

salt cedars are deadly among willows; and human populations continue to kill for food and water. Living with the natural world is tough, hard work, requiring sacrifice and energy. We must never play dirty tricks on students of any age.

Finally, an important note about the Johnson Publishing Company. This relatively small publisher is making every effort to be environmentally correct. Not only are they publishing on recycled paper, but they are using soybean-based ink (a renewable resource), sewing with cotton thread, using biodegradable glue and replacing the plastic wrapping with a semi-transparent paper of natural fiber.

The important message contained in the book, combined with the environmental sensitivity of the publisher, presents an important prescription for the future. Reading the book once will stimulate one to read it a second time. The end notes and appendix will be important references for years to come.

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Animal Consciousness. By Daisy Radner & Michael Radner. 1989. Prometheus Books (700 East Armherst St., Buffalo, NY 14215). 250 pp. \$34.95 hardcover.

Animal Consciousness is a two-part examination of the philosophical question, "Are animals conscious of themselves as a living entity, and if they are, what are the implications for humans in our various relationships with animals (ecological, the use of animals in biomedical research, agricultural production, keeping of pets, etc.)."

The book is clearly divided into two parts. The first part is devoted to a philosophical discussion of the question, "What is consciousness?" The authors address the question initially from a historical viewpoint, starting with a discussion of the attitudes of Greek philosophers, primarily Aristotle, and swiftly work up to the 17th century philosophers, primarily Descartes.

Within this framework they ask a number of questions, such as what is mind? Is it a substance in the Aristotelian sense—does it have form, color; can it be seen; what is consciousness; and what is the relationship of mind to consciousness; can consciousness be tested and if so, how?

From the beginning the authors emphasize that their viewpoint hinges on

the proposition that most scientists or philosophers who have addressed these questions have done so from an anthropocentric position. The Radners indicate that they believe we ought to use a zoocentric viewpoint in order to arrive at a realistic conclusion.

The primary philosophical purpose of this first section, subdivided for clarity into five chapters, is an indepth examination of what actually is Descartes' theory of mind, and, once this theory of mind is properly reconstructed, is there any justification for denying a Cartesian mind to animals? This section is a concise, clear summary, and anyone who took Philosophy 101 in college (even if she/he has never opened a philosophy theory book since) should be able to follow the argument.

Part two is the payoff for scientists. It advances the discussion to include Darwinian evolutionary theory and post-Darwinian thinking. Here the authors' primary interest centers on the relationship between consciousness and intraspecies, as well as interspecies, communication. Obviously, in man we can examine consciousness through the medium of language, but what is the role of the various means of communication used by animals? Predictably we begin with language acquisition by higher primates and review the work of the Gardiners' Premak, Terrence, etc. We proceed, also predictably, to bee communication, signaling in sticklebacks, monkey calls, alarm calls by large carnivores and so on. The questions asked, and answered in the affirmative, are: Are these types of communication intentional? Can they be studied scientifically and therefore yield scientifically valuable data?

Having arrived at the conclusion that in a zoocentric sense animals do indeed have consciousness, and that this property can indeed be empirically examined, the authors affirm that this must have bearing on the morality of our relationship with, and treatment of, animals.

Enter the value of this book for the biologist. Increasingly, in elementary, high school and college classrooms, the questions of animal rights arise, whether we are discussing ecological problems, economic/ecological problems, i.e. the use of woodlands for the lumber industry, medical research or dissection lab exercises. Admittedly, this book is not summer hammock reading. It is, however, well worth the effort. I would also point out that the book is unique. I have not come across another discussion solely devoted to

this topic in the literature. The style is clear, the philosophic expositions easy to follow, the conclusions clearly delineated. The occasional repetitions are used primarily to re-emphasize or clarify a point. I would like to see it available in all high school and college libraries.

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The Ants. By Bert Hölldobler & Edward O. Wilson. 1990. Harvard University Press (79 Garden St., Cambridge, MA 02138). 732 pp. \$65.

This is an incredible book. It will be the standard reference work on ants until well into the next century unless the authors publish a revision. Dedicated to "the next generation of myrmecologists," this book should inspire many a reluctant scientist or educator to devote more time and energy to these remarkable animals.

Is my enthusiasm colored by my preconception that ants are inherently interesting? Doubtless. But the authors have anticipated that there might be a general lack of enthusiasm for this subject. The first chapter is titled, "The importance of ants." The authors write, "The neglect of ants in science and natural history is a shortcoming that should be remedied, for they represent the culmination of insect evolution, in the same sense that human beings represent the summit of vertebrate evolution." Though you might disagree, the authors pique your interest by appealing to your chauvinism.

Ant diversity and abundance is legendary. In New Guinea, 219 species were collected in one square mile, and in the Ivory Coast there are an estimated 20 million worker ants per hectare. Ants are found almost everywhere, from the Arctic Circle to Tierra del Fuego. They are predators, seed harvesters, leaf-cutters and fungus-cultivators. Ants can live in all kinds of natural and unnatural places from dead stems to abandoned plumbing to the inside of plaster walls. Some species can even spend two weeks or more under water! As subjects for studies in behavior, ecology and evolution, they offer unparalleled opportunities. The authors wish to persuade all of us, from teachers of elementary school to graduate professors, that ants have been underutilized as objects of study. I must agree.

The final chapter (20) of this book