

## Changes in *PhyloCode* Version 5

Because version 5 was made available without a preface or index, the modifications relative to version 4 are summarized in this document, to be maintained at [www.phylocode.org](http://www.phylocode.org) for future reference. Version 5 includes major revisions of Articles 9 (phylogenetic definitions) and 11 (specifiers and qualifying clauses) and scattered changes in many other parts of the code. The following summary does not include minor clarifications or minor changes in wording, punctuation and formatting that do not affect the functioning of the code.

The most important change in Version 5 is the expansion of the treatment of phylogenetic definitions, which in many ways are the heart of this code. What was formerly a long and complicated note (Note 9.3.1) and three related recommendations (9.3B, 9D, and 9E) have been expanded into six articles (9.4–9.7 and 9.9–9.10). Following a proposal by de Queiroz (2013) motivated by a distinction emphasized by Martin et al. (2010), node-based and branch-based definitions have been replaced with minimum-clade and maximum-clade definitions, respectively, throughout the code. The primary reason for this change is to employ definitions that are applicable in the context of both common interpretations of phylogenetic trees—one in which branches represent lineages and nodes represent ancestors at lineage-splitting events, the other in which branches represent relationships and nodes represent taxa (the term “branch-based” is inappropriate in the latter context, in which all phylogenetic definitions are effectively node-based).

Another important change in Article 9 is the explicit recognition of definition categories for the names of crown clades (Art. 9.9) and total clades (Art. 9.10), the variants of which (e.g., the maximum-crown-clade definition, which is roughly equivalent to the branch-modified node-based definition of Version 4) are presented more systematically and thoroughly than in previous versions of the code, combining new information with content that was previously scattered among various articles. Two kinds of total clade definitions (maximum-total-clade and crown-based total-clade) are described in Art. 9.10; most of this material is new. Additionally, Note 9.5.1 describes a kind of minimum-clade definition that has no analog in previous versions of this code, the directly-specified-ancestor definition, in which the ancestor in which the clade originated is identified by name rather than being specified indirectly through its descendants, and Note 9.9.1 describes its use for defining the names of crown clades.

In Version 5, some of the recommended wordings for definitions have been modified for improved clarity. The use of "or" in “branch-based” definitions in previous versions of the code to separate multiple external specifiers was incorrect with regard to the intended stipulation. For example, the definition "the largest clade containing A but not Y or Z" was intended to designate the clade composed of A and everything that is closer to A than to both Y and Z. However, use of the "or" operator (indicating inclusive disjunction) indicates that the designated clade is composed of A and everything that is closer to A than to either Y or Z. Replacing "or" with "and" (indicating conjunction) fixes the problem (however, the “or” operator is still appropriate in certain types of qualifying clauses; see Note 9.6.2). The recommended wordings for apomorphy-based and

apomorphy-modified crown-clade definitions were also changed. The old wording “the clade exhibiting” is ambiguous because larger clades than the one whose name is being defined could be interpreted as exhibiting the cited character. The system of abbreviations for definitions (Note 9.4.1) was revised in order to accommodate the aforementioned changes and to improve clarity. In addition, although the previous versions of the code used  $\nabla$  to signify a crown clade, this symbol simply resembles the representation of a clade, which is the meaning adopted in Version 5; the abbreviation for "crown clade" is now "crown  $\nabla$ ". Symbols are also now provided (Note 11.12.1) for qualifying clauses.

Several other changes were made in Article 9: A sentence was added (Art. 9.8) clarifying that if multiple apomorphies are used in an apomorphy-based definition, subsequent authors are to interpret the definition as applying to the clade characterized by the presence of all of them. The recommendation (old 9.9A) to cite an author's given name(s) in full if the surname is common has been removed from the code; with modern search methods, this is no longer necessary. The stipulation that if an author of a definition (e.g., of a crown clade name) intends to define "extant" as anything other than extant on the publication date of the definition, the intended meaning must be indicated in the protologue was made into a rule (Art. 9.11).

There are numerous substantive changes in Article 11. Note 11.1.1 in version 4 stated that when a species is used as a specifier, the implicit specifier is the type specimen of that species under the appropriate rank-based code. By effectively equating the species with the type of its name, that wording obscured the ramifications of explicitly using the type, rather than the species, as the specifier. The distinction is important because some users of this code prefer to use specimens rather than species as specifiers. In Version 5, the statements (in old Notes 11.1.1 and 13.2.2) equating a species name with its type have been eliminated. New Articles 11.4 and 11.6 explain the ramifications of using a species versus the type of the species name, respectively, as a specifier.

When defining the names of low-level clades that coincide with or overlap the boundaries of species, differences in species criteria and inferred species boundaries may result in a name being applied to different clades even in the context of the same phylogeny. In some cases, using a particular species as a specifier may result in the application of the name to a different clade than if the type specimen of that species name were instead used. New Recommendations 11H and 11I are intended to reduce the likelihood of this undesirable outcome and address it when it occurs. The situations when it is permitted to use specimens that are not types as specifiers has been expanded, but doing so outside of these situations is now prohibited (new Art. 11.7) rather than simply discouraged (old Rec. 11.4A).

Version 5 provides more guidance in constructing phylogenetic definitions that restrict the use of the name under particular phylogenetic hypotheses. Old Article 11.9 has been partitioned into three Articles. The first (Art. 11.12) and its examples now deals exclusively with qualifying clauses. The second (Art. 11.13) and its examples detail three ways in which a phylogenetic definition can be formulated, without the inclusion of

a qualifying clause, so that the defined name will not apply to any clade under particular phylogenetic hypotheses. The third (Art. 11.14) and its example illustrate how the application of a name can be restricted with respect to clade composition under alternative hypotheses of relationship without the name becoming inapplicable under the alternative phylogenetic hypotheses.

The recommendation that plant fossil “morphotaxa” not be used as specifiers (part of Rec. 11C) has been eliminated. The latest version of the botanical code (*ICNAFP*) no longer recognizes morphotaxa. Furthermore, because the scientific names of most wholly extinct plant taxa are based on the names of fossils that were referred to as morphotaxa under previous versions of the *ICNAFP*, the inclusion of morphotaxa in Rec. 11C made it impossible to name many extinct plant clades without adopting different names for them than those used under the *ICNAFP*.

In October 2011, the CPN received a proposal by Nico Cellinese, David Baum and Brent Mishler concerning the treatment of species in this code, the justification for which was published by Cellinese et al. (2012). Their fundamental premise was that the code is too strongly tied to a particular view on the nature of species, which is not accepted by everyone who would like to use phylogenetic nomenclature, and their proposed solution was to eliminate all mention of species in the code. The proposal was publicized on the ISPN website and stimulated more than a year of intermittent discussion on the CPN listserv. In the end, the CPN accepted the underlying premise of the proposal but rejected the proposed solution, which would have entailed radical changes in the code, including: eliminating the use of species as specifiers (thus only specimens would be specifiers); permitting the establishment of preexisting specific epithets as clade names; redefining the term “homonym” such that established clade names may be identical provided that the authors and publication years differ; and elimination of Article 21, which provides recommendations on how to use species names governed by the rank-based codes in conjunction with clade names governed by this code. Instead of eliminating all reference to species, the definition of “species” has been broadened to accommodate the view that the species category is simply a rank in the Linnaean hierarchy, while continuing to accommodate the view that it is a kind of biological entity. This broadening of the adopted species definition resulted in scattered changes, such as the rewording of Art. 1.1 and the elimination of Recommendation 21.4C (see below). In addition, the CPN discussion of the Cellinese et al. proposal led to other changes not proposed by those authors, especially changes in Article 11 related to using species versus type specimens as specifiers (see above) and the simplification of Article 21 (see below).

The rest of the substantive changes introduced in Version 5 are described below in the order of appearance in the code.

The distinction among node-based, branch-based, and apomorphy-based clades (old Art. 2.2 and elsewhere in Version 4) has been eliminated because the descriptors are attributes of definitions rather than clades, and they are no longer used for different categories of definitions, as discussed above.

Art. 6.2 now states explicitly that unranked scientific names that are already in use prior to their establishment as clade names under this code qualify as preexisting names even though they are not governed by any rank-based code, a point that was unclear in Version 4.

A new Note 7.2.2 details the parts of a protologue that must not be restricted to an electronic supplement if they are to be considered published according to Article 4. However, a CPN subcommittee is currently working on recommendations for accommodation of electronic publication, so Note 7.2.2 may become unnecessary in future versions of the code.

Recommendation 10D concerns choosing new names for clades when the preexisting name cannot be converted because it is a cross-code homonym (i.e., used in more than one rank-based code) that has already been established under this code for a different clade. In Version 5, this recommendation has been revised to suggest the prefix *Protisto-* (rather than *Zoo-*) for non-animals covered by the *ICZN* (i.e., "protozoans"), and the prefix *Bacterio-* (rather than *Monero-*) for all organisms whose names are governed by the *ICNB* plus the cyanobacteria (governed by the *ICNAFP*).

New Article 14.4 states that if a panclade name and a name that was not explicitly established as applying to a total clade are judged to be heterodefinitive synonyms, the panclade name has precedence even if it was published later. This rule was added to address situations in which a panclade name has been established as the name of a particular total clade, and subsequently an earlier published name turns out, through a new understanding of phylogeny, to apply to the same total clade. In such situations, retention of the panclade best serves the goal of nomenclatural stability. This rule does not give panclade names precedence over other names that were explicitly proposed as applying to total clades.

Two changes in Version 5 are intended to alleviate confusion over nominal authorship of converted clade names. Wording has been added to Article 19.1 clarifying that the nominal author is the first person to publish a particular name, even if that author applied it to a taxon that differed somewhat in composition from the clade for which the name is being converted (provided that it is not a homonym; see Note 9.15A.1). Secondly, a new Note (19.1.2) clarifies that to qualify as the nominal author of a converted name, the first person to publish the preexisting name does not have to have provided a description or diagnosis *in Latin*, in spite of the requirement under the *ICNAFP* that the description or diagnosis for non-fossil taxa published between 1935 and 2011 be in Latin. Consequently, in some cases a different person is considered to be the author of a preexisting name under this code than under the *ICNAFP* (as is also true for authorship under this code versus the *ICZN* but for different reasons; see Note 9.15A.2).

Article 21, which provides recommendations on how to use species names governed by the rank-based codes in conjunction with clade names governed by this code, has been somewhat simplified in Version 5. Old Article 21.3, which concerns infraspecific taxon names under the rank-based codes, has been incorporated into Art. 21.1. Old

Recommendation 21.4C and its Notes, which encouraged providing evidence that a new species represents a separately evolving lineage when naming it under a rank-based code, have been eliminated both because they adopted a particular species concept and because they concerned taxonomy rather than nomenclature. The term "prenomen," which refers in Version 4 to the first word of a species binomen, was deemed unnecessary and is no longer used in Version 5.

In Articles 22.9–22.11, it has been clarified in Version 5 that these rules for modifying this code apply only after its initial ratification and implementation, not to pre-implementation drafts and revisions. Also, in Art. 22.10, the required waiting time between publication of a proposed modification and the CPN vote to approve or reject it has been reduced from six to three months.

There are many additions to the glossary, and some deletions of terms that are no longer used in this code.

Appendix C (Equivalence of Nomenclatural Terms) has been revised to reflect changes in the latest (2011) draft of the *BioCode* and the *ICZN* (amendments approved in 2012).

#### **Literature Cited**

- Cellinese, N., D. A. Baum, and B. D. Mishler. 2012. Species and phylogenetic nomenclature. *Syst. Biol.* 61:885–891.
- de Queiroz, K. 2013. Nodes, branches, and phylogenetic definitions. *Syst. Biol.* 62:625–632.
- Martin, J., D. Blackburn, and E. O. Wiley. 2010. Are node-based and stem-based clades equivalent? Insights from graph theory. *PLOS Curr.* 2:1–12.