INTRODUCTION

Aim of this Book

Animal Behavior Desk Reference, A Dictionary of Behavior, Ecology, and Evolution is an annotated dictionary intended to help aid scientific communication, in particular in the fields of animal behavior, ecology, evolution, and related branches of biology. I created this book for students, teachers, researchers, writers, editors, and others active in science. This third edition contains over 800 new terms and definitions, 48 new figures, and thousands of additions to and improvements of material presented in the second edition.

A book such as this one can never be complete. Therefore, I certainly welcome constructive criticisms and further information that should be included for its improvement, such as previously published definitions, new definitions of existing terms, your view of definitions already in this book, and new terms with their definitions. Your e-mails (barrowse@georgetown.edu) and annotated reprints regarding these subjects are especially welcome. If you have coined a term(s) included in this book, and I do not attribute this properly, please let me know.

Many references are secondary ones, *e.g.*, "Smith (1946 in Jones 1990)," because I wanted to indicate the source of an author's interpreted information, because I could not examine certain primary references, or for both reasons. If I have cited your work secondarily, I would be very pleased to receive a copy of your publication (with highlighted relevant parts) to facilitate quoting your work directly in the future. Further, if I have misinterpreted your writing with regard to a definition(s) or other information, please let me know.

The Need for Precise Terminology

Austin (1957, 7–8) told us "... words are our tools, and, as a minimum, we should use clean tools: we should know what we mean and what we do not, and we must forearm ourselves against the traps that language sets us." It follows that for effective, efficient communication, people should have, or at least understand, the same precise terminology. Such terminology can certainly aid the advancement of basic, theoretical, and applied science. Phenomena are often further elucidated when they are placed into proper order with useful names (Brosius and Gould 1992, 10709). Dawkins (1986, 110–111) discusses how definitions have had an enormous impact on the way people perceive, *e.g.*, in communication. "They have affected what we regard as 'communication' and 'signals' and whether we see communication as involving any sort of transfer of information. . . . Much of the confusion over 'information transfer,' too, appears to have been largely brought about by the way it is defined. Arguments which appear to be over something profound about animal communication (such as whether information is being transferred or not) often turn out to be nothing more than whether a protagonist is adopting the technical or the more everyday meaning of the term." As another example, Dewsbury (1999) discusses terminological problems in a section of his paper called "the mischief of words." He expresses his concern about how biologists use the terms "function," "ultimate," and "ultimate causation."

To promote the understanding of terminology, some societies, *e.g.*, the Animal Behavior Society and American Society of Parasitologists have, or have had, committees dedicated to this subject. Because the Avian Brain Nomenclature Consortium believes "that names have a powerful influence on the experiments that we do and the way in which we think," the Consortium published a new nomenclature for parts of bird brains (Jarvis et al. 2005, 151). The inaccurate evolution-based terminology for vertebrate brains that was used throughout the 20th century became a severe impediment to the communication of scientific discoveries and the generation of new insights (page 155). Some of the many printed dictionaries and encyclopedias that define biological terms (meaning biological in the broad sense) include Allaby 1989, Campbell and Lack 1985, Chapin 1968, Collocot and Dobson 1974, Cumming 1972, Drever 1974, Eysenck et al. 1979, Goldenson 1984, Harré and Lamb 1983, Heymer 1977, Hinsie and Campbell 1976, Hurnik et al. 1995, Immelmann 1977, Immelmann and Beer 1989, Keller and Lloyd 1992, King and Stansfield 1985, Lincoln et al. 1985, Medawar and Medawar 1983, Roe and Frederick 1981, Seymour-Smith 1986, Steen 1973, Storz 1973, Torre-Bueno 1978, and Wolman 1973.

Confusion about Meanings of Terms

Biologists in general strive to obtain a superior terminology, unfortunately not yet with total success. Confusion and controversy about meanings are common as I indicate in many entries of this dictionary. Many terms, not to mention the concepts that they represent, are obviously in need of further study of their already designated meanings. The confusion and controversies arise for many reasons, including:

- A satisfactory definition of a term might not yet exist due to our present state of knowledge; *e.g.*, see aggression, awareness, and consciousness.
- The name of a term is a nontechnical English word(s) which already has a common dictionary definition(s); *e.g.*, see altruism, selfishness, and spite. Such nontechnical words often "have a variety of meanings and are surrounded by a dense atmosphere of values and associations" (Wilson and Dugatkin 1992, 29). Therefore, such words can confound communication even if they are precisely defined in scientific literature. Keller (1992) describes how "competition" with its established colloquial meaning permits the simultaneous transfer and denial of its colloquial connotations when it is used technically. Colloquial connotations can lead plausibly to one set of inferences about a concept and close off others. "Eugenics" was originally defined technically and nonpolitically, yet some people now find it difficult to think of eugenics without negative political connotations.
- The name of a term is a foreign word(s) that may be hard to remember and interpret accurately; *e.g.*, see umwelt and zeitgeber.

- The name of a term is a technical word that may be hard to remember and understand without an explicit definition; *e.g.*, see apotreptic behavior and epidiectic display.
- The term is only implicitly defined with regard to all, or some, of its meanings in the scientific literature. To my dismay, I have omitted some terms and some definitions from this book because I could not formulate a satisfactory definition from information provided in written material.
- The term is explicitly, but not correctly, defined in all scientific literature, textbooks, or both. For example, consider "inclusive fitness." Grafen (1982) lists fourteen commonly used animal-behavior textbooks that defined this term erroneously or inadequately. Dawkins (1986, 44) later advises, "It is best not to read too much about inclusive fitness as much of what has been written is misleading."
- The term has more than one technical definition that can vary in their degrees of difference from one word (such as partially, possibly, or potentially) through many words; *e.g.*, see species. In some cases the same term can even have opposite meanings; *e.g.*, see true altruism and overdispersed distribution.
- Many terms have evolved in their meanings as scientists learned more about the concepts that they represent, research focus shifted, or both. Isolation was originally used for both geographical isolation and reproductive isolation; variety was used, for instance by Darwin, for a single individual or a population; and teleological was used for four distinct phenomena (Mayr 1982, 43); *e.g.*, also see communication, evolution, fitness, gene, homology, species, and territory.
- The term may have one through many synonyms, sometimes including a perplexing one that uses the same word(s) for a very different concept; *e.g.*, see adaptation and homology. In some cases, imprecise language led to virtual synonymies of important terms that should retain distinct usages, *e.g.*, these terms and their associated ones: coevolution, guild, and keystone species (Fauth et al. 1996, 282).
- The term has more than one spelling, capitalization, or hyphenation style; *e.g.*, see homeotherm, endosymbiosis hypothesis, the Modern Synthesis, and molecular-clock hypothesis.
- The same concept is referred to using two, or more, of these words: hypothesis, law, rule, and theory. Examples are locale-odor hypothesis and Allen's rule.
- Authors often shorten a concept's name; *e.g.*, they use adaptation to mean a specific kind of adaptation such as physiological adaptation and selection to mean a specific kind of selection, such as artificial selection.
- Many scientific words are long. Especially long words are the chemical names for deoxyribonucleic acid (207,000 letters), tryptophan synthetase (1,900), tobacco mosaic virus (1,185), pneumonoultramicroscopicsilicovolcanoconiosis (45, a lung disease caused by breathing fine dust), and hepaticocholangiocholecystenterostomies (39, a surgical operation that creates channels of communication between gall bladders and hepatic ducts or intestines) (Ash 1996, 108).
- Different dictionaries define the same term differently; *e.g.*, atavism (Hrdy 1996, 851; Thornhill and Gangestad 1996, 853).
- The original words of a term (*e.g.*, theory of mind, *q.v.*) are confusing, but researchers continue to use such a term because it has been widely used. Further, when a researcher wishes to use a non-confusing name, or less confusing name, for a concept, a publisher may talk him out of it; therefore, the original confusing name continues in the literature (Ashington 1998, 32–33).

Many concerned scientists have tried to rescue us from terminological pitfalls. I applaud them. For instance, Hailman (1976) insightfully suggests how to improve behavioral terminology by emphasizing logic, informational content, and efficiency, rather than historical origins of stability. Brown (1987, 297) lists very helpful guidelines for using biological terms. Fitch (1976) even organized others to petition against a confusing definition of *homology* that refers to similarity of nucleotide sequences (= sequence homology) (Lewin 1987a).