PhyloCode: A Phylogenetic Code of Biological Nomenclature

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Preface

The development of the PhyloCode grew out of a recognition that the current Linnaean system of nomenclature, as embodied in the preexisting botanical, zoological, and bacteriological codes, is not well suited to govern the naming of clades and species. These are the entities that compose the tree of life, and for this reason they are among the most theoretically significant entities above the organism level. In order to promote clear communication and efficient storage and retrieval of biological information, clades and species require names that explicitly and unambiguously refer to those entities and do not change with time. The preexisting codes fail to provide such names for either kind of entity. Supraspecific names are often associated with clades under the preexisting codes, but because those names are operationally defined in terms of ranks and types, they often fail to retain their associations with particular clades. And species names change whenever species are referred to a different genus, whether as the result of phylogenetic or phenetic considerations. In both cases, an entity whose hypothesized composition has not changed may be given a different name under the preexisting codes based on considerations of rank (if a clade) or genus assignment (if a species). The former is particularly objectionable given the wide recognition that rank assignment is subjective and biologically meaningless.

In contrast to the preexisting codes based on the Linnaean system of nomenclature, the PhyloCode will provide rules for the express purpose of naming the parts of the tree of life--both species and clades--by explicit reference to phylogeny. In doing so, the PhyloCode extends "tree-thinking" to nomenclature. This parallels the extension of tree-thinking into taxonomy, as manifested in the concept of species as lineage segments and the concept of supraspecific taxa as clades. The nomenclatural and taxonomic developments are complementary but independent. Lineages and clades can be named using the traditional Linnaean system of nomenclature (albeit with the problems noted above), and a nomenclatural system based on phylogenetic principles does not require equating taxa with species and clades. Nevertheless, the PhyloCode is designed for naming species and clades. (Only clade names are governed in this version of the PhyloCode, but rules governing species names will be added in the future.)

The PhyloCode is designed so that it can be used concurrently with the preexisting codes or (after rules governing species names are added) as the sole code governing the names of taxa, if the scientific community ultimately decides that it should. The intent is not to replace existing names but to provide an alternative system for governing the application of both existing and newly proposed names. In developing the PhyloCode, much thought has been given to minimizing the disruption of the existing nomenclature. Thus, rules and recommendations have been included to ensure that most names will be used in ways that approximate their current usage. However, names that apply to clades will be redefined in terms of phylogenetic relationships rather than taxonomic rank and will therefore not be subject to the subsequent changes that occur under the Linnaean system due to changes in rank. Because the taxon membership associated with a name will sometimes differ somewhat under the Linnaean and phylogenetic systems, suggestions are provided for indicating which code governs a name when there is a possibility of confusion.

The starting date of the PhyloCode has not yet been determined and is cited as 1 January 200n in the draft code. Names that were provided with published phylogenetic definitions before that date are not considered to be established under the PhyloCode. The starting date will be scheduled to coincide with the publication of a companion volume that will provide phylogenetic definitions for many widely used clade names. This volume will also provide an opportunity for the authors of names that were given phylogenetic definitions before the starting date to republish them in accordance with the PhyloCode and thereby establish their nomenclatural precedence. The delayed starting date will provide the time needed to prepare the companion volume and establish a registration system. It will also permit sufficient time for experimentation with the PhyloCode with no permanent nomenclatural consequences. Some changes in the code will no doubt result. It is hoped that many people will avail themselves of this opportunity to explore the ramifications of phylogenetic nomenclature in the taxa with which they are familiar.

Properties of Phylogenetic Nomenclature. The phylogenetic system of nomenclature embodied in the PhyloCode has the following properties: 1) The system is rankless. Although taxa are hierarchically related, assignment of rank is not part of the naming process and has no bearing on the spelling or application of taxon names. 2) Rules are provided for naming clades and will eventually be provided for naming species. In this system, the categories "species" and "clade" are not ranks but different kinds of biological entities. A species is a segment of a population lineage, while a clade is a monophyletic group of species. Both are products of evolution that are discovered, rather than created, by systematists, and both have an objective existence regardless of whether they are named. 3) In contrast to the preexisting codes, supraspecific names do not have types in the sense that this term is used in the preexisting codes (although some clade names may have a preexisting genus name as a root). Instead, a supraspecific name is given a phylogenetic definition and applies to whatever clade fits that definition, regardless of its hypothesized composition. Species, specimens, and synapomorphies cited within these definitions are called specifiers because they are used to specify the clade to which the name applies. Thus, specifiers function somewhat like types in providing reference points that determine the application of a name. Until the PhyloCode includes rules governing species names, the names of species used as specifiers must be those governed by the preexisting codes. 4) Another novel aspect of the PhyloCode is that it permits the taxonomist to restrict the application of names with respect to clade composition. If a taxonomist wishes to ensure that a name refers to a clade that either includes or excludes particular subtaxa, the definition may contain a qualifying clause specifying conditions under which the name cannot be used. 5) Fundamental differences between the phylogenetic and traditional systems in how supraspecific names are defined lead to operational differences in the determination of synonymy and homonymy. For example, under the PhyloCode, synonyms are names whose phylogenetic definitions specify the same clade, regardless of prior associations with particular ranks; in contrast, under the preexisting codes, synonyms are names of the same rank based on types within the group of concern, regardless of prior associations with particular clades. 6) As with the preexisting codes, precedence determines the correct name of a taxon when synonyms or homonyms exist. In general, precedence is based on the date of establishment under the PhyloCode, but a later-established name may be conserved over earlier names for the same taxon under exceptional circumstances at the discretion of the International Committee on Phylogenetic Nomenclature. The requirement that all established names be registered will reduce the frequency of accidental homonyms.

Advantages of Phylogenetic Nomenclature. Phylogenetic nomenclature has several advantages over the traditional system. In the case of clade names, it eliminates a major source of instability under the preexisting codes--name changes due solely to shifts in rank. It also facilitates the naming of new clades as they are discovered. Under the preexisting codes, it is often difficult to name clades one at a time, the way that new species are named, because a taxon name is affected by its rank, which in turn depends on the ranks of more and less inclusive taxa. In a group in which the standard ranks are already in use, naming a newly discovered clade requires either the use of an unconventional intermediate rank (e.g., supersubfamily) or the shifting of less or more inclusive clades to lower or higher ranks, thus causing a cascade of name changes. This problem encourages systematists to delay naming clades until an entire classification is developed. In the meanwhile, well supported clades are left unnamed, and taxonomy falls progressively farther behind knowledge of phylogeny. This is a particularly serious drawback at the present time, when recent advances in molecular biology and computer technology have led to a burst of new information about phylogeny, much of which is not being translated into taxonomy. The availability of the PhyloCode will permit researchers to name newly discovered clades much more easily than they can under the preexisting codes. For many researchers, naming clades is just as important as naming species. In this respect, the PhyloCode reflects a philosophical shift from naming and classifying species to naming both species and clades. This does not mean, however, that all clades must be named. Criteria that influence the decision whether to name a clade include level of support, phenotypic distinctiveness, economic importance, etc.

When the PhyloCode is extended to species, it will improve nomenclatural stability here as well, by removing the linkage to a genus name. A major source of instability in species names under the preexisting codes (except the viral code, which does not use binomial nomenclature), revision of generic limits, will thereby be eliminated. There will, of course, be a consequent absence of hierarchical information in species names governed by the PhyloCode; specifically, one will not be able to infer phylogenetic relationship from these names in the way that one can infer genus assignment from species names governed by the preexisting codes. However, an underlying principle of the PhyloCode is that the primary purpose of a taxon name is to provide a means of referring unambiguously to a taxon, not to indicate its relationships. From this perspective, the loss of nomenclatural stability of species names under the preexisting codes is too high a price to pay for incorporating taxonomic information (genus assignment) into the names. Moreover, although such information will not be built into species names under the PhyloCode, phylogenetic position can easily be indicated by associating the species name with the names of one or more clades to which it belongs.

Another benefit of phylogenetic nomenclature is that abandonment of ranks eliminates the most subjective aspect of taxonomy. The arbitrary nature of ranking is not widely appreciated by non-taxonomists. This misunderstanding leads to faulty reasoning on the part of some researchers, who treat taxa at the same rank as if they are comparable in some biologically meaningful way. That is, they commit the error of counting genera or families rather than counting clades or species that possess properties relevant to the question of interest or tracing the evolution of these properties on a phylogenetic tree. This kind of error is not possible in a rankless system.

History. The theoretical foundation of the PhyloCode was developed in a series of papers by de Queiroz and Gauthier (1990, 1992, 1994), which built on earlier suggestions that a taxon name could be defined by reference to a part of a phylogenetic tree (Ghiselin 1984; Rowe 1987; de Queiroz 1988). The theory was in development for several years before the first of these theoretical papers was published, and explicit phylogenetic definitions were used in some earlier papers (Gauthier, 1984, 1986; de Queiroz,1985, 1987; Gauthier et al., 1988; Estes et al., 1988; Rowe,1988). Several other papers contributed to the development of phylogenetic nomenclature (Rowe and Gauthier, 1992; Bryant 1994, 1996, 1997; de Queiroz 1994, 1997a,b; Sundberg and Pleijel 1994; Schander and Thollesson 1995; Lee 1996a, b, 1998, 1999a, b; Wyss and Meng 1996; Cantino et al. 1997; Kron 1997; Baum et al., 1998; Cantino 1998, 2000; Eriksson et al., 1998; Hibbett and Donoghue 1998; Moore 1998; Schander 1998a, b; Cantino et al., 1999; Pleijel, 1999; Sereno 1999). Other papers have discussed or applied phylogenetic nomenclature, including several by members of the PhyloCode advisory group. Three symposia have focused on phylogenetic nomenclature. The first one (1995), organized by Richard G. Olmstead and entitled "Translating Phylogenetic Analyses into Classification," took place at the annual meeting of the American Institute of Biological Sciences in San Diego, California, U.S.A. The 1996 Southwestern Botanical Systematics Symposium at the Rancho Santa Ana Botanic Garden in Claremont, California, U.S.A., organized by J. Mark Porter and entitled "The Linnean Hierarchy: Past Present and Future," focused in part on phylogenetic nomenclature. Philip Cantino and Torsten Eriksson organized a symposium at the XVI International Botanical Congress in St. Louis, Missouri, U.S.A. (1999), entitled "Overview and Practical Implications of Phylogenetic Nomenclature."

The preparation of the PhyloCode began in the autumn of 1997, following a decision by Michael Donoghue, Philip Cantino, and Kevin de Queiroz to organize a workshop for this purpose. The workshop took place August 7-9, 1998, at the Harvard University Herbaria, Cambridge, Massachusetts, U.S.A., and was attended by 27 people from five countries: William S. Alverson, Harold N. Bryant, David C. Cannatella, Philip D. Cantino, Julia Clarke, Peter R. Crane, Noel Cross, Michael J. Donoghue, Torsten Eriksson, Jacques Gauthier, Kancheepuram Gandhi, Kenneth Halanych, David S. Hibbett, David M. Hillis, Kathleen A. Kron, Michael S. Y. Lee, Alessandro Minelli, Richard G. Olmstead, Fredrik Pleijel, J. Mark Porter, Kevin de Queiroz, Heidi E. Robeck, Timothy Rowe, Christoffer Schander, Per Sundberg, Mikael Thollesson, and André R. Wyss. An initial draft of the code prepared by Cantino and de Queiroz was provided to the workshop participants in advance and was considerably revised by Cantino and de Queiroz as a result of decisions made at the meeting. The initial draft of Article 21 was written by F. Pleijel, A. Minelli, and K. Kron and subsequently modified by M. Donoghue and P. Cantino. The initial drafts of Recommendations 10D and 11.8B were contributed by T. Rowe. Article 8 and Appendix A were written largely by T. Eriksson. William M. Owens provided the Latin terms in Article 9.3. Whenever possible, the writers of the PhyloCode used the draft BioCode (Greuter et al. 1998) as a model for the unification of the preexisting codes. Thus, the organization of the PhyloCode, some of its terminology, and the wording of certain rules is derived from the BioCode. Other rules are derived from one or more of the preexisting codes, particularly the Botanical and Zoological Codes (Greuter et al. 1994; International Commission on Zoological Nomenclature 1985, 1999). However, many rules in the PhyloCode have no counterpart in the any code based on the Linnaean taxonomic categories because of fundamental differences in the definitional foundations of the systems.

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Preamble

1. Biology requires a precise, coherent, international system for naming clades and species of organisms. The PhyloCode attempts to satisfy this need by providing rules for naming clades (this version) and species (future versions) and describing the nomenclatural principles that form the basis for those rules.

2. The PhyloCode is applicable to the names of all clades (this version) and species (future versions) of organisms, whether extant or extinct.

3. The PhyloCode may be used concurrently with the preexisting codes.

4. Although the PhyloCode relies on the preexisting codes (i.e., *International Code of Botanical Nomenclature* (ICBN), *International Code of Zoological Nomenclature* (ICZN), *International Code of Nomenclature of Bacteria: Bacteriological Code* (BC), *International Code of Virus Classification and Nomenclature* (ICVCN)) to determine the acceptability of preexisting names, it governs the application of those names independently from the preexisting codes.

5. The PhyloCode includes rules, recommendations, and notes. Rules are mandatory. Recommendations are not mandatory, but systematists are encouraged to follow them. Notes are intended solely for clarification.

6. The PhyloCode will take effect on 1 January 200n and is not retroactive.

Division I. Principles

1. Reference. The primary purpose of taxon names is to provide a means of referring to taxa, as opposed to indicating their characters, relationships, or membership.

2. Clarity. Taxon names should be unambiguous in their designation of particular taxa. Nomenclatural clarity is achieved through explicit definitions.

3. Uniqueness. To promote clarity, each taxon should have only one accepted name, and each accepted name should refer to only one taxon.

4. Stability. The names of taxa should not change over time. As a corollary, it must be possible to name newly discovered taxa without changing the names of previously discovered taxa.

5. Phylogenetic context. The PhyloCode is concerned with the naming of taxa and the application of taxon names within a phylogenetic context.

6. The PhyloCode permits freedom of taxonomic opinion with regard to hypotheses about relationships; it only concerns how names are to be applied within the context of a given phylogenetic hypothesis.

Division II. Rules

Chapter I. Taxa

Article 1. The Nature of Taxa

1.1. Taxonomic groups of organisms are called taxa (singular: taxon). Taxa may be clades or species, but only clade names are governed by this version of the PhyloCode.

Article 2. Clades

2.1. Every individual organism belongs to at least one clade (i.e., the clade comprising all of life). Each organism also belongs to a number of nested clades (though the ancestor of the clade comprising all life does not belong to any other clade).

2.2. It is not necessary that all clades be named.

Article 3. Hierarchy and Rank

3.1. The system of nomenclature described in this code is rankless. Although clades are hierarchically related, assignment of a categorical rank (e.g., genus, family, etc.) is not part of the formal naming process and has no bearing on the spelling or application of taxon names.

Note 3.1.1. In this code, the terms "species" and "clade" refer to different kinds of biological entities, not ranks.

3.2. The concepts of synonymy, homonymy, and precedence adopted in this code (see Arts. 12-14) are, in contrast to the preexisting codes, independent of categorical rank.

Chapter II. Publication

Article 4. Publication Requirements

4.1. The provisions of this article apply not only to the publication of names, but also to the publication of any nomenclatural act (e.g., a proposal to conserve a name).

4.2. Publication, under this code, is defined as distribution of text (but not sound), with or without images, in a peer-reviewed book or periodical. To qualify as published, works must consist of numerous (at least 100 copies), simultaneously obtainable, identical, durable, and unalterable copies, distributed in a way that makes the work generally accessible as a permanent public record to the scientific community, be it through sale or exchange or gift, and subject to the restrictions and qualifications in the present article.

Note 4.2.1. Approval of a work by a thesis or dissertation committee does not constitute peer review.

4.3. The following do not qualify as publication: (a) dissemination of text or images solely through electronic communication networks (such as the Internet) or through storage media (such as CDs, diskettes, film, microfilm and microfiche) that require a special device to read; (b) theses and dissertations; (c) abstracts of articles, papers, posters, texts of lectures, and similar material presented at meetings, symposia, colloquia or congresses, even if the abstract is published in a peer-reviewed journal; (d) the placing of texts or images in collections or exhibits, for example, on labels (including specimen labels, even if printed) or information sheets; (e) the reproduction of hand-written material in facsimile, for example, by photocopy; (f) patents and patent applications; (g) newspapers and periodicals intended mainly for non-biologists, abstracting journals, trade catalogues, and seed exchange lists; (h) anonymous works.

Note 4.3.1. If a name is disseminated through electronic publication (see Art. 4.3a), it must also satisfy the requirements in Article 4.2.

Article 5. Publication Date

5.1. The publication date is the date on which publication, as defined in Article 4, took place. In the absence of proof establishing some other date, the one appearing in the publication itself must be accepted.

Chapter III. Names

Section 1. Status

Article 6

6.1. Established names are those that are published in accordance with Article 7 of this code. Unless a name is established, it has no status under this code.

Recommendation 6.1A. In order to distinguish scientific names from other (e.g., vernacular) names, all names established under this code should be italicized when they appear in print.

Recommendation 6.1B. In order to indicate which names are established under this code and therefore have explicit phylogenetic definitions (and whose endings are not reflective of rank), it may be desirable to distinguish these names from supraspecific names governed by preexisting codes, particularly when both are used in the same publication.

Example 1: The letter "P" (bracketed or in superscript) might be used to designate names governed by the PhyloCode, and the letter "L" to designate names governed by the preexisting Linnaean codes. Using this convention, the name "*Ajugoideae*[L]" would apply to a plant subfamily which may or may not be a clade, whereas "*Teucrioideae*[P]" would apply to a clade which may or may not be a subfamily.

Example 2: If the name *Teucrioideae* applied to both a clade (PhyloCode) and a subfamily (ICBN), they could be distinguished as Clade *Teucrioideae* versus Subfamily *Teucrioideae*.

6.2. Preexisting names are scientific names that, prior to their establishment under this code, were either: (a) "legitimate" (ICBN, BC), "potentially valid" (ICZN), or "valid" (ICVCN); or (b) in use but not governed by any code (e.g., zoological names ranked above the family group).

6.3. Converted names are preexisting names that have been established according to this code.

6.4. An acceptable name of a taxon is one that is in accordance with the rules of this code; that is, it is both (a) established and (b) not a non-conserved later homonym (Art. 15).

6.5. The accepted name of a taxon is the name that must be adopted for it under this code. It must (1) be established (Art. 7), (2) have precedence (Arts. 12-15) over alternative uses of the same name (homonyms) and alternative names for the same taxon (synonyms), and (3) not be rendered inapplicable by a qualifying clause in the context of a particular phylogenetic hypothesis (Art. 11.9).

Section 2. Establishment

Article 7. General Requirements

7.1. Establishment of a name can only occur on or after 1 January 200n, the starting date for this code.

7.2. In order to be established, a name of a taxon must: (a) be published as provided for by Article 4; (b) be adopted by the author(s), not merely proposed for the sake of argument or on the condition that the group concerned will be accepted in the future; (c) comply with the provisions of Articles 7 and 9-11; (d) be registered as provided for in Article 8, and the registration number be cited in the protologue; and (e) comply with the provisions of Article 17.

Note 7.2.1: The protologue is everything associated with a name when it was first established (this code), validly published (ICBN, BC), or made available (ICZN), for example, description or diagnosis, phylogenetic definition, registration number, designation of type, illustrations, references, synonymy, geographical data, specimen citations, and discussion.

7.3. When a publication contains a statement to the effect that names or nomenclatural acts in it are not to be considered for nomenclatural purposes, names that it may contain are considered as not established.

Article 8. Registration

8.1. In order for a name to be established under the PhyloCode, the name and other required information must be submitted to the PhyloCode registration database. A name may be submitted to the database prior to acceptance for publication, but it is not registered (i.e., given a registration number) until the author notifies the database that the paper or book in which the name will appear has been accepted for publication.

Note 8.1.1: Specification of the data that are required for registration can be obtained via the Internet or directly from the database administrator. The registration procedure, a provisional list of required data, and the pertinent addresses are found in Appendix A.

Recommendation 8.1A. A name should not be submitted to the registration database more than one month before it is submitted for publication.

Recommendation 8.1B. Registration of a name whose spelling or definition is identical to one that already exists in the database should be avoided. However, such names are not treated by this code as homonyms or synonyms until published.

Recommendation 8.1C. In order for the database to be as useful as possible for the scientific community, the author should provide the database with the publication reference as soon as the name is published.

8.2. At the submitter's request, a name or definition that he or she proposed can be changed or removed from the registration database if it is not yet published.

Recommendation 8.2A. The submitter of an unpublished registered name or definition who decides to change it or not to publish it should notify the database administrator promptly.

8.3. If the definition given at the time of registration differs from that given in the protologue, then the published definition is to be considered correct, and the database is to be annotated to alert users to the discrepancy.

Recommendation 8A. If a name or definition has been registered, but there is no indication in the registration database whether it was ever published, the name or definition should not be published by another person who has not first attempted to determine whether it was ever published. If bibliographic databases fail to resolve the question, a serious effort should be made to contact the person who registered the name or definition. (Contact information submitted with the name and maintained in the database may facilitate this.)

Recommendation 8B. If a serious but unsuccessful attempt has been made to determine whether a registered name was ever published, and the name is new (not based on a preexisting name), it is better to choose a different name, rather than use the same name and risk creating a homonym. If, in the same situation, the registered name is based on a preexisting name, it is better to publish a definition of this name, even at the risk of creating a homonym, rather than choose another, less appropriate name. This is particularly true if the registered name is widely used.

Chapter IV. Clade Names

Article 9. General Requirements for Establishment of Clade Names

9.1. The names of clades may be established through conversion of preexisting names or introduction of new names.

9.2. In order to be established, the name of a clade must consist of a single word and begin with a capital letter (see also Art. 17).

9.3. In order to be established, converted clade names must be clearly identified as such in the protologue by the designation "converted clade name" or "nomen cladi conversum." New clade names must be identified as such by the designation "new clade name" or "nomen cladi novum."

9.4. In order to be established, a clade name must be provided with a phylogenetic definition, written in English or Latin, linking it explicitly with a particular clade. The name applies to whatever clade fits the definition.

Note 9.4.1: Examples of phylogenetic definitions are node-based, stem-based, and apomorphy-based definitions. A node-based definition may take the form "the clade stemming from the most recent common ancestor of A and B" (and C, D, etc., as needed) or "the least inclusive clade containing A and B" (and C, D, etc.), where A-D are specifiers (see Art. 11.1). A node-based definition may be abbreviated as Clade (A+B). A stem-based definition may take the form "the clade consisting of Y and all organisms that share a more recent common ancestor with Y than with W" (or V or U, etc., as needed) or "the most inclusive clade containing Y but not W" (or V or U, etc.). A stem-based definition may be abbreviated as Clade (Y<--W). An apomorphy-based definition may take the form "the clade stemming from the first species to possess character M synapomorphic with that in H." An apomorphy-based definition may be abbreviated as Clade (M in H). Other wordings and other kinds of phylogenetic definitions are possible.

Note 9.4.2: The application of a phylogenetic definition, and thus also a phylogenetically defined clade name, requires an hypothesized phylogeny.

9.5. In order for conversion to be effected, the preexisting name that is being converted to a phylogenetically defined clade name must be clearly indicated, and a direct and unambiguous bibliographic citation (see Art. 9.6) demonstrating its prior use must be provided. If the citation provided does not refer to the original publication of the name, this fact must be stated.

Note 9.5.1: Errors in the bibliographic citation for a preexisting name should be corrected by subsequent authors, but they do not invalidate the establishment of the corresponding converted name.

Recommendation 9.5A. If possible, the bibliographic citation for the preexisting name should refer to the original publication of the name. If the original publication cannot be determined, a subsequent use of the name may be cited instead.

9.6. In order for a bibliographic citation to be direct and unambiguous, it must include author(s) (see Art. 19), year, title, journal name (where applicable), page(s), and plate or figure reference (where applicable).

Note 9.6.1: If the protologue or subsequent use of the name to which a bibliographic citation refers is part of a publication with consecutive pagination, the page on which the protologue or subsequent use appears should be cited, as opposed to citing only the range of pages of the entire publication.

Recommendation 9A. Clades to be named should be based on a published phylogeny derived via an explicit, reproducible analysis.

Recommendation 9B. Establishment of names for poorly supported clades should be done with careful consideration of possible nomenclatural consequences if the phylogenetic hypothesis turns out to be incorrect. It may frequently be advisable to use only informal names for poorly supported clades.

Recommendation 9C. Conversion of preexisting names to clade names should be done with a thorough knowledge of the group concerned, including its taxonomic and nomenclatural history and previously used diagnostic features. Wholesale conversion of preexisting names by authors who have not worked on the systematics of the groups concerned is strongly discouraged.

Recommendation 9D. If the composition of the clade designated by a name is likely to be in question, the protologue should include a reference to the hypothesized phylogeny that provided the context for the definition.

Note 9D.1: This reference phylogeny is not part of the definition and does not prevent the name from being applied in the context of alternative phylogenies.

Recommendation 9E. In order to facilitate referral of species that are not cited in the definition of a clade name or included in the phylogenetic analyses that provide evidence for the existence of the clade, it will often be worthwhile to include in the protologue an English or Latin description or diagnosis, a list of synapomorphies, and/or a list of included taxa.

Recommendation 9F. If an apomorphy-based definition is used, the apomorphy should be described or illustrated in sufficient detail that users of the definition will understand the author's intent.

Article 10. Selection of Clade Names for Establishment

10.1. A preexisting specific or infraspecific epithet may not be converted to a clade name.

Note 10.1.1: This rule prohibits the intentional conversion of an epithet to a clade name. However, the accidental use of a clade name that is spelled identically to an epithet of a distantly related species or infraspecific taxon does not violate this rule or invalidate the clade name.

Recommendation 10A. Clade names should be selected in such a way as to minimize disruption of current usage. When establishing the name of a clade, a preexisting name that has been applied to this clade should generally be selected if such a name exists. If more than one preexisting name has been applied to the clade, the name that is most widely and consistently used for it should generally be chosen. Similarly, if a preexisting name is phylogenetically ambiguous because it has been applied to more than one clade, it should generally be established for the clade to which it has been most widely and consistently applied. If there is no preexisting name for the clade, or if all preexisting names are so phylogenetically ambiguous that their use may cause confusion, a preexisting name that has been applied to a paraphyletic group stemming from the same ancestor may be used, or a new name may be established.

Recommendation 10B. In selecting new clade names, an effort should be made to avoid any name that, under a preexisting code, applies to a non-overlapping group.

Recommendation 10C. In selecting new clade names, an effort should be made to avoid names that are so similar to names that were previously established under this code that they are likely to be confused.

Recommendation 10D. Names referring to mitotic asexual morphs (anamorphs) of ascomycete and basidiomycete fungi are treated by the ICBN and Draft BioCode as applicable only to the organ or morph represented by their type, not to the fungus in all its morphs (holomorph), which is considered to be represented by the teleomorph, i.e. the morph characterized by the production of asci/ascospores, basidia/basidiospores, teliospores, or other basidium-bearing organs. Because of the frequent polyphyly of the sets of species to which anamorph names traditionally apply, the names of clades of ascomycete and basidiomycete fungi should not be based on the names of anamorphs unless there is reason to believe that the group generally associated with the anamorph name is monophyletic.

Article 11. Specifiers and Qualifying Clauses

11.1. Specifiers are species, specimens, or synapomorphies cited in a phylogenetic definition of a name as reference points that serve to specify the clade to which the name applies. All specifiers used in node-based and stem-based definitions of clade names, and one of the specifiers used in apomorphy-based definitions of clade names, are species or specimens. The other specifier used in an apomorphy-based definition of a clade name is a synapomorphy. If subordinate clades are cited in a phylogenetic definition of a more inclusive clade, their specifiers must also be explicitly cited within the definition of the more inclusive clade.

11.2. An internal specifier is a specifier that is explicitly included in the clade whose name is being defined; an external specifier is one that is explicitly excluded from it. All specifiers in node-based and apomorphy-based definitions are internal, but stem-based definitions must always have at least one specifier of each type.

11.3. When a species is used as a specifier, the author and publication year of the species name must be cited.

11.4. When a type specimen is used as a specifier, the species name that it typifies and the author and publication year of that species name must be cited.

11.5. Specimens that are not types may be used as specifiers only if the specimen does not belong to a named species under any code.

Note 11.5.1: Permitting the use of specimens that are not types as specifiers makes it possible to name a clade without necessarily naming species to accommodate every specifier if one or more specifiers do not already belong to named species.

Recommendation 11.5A. If a specimen that is not a type is used as a specifier in the situation described in Article 11.5, and a species that includes this specimen is subsquently named, this specimen should be chosen as the type of the species name.

11.6. When a specimen that is not a type is used as a specifier in a phylogenetic definition, the institution or collection in which the specifier is conserved must be identified, as well as the collection number or other information needed to establish the identity of the specimen.

11.7. When a specimen that is not a type is used as a specifier in a phylogenetic definition, a brief description of the specimen must be provided, sufficient to convey a mental image and distinguish the specimen from organisms with which it might be confused.

11.8. In the interest of consistency with the preexisting codes, a clade whose name is converted from a genus name under a preexisting code, or is derived from the stem of a genus name, should include the type of the genus name. Therefore, when a clade name is converted from a preexisting genus name or is a new or converted name derived from the stem of a genus name, the definition of the clade name must use the type species of that genus as an internal specifier.

Example 1: If the preexisting name *Magnoliales*, which is based on the genus name *Magnolia*, is converted to a clade name, its definition must use the type species of Magnolia as an internal specifier.

Example 2: If *Ajugina*, which is not a preexisting name but is based on the preexisting genus name *Ajuga*, is adopted as the name of a clade, the definition of *Ajugina* must use the type species of *Ajuga* as an internal specifier.

Recommendation 11.8A. If it is questionable whether a type species of a genus is part of the clade to be named, then the type species should not be used as a specifier (see Rec. 11B), and neither that genus name nor a name derived from the stem of that genus name should be formally defined as referring to that clade.

Example 1: If it is questionable whether the type species of *Magnolia* belongs to a clade that is to be named, this species should not be used as a specifier, and the clade should not be named *Magnolia*, *Magnoliales* or any other name based on the stem of the name *Magnolia*.

Note 11.8A.1. Failure to include the type species of a genus in an analysis is not, in itself, reason to invoke Recommendation 11.8A. There may be evidence suggesting that another species that was included in the analysis is closely related to the type.

Recommendation 11.8B. If it is questionable whether the type specimen of a preexisting name belongs to the clade to be named (e.g., because of the fragmentary nature of the specimen), then that preexisting name (or its type) should not be used as a specifier (see Rec. 11C), and the corresponding name should not be converted to a clade name.

Example 1: Under the ICBN, the names *Cordaites*, *Cordaixylon*, and *Mesoxylon* refer to genera of extinct gymnosperms. The types of the latter two names are fossil stems, but it has been possible to reconstruct whole plants that belonged to each genus. The oldest of the three names, *Cordaites*, is typified by fossil leaf material that could have been produced by a member of either *Cordaixylon* or *Mesoxylon*. If a clade is named that includes plants with *Cordaixylon*-type stems but not *Mesoxylon*-type stems, the type species of *Cordaites* should not be cited as a specifier because its type specimen may not belong to this clade, and the clade should not be named *Cordaites*.

11.9. In order to restrict the application of a name with respect to clade composition (i.e., under alternative hypotheses of relationship), phylogenetic definitions may include qualifying clauses specifying conditions under which the name cannot be applied to any clade (see Example 1). It is also possible to restrict clade composition under alternative hypotheses of relationship through careful wording of definitions (see Examples 2 and 3).

Example 1: The name *Pinnipedia* is traditionally applied to a group composed of sea lions (*Oatriidae*), walruses (*Odobenidae*), and seals (*Phocidae*). However, under some phylogenetic hypotheses, the sister group of one or more of these taxa is a group of terrestrial carnivorans. If the name *Pinnipedia* is defined as "the clade stemming from the most recent common ancestor of *Otaria byronia* de Blainville 1820, *Odobenus rosmarus* Linnaeus 1758, and *Phoca vitulina* Linnaeus 1758, provided that it possessed flippers homologous with those in the aforementioned species," then the name would not be applicable to any clade in the context of phylogenetic hypotheses in which the most recent common ancestor of these species was inferred not to have had flippers. The phrase "provided that it possessed flippers homologous with those in the aforementioned species" is a qualifying clause.

Example 2: Suppose the name *Lepidosauriformes* was defined as referring to the most inclusive clade containing *Lacerta agilis* Linnaeus 1758 but not *Youngina capensis* Broom 1914 (Fig. 1).

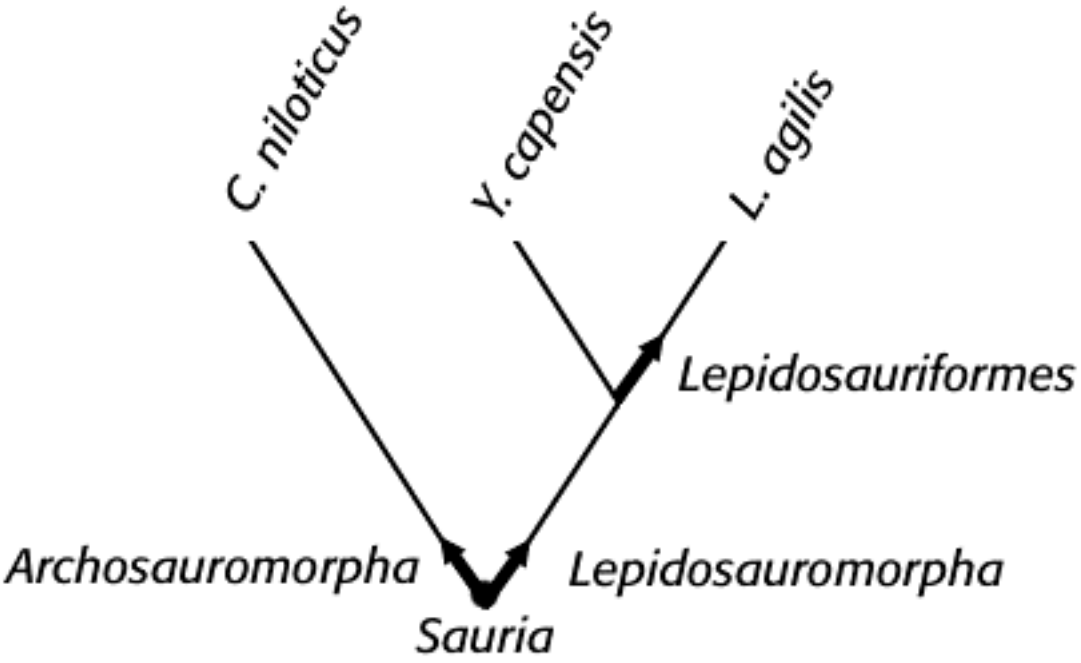

Figure 1

Further suppose that all of these taxa were considered subclades of the more inclusive clade *Lepidosauromorpha* (Clade (*Lacerta agilis* <-- *Crocodylus niloticus* Laurenti 1768)), which was considered the sister group of the clade named *Archosauromorpha* (Clade (*Crocodylus niloticus* <--*Lacerta agilis*)). If *Youngina capensis* turned out to be outside of the clade stemming from the most recent common ancestor of *Lacerta agilis* and *Crocodylus niloticus* (a node-based clade named *Sauria*), then the name *Lepidosauriformes* would refer to a clade more inclusive than the clade named *Lepidosauromorpha*, reversing the former hierarchical relationships of the names (Fig. 2).

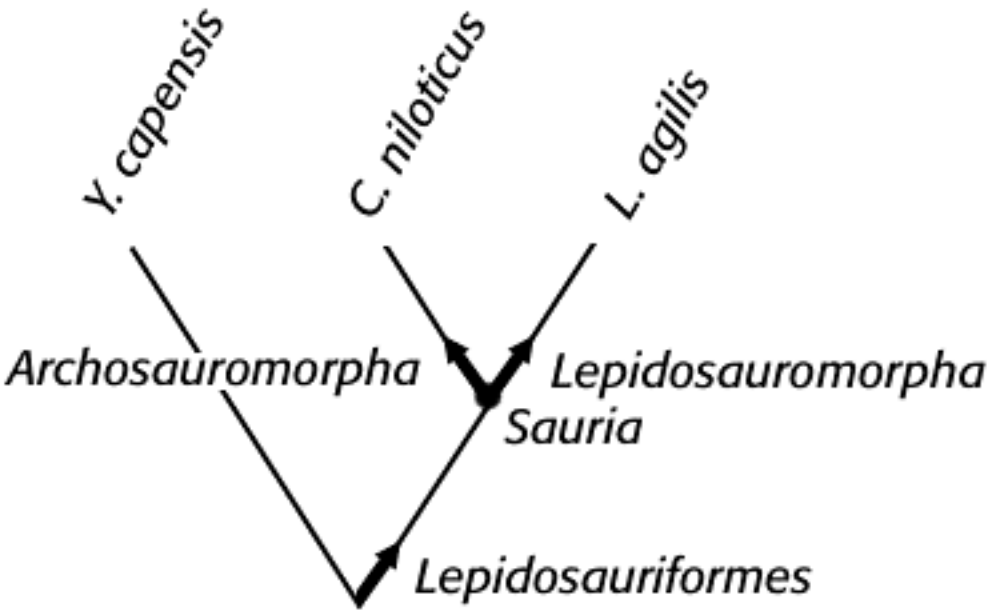

Figure 2

In order to prevent these names from reversing their hierarchical relationships, the name *Lepidosauriformes* could be defined as "the most inclusive subclade of *Sauria* (Clade (*Lacerta agilis* + *Crocodylus niloticus*)) containing *Lacerta agilis* but not *Youngina capensis*," in which case *Lepidosauriformes* would become a synonym of *Lepidosauromorpha* (rather than the name of a more inclusive clade) in the context of the new phylogenetic hypothesis (Fig. 3).

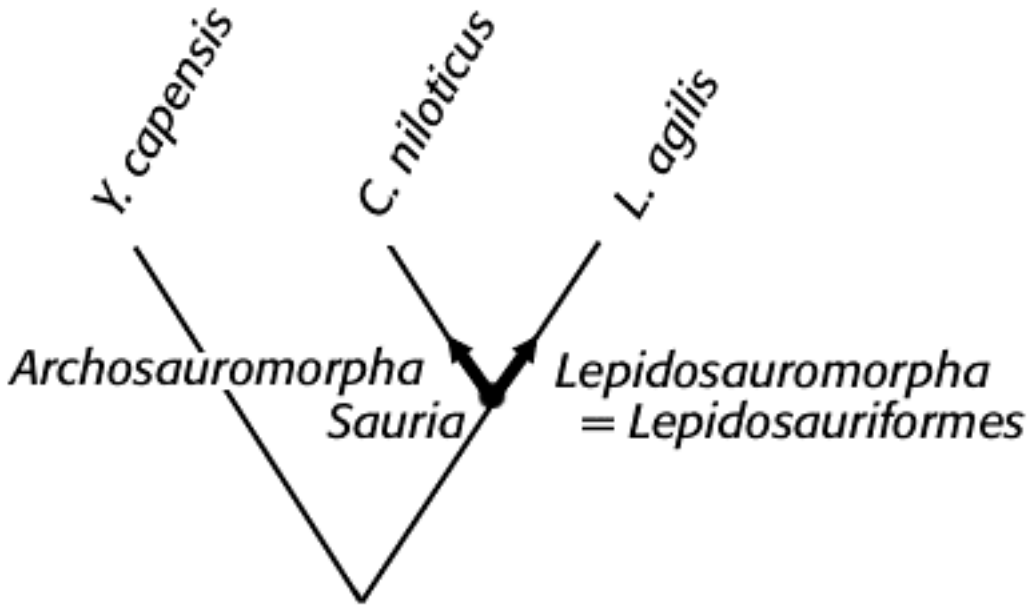

Figure 3

The first definition leaves the application of the name *Lepidosauriformes* unrestricted; the second definition restricts its application to a subclade of *Sauria*. However, the same restriction can be achieved by defining *Lepidosauriformes* as the most inclusive clade containing *Lacerta agilis* but not *Youngina capensis* or *Crocodylus niloticus*.

Example 3: If a name is defined through a stem-based definition with more than one internal specifier, and one internal specifier is later found to be more closely related to the external specifier than to the other internal specifier, the definition does not apply to any clade. For example, suppose the name *Halecostomi* had been defined as referring to the most inclusive clade comprising *Amia calva* Linnaeus 1766 and *Perca fluviatilis* Linnaeus 1758 but not *Lepisosteus osseus* Linnaeus 1758. And suppose that subsequent analyses indicated that *Lepisosteus osseus* and *Perca fluviatilis* share a more recent common ancestor with one another than either does with *Amia calva*. If so, then there is no clade that fits the definition of *Halecostomi* (because there is no clade that includes both *Amia calva* and *Perca fluviatilis* but not *Lepisosteus osseus*), and that name cannot be used in the context of the accepted phylogeny.

11.10. Provided that a clade name is acceptable, it remains eligible for use even if there is no clade that fits its definition under a subsequently proposed phylogenetic hypothesis. The name would not be used in the context of that hypothesis, but it would remain eligible for future use under any hypotheses in which there is a clade that fits its definition.

Example 1: Although the name *Pinnipedia* is inapplicable under certain phylogenetic hypotheses if the qualifying clause in Article 11.9, Example 1 is used, the name remains eligible for use under other hypotheses.

Recommendation 11A. Definitions of converted clade names should be stated in a way that attempts to capture the spirit of historical use to the degree that it is consistent with the contemporary concept of monophyly. Consequently, they should not necessitate, though they may allow, the inclusion of subtaxa that were historically excluded from the taxon. To accomplish this goal, internal specifiers of converted clade names should be chosen from among the set of taxa that were considered to form part of a taxon under either the original or traditional ideas about the composition of that taxon, and they should not include members of subtaxa that were not historically considered part of the taxon.

Example 1: The name *Dinosauria* was coined by Owen for the taxa *Megalosaurus*, *Iguanodon*, and *Hylaeosaurus*, and traditionally the taxon designated by that name has included these and certain other non-volant reptiles. It has not traditionally included birds. Although birds are now considered part of the dinosaur clade, the name *Dinosauria* should not be defined using any bird species as internal specifiers. Such a definition would force birds to be dinosaurs, thus trivializing the question of whether birds are dinosaurs. Instead, internal specifiers should be chosen from among taxa that have traditionally been considered dinosaurs; e.g., *Megalosaurus bucklandi* von Meyer1832, *Iguanodon anglicus* Holl 1829, and *Hylaeosaurus armatus* Mantell 1833.

Recommendation 11B. If there is reason to question that a species is a member of a particular clade, that species should not be used as a specifier in the definition of the name of that clade.

Recommendation 11C. It follows from Recommendation 11B that phylogenetic definitions of clade names should not use as specifiers species whose type specimens are ambiguous (e.g., because they are lost or fragmentary). Because they are commonly based on ambiguous types, ichnotaxa (ICZN) and species belonging to form genera (ICBN) should not be used as specifiers. When this recommendation is combined with Article 11.8, it follows that clade names should not be based on the names of ichnotaxa or form genera.

Recommendation 11D. In a node-based definition, it is best to use a set of internal specifiers that includes representatives of all subclades that are likely to be basal within the clade being named, unless doing so would be contrary to recommendation 11B. Constructing a node-based definition in this way will reduce the chance that, under a new phylogenetic hypothesis, the name will refer to a less inclusive clade than originally intended.

Recommendation 11E. In a stem-based definition, it is best to use a set of external specifiers that includes representatives of all clades that are likely to be the sister group of the clade being named. Constructing a stem-based definition in this way will reduce the chance that, under a new phylogenetic hypothesis, the name will refer to a more inclusive clade than originally intended.

Chapter V. Selection of Accepted Names

Article 12. Precedence

12.1. Nomenclatural uniqueness is achieved through precedence, the order of preference among established names. When homonyms or synonyms exist, precedence determines the selection of accepted names.

Note 12.1.1: Although the entity to which precedence applies in this code is referred to as a name, it is really the combination of a name and its definition. In different cases, one or the other of these components is more important. Specifically, in the case of synonyms, precedence refers primarily to the name, whereas in the case of homonyms, precedence refers primarily to the definition.

12.2. Precedence is based on the date of establishment, with earlier-established names having precedence over later ones, except that later-established names may be conserved over earlier ones under the conditions specified in Article 15.

Note 12.2.1. In the case of homonymy involving names governed by two or more preexisting codes (e.g., the application of the same name to a group of animals and a group of plants), precedence is based on the date of establishment under the PhyloCode. However, the International Committee on Phylogenetic Nomenclature (see Art. 21) has the power to conserve a later-established homonym over an earlier-established homonym. This might be done if the later homonym is much more widely known than the earlier one.

12.3 For the determination of precedence, the date of establishment is considered to be the date of publication (see Art. 5), not the date of registration (but see Arts. 13.4 and 14.3).

Article 13. Homonymy

13.1. Homonyms are names that are spelled identically but potentially refer to different taxa. In this code, homonyms are established and identically spelled clade names based on different phylogenetic definitions.

Note 13.1.1: Homonyms may refer to the same taxon under some phylogenetic hypotheses but to different taxa under other hypotheses.

Example 1: Suppose that Pedersen defined *Lamiaceae* as the name of the least inclusive clade containing *Lamium purpureum* Linnaeus 1753 and *Congea tomentosa* Roxburgh 1819, and Ramírez defined *Lamiaceae* as the name of the least inclusive clade containing *Lamium purpureum* Linnaeus 1753 and *Symphorema involucratum* Roxburgh 1798. If so, these two definitions would refer to the same clade in the context of any phylogeny in which *Congea tomentosa* and *Symphorema involucratum* are more closely related to each other than either is to *Lamium purpureum*, but not if *Congea tomentosa* is more closely related to *Lamium purpureum* than it is to *Symphorema involucratum*.

Note 13.1.2. It may be desirable to emend a definition in order to permit the continued use of a widely known name that might otherwise have to be abandoned because the original phylogenetic definition did not accurately describe the widely understood concept of the clade. However, publishing a new definition in association with a previously established name creates a homonym. The only way to emend a definition and have it become the accepted definition is to create a homonym and apply to have it conserved by the International Committee on Phylogenetic Nomenclature (see Arts. 15 and 21.6).

Example 1: If *Lamiaceae* were defined through a node-based definition that included *Tetrachondra hamiltonii* Oliver 1892 as a specifier, and it was subsequently discovered that *Tetrachondra* is actually a basal branch of what was formerly thought to be a more inclusive clade, *Lamiales*, which also had a node-based definition, the names *Lamiaceae* and *Lamiales* would become synonyms. If *Lamiales* were published before *Lamiaceae* and therefore had precedence, *Lamiaceae* would not be the accepted name of any taxon. Because *Lamiaceae* is a widely used name, it might be advantageous to permit its continued use as the name of a subclade of *Lamiales* by providing it with a new definition that does not include any species of *Tetrachondra* as a specifier, thereby creating a homonym (*Lamiaceae*). The new definition would become the accepted one if (and only if) the homonym associated with it is conserved by the International Committee on Phylogenetic Nomenclature.

13.2. Phylogenetic definitions are considered to be different if either: 1) they are of the same kind (e.g., node-based, stem-based, etc.) but cite different specifiers and/or have different restrictions specified in their qualifying clauses (if any), or 2) they are of a different kind.

Note 13.2.1. Alternative wordings of node-based definitions such as those provided in Note 9.4.1 are not considered to be different, provided they are based on the same specifiers and have the same restrictions. The same is true of alternative wordings of stem-based definitions (e.g., those in Note 9.4.1), apomorphy-based definitions, and other types of phylogenetic definitions that are not explicitly mentioned in this code.

Note 13.2.2: A species and its type specimen are considered to be the same specifier.

Note 13.2.3: The two kinds of definitional differences noted in Article 13.2 result in two kinds of homonyms. Homonyms of the first kind are analogous to those that occur under the preexisting codes, whereas homonyms of the second kind are unique to this code.

Example 1: If Mukherjee defined *Prunella* as the name of the least inclusive clade containing *Prunella modularis* Linnaeus 1758 and *Prunella collaris* Scopoli 1769 (which are birds), and Larsen defined *Prunella* as the name of the least inclusive clade containing *Prunella laciniata* Linnaeus 1763, *Prunella grandiflora* Scholler 1775, *Prunella vulgaris* Linnaeus 1753, and *Prunella hyssopifolia* Linnaeus 1753 (which are plants), *Prunella* of Mukherjee and *Prunella* of Larsen would be homonyms of the first kind.

Example 2: Gauthier et al. (1988) defined the name *Lepidosauromorpha* as referring to the clade composed of *Lepidosauria* and all organisms sharing a more recent common ancestor with *Lepidosauria* than with *Archosauria* (a stem-based definition). Laurin (1991) defined the name *Lepidosauromorpha* as referring to the clade stemming from the most recent common ancestor of *Palaeagama*, *Saurosternon*, *Paliguana*, *Kuehneosaurus*, and *Lepidosauria* (a node-based definition). Thus, *Lepidosauromorpha* of Gauthier et al. and *Lepidosauromorpha* of Laurin are homonyms of the second kind.

13.3. If a name has been established for two or more different taxa, the only taxon for which it is an acceptable name is the taxon to which it was applied earliest, except in cases of conservation (Art. 15). A later homonym, unless conserved, is not an acceptable name of any taxon.

13.4. When two or more homonyms have the same publication date (Art. 5), the one that was registered first (and therefore has the lowest registration number) takes precedence.

13.5. If the oldest name of a taxon is not acceptable because it is a later homonym, it is replaced by the established name that has precedence. If all established names that apply to the taxon are not acceptable because they are later homonyms, a replacement name may be explicitly substituted for the earliest-established name that applies to the taxon. A replacement name must be established, following the procedures in Article 7. The definition of a replacement name for a clade is the definition of the name it replaces.

13.6. In order to be established, a replacement name must be clearly identified as such in the protologue where the replacement is published, by the designation "replacement name" or "nomen novum."

13.7. In order for a replacement name to be established, the replaced name on which it is based must be clearly indicated by a direct and unambiguous bibliographic citation (see Art. 9.6) that includes its author, date, and the journal or book in which the name was originally published. The registration number of the replaced name must also be cited.

Article 14. Synonymy

14.1. Synonyms are names that are spelled differently but refer to the same taxon. In this code, synonyms must be established and may be homodefinitional (based on the same definition) or heterodefinitional (based on different definitions). The criteria for determining whether definitions are different are described in Article 13.2, including Notes 13.2.1 and 13.2.2.

Note 14.1.1. Homodefinitional synonyms are synonyms regardless of the phylogenetic context in which the names are applied. However, in the case of names with different definitions, the phylogenetic context determines whether the names are heterodefinitional synonyms or not synonymous.

Example 1: Suppose that *Hypothetica* were defined as the least inclusive clade containing species A and B, and *Cladia* were defined as the least inclusive clade containing species C and B. In the context of any hypothesized phylogeny in which A is more closely related to C than either is to B, *Hypothetica* and *Cladia* would be heterodefinitional synonyms. However, in the context of an alternative hypothesis that A and B are more closely related to each other than either is to C, *Hypothetica* and *Cladia* would not be synonymous.

Note 14.1.2. Node-based, apomorphy-based, and stem-based definitions (Note 9.4.1) usually designate different clades, although they may be nested clades that differ only slightly in inclusiveness. Therefore names based on two or more of these different kinds of definitions are usually not synonyms.

14.2. If there are two or more synonyms for a taxon, the accepted name for that taxon is the earliest acceptable one that applies to it, except in cases of conservation

14.3. When two or more synonyms have the same publication date (Art. 5), the one that was registered first (and therefore has the lowest registration number) takes precedence.

Article 15. Conservation

15.1. Conservation of names (i.e., the combination of name and definition; see Note 12.1.1) is a means of overriding precedence based on date of establishment (Art. 12.2) in the interest of nomenclatural stability.

15.2. Conservation of names is possible only under extraordinary circumstances to be governed by the International Committee on Phylogenetic Nomenclature (see Art. 21).

15.3. Only established names may be conserved.

15.4. Once a name has been conserved, the entry for the affected name in the registration database is to be annotated to indicate its conserved status relative to other names that are simultaneously suppressed. The entries for suppressed names are to be similarly annotated.

15.5. In the case of heterodefinitional synonyms, the earlier name may be conditionally suppressed so that it may be used when not considered synonymous with the later name. In the case of homonyms and homodefinitional synonyms, suppression is unconditional.

15.6. When a name is unconditionally suppressed, there are no conditions under which it has precedence with regard to either synonymy or homonymy. Therefore, if a homodefinitional synonym has been suppressed, that name can be established subsequently with a different definition without creating a homonym.

15.7. When a conserved name competes with names against which it has not been explicitly conserved, the earliest of the competing names has precedence.

Chapter VI. Provisions for Hybrids

Article 16.

16.1. Hybrid origin of a taxon may be indicated by placing the multiplication sign (x) in front of the name. The names of hybrid taxa otherwise follow the same rules as those of non-hybrid taxa.

16.2. An organism that is a hybrid between named taxa may be indicated by placing the multiplication sign between the names of the taxa; the whole expression is then called a hybrid formula.

Recommendation 16.2A. In cases in which it is not clear whether a set of hybrid organisms represents a taxon (as opposed to independently produced hybrid individuals that do not form a species or clade), authors should consider whether a name is really needed, bearing in mind that formulae, though more cumbersome, are more informative.

Chapter VII. Orthography

Article 17. Orthographic Requirements for Establishment

17.1. In order to be established, a clade name must be composed of more than one letter and consist exclusively of letters of the Latin alphabet, which is taken to include j, k, w and y, rare or absent in classical Latin. If other letters, ligatures, numerals, or diacritical signs foreign to classical Latin appear in a name, it cannot be established (but see Note 17.1.1). When such letters, ligatures, or diacritical signs appear in the protologue of a preexisting name, they must be transcribed at the time of conversion in conformity with the preexisting code that is applicable to the taxon concerned.

Note 17.1.1. The use of the diaeresis, indicating that a vowel is to be pronounced separately from the preceding vowel, is not part of the orthography of a name, though it may be included in an established name as an optional pronunciation guide.

17.2. A name may not contain hyphens or apostrophes. Hyphens or apostrophes in a preexisting name must be deleted at the time of conversion (see also Art. 18.7).

17.3. When a preexisting name has been published in a work where the letters u and v or i and j are used interchangeably, or are used in any other way incompatible with modern practices (e.g., one of those letters is not used or is used only when capitalized), those letters must be transcribed at the time of conversion in conformity with modern usage.

Example 1: *Vffenbachia* Fabr. (1763) would be changed to *Uffenbachia* when converted.

17.4. In order to be established, the spelling of a converted name must be identical to that of the preexisting name on which it is based.

Recommendation 17.4A. When a preexisting name is converted, the spelling in prevailing use should be retained. As a general guideline, adoption of a spelling by two-thirds of the authors who have used the name in the past 25 years would qualify as prevailing use. If it is not clear which spelling is the prevailing one, the original spelling should be adopted for the converted name, except for the correction of orthographical (including typographical) errors and the mandatory corrections imposed under Articles 17.1-17.3. In this code, the original spelling is the one used in the protologue.

Recommendation 17A. Names established under this code should be pronounceable. Thus, every syllable should contain a vowel (or diphthong), and combinations of consonants that do not generally occur in either Latin or English should be avoided unless they are contained within the name of a person, place, or other entity after which a taxon is named.

Recommendation 17B. New clade names should follow the rules and recommendations of the preexisting codes with regard to Latin grammar. However, failure to follow those rules and recommendations does not nullify the establishment of names under the PhyloCode.

Article 18. Subsequent Use and Correction of Established Names

18.1. The original spelling of a name established under this code is the correct spelling and should be retained in subsequent publications, except for the correction of typographical errors (see Art. 18.5). The original spelling is the one that is used in the protologue at the time of establishment and that is registered (see Art. 8).

Note 18.1.1. The original spelling of a converted name is correct so long as it is based on one of the spellings of the preexisting name, even if the prevailing spelling was not adopted (see Rec. 17.4A).

18.2. Spellings that do not follow Recommendation 17B (for example, incorrect latinization or use of an inappropriate connecting vowel) and spellings that contain incorrect transliterations are not to be corrected.

18.3. If the registered spelling of a name disagrees with the spelling in the protologue, the author should determine which is correct. If the author determines that the registered spelling is incorrect, it is to be corrected in the registration database and a note added stating that the change was made. If the protologue is incorrect, the registration database is to be annotated to alert users that this is the case.

18.4. If the registered spelling of a name disagrees with the spelling in the protologue or the name is spelled more than one way in the protologue, and the author is no longer alive or is otherwise unable to determine which spelling is correct, the following guidelines are to be used: If it is clear that all but one of the spellings are typographical errors, the remaining one is treated as correct. If it is not clear which spellings are typographical errors, the one that is most consistent with Recommendation 17B is treated as correct. If it is not clear which spellings are typographical errors, and it is not clear that one is more consistent with Recommendation 17B than the others, the one immediately associated with the designation "new clade name," "converted clade name," etc. is treated as correct. If the registered spelling is determined to be incorrect, it is to be changed in the registration database and a note added stating that the change was made. If the protologue is incorrect, the registration database is to be annotated to alert users that this is the case. Such decisions regarding the correct spelling of a name may be made by any person but must be published (Art. 4) before the registration database is corrected or annotated.

Recommendation 18.4A. The person making an orthographic correction of the sort covered by Article 18.4 should notify the database administrator promptly after publishing it.

18.5. If the registered spelling of a name and the spelling in the protologue agree but contain a typographical error, the author may publish a correction. If the author is no longer alive or is otherwise unable to correct the error, any person may publish a correction. Once published, the name is to be corrected in the registration database and a note added stating that the change was made.

Note 18.5.1: A correction slip inserted in the original publication does not qualify as a published correction. Publication of corrections must satisfy the requirements of Article 4.

Recommendation 18.5A. The person making an orthographic correction of the sort covered by Article 18.5 should notify the database administrator promptly after publishing it.

18.6. Accidental misspellings of a name that appear in print subsequent to establishment are not to be treated as new names but as incorrect spellings of the established name. The same is true of unjustified corrections (i.e., any correction that does not fall under Articles 18.3 - 18.5, particularly those that violate Article 18.2).

18.7. If a name is published with a hyphen or apostrophe, the correct spelling of the name is the same but with the hyphen or apostrophe deleted.

Chapter VIII. Authorship of Names

Article 19.

19.1 A taxon name is to be attributed to the author(s) of the protologue, even though authorship of the publication as a whole may be different.

Note 19.1.1. In some cases, a breadth of evidence may need to be considered to determine the correct author attribution, including ascription of the name, statements in the introduction, title, or acknowledgements, typographical distinctions in the text, and even statements made in other volumes and editions in the same series or in entirely different publications.

Note 19.1.2. In the absence of evidence to the contrary, the authorship of the protologue can be assumed to be the same as the authorship of the entire publication in which it appears.

19.2. A replacement name is to be attributed to the author(s) of that name, not to the author(s) of the replaced name.

19.3. A preexisting taxon name is to be attributed to the author(s) of the protologue when only the name, but not the rest of the protologue, is attributable to a different author or authors.

19.4. When the prevailing spelling of a preexisting name differs from the original spelling, the prevailing spelling is to be attributed to the author of the publication in which the original spelling was used.

Chapter IX. Citation of Authors and Registration Numbers

Article 20.

Note 20.0.1. In some cases, it may be desirable to cite the author(s) who established a name. In doing so, Article 20 must be followed.

20.1. If the author of a converted name is cited, the author of the preexisting name on which it is based must also be cited. The author of the preexisting name is to be cited in square brackets.

Example 1. If Larson established a converted clade name *Hypotheticus*, based on the preexisting name *Hypotheticus* of Meekins, the citation of the converted name would be *Hypotheticus* [Meekins] Larson.

20.2. If a preexisting name was used in association with more than one rank, the author(s) cited may be the original author of the name, the author associated with the most widely used rank at the time of conversion, or both. The author associated with the most widely used rank at the time of conversion is to be cited in brackets; the original author is to be cited in parentheses.

Example 1. If Larson established a converted clade name *Hypotheticus*, based on the preexisting genus name *Hypotheticus* of Meekins, which in turn was based on the preexisting subgenus name *Hypotheticus* of Ives, the full citation of the converted name would be *Hypotheticus* [(Ives) Meekins] Larson. If one wanted to cite only the original author of the preexisting name, the citation would be *Hypotheticus* (Ives) Larson. If one wanted to cite only the author associated with the most widely used rank of the preexisting name at the time of conversion, the citation would be *Hypotheticus* [Meekins] Larson.

Note 20.2.1. The publication years of the preexisting name and converted name may follow these names within the brackets and/or parentheses, as appropriate, and after the brackets.

Example 1. Using Example 1 of Article 20.2, the full citation would be *Hypotheticus* [(Ives 1910) Meekins 1956] Larson 2003.

20.3. If the author of a replacement name (see Arts. 13.5, 19.2) is cited, the author of the definition of the replaced name must also be cited. The author of the definition of the replaced name is to be cited in braces.

Example 1. If Clarke published *Hypotheticus* as a replacement for the established name *Cladus* Holmes, the full citation of the replacement name would be *Hypotheticus* {Holmes} Clarke.

20.4. If the author of a homonym that has been conserved for the purpose of emending a definition (see Note 13.1.2) is cited, the author of the original definition must also be cited. The author of the original definition is to be cited using "<" and ">" symbols.

Example 1: If the name *Hypotheticus* was originally established by Stein, and Maki subsequently published the homonym *Hypotheticus* in order to emend Stein's definition, and the International Committee on Phylogenetic Nomenclature conserved *Hypotheticus* Maki over *Hypotheticus* Stein, the full citation would be *Hypotheticus* <Stein> Maki.

20.5. When authorship of a name differs from authorship of the publication in which it is established, both may be cited, connected by the word "in." In such a case, "in" and what follows are part of a bibliographic citation and are omitted unless the publication is being referred to, at least by its year.

20.6. The optional use of "ex" under the ICBN to cite author(s) to whom the name, but not the rest of the protologue, is attributable is not adopted in this code.

Recommendation 20A. Bibliographic references to the protologue of established names are available in the registration database and may be accessed by either taxon name or registration number. However, only the registration number is reliably unique. Therefore, in cases of potential ambiguity, the registration number should be cited at least once in any publication in which the corresponding name is used.

Chapter X. Governance

Article 21.

21.1. The Society for Phylogenetic Nomenclature (SPN) is an international, non-profit organization with no membership restrictions. Two committees of the SPN have responsibilities that pertain to this code: the International Committee on Phylogenetic Nomenclature (ICPN) and the Registration Committee. [Note: These organizations do not yet exist. They will be established before the PhyloCode is implemented.]

21.2. The Registration Committee is responsible for managing the PhyloCode registration database. It has the authority to set policy concerning the routine operation of the database, so long as such decisions do not conflict with the provisions of the PhyloCode. The members of the Registration Committee will be appointed by the SPN through a vote of the officers and council.

21.3. ICPN has the responsibility and power to:
(a) rule on applications for suppression or conservation of names;
(b) resolve ambiguities in the provisions of the PhyloCode;
(c) amend the provisions of the PhyloCode; and
(d) produce future editions of the PhyloCode.

21.4. The members and officers (Chair and Secretary) of the ICPN will be elected by the membership of the SPN. The number of members in the ICPN will be determined by the SPN.

21.5. Members and officers of the ICPN will be elected for five-year terms. Members may be elected for up to three consecutive terms, but an officer may not serve consecutive terms in the same office.

21.6. Applications for suppression or conservation of names must be submitted to the ICPN. Once received, they will be published (Art. 4) and made available on the PhyloCode website.

21.7. Decisions by the ICPN on applications for suppression or conservation of names, and interpretation of the rules (in case of ambiguity), require approval by only a simple majority of the ICPN. (See also Art. 21.10.) Decisions will be published and announced on the PhyloCode website, and the affected names will be annotated in the registration database.

21.8. Proposed modifications of the PhyloCode must be submitted to the ICPN. Once received, they will be published (Art. 4) and made available on the PhyloCode website.

21.9. Proposed modifications of the PhyloCode may not be voted upon until at least six months have elapsed from the date of their publication, to allow for discussion by the systematics community and communication of opinions to the members of the ICPN.

21.10. Decisions to modify the code must be approved by a two-thirds vote of the ICPN.

21.11. Any decision adopted by ICPN will be published and announced on the PhyloCode website. Decisions take effect immediately upon publication.

Glossary

acceptable name. An established name that is not a (non-conserved) later homonym and thus may potentially be an accepted name.

accepted name. The name that must be adopted for a taxon under this code.

clade. One of the two kinds of biological entities whose names are governed by this code; a group of species comprising a common ancestor and all of its descendants.

categorical rank. In the preexisting codes, a formal taxonomic rank such as family or genus.

conditionally suppressed name. A name that is suppressed only in phylogenetic contexts in which it is a synonym of a particular conserved name (see suppressed name).

conserved name. An established name that the International Committee on Phylogenetic Nomenclature has ruled should have precedence over earlier synonyms or homonyms.

converted name. A preexisting name that has been established in accordance with the rules of this code.

definition. A statement specifying the meaning of a name (i.e., the taxon to which it refers).

description. A statement of the features of a taxon (or its component organisms), not limited to those that distinguish it from related taxa.

diagnosis. A brief statement of the features of a taxon that collectively distinguish it from other taxa with which it might be confused.

established name. A name that is published in accordance with Article 7 of this code, which may or may not be an acceptable or accepted name.

external specifier. A specifier that is explicitly excluded from the clade whose name is being defined. Stem-based definitions have external specifiers, but node- and apomorphy-based definitions do not (see internal specifier).

heterodefinitonal. Based on different phylogenetic definitions (see synonym).

homodefinitional. Based on the same phylogenetic definition (see synonym).

homonym. A name that is spelled identically to another name but potentially refers to a different taxon. In this code, homonyms are established and identically spelled clade names based on different phylogenetic definitions.

hybrid formula. An expression consisting of the names of two taxa separated by a multiplication sign, designating a single organism or set of organisms of hybrid origin.

internal specifier. A specifier that is explicitly included in the clade whose name is being defined. All specifiers in node-based and apomorphy-based definitions are internal, but only some of the specifiers in stem-based definitions are (see external specifier).

lineage. A series of entities (e.g., organisms, populations) that form a single unbroken and unbranched sequence of ancestors and descendants. That a lineage is unbranched does not deny the existence of side-branches, which are not parts of the lineage in question, or of branching at lower organizational levels (e.g., organelle lineages within a population lineage). There may even be branching at the organizational level in question as long as it is judged to be temporary.

Linnaean system (of nomenclature). An integrated set of principles and rules governing the naming of taxa and the application of taxon names that is based on the Linnaean hierarchy of taxonomic categories. "Linnaean" here refers not specifically to the categories used by Linnaeus himself (e.g., he did not use families), but to the set of categories derived from that used by Linnaeus that was adopted by most 20th century taxonomists and used (at least in part) as the basis for the International Code of Botanical Nomenclature, the International Code of Zoological Nomenclature, and the International Code of Nomenclature of Bacteria. Also referred to as the "traditional system."

monophyletic. A group consisting of an ancestor and all of its descendants; usually used for groups the members of which are more closely related to each other than to any non-members in terms of common ancestry.

name. A word or words used to designate (refer to) an organism or a group of organisms. See acceptable name, accepted name, established name, replacement name, scientific name, taxon name.

orthography. The spelling of a name.

paraphyletic. A group consisting of an ancestor and some but not all of its descendants.

phylogenetic definition. A statement explicitly linking a taxon name with a particular clade.

phylogenetic. Of or pertaining to the history of ancestry and descent.

phylogenetic system (of nomenclature). An integrated set of principles and rules governing the naming of taxa and the application of taxon names that is based on the principle of common descent. This code describes a phylogenetic system of nomenclature.

polyphyletic. A group that has multiple phylogenetic origins and thus excludes the most recent common ancestor of its members.

precedence. The order of preference among established names, used to select the accepted name from among them. In general, precedence is based on the date of establishment, with earlier-established names having precedence over later ones, but later-established names may be conserved over earlier ones.

preexisting codes. The codes of biological nomenclature that were in operation when the PhyloCode was drafted (1997-2000)--specifically, the International Code of Botanical Nomenclature, the International Code of Zoological Nomenclature, the International Code of Nomenclature of Bacteria and the International Code of Virus Classification and Nomenclature.

preexisting name. A scientific name that, prior to its establishment under the PhyloCode, was either: (a) "legitimate" (ICBN, BC), "potentially valid" (ICZN), or "valid" (ICVCN); or (b) in use but not governed by any code (e.g., zoological names ranked above the family group).

protologue. Everything associated with a name when it was first established (PhyloCode), validly published (ICBN, BC), or made available (ICZN), for example, description, diagnosis, phylogenetic definition, registration number, designation of type, illustrations, references, synonymy, geographical data, specimen citations, and discussion.

qualifying clause. A part of a phylogenetic definition that specifies conditions under which the defined name cannot be applied.

replacement name. A new name explicitly substituted for a previously established name that is not acceptable because it is a later homonym. (This term is used in a broader sense under the ICZN to include what the ICBN refers to as a superfluous name and the ICZN refers to as an unjustified replacement name. In the terminology of this code, this is a name that was substituted for another name that was acceptable and should therefore have been used.)

scientific name. A name that either is formed and governed by one of the codes of biological nomenclature or is of a similar Latinized form (e.g., zoological names ranked above the family group).

species. One of the two kinds of biological entities whose names will eventually be governed by this code; a segment of a population-level lineage that is separate from other such lineage segments as indicated by one or more of various possible criteria (e.g., distinguishability, reproductive isolation, monophyly, etc.).

specifier. A species, specimen, or synapomorphy cited in a phylogenetic definition of a name as a reference point that serves to specify the clade to which the name applies.

suppressed name. A name that would normally have precedence but does not, due to a decision by the International Committee on Phylogenetic Nomenclature to give precedence to a later synonym or homonym.

synonym. A name that is spelled differently than another name that refers to the same taxon. In the case of clade names, synonyms may be homodefinitional or heterodefinitional.

taxon. A taxonomic group of organisms. In this code, taxa may be clades or species.

taxon name. The word (or, in preexisting codes, words) used to designate a taxon.

type (= *nomenclatural type*). In the preexisting codes, the specimen, specimens, or subordinate taxon to which a taxon name is permanently attached; the type provides the standard of reference that determines the application of a name.

unconditionally suppressed name. A name that has been suppressed by the ICPN in all phylogenetic contexts (see suppressed name); there are no conditions under which it would have precedence over any other name.

Table 1. Equivalence table of nomenclatural terms used in the Draft PhyloCode, the Draft BioCode and the current biological codes, except the International Code of Virus Classification and Nomenclature (patterned after a similar table in the Draft BioCode). The criteria represented by terms treated here as equivalent are not always exactly the same (e.g., establishment of a clade name in the PhyloCode requires a phylogenetic definition, which is not a requirement of any other code). BioCode = Draft BioCode (Taxon 47: 127-150 [1997]). Bacteriological Code = International Code of Nomenclature of Bacteria (1992). Botanical Code = International Code of Botanical Nomenclature (1994). Zoological Code = International Code of Zoological Nomenclature (1999).

PhyloCode	**BioCode**	**Bacteriological Code**	**Botanical Code**	**Zoological Code**
Publication and precedence of names				
published	published	effectively published	effectively published	published
precedence earlier later	precedence earlier later	priority senior junior	priority earlier later	precedence senior junior
Nomenclatural status				
established converted acceptable registration	established ---------- acceptable registration	validly published ---------- legitimate validation	validly published ---------- legitimate registration	available ---------- potentially valid ----------
Taxonomic status				
accepted	accepted	correct	correct	valid
Synonymy and homonymy				
homodefinitional heterodefinitonal	homotypic heterotypic	objective subjective	nomenclatural taxonomic	objective subjective
replacement name	replacement name	----------	avowed substitute	new replacement name
Conservation and suppression				
conserved	conserved	conserved	conserved	conserved
suppressed	suppressed/ rejected	rejected	rejected	suppressed

Appendix A. Registration Procedures and Data Requirements

Most recent revision: April 2, 2000

This appendix may be revised more frequently than the main body of the code and without a formal meeting of the ICPN. The most recent information is available on the Internet [URL will be inserted here] or from the PhyloCode database administrator: [address will be inserted here].

I. Registration Procedures

After a name is submitted to the database, the registration submission is checked for missing data and the data are entered into a publicly available database under the auspices of the Society for Phylogenetic Nomenclature. No registration number is issued at this time if the paper or book in which the name will appear has not yet been accepted. Once the paper or book has been accepted for publication, the author must submit the information that it has been accepted in order to receive a registration number. Alternatively, an author may wait until after acceptance for publication before submitting the name, in which case the registration number will be issued immediately.

If the spelling or definition of a submitted name is identical to one that already exists in the registration database, the author will be warned.

Registration should, if possible, make use of the Internet interface to the registration database. Submission of registration forms by mail is also permitted.

II. Data Fields (Mandatory data are indicated with an asterisk.)

1. Data common to all names

Contact information (For each author): Name*, mailing address*, Phone number*, Fax number, email address, home page URL.
Name to be registered*
Type of name* (new clade name, converted clade name)
Date of registration*
Bibliographic reference to publication
Date of publication
Author's comments
Administrator's annotations

2. Data particular to clade names

Definition type* (node based, stem based, apomorphy based, other ...)
Phylogenetic definition*
List of specifiers*, at least two being mandatory
For each species cited as a specifier: Name*, author*, year of publication*, code which governs the name*, URL of taxonomic database holding information
For a synapomorphy cited as a specifier: Description*
For a type specimen cited as a specifier: Species name typified*, author of species name typified*, year of publication of species name typified*
For a specimen (other than a type) cited as a specifier: repository institution*, collection data needed to locate the specimen*, description*
Qualifying clause
Reference phylogeny (bibliographic reference, URL, or Accession number in public repository)

2.1. Data particular to converted clade names

Preexisting name*
Author of preexisting name*
Direct bibliographic reference to original publication of preexisting name (including year)*
Code governing the preexisting name*
URL of taxonomic database holding information about the name

2.2. Data particular to new clade names

For a replacement name: Replaced name*

3. Data particular to species names
[To be completed when rules governing species names are added to the PhyloCode]