BOOKS: PHILOSOPHY OF BIOLOGY

# Finding Purpose in Life

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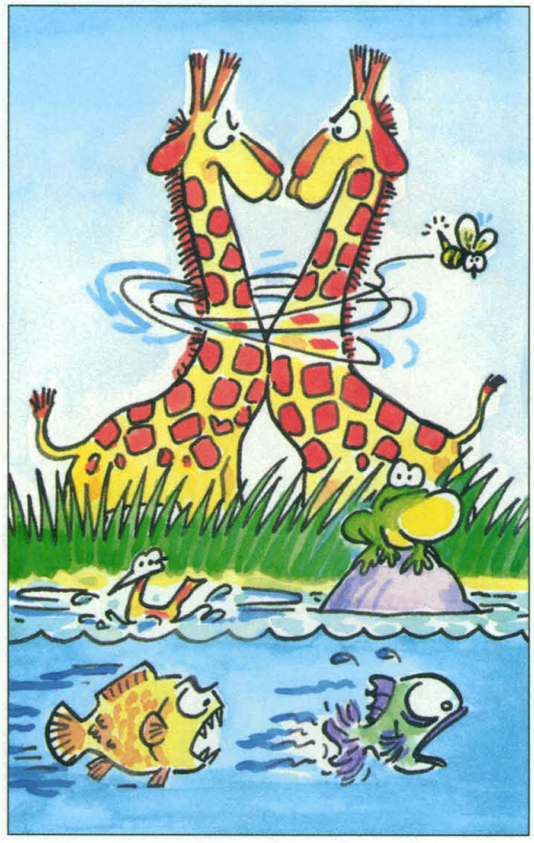
**Nature's Purposes**
**Analyses of Function and Design in Biology**
*Colin Allen, Marc Bekoff, and George Lauder, Eds.*
MIT Press, Cambridge, MA, 1998. 603 pp. $55. ISBN 0-262-01168-9. Paper, $30. ISBN 0-262-51097-9

Biologists often speak and write about the functions of animal and plant structures. We may tell you, for example, that the function of the piranha's sharp teeth is for biting chunks out of prey, and that the rattlesnake's rattle is for warning off potential attackers. We discuss the functions of behaviors as well as of structures; male frogs call to advertise themselves as mates and the function of bats' calls is to locate prey and obstacles. The language we use is described as teleological.

We often find ourselves asking teleological questions: what is the function of this structure or behavior? For example, it has generally been held that the long necks of giraffes evolved because long-necked ancestors were better able to eat leaves from the higher branches of trees, but Robert Simmons and Lue Scheepers have offered a different explanation (*1*). They observed that, even in the dry season when food is least plentiful, giraffes in the wild seldom feed with their necks fully stretched. Male giraffes, however, fight by swinging their heads and necks at each other, which suggests that the long neck is primarily for fighting rather than for feeding. Another recent example of a discussion of function concerns phalaropes, small sea birds that float on the surface of shallow water, swimming rapidly round in small circles. Bryan Obst and his colleagues showed that this movement drives surface water radially outwards, drawing water up from below to replace it (*2*). Thus small animals that had been resting on the bottom are brought to the surface, where the bird can reach and eat them.

The dogma is that teleology is unscientific, and in some contexts it is. Statements that the sun is for lighting the world, or that the moon is for calculating the date of Easter, have no place in science. But teleological language is often used by biologists, and can hardly be avoided except by circumlocution. Some biologists may regard it merely as appropriate shorthand, but for many of us it is the best way to convey what we have to say.

Teleological language is commonly justified by reference to natural selection. If piranhas have sharp teeth because the fish best able to bite chunks out of prey were favored by natural selection, then surely the teeth are for taking bites from prey. A problem with this approach is that there are very few cases in which the selective advantages given by different traits have actually been measured. It seems plausible to suppose that the evolution of piranha teeth was driven by selection for cutting ability, but we have no direct evidence that that was the case.



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An alternative view is that teleological statements merely tell us what things do. If the piranha's teeth cut through the flesh of prey, then that is their function. This usage can lead to difficulties, as several of the authors in *Nature's Purposes* point out. Bigelow remarks that the function of bee's stings seems clear, even though most individual bees never use their stings. Similarly, Nagel is reluctant to conclude that the function of long hair on dogs is to harbor fleas.

The editors of this book are a philosopher, a student of animal behavior, and a functional morphologist. They have assembled 22 papers on the nature and functions of teleology in biology, published at various times between 1964 and the present, most of them in philosophical journals. These offer many different viewpoints, but also cover the same ground repeatedly. From the frequency with which the later papers refer to the earlier ones, it appears that at least most of the key papers have been included. The editors have added a 22-page introduction.

Not surprisingly, the papers by biologists, more than those by philosophers, are concerned with problems that biologists face in the course of their work. There is a paper by Rudwick on how we can infer the functions of structures in extinct animals. To test whether a fossil structure had a particular function he compares it to a paradigm, the best imaginable design for performing that function. It is arguable that this method would prevent us from concluding that the function of the mantle of an extinct cephalopod was for swimming, because it could have swum faster and more economically with a fish-like tail.

In another paper written by biologists for biologists, Gould and Vbra point out that the current function of a structure may not be the one that directed its earlier evolution; feathers evolved originally as heat insulation, but happened to have potential for flight. Gould and Vbra offer the term "exaptation" for such traits, but even though their paper was published 16 years ago the term has found little use in biology.

Philosophers of biology may find this collection useful, as a convenient compilation of the major papers in one part of their field. Some of them may wish to teach advanced courses on teleology, in which case their students will find this book most helpful. But practicing biologists seem less likely to make much use of the book; for us, a short critical review of the field would have been more attractive.

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**References**

1. R. E. Simmons and L. Scheepers, *Am. Nat.* **148**, 771 (1996).
2. B. Obst *et al.*, *Nature* **384**, 121 (1996).