research and literature with presentation of new findings. The subject of one is an applied study of the effect of pesticides in deterring ant predation of aerially sown agricultural seed. This seems out of place in a volume on coevolutionary relationships. New ideas on ant-plant associations emerge from a few chapters, including the hypothesis that myrmecochory is an adaptation of plants living in poor soils. The final chapter is a worldwide review of ant-plant interactions that in quality supersedes other reviews of which I am aware. It is followed by an excellent comprehensive bibliography of literature up to and including 1981.

The value of this collection is in its synthesis of past literature and present research on ant-plant associations in Australia, North America, and South Africa. In addition, it develops in the reader an awareness of research in progress and provides easy access to the literature for those entering or interested in the field. It is a valuable companion to recent review papers on granivory in desert ecosystems and community structure in ants and a worthwhile supplement to current treatments of animal-plant coevolution.

JAMES F. A. TRANIELLO
Department of Biology,
Boston University
Boston, Massachusetts 02215

Salt Appetite

The Hunger for Salt. An Anthropological, Physiological and Medical Analysis. DEREK DENTON. Springer-Verlag, New York, 1982. xx, 650 pp., illus. $149.80.

This book is by far the most comprehensive examination yet undertaken of the abundant and diverse literature on the appetite, or hunger, for salt. Denton's goal is to set the subject in a broad context by discussing it from both a behavioral and a biological vantage. Using this discussion as a basis, Denton then addresses the wide-ranging and at times controversial literature on the medical implications of salt intake and the etiology of hypertension. Much of the work of Denton and his colleagues is discussed in the book.

Sodium is essential for such processes as neuronal function, cellular metabolism, and blood pressure regulation. A central theme of the book is that for many mammals, particularly humans, selective pressures favored the evolution of mechanisms insuring adequate levels of sodium. Denton cites anthropological evidence suggesting that environmental salt was scarce throughout much of primate and human evolution. He goes on to suggest that by virtue of a largely vegetarian diet (meat was rarely available) sodium intake was low relative to potassium intake and that this dietetic pattern favored the development of salt appetite and a complex endocrine system for sodium conservation. In a chapter on salt in history, Denton discusses the symbolic and social, as well as the physiological, aspects of salt.

Denton gives numerous examples of salt hunger exhibited by animals in their natural habitats and by humans in clinical studies. The salt appetite drive is aided by a recognition system in the salt taste receptors. Denton reviews the evidence that sodium deficiency, and presumably also experience, can enhance a hunger for salt. He discusses the contribution of taste to the more general problem of learning to consume foods that are nutritious and to reject those that are toxic. The rich literature on learned appetites and learned aversions illustrates the capacity of organisms to associate the taste of a substance with its gastrointestinal effects.

In addition to salt appetite, animals have efficient mechanisms for retaining salt by way of increased activity of the renin-angiotensin system and aldosterone biosynthesis in response to physiochemical changes associated with sodium regulation. A significant part of the book is devoted to research investigating these changes and the degree to which they may be causally linked with both endocrine response and salt appetite. For much of the discussion Denton draws upon his own research, in which sheep are used as a model preparation for the study of endocrine factors and sodium and water homeostasis. One of the more controversial chapters concerns the putative brain renin-angiotensin system and its possible role in sodium deficiency.

In the final chapter, on salt intake and hypertension, Denton argues that excessive salt intake throughout life is a plausible factor in the genesis of hypertension, particularly given selection pressures that favor both salt hunger and salt retention. Confronted with a high-salt environment, humans are naturally inclined to overindulge in salt but have insufficient mechanisms for excreting it. Along these lines Denton suggests that the greater incidence of hypertension among North American blacks may be the legacy of greater and more persistent stress on sodium homeostasis.

Initially, the book's length is startling given the subject matter, but the length is easily understood given the book's scope. The book contains controversial but interesting material on cannibalism, pica, and electrical brain stimulation and stream of consciousness passages that may seem peripheral to the topic but are nevertheless woven nicely into the fabric of the book. Most of the published work on salt hunger appears in review articles, book chapters, or symposium proceedings; Denton's book is the only place where all the literature is integrated in a single text. He should be applauded for his authoritative and scholarly effort.

ROBERT J. CONTRERAS
Department of Psychology,
Yale University,
New Haven, Connecticut 06520

Solar Astronomy

The Sun, Our Star. ROBERT W. NOYES. Harvard University Press, Cambridge, Mass., 1982. viii, 264 pp., illus. $20. Harvard Books on Astronomy.

The study of the sun is, after the study of planetary motions, the oldest branch of scientific astronomy. In spite of its obvious importance as the source and sustainer of life on the earth and as a Rosetta stone for the study of other stars, the sun tends to get little or no attention in many beginning university astronomy courses and textbooks in this country. This is one reason that *The Sun, Our Star* is so welcome. It is an accurate, up-to-date review of solar research, written for the intelligent person who has a little knowledge of physics and astronomy.

The Sun, Our Star replaces the book *Our Sun* by the late Donald H. Menzel in the series Harvard Books on Astronomy. The Menzel book, first published in 1949, was a spirited description of the solar research of that era. It was a thorough review, accurate yet entertainingly written—in short, a tough act to follow. But Robert Noyes has risen to the occasion, creating a comprehensive description of the sun and of current research on its structure, its active phenomena, and its ultimate fate. The book is attractively illustrated with photographic views of the sun in its many aspects and numerous diagrams to help as Noyes leads the assiduous reader through the complexities of solar research.

The book is sprinkled with interesting asides, such as a story about a flock of homing pigeons disoriented and ulti-

mately lost because of a large magnetic disturbance that originated from an energetic flare on the sun or references to our descendants billions of years from now and their heroic efforts to maintain their civilization throughout the vicissitudes of the later evolution of the sun. Such an approach keeps the account of the subject from becoming overly pedantic, and the result is a very readable book.

The book begins with a description of the sun as an astronomical object. Stars are the fundamental building blocks of the astronomical universe. Fortunately the sun is quiet and well behaved compared with many of the more bombastic stars studied by astronomers. There is a chapter on the interior of the sun, including a discussion of the means we now have of "observing" the interior layers. This is a new and particularly exciting aspect of solar physics, and this account of the topic brings the reader up to the latest research results. A chapter on sunspots and solar activity is richly illustrated and presents the whole puzzling story of the 11-year solar activity cycle and its many fascinating aspects. The latest views on the mechanism of the activity cycle are discussed, and a thorough treatment of the "Maunder minimum"—the 70-year interval about 300 years ago when the activity cycle seemed to disappear—places this event in the context of other suspected long-term historic activity minima and maxima. The author also devotes a chapter to recent spacecraft observations of the sun, covering wavelength ranges that are inaccessible from the ground. Such observations have been productive and have brought about a whole new approach to problems such as the mystery of the heating of the solar corona.

One of the most interesting chapters deals with possible connections between the sun and the earth's climate. This is the first popular discussion I have seen of this topic, and Noyes handles what is in fact a very controversial subject fairly and objectively. This subject has been characterized at times by poor or incomplete statistical analyses to the extent that it was for a time not a "respectable" one to study. More recently interest has increased in sun-weather relations, especially after the demonstration of some irrefutable correlations, but a mechanism for a connection between the sun and the earth's climate still eludes us.

On the whole, there is a good balance in the book between the various aspects of solar research. One might wonder, however, why the author included a chapter on energy alternatives for the future of our civilization. The chapter is an interesting essay on the subject, but even if solar energy generation is a viable long-term solution to the world's energy needs this topic really has nothing to do with the sun or solar research.

The book can be recommended for the reader who is curious about the astronomical universe. Those who follow the author in his careful explanation of the sun will be richly rewarded for their efforts.

ROBERT HOWARD

Mount Wilson and Las Campanas Observatories of the Carnegie Institution of Washington, Pasadena, California 91101

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