

The Definitions of Species and Clade Names: A Reply to Ghiselin

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Ghiselin (1993) has criticized my proposal (de Queiroz 1992) that phylogenetic definitions of taxon names (de Queiroz and Gauthier 1990) provide a means of reconciling the position that taxa are individuals (composite wholes) with the traditional method of defining taxon names in terms of necessary and sufficient properties (intensional definitions), which implies that taxa are classes. As Ghiselin points out, he and I agree as to how systematists are to define the names of species and clades, that is, biological taxa. We also seem to agree that the definitions of taxon names are interpretable as ostensive definitions, and that many of the properties possessed by individual organisms, species, and clades are not defining properties. Where we differ concerns whether the definitions of species and clade names can be considered to be stated in terms of logically necessary (defining) properties, and thus whether they represent a means reconciling traditional and individualist views on the nature of taxa and the definitions of taxon names. Here I will argue 1) that the definitions of species and clade names are indeed stated in terms of defining properties, 2) that Ghiselin's conclusion to the contrary is based on a misinterpretation of what are the defining properties, and 3) that Ghiselin's conclusion concerning the irreconcilability of traditional and individualist views results from his maintaining false dichotomies between intensional and ostensive definitions and between classes and individuals.

Ghiselin believes that the properties I considered defining are not logically necessary but simply matters of contingent fact. Although I agree with his proposition that mere use of a property in a definition does not necessarily mean that the property is defining in the sense of being logically necessary, I maintain that the properties I identified are in fact logically necessary. The property I identified as defining the name of a higher taxon, considered as a whole, is being a particular clade. Because of their composite nature, taxa can also be considered in terms of their parts. Thus, the defining property of the name of a

higher taxon, considered as a group or set of organisms, is being an organismal part of a particular clade. For example, the name "Mammalia" might be defined as the clade stemming from the most recent common ancestor of horses and echidnas, and "mammals" would then be defined as those organisms that are parts of this clade. In my previous paper (de Queiroz 1992), I distinguished between these two kinds of definitions, but I did not distinguish between the corresponding names. This was in keeping with the tradition of treating names such as "Mammalia" and "mammals" as if they are merely formal and vernacular names for the same thing (whether the clade itself or the set of its organismal parts). A more precise terminology would use different names, as in my example, for the clade considered as a singular composite whole and the class or set of its component organisms.

In any case, both kinds of definitions are stated in terms of logically necessary properties. Considering the term "mammals", for example, being a part of the clade stemming from the most recent common ancestor of horses and echidnas is not merely a contingent property. Just as it is logically necessary for a person to be married (and male) to be a husband, it is logically necessary for an organism to be part of the clade stemming from the most recent common ancestor of horses and echidnas to be a mammal. A descendant of this ancestor that is not a mammal, for example, a non-mammalian horse, is just as much a logical impossibility, or contradiction in terms, as an unmarried husband. Ghiselin concedes that "[t]he closest we get to a 'defining property' is what makes the entity named being 'that clade'" (p. 221). But the reason he does not consider a property that something must possess to be designated by a particular name to qualify as truly defining seems to be only that the property applies to a concrete rather than an abstract entity.

Generalizing the method of defining clade names and extending it to the names of time-extended populations, I identified the defining property of the name of such a population, considered as a whole, as being a particular nexus of reticulating organism lineages. Likewise, the defining property of the name of a time-extended population, considered as a class or set of organisms, is being a part of that reticulating nexus. Thus, "*Canis familiaris*" might be defined as the population lineage of which Lassie is a part, and "domestic dogs" might be defined as the organismal parts of that lineage. Considering the definition of "human being", Ghiselin (1980:81) himself has stated that "[a]n organism is a human being *if and only if* it is a part of *Homo sapiens*" (emphasis added), which seems to imply that being a part of a particular species is logically necessary for an organism to qualify as fitting the definition of "human being". Thus, some of Ghiselin's own statements support the proposition that the definitions of taxon names are stated in terms of logically necessary properties.

In arguing that the properties used in the definitions of taxon names are contingent rather than logically necessary, Ghiselin seems to have confused the means used to specify the defining properties with the defining properties themselves. Specifically, he seems to have confused the particular parts mentioned explicitly in the definitions, the existence of which is indeed

contingent, with the true defining properties those parts are used to specify. In the case of clade names, the parts in question are descendant taxa, which are used as a means of specifying particular ancestors and, derivatively, the clades stemming from them. For example, I used horses and echidnas above to specify the clade/ancestor designated by the name "Mammalia". Ghiselin points out that Mammalia was the same clade before horses and echidnas came into existence, and it would be the same clade even if history had been somewhat different, for example, if neither horses nor echidnas had ever evolved. He takes this as evidence that the properties I considered defining are not logically necessary.

Although definitions that can accommodate temporal and counter-to-fact conditionals may well be desirable, the conditionals do not themselves imply, contrary to Ghiselin's conclusion, that the properties identified as defining are merely contingent. Being a part of a particular clade that eventually and contingently gave rise to horses and echidnas in the actual world is what is logically necessary to be a mammal, not being a part of a clade that immediately and necessarily gave rise to horses and echidnas in all possible worlds. Indeed, the existence of horses and echidnas is not even necessary to define the name of the clade/ancestor in question, for house mice and platypuses, or monotremes and therians, would do just as well. Even in a counter-to-fact world where horses did not exist, it would still be logically necessary for an organism to be descended from the same common ancestor that gave rise to horses and echidnas in the actual world to be a mammal.

A similar conclusion holds for the definitions of species names, where the type specimen serves as a convenient means of specifying the particular population lineage being named. Being a part of the species that eventually and contingently gave rise to the organism that was chosen as the type specimen in the actual world is what is logically necessary to be designated by a particular species name, not being a part of a species that immediately and necessarily gave rise to this organism in all possible worlds. Indeed, the existence of the organism in question is not even necessary to define the name of the species in question, for any of the organisms that are parts of this species would do as well. The contingent existence of the parts mentioned explicitly in the definitions of species and clade names is thus entirely consistent with the proposition that these definitions are based on logically necessary properties.

Ghiselin presents another argument against the proposition that defining properties are involved in the definitions of taxon names, which is based on extending considerations about definitions to the names of organisms. If clades and species are individuals, he argues, then accepting the proposition that the definitions of their names are based on defining properties implies that the definitions of the names of organisms are also based on defining properties. Although Ghiselin argues that certain properties used in the ostensive definitions of organism names (such as being bearded) are not defining properties, he presents no argument against the possibility of formulating definitions based on defining properties. Instead, he seems to take the impossibility of this task as

self-evident. Alternatively, we might consider whether it is in fact possible to define organism names in terms of logically necessary properties.

Extending the method of defining clade and species names to the names of organisms, the defining property of the name of an organism, considered as a whole, is being a particular living being. Consideration of the class or set of parts that make up an organism is more complicated than in the case of species and clades. At one organizational level, species and clades are composed solely of organisms, whereas many multicellular organisms are composed not only of cells, but also of noncellular substances such as blood plasma and extracellular minerals (e.g., as in bone). Nevertheless, being a part of a particular organism can still be viewed as the property that is necessary and sufficient to be designated by a particular name. Humans exhibit a passion for naming the sets of organisms that make up particular clades and species as well as the individual organisms themselves. They tend to be less concerned with naming the sets of cells and other things that make up particular organisms. But this probably reflects a human bias in favor of a particular level of organization, because there is nothing that logically prohibits defining a name so that it designates the set of parts of a single organism. Consequently, there is nothing about Ghiselin's analogy with organisms that calls into question the status of the properties used in the definitions of species and clade names as logically necessary.

The underlying source of the disagreement between Ghiselin and myself seems to be a fundamental difference in how we view the relationships between intensional and ostensive definitions, classes and individuals, and consequently, traditional and individualist perspectives. Although Ghiselin correctly characterizes my proposal as an attempt to reconcile traditional and individualist perspectives, he is an advocate of the latter view and continues, for the most part, to treat intensional and ostensive definitions, and classes and individuals, as if they are mutually exclusive categories. But my point is that these categories no longer need to be viewed as strict alternatives. Defining the names of clade and species taxa intensionally is not incompatible with defining them ostensively, nor is viewing clade and species taxa as classes incompatible with viewing them as individuals. Therefore, traditional and individualist positions are not truly in conflict, or more accurately, their synthesis represents a single coherent position.

The synthesis of traditional and individualist positions incorporates elements of both former positions; it also accounts for both of their failures. It retains the traditional proposition that the names of taxa can be defined in terms of necessary and sufficient properties, and hence, that it is appropriate to view taxa as classes. But it also identifies as a failure of the traditional position its inability to formulate intensional definitions that adequately specified the meanings of taxon names. Likewise, the new position retains the individualist proposition that taxa are composite wholes (individuals), the names of which can be defined ostensively. But it also identifies as a failure of the individualist position the erroneous conclusion that it is impossible to define taxon names in terms of necessary and sufficient properties, and hence, that it is inappropriate to view taxa as classes.

In my view, the failures of both traditional and individualist positions, as well as the very existence of a traditionalist-individualist dichotomy, resulted at least partly from incomplete adoption of an evolutionary world view. Although both traditionalists and individualists adopted an evolutionary concept of taxa, they both retained a non-evolutionary concept of defining properties. Both groups restricted their considerations of defining properties to traditional systematic characters, that is, organismal traits. But organismal traits are subject to loss and other forms of modification, and therefore they cannot serve as an adequate basis for defining the names of evolutionary taxa (Hull 1965; Beatty 1982; Sober 1988; de Queiroz and Gauthier 1990; de Queiroz 1992). Having hair cannot be a logically necessary property in the definition of the name "Mammalia" any more than being bearded can be a logically necessary property in the definition of M. T. Ghiselin's name, for just as Dr. Ghiselin remains the same human being after shaving, Mammalia remains the same clade after the organisms in one or more of its component species no longer grow hair at any stage in their life cycle. Consequently, restricting considerations of defining properties to traditional systematic characters prevented traditionalists from formulating adequate definitions for the names of evolutionary taxa, and it led individualists to conclude that the names of evolutionary taxa could not be defined in terms of necessary and sufficient properties.

Both manifestations of this problem are solved by adopting an evolutionary concept of defining properties. The defining properties of taxon names are not organismal traits; instead, they are the biological relationships that unite organisms into species and clades. Under this view, traditionalists are no longer prevented from formulating definitions that capture the intended evolutionary meanings of taxon names, and individualists no longer need to conclude that it is impossible to define the names of taxa in terms of necessary and sufficient properties. Moreover, the supposed dichotomy between traditional and individualist views on the definitions of taxon names is seen to be false. Defining the names of clade and species taxa intensionally is not an alternative to defining them ostensively, for the necessary and sufficient properties involved in the definitions of taxon names are relationships that can only be specified by pointing to an individual species or clade.

Exposing a false dichotomy between intensional and ostensive definitions also implies a false dichotomy concerning the interpretation of taxa as classes versus individuals. A class is a group whose members belong to that group for the very reason that they possess a particular property or properties; that is, a class is a group the name of which is defined in terms of logically necessary properties. Therefore, defining the names of species and clades in terms of logically necessary properties implies that taxa are classes. Although previous authors have most commonly associated defining properties with spatiotemporally *unrestricted* classes, the defining properties of taxon names refer to entities that are restricted in space and time. In other words, viewed as classes, taxa are spatiotemporally *restricted* classes. Each such class has as its extension either a single species or clade, or the organismal parts of a single

species or clade. Consequently, the view that taxa are classes is not an alternative to the view that taxa are individuals, for each taxon viewed as a class is instantiated by either a single individual or the parts of a single individual. The distinction between classes and individuals is not nearly as sharp as Ghiselin believes.

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BIBLIOGRAPHY

- Beatty, J.: 1982, 'Classes and Cladists', *Systematic Zoology* **31**, 25–34.
- Ghiselin, M. T.: 1980, 'Natural Kinds and Literary Accomplishments', *The Michigan Quarterly Review* **19**, 73–88.
- Ghiselin, M. T.: 1995, 'Ostensive Definitions of the Names of Species and Clades', *Biology and Philosophy* **10**, 219–222 (this issue).
- Hull, D. L.: 1965, 'The effect of Essentialism on Taxonomy – Two Thousand Years of Stasis (1)', *British Journal for the Philosophy of Science* **15**, 314–326.
- de Queiroz, K.: 1992, 'Phylogenetic Definitions and Taxonomic Philosophy', *Biology and Philosophy* **7**, 295–313.
- de Queiroz, K. and J. Gauthier: 1990, 'Phylogeny as a Central Principle in Taxonomy: Phylogenetic Definitions of Taxon Names', *Systematic Zoology* **39**, 307–322.
- Sober, E.: 1988, *Reconstructing the Past. Parsimony, Evolution, and Inference*, MIT Press, Cambridge.