartime interest in radar technology and microwaves led directly to the development in 1951 of the first maser device by Charles H. Townes (middle) and colleagues at Columbia University But the original idea also seems to have been independently conceived by Joseph Weber at the University of Maryland, and by Alexander M. Prokhorov (left) and Nikolai G. Basov (right) at the Lebedev Physics Institute in Moscow. The field grew rapidly and involved many of the people who later developed the laser. This fascinating and often controversial history is told in Jeff Hecht's *Laser Pioneers*, which contains 13 interviews with the researchers who made the breakthroughs. A revised edition is now published by Academic Press, price $39.95.