Descent and Logic in Biosystematics

An Essay

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1 • ABOUT THIS ESSAY

Here is a short work about biological systematics as interpreted, appreciated, and sometimes criticized by a physician biologist. In it I discuss conventional methods of biological taxonomy and suggest a new one. And I go beyond taxonomic practice to discuss biosystematics—including not only theory of biological taxonomy but also species concepts, speciation models, cladistic analysis, and evolutionary hypotheses. This essay is addressed to biological taxonomists and to philosophers with an interest in biology, and more broadly to all biologists, naturalists, and others who draw on biological taxonomy and biosystematics and are willing to attend to the difficulties of these subjects.

I first became interested in biological taxonomy while learning how to identify disease-causing microorganisms. I did not study the topic in depth until I took on the job of writing a manual for public health workers. In searching for help with this task, I turned to the methods of biological taxonomy. By studying the making of taxonomic keys for identifying specimens, I hoped to gain ideas for making decision trees to help non-physicians diagnose sick persons. The word diagnosis, used by both biological taxonomists and health workers, suggested a parallel; and nosology—classifying diseases—is a form of biological taxonomy. Both disciplines pertain to biological categories (taxa in biological taxonomy, diseases in nosology) and both have methods for assigning specimens or persons to these categories (Huneman et al. 2015, xiii).

However, on comparing further I found an important difference. Biologists assign no specimen to more than one species; taxonomically, species are supposed to be mutually disjoint (to share no specimen). On the other hand, disease categories are not mutually disjoint; the medical diagnostician cannot assume an ill person has only one illness. I learned too that there are problems in

biological taxonomy. Biological taxonomists themselves point these out; for example, see Garnett and Christidis (2017), Raposo et al. (2017), and Wheeler (2008, 1–17). What I thought of as secure and uncontroversial was not. I felt I could address some of these difficulties constructively from a fresh viewpoint. The result is this essay.

Biological taxonomists have not yet made full use of the information obtainable by observing organism by organism descent, nor fully used certain instructive parts of human biology. In addition, taxonomists do not always make use of easy logical methods, despite the work of Beckner (1959, 1963), Gregg (1954), Woodger (1929, 1937), and others. This is not to say that the untidy phenomena of living beings follow or should follow human logic. Many taxonomic and biosystematic difficulties reflect the intricate relationships of living beings in our world. However, some arise partly from taxonomic practices, methods, and strategies, and these are amenable and can sometimes be modified logically without oversimplifying associated biological phenomena. For example, keeping species disjoint, by defining them so no specimen is assignable to more than one of them, is complicated by the phenomenon of hybridization. In this essay I suggest methods for dealing with this taxonomic difficulty conservatively.

The language I use is mostly of the here and now. I do not make hypotheses about prehistory. This might seem an unnecessary, even perverse, restraint; but it has an advantage. It leads to an uncustomary but useful viewpoint from which to consider biological taxonomy, biosystematics, and present-day biological evolution.

When possible, I illustrate my interpretations and suggestions with concrete examples from published reports by field biologists and experimental taxonomists. Sometimes I use imaginary scenarios to raise a question or to illustrate an idea. I have tried to make these scenarios fit what is known or discoverable about living beings but make no claim that they have the force of field or laboratory observations.

The bibliography in this essay is selective, not exhaustive. I have chosen to cite early authorities, not just recent studies, whenever early work has not been superseded.

The first time I use a term in a special way in this essay, I explain my usage. I also define the term in the glossary preceding this introductory chapter.

Synopsis

To avoid breaking a chain of argument, I have put some ancillary material in appendices. This attempt to attain linearity, and my sometimes-unconventional perspective, might make it difficult for the reader to delve directly into later chapters, many of which depend on ideas developed in the earlier ones.

This essay covers four areas: first, a review and interpretation of contemporary practice and theory of biological taxonomy; second, some suggested practices, methods, and tests for biological taxonomists to consider for use in their work; third, some ways to use these suggestions in observational and experimental studies; and fourth, the relevance of my suggestions to some parts of biosystematics, such as species concepts, speciation models, phylogenomics, and evolutionary theories. However, the material does not always fall neatly into these four divisions.

In the first chapters I do summarize and interpret certain biological practices described or recommended in the taxonomic literature: practices for defining and naming species, for identifying specimens, and for classifying biological taxa. And I briefly review taxonomic nomenclatural codes and keys. In these first chapters I explain my use of biological terms such as organism, living being, specimen, genealogy, phylogeny, pedigree, lineage, and homolog. I restore from the older literature some now-unfamiliar terms and I introduce a few newly coined terms such as biological signifier, biological disposition, distributive expression, pedigreeable collection, taxonomic orphan, mediary living being, and species-specific ontogenetic suite. I point out the double meanings of some biological terms and introduce separate terms for these meanings. For example, I disambiguate the word species by reviving the word linneon for the idea of each species as a class defined morphologically, and by using a second term, natural species, for the idea of each species as a lineage-segment maintained via reproductive events. I acknowledge and spell out some of the assumptions I make in this essay to alert the reader to them. I try to avoid shifting from one assumption to a conflicting

one in midstream (Berkeley 1734, XV). Finally, I make clear my preference for biological conclusions that are based on observations of nonartificial—not disturbed or altered by human activity—phenomena.

In Chapters 2 and 3 I review certain biological phenomena relevant to taxonomy and biosystematics. Chapter 4 is a survey of the methods of biological taxonomy, including a comparison of two sorts of biological classifications; chapter 5 presents ways of avoiding some ambiguities of taxonomic terms; and chapter 6 is about the theory and practice of mutual exclusiveness and nonexclusiveness in taxonomic defining. Chapter 7 presents my perspective on some of the philosophy behind the biological practices and methods discussed in the first six chapters. In it I analyze some species concepts proposed in the biological literature, and suggest a way to accommodate their differences. Chapter 8 shows how thinking about human biology illuminates certain parts of nonhuman taxonomy. In chapter 9 I go into more detail about defining each species, assigning specimens to species, and hybridization. I discuss the relationship between the use of morphology and the use of parent-offspring relationships when defining species and when identifying specimens.

In a sense these chapters are preliminary, forearming the reader to understand and evaluate the remaining chapters. In the first of these later chapters I suggest a new taxonomic practice, one based on the idea of internal genealogical interruption. In chapters 11 to 13 I describe and interpret some proposed speciation models and suggest methods for seeking present-day speciation events. Chapter 14 presents a review of the practices I have suggested and shows how to apply them to some problems of biosystematics and biological taxonomy. Chapter 15 is about the relevance of biological taxonomy to the study of biodiversity. Finally, chapter 16 is an analysis of the scientificity of evolutionary hypotheses and theories.

I have not been able to attain Woodger's reserve:

> The 'Sceptical Biologist' has nothing to do with teaching investigators their business. He is concerned with interpretations: not with weighing empirical evidence upon which they are based, but with the most general assumptions, presuppositions, postulates, etc., which underlie them (1929, 2).

I do attend to empirical evidence, and I do want naturalists, biophilosophers, and biological taxonomists to take my approach seriously and to use in their work those suggestions of mine that pass scrutiny.

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