



Reflections on defining “taxon names”, and on scientific names in general

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Abstract

Some comments are offered on aspects of defining “taxon names”, using as a starting point the debate between Stuessy and Queiroz (plus Cantino), in 2000–2001. It is argued here that both sides in that debate were restating established positions, rather than addressing the basic question. It appears desirable to be more precise and it is important to specify context. The end-user expects a taxon name to be defined, and justly so. A taxonomic definition of a name should not be influenced by nomenclatural considerations but should be based on taxonomy only; a point worth noting is that there can be as many taxonomic definitions as there are taxonomic viewpoints. As to nomenclature, it is pointed out that, by its internal workings, a *Code* does not govern mere strings of characters (names), but rather formal entities.

Keywords

Code, database, label, nomenclature, taxonomy.

Introduction

In 2000–2001, there was a debate between Stuessy and, mainly, Queiroz (Queiroz 2000; Queiroz & Cantino 2001; Stuessy 2000, 2001), with a contribution by Jørgensen (2000). This was part of a larger debate on the desirability of phylogenetic nomenclature, but the issue focused on here is the question of whether or not “taxon names” are defined. Stuessy held that “taxon names” were not defined, but were just labels, while Queiroz (plus Cantino) held that “taxon names” were defined, but that these definitions did not refer to taxon circumscriptions.

Both Stuessy (2001: 185) and Queiroz & Cantino (2001: 821, quoting “Definitions apply only to words, not to the things to which the words correspond”) agreed that (for the purposes of this discussion) only words can be defined, not taxa. Both sides subscribed to “A definition is a statement specifying the meaning of a word. In the context of biological nomenclature the words of interest are taxon names” (Queiroz, 1997: 133). However, it is noticeable in the debate that neither side was all that clear on what they meant by “taxon name”.

It seems that it is past time to add some perspective, even at the risk of stating the overly obvious.

Methods

For purposes of this paper, nomenclature refers to the three (main) type-based *Codes*. These are, arranged alphabetically, the *International Code of Nomenclature for algae, fungi, and plants* (ICNafp), consisting of the book, now the *Shenzhen Code* (Turland *et al.* 2018), the online Appendices (Wiersema *et al.* 2018–), and the updated Chapter F (May *et al.* 2019); the *International Code of Nomenclature of Prokaryotes* (ICNP), now the 2022 Revision (Oren *et al.* 2023); and the *International Code of Zoological Nomenclature* (ICZN), consisting of the book, now in its 4th edition (Anonymous 1999) and the three amendments effected (Anonymous 2003, 2012, 2017). Not included is the *International Code of Nomenclature for Cultivated Plants* (ICNCP) or *Cultivated Plant Code*, now in its 9th edition (Brickell *et al.* 2016), which is similar in some respects, but which requires its taxa to be uniform (in a specified respect) and which uses “nomenclatural standards” (representing that uniformity), not types.

For purposes of this paper, a name is a scientific name formally established, fulfilling the requirements set by the relevant *Code*; a validly published name (ICNafp, ICNP) or an available name (ICZN). A taxon is a group of organisms that a taxonomist accepts as a coherent group, or stated more strictly, a taxon is a scientific hypothesis drawn up by a taxonomist as to how a group of organisms is composed. A current name is the name to be used for a taxon, according to the relevant *Code*; a correct name (ICNafp, ICNP) or a valid name (ICZN). A type is a nomenclatural type (ICNafp), a type (ICNP) or a name-bearing type (ICZN).

These three *Codes* differ in many respects, not only in terminology, but also in concepts, even fundamental ones. On the other hand they do share similarities, including in some fundamental principles. This makes it possible to formulate statements on selected topics which are true across *Codes*, although careful phrasing is critical. To effect this, general terms need to be used; terminology specific to a particular *Code* is to be avoided, as is any unnecessary reference to detail (clearly, the *Codes* do not lack in technical details).

End-user

The end-user of scientific names of organisms takes these for granted as a means for scientific (and other) communication, taking in stride the not so minor miracle that the mechanisms that result in names of organisms are accepted world wide, even if there are different mechanisms for different groups (the way to determine the current name for a bird being different from that to determine, say, the current name for a fungus). In many cases, as in when there is no suitable common or trade name, the end-user has no reliable means to refer to a taxon other than by using the “taxon name”. The “taxon name” stands for the taxon; to the end-user the “taxon name” and the taxon are interchangeable, one and the same.

To the end-user, the question of whether or not “taxon names” are defined is a non-issue: of course names of taxa must be defined. If the scientific name of some obscure group of organisms is not defined (and defined accurately, setting clear boundaries), what use is it? Or for that matter, how can taxonomy call itself any kind of science if it disdains to define its named units? For example, if a legal text includes the scientific name of a taxon to accord some special status to that taxon, or to a product of a taxon, how can this have any effect if this name is not defined?

To the end-user, the problem with “taxon names” is quite different: those taxonomists seem to keep changing names of taxa, substituting unknown names for well-known ones, or bickering about what exactly they mean by a particular name.

Obviously the end-user has a right to expect that any “taxon name” in use is defined, and this can only be done by a taxonomist (if extant for that group). To a taxonomist, hopefully, a “taxon name” is the name of a taxon, that is the current name of a taxon.

This seems obvious, so why a debate?

Re-examining the debate

Although the participants in the debate held viewpoints that were far apart, they did have something in common.

The position by Queiroz & Cantino (2001: 821), “Under the traditional system, [the name *ASTERACEAE* Bercht. & J. Presl (1820)] is defined as ‘the family containing the genus *Aster*’ [L. (1753)]” (page 822), appears to have multiple problems. Firstly, the name of a family may well be formed from a non-current generic name: the family *CARYOPHYLLACEAE* Juss. (1789) does not contain a genus ‘*Caryophyllus*’—the name is formed from the generic name *Caryophyllus* Mill. (1754), non L. (1753). A second issue is that in this approach all non-current family names (that is, synonyms) would be defined as current families. A third, and more serious issue is that this definition does not seem to be of much practical value: it does not even hint at where the boundaries of the taxon may be.

This definition by Queiroz & Cantino illustrates their position (page 821) that (traditional) nomenclature uses definitions of taxon names that are *ostensive* (“by pointing”), as opposed to *intensional* (“in terms of necessary and sufficient (defining) properties”). This has two obvious flaws: [1] it applies a nomenclatural approach to a taxonomic issue, and [2] it misunderstands that nomenclatural approach, namely the type method. The first issue seems to be a perennial problem (see more below).

On the second point, the type method does not work by ostension (pointing to an example), but by setting an objective standard of reference for the application of a name. In other words, a type serves as an anchoring point, not as an example: the type that fixes the name of a taxon may well be atypical for that taxon (see Figure 1).

The position of Stuessy may be characterized by his statement that names “are solely labels for purposes of communication” (2001: 185), which is a common position among nomenclaturists. This is what Pavlinov (2022) refers to as “nominalism”, namely: “a name is just a name”. Nominalism is set apart as compared to the practice up to Linnaean times (“essentialism”), where the name itself (now termed a “phrase name”) was the definition. The starting-point of nominalism is placed when Linnaeus placed short (usually just one word) mnemonic devices (“trivial names”) in the margin of his works which were promoted to become the second or third part of two-part (binary) and three-part (ternary) names (the generic name becoming the first part). Nominalism is the practice where the name itself (except for some names in higher ranks) does not (necessarily) contain anything of descriptive value, anything that refers to a property of the organism. For example, if an expedition financed by a benefactor turns up several hundred species that are considered to be new to science it is not unusual to give some of these species names that commemorate the benefactor. Clearly in such cases there can be no intrinsic connection between a name and the properties of the new species. In that sense these names are labels, which can be stuck on at will on the new species (at that stage it is almost a game of chance to choose species that will stand the test of time and not be reduced to synonymy, later). And even if it appears that a name may be of descriptive value, it needs not be accurate. For example: inferring from the name *Simmondsia chinensis* C.K.Schneid. (1907) that this taxon originates in China is done at one’s own risk.

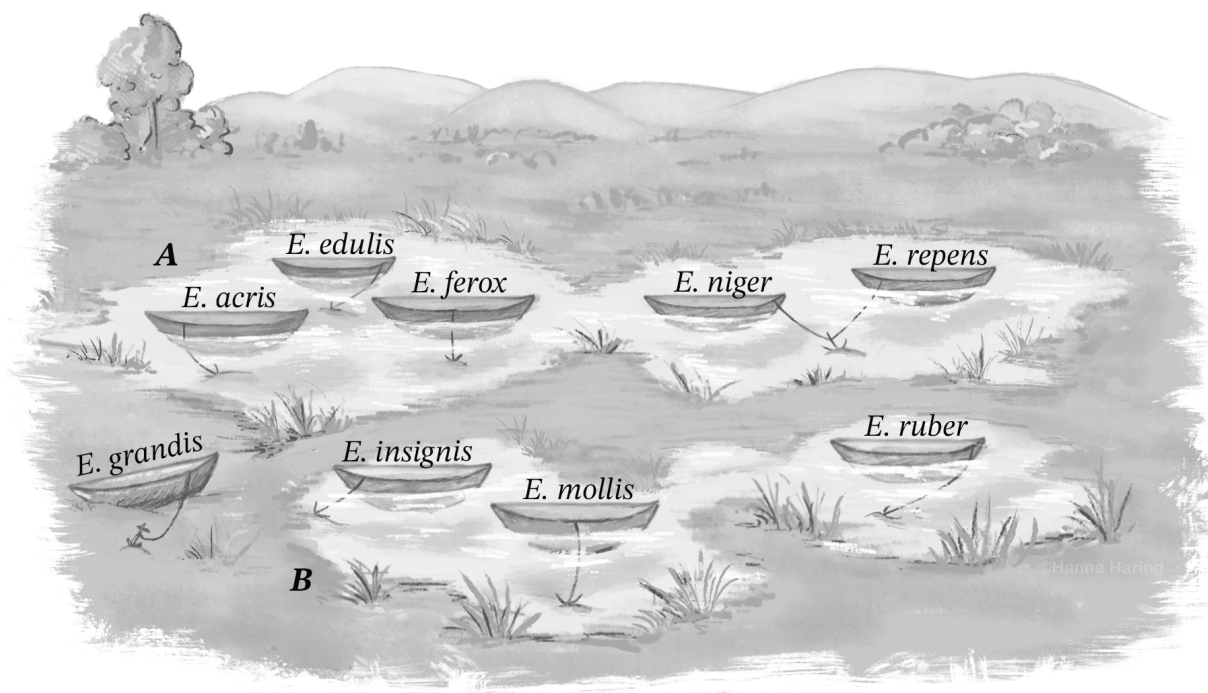


FIGURE 1. Simple graphic representation of the basic relationship between names, taxa and types.

Taxonomy is a branch of science that deals with organisms: its core business is to recognize and delimit groups of organisms: “taxonomic groups” or “taxa” for short. Taxa are dynamic: if new information comes in or different scientific methods are applied, the delimitation of taxa may well change. On the other hand, nomenclature deals with names, which each consist of one to three words. Nomenclature aims to put the names of the past in order, and to guide the creation of names for the future. Names by themselves are very stable (almost unalterable): it is the application of names which is alterable. Names (words) and taxa (groups of organisms) are very different. To bridge this gap, names are connected to taxa by types (except for some names in higher ranks).

To make it clear that types are not examples (and are not to be misused for ostension or typology), taxa, in this case at the rank of species, are each represented as a body of water, plotted along two axes (not shown) representing taxonomically diagnostic characters. In this case, there are two taxa (A and B), which are judged to belong to the genus ‘*Exemplus*’.

Names can be viewed as boats floating on the water and anchored on the bottom. The anchor-points (represented by small anchors) are the types. This should illustrate that there is no fixed relation between a type and any particular place in a taxon: a type can be located quite far from the centre, differing considerably as to characters: it is then ‘atypical’. A total of nine names (each a combination under ‘*Exemplus*’) is shown. Of one name the type cannot be identified to the extent necessary to place it in a taxon, as if ending up on dry land. The other eight names are anchored in the two taxa by seven types. This is possible because *E. niger* and *E. repens* have the same type, demonstrating that although any one name can have no more than a single type, one and the same type can be common to any number of names. Of these two names with the same type at least one was dead on arrival and may never be used; this may apply also to other of these names (not specified here). Obviously, only one name per taxon can be the “taxon name”. In the sketched situation there are two taxa, so here there must be two “taxon names”, to be selected by application of the relevant *Code*. If it should happen that *E. grandis* is a particularly well-known name, it can be brought back into play by substituting a different type, which is clearly identifiable.

It can be imagined that the outlines of taxa are variable, changing as if the level of the water rises or drops. Such an event may occur in a revision: on the one hand, a split may occur, as if by a drop in the water level, into three or four taxa (bodies of water), requiring three or four taxon names. If the two taxa should be joined, as if by a (sufficient) rise of the water level, there can be only one.

Execution of illustration by Hanna Haring <www.hannaharing.com>.

The shift to what is described as nominalism marks the point where the perennial question “What does that name mean?” should no longer be taken as “What does that name tell us about this organism?” but as “What is the trick to remembering that name?”. Nominalism should not be taken to mean that the name cannot be defined; it just means that the name itself stopped being, or stopped containing, the definition.

The position by Jørgensen (2000) may be characterized by his citation of two phrases he attributed to Weresub: “Names have types but no circumscriptions” and “Taxa have circumscriptions but no types”, which is alright as far as it goes, but again suffers from an imperfect perspective: it restricts itself to nomenclature only.

So it appears that all three participants called on nomenclature, in some way or other, to bolster their arguments. This seems to be an incomprehensible misunderstanding. The purpose of any *Code* is to prescribe (normatively) which existing name is to be used for a taxon with a particular circumscription, position, and rank (again, except for some names at higher ranks), or, if no existing name qualifies, how to publish a new name. In addition, a *Code* prescribes how this name is to be spelled. All the *Codes* emphasize that this is their only function and that they in no way intend to interfere with taxonomic thinking or practice. This was expressed graphically by Ramsbottom (1942: 439) with his “[n]omenclature is the handmaiden of taxonomy, not the mistress”. The idea that anything in a *Code* could prevent a taxonomist in any way from defining a “taxon name”, or in a way influence a taxonomic definition, should be anathema.

The two phrases cited by Jørgensen (2000) should be accompanied by “but once a name is adopted as the (current) name of a taxon, it stands for that taxon and is defined by the circumscription of that taxon”.

Inside taxonomy

Another issue is that of what form a definition as used by taxonomy takes. As cited above, Queiroz & Cantino (2001: 821) promoted ostensive definitions, as opposed to intensional ones. As pointed out above, it is not useful to define a “taxon name” by pointing out a single example. This is not to say that defining by ostension can never be useful. For example, in teaching, showing a student some two dozen examples representing all possible growth forms, degrees of woodiness, flower colours, etc., can be quite effective in getting across a general idea of what kind of plants one considers to belong to the family *ASTERACEAE*. But as a method for setting exact boundaries, it distinctly falls short.

Often mentioned in the same breath as ostensive and intensional definitions are *extensional* definitions (by listing all components). Obviously, with regard to any taxon above the rank of species it is (almost always) possible to provide a definition by listing all (sub)taxa one considers to belong to this taxon. Many people are comfortable with extensional definitions, and so are databases, even unsophisticated ones.

As to intensional definitions, these are about the essence that a taxonomist aims to communicate when using a name. Given the breakneck speed at which taxonomy develops, in some areas, versus the persistence of some methods, in other areas, this essence may vary wildly. Thus, there can be as many definitions of such a “taxon name” as there are taxonomic treatments of the relevant taxon. To some extent, these various definitions can be differentiated. For example, the family name *MALVACEAE* Juss. (1789) as used by Cronquist (1981) communicates a concept that is markedly different from what the Angiosperm Phylogeny Group [APG] (Bremer *et al.* 1998) uses it for. This can be indicated by an addition like “sensu Cronquist” or “sensu APG” although this refinement will be beyond most end-users.

A point that may easily be overlooked is that an intensional definition can differ in scope from an extensional one. An extensional definition of a supraspecific taxon will have a scope limited to the combined outer limits of the scopes of its components, while an intensional definition may also be framed as a hypothesis, with predictive value as to future members. Thus, an intensional definition of an unispecific genus may be wider in scope than that of its one known species, while from an extensional viewpoint the genus will automatically have the same scope as the species.

Inside nomenclature

A taxonomist will tend to look at nomenclature from the outside, that is, to regard nomenclature as being a black box, to be judged by its output. The output of any nomenclatural process is a name that taxonomists can use as the current name of a taxon, which they can use to communicate whatever they wish to communicate. The names that did not make it, the other names in the same rank that apply (by typification or otherwise) to that taxon, are called synonyms (at least by the end-user).

In reality, nomenclature is not a black box; it is quite possible to look inside the box (that is, each box, one for every *Code*), and to directly observe nomenclatural processes in action. To those nomenclature processes, the circumscription of a taxon, which is all-important to taxonomy, is only the starting point. The next step is to inventory all the names that apply, that is, all the names of which the type is included in the circumscribed taxon (see Figure 1) and, also, all the names that are not (yet) typified but that are nevertheless judged to belong there.

An important issue is that in choosing between those names, a dichotomy exists. On the one hand there are names that are in use as current or that can become current, depending. On the other hand, there are names that cannot be used as current at all, ever: illegitimate names and ineligible names (Rijckevorsel 2021) (ICNafp, ICNP) and objectively invalid names (ICZN). An early term coined for such names that can never be used was “totgeborenen Namen” (Hayek 1908) or “noms mort-nés”, that is, “stillborn names”, which more clearly conveys that such names were dead on arrival. At best such names may be said to have (initially) been intended as “names for taxa”, but they never fulfilled this intention, and never will (except by special intervention).

Another noticeable point is that once a name has been published it remains in existence forever (barring some fairly extreme action under the relevant *Code*). Even if it cannot ever become a current name of a taxon, it will affect other names, if only because of homonymy.

Speaking of homonymy: it is clearly understood that, for example, *Caryophyllus* L. (1753) and *Caryophyllus* Mill. (1754) are different names. According to the *Codes*, the author citation is not part of the name, which leaves the question of how one string of characters can differ from another string of these same characters (in the same order). This is beyond explanation: there must be more to it than that. An attempt to address this was made by Dubois (2000), who proposed adopting a concept, termed a “nominal-complex”, to consist of scientific name + author + date. Unfortunately, this is only a halfway solution, as there are cases (admittedly not many) of different names with the same spelling, by the same author, published on the same page of the same book.

From a conceptual viewpoint, it seems fairly obvious that what the *Codes* in effect deal with are not strings of characters (names) but rather formal entities. These entities exist only, or mostly, in the nomenclatural universe governed by the relevant *Code*, a universe which, conversely, is comprised of these entities. These formal entities do not just serve as sources of ‘labels’, but have various properties, such as authors, dates, ranks, correct spellings (and perhaps original spellings), types, etc. Any particular entity can be defined, from a nomenclatural perspective, along the lines of, say, *MALVACEAE* as “a formal entity in the rank of family, established by publication by Jussieu on page

271 of his *Genera Plantarum* in 1789, existing as part of the nomenclatural universe governed by the ICNafp, listed in App. IIB of that *Code*, with precedence as of 1789 over entities listed in App. IIB that were established at later dates, and over any entities in that rank not listed in App. IIB, and typified by the type of the generic name *Malva* L. (1753)". Or, in more familiar terms: "a conserved botanical name in the rank of family, validly published by Jussieu (*Genera Plantarum*: 271. 1789), formed from the generic name *Malva*" or in condensed form (only in an appropriate context): "*MALVACEAE* Juss. Gen. Pl.: 271. 4 Aug. 1789, nom. cons. Typus: *Malva* L.".

Exactly what would be desirable to include as being part of such a formal entity might be debated. At a minimum it should include a reference to the publication that established the name, the protologue, and a reference to the type; that is the protologue of the name itself or the protologue that automatically created the name. The protologue should yield author (there are some exceptions) and date; and, obviously, a type can be referenced only if there actually is a type. The simplest approach would be to include any property which has been formalized nomenclaturally, while excluding purely taxonomically determined properties like circumscription. Rank has a nomenclatural aspect.

Anyway, using these formal entities as the basis of consideration should make it easier to formulate how a name (a string of characters), a date, an author, a type, etc., relate to each other. Is a date a property of a name (how?) or part of a formal entity? It also makes it easier to explain homonyms and different spellings. It should be noted that databases are quite comfortable with these formal entities, much more comfortable than with most aspects of taxa.

The existence of such a nomenclatural universe is a logical consequence of how a *Code* of nomenclature functions. The basic mode of operation of any *Code* of nomenclature is to tackle the very varied historical reality and to distill (or create) from this a single parallel, purely nomenclatural reality. This is a necessity, ensuring that taxonomists are not left to their own devices in interpreting the very extensive literature created by innumerable taxonomists (and would-be taxonomists). Some efforts found in this literature are accorded a nomenclatural status by a *Code* of nomenclature (thus including them in the parallel reality) while other efforts are completely disregarded (leaving them out of the parallel reality). Given the retroactive nature of a *Code* of nomenclature, this parallel, nomenclatural (past) reality can at any moment be altered; it can be adjusted to meet needs that are deemed urgent. In general, such alterations will be small (usually affecting one name of a taxon at a time), but the prokaryote decision on Approved Lists, whisking into non-existence all pre-1980 'names' not listed therein, shows that alterations can be quite substantial; a recent change that drew some media attention was the decision by the 2024, XX IBC to accept a proposal (Smith & Figueiredo, 2021) that epithets in names governed by the ICNafp that were historically published as starting with *caff*[f][e]*r*- are to be read as starting with *af*[e]*r*-. In addition, of course, a *Code* of nomenclature needs to offer guidance to taxonomists in their practice of creating new names, in an ongoing effort to encourage (future) historical reality to stay as close as possible to this (future) parallel, nomenclatural reality.

The various nomenclatural universes (each *Code* governs its own nomenclatural universe) are mostly independent, but there is some interaction, and it is noticeable that the ICNP takes more care to avoid confusion than the other two *Codes*. In this respect, relationships between the *Codes* are not necessarily symmetrical. The various nomenclatural universes do share a few grand principles but differ in many things, including conceptual detail. It likely will be necessary to formulate additional concepts for zoology: it appears that a species-group name should also be recognized as a formal entity in its own right (in the ICNafp and ICNP epithets cannot have a status by themselves; they exist only as parts of a name). Such an additional formal entity obviously interacts with one or more of the formal entities that comprise a full scientific name, but the exact nature of the relationship is not immediately clear. Overall, zoological nomenclature has a more complex structure, as compared to 'botanical' and prokaryote nomenclature.

Forward

One of the issues hindering the debate between Stuessy and Queiroz (plus Cantino) on whether or not “taxon names” are defined was a lack of clarity. Neither side was clear on what exactly they meant by “taxon names”. They are not alone in this. The ICNafp and ICNP are similarly imprecise, each repeatedly declaring that it governs “names of taxonomic groups” (ICNafp Prin. I, II, V) or “names of taxa” (ICNafp Art. 7.1, 8.4, 10.10, etc.; ICNP Prin. 5, Rule 6, 30, etc.). Names of taxa (that is, current names) are what these *Codes* aim to achieve, but these are only a part of what they actually govern, which rather are all names that are formally established (“validly published”) under that *Code*, irrespective of their status. Surely it would be an improvement if these *Codes* indicated names in general, including names that were dead-on-arrival upon publication, not as “names of taxa” but as “names for taxa”, as “scientific names” (as in the ICZN), or, more fully, as “names governed by this *Code*”. This ambiguity also occurs elsewhere: in the esoteric discussion by philosophers referenced by Lidén (2020: 213) on the type specimens of species/taxa (the idea that taxa have types is a philosophers-only concept, although the wording of the ICNP appears confusing in this respect; also see Figure 1), philosophers were also disinclined to specify what they mean by “taxon names”.

Even in general language, more awareness may help. The question “how would you define *MALVACEAE?*” is inherently ambiguous. On the one hand, it can be expanded to “how would you define the family *MALVACEAE?*”, in which case it will be appropriate to answer with a taxonomic definition, that is, a circumscription. On the other hand, if expanded to “how would you define the name *MALVACEAE?*”, it will be appropriate to answer with a nomenclatural definition, that is, of the formal entity that exists in a nomenclatural universe.

Concluding

Answering a question after the definition of a “taxon name” should depend on the perspective of who it is that asks the question. To the end-user, the “taxon name” stands for the taxon; there is no other way to refer to the taxon. It is inevitable that a “taxon name” is defined; the end-user just hopes that use of this “taxon name” is free of ambiguity. The taxonomist is the one who draws up this definition (by circumscribing this taxon) and is concerned that what the end-user deals with is the right definition (and not that of anybody else). To the nomenclaturalist, a “taxon name” is an end product of what may be a somewhat complex process: a “taxon name” is a state of being. Taken as a whole, “taxon names” are not a natural group. The “taxon name” of a plant is part of the same universe as any “non-taxon name” for a plant, and this universe is different from that where the “taxon name” of a prokaryote lives. What should deserve more attention of the nomenclaturalist is that a *Code* does not really deal with mere strings of characters (names), but with more complex entities.

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