

(274–280) Proposals to amend the *Code* to harmonize botanical and zoological nomenclature used for the so-called “ambiregnal” microorganisms (as exemplified by fossils)

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When the International Fossil Plant Names Index (IFPNI; <http://ifpni.org/>) was established in 2014 as a global registry of scientific names of fossil organisms covered by the *International Code of Nomenclature for algae, fungi, and plants* (ICN; Turland & al. in Regnum Veg. 159. 2018), it was realized that some plant microfossils (and exceptionally some macrofossils) were initially described as zoological taxa under the rules of the *International Code of Zoological Nomenclature* (ICZN; Ride & al., Int. Code Zool. Nomencl., ed. 4. 1999; <https://www.iczn.org/the-code/the-code-online/>), but later were revised and attributed to algae, fungi or even plants. A large group of fossil problematic microorganisms, Acritarcha, as well as the traditional so-called “ambiregnal” groups of flagellates/algae (Dinoflagellates, Prasinomonada, Haptomonada, Volvocina, etc.) and Myxomycetes/Mycetozoa are now governed simultaneously by the ICN and the ICZN. These groups of organisms are simultaneously indexed in Index Nominum Algarum, MycoBank and Index Fungorum as well as the zoological indices, Nomenclator Zoologicus and Zoological Record. ICN Art. 45 regulates the conditions when the algal or fungal names published under other *Codes* (zoological and former bacteriological, now prokaryotic) are accepted with the dates and authorship from the original protologue to avoid conflicting treatment of the names.

The existence of so-called “ambiregnal” taxa necessitates a new principal requirement for the established IFPNI to be compatible with both *Codes*. It was always very important in some exceptional, but numerous, cases when fossil species originally described as animals were partially later reclassified into botanical fossil taxa, or otherwise, when fossils originally described as plants or algae were transferred into the animal kingdom, leaving botanical nomenclature with the names only for considerations of homonymy. In reality, numerous more confused situations exist in palaeobotany when only part of the former generic circumscription of plant fossils is retained in botanical nomenclature, with another part of the genus (including its type) no longer considered as plant fossils, but fossil animals. For example, the fossil-plant genus *Ptilophyton* Dawson (in Canad. Naturalist & Quart. J. Sci. 8: 385. 1878), originally established as fossil plants, was later reclassified with 3 fossil-species transferred into the animal kingdom (including the type of the genus, *P. vanuxemii* (Dawson) Dawson), but only one species, *P. thompsonii* Dawson (l.c.: 385. 1878) was left in palaeobotany as a species of progymnosperm, *Protopteridium thompsonii* (Dawson) Kräusel & Weyland. In such cases, retrospective registration of fossil plant names was done for *Ptilophyton* Dawson, but mentioning its current taxonomic status as a genus of fossil animal Graptolites (IFPNI: [http://ifpni.org/genus.htm?id=](http://ifpni.org/genus.htm?id=779990C7-46EF-4E2A-9D92-E59B98641CF4)

[779990C7-46EF-4E2A-9D92-E59B98641CF4](http://ifpni.org/genus.htm?id=779990C7-46EF-4E2A-9D92-E59B98641CF4)). The fossil-generic name *Ptilophyton* Dawson, though reconsidered in the 1930s to apply to fossil animals, and thus excluded from the plant kingdom, is nevertheless regarded as a senior homonym for the genus of fossil algae, *Ptilophyton* Vologdin (in Dokl. Akad. Nauk S.S.S.R. 175: 1145. 1967). This example of confused nomenclature of fossils illustrates the necessity of the complete record of fossil plant names, irrespective of their later taxonomic assignment to either plants or animals.

Botanical nomenclature is independent of zoological nomenclature, but there are several important groups of microorganisms and their fossil counterparts, which interlinked both nomenclatures in the indexing of names. The differences in the application of the respective *Codes* resulted in so-called “dual” nomenclatures in botany and in zoology, where the same organism might have a different correct name under each *Code*. In order to resolve problems with different nomenclature regulations, IFPNI was upgraded to also accommodate provisions of the ICZN. As a result, to achieve compliance with both *Codes*, the correct registration of fossil microorganisms requires further formal clarification of the provisions and regulations of the ICN for the nomenclature of microorganisms governed by both *Codes* under Art. 45.

The main aim of the following proposed new provisions for the ICN is to build a workable environment for existing indexing centres of plant fossils, algae and fungi, dealing with registration and nomenclatural evaluation of the names generated under other nomenclature *Codes*. A few important omissions have been found in the existing provisions, and they are resolved below by new proposals. The aim is to avoid “dual” nomenclature, with one name correct in botany and another in zoology under different *Codes*, but applying to the same organism.

(274) Add two new Examples after Art. 45.1:

“Ex. n1. *Bacillariaceae* Bory (Dict. Class. Hist. Nat. 2: 127. 1822, ‘*Bacillariées*’), originally published with a French termination in vernacular form for a family then considered to be animals (animalcules), is available under the *International Code of Zoological Nomenclature* (ICZN Art. 11.7.2) and is validly published as the name of a family of algae and retains its original authorship and date but with the original termination changed in accordance with Art. 18.4 and 32.2, Art. 18.4 last sentence notwithstanding, with the diatoms now treated as algae.”

“Ex. n2. *Prorocentraceae* F. Stein (Organism. Infusionsthiere 3 (2): 8, 16–17. 1883, ‘*Prorocentrinen*’), originally published with a German termination in vernacular form for a family of protozoans,

is available under the *International Code of Zoological Nomenclature* (Art. 11.7.2) as the name of a family of protists. When the dinoflagellate taxon is treated as a algae, its name is validly published and retains its original authorship and date but with the original termination changed in accordance with Art. 18.4 and 32.2, Art. 18.4 last sentence notwithstanding.”

These two new Examples are proposed to make it clear that family names published with non-Latin terminations and considered not validly published under Art. 18.4 last sentence, but treated as available if published prior to 1900 in zoological nomenclature, should also be permitted by the *ICN* in order to avoid production of dual correct nomenclatures for the same suprageneric groupings, one currently correct in botany: e.g. *Prorocentraceae* Buetschli (in Bronn, Kl. Ordn. Thier-Reichs 1: 1002. 1885, ‘*Prorocentrina*’), as first latinized but still with an improper and correctable termination, and the second correct in zoology: *Prorocentraceae* F. Stein (Organism. Infusionsthiere 3(2): 8, 16–17. 1883, ‘*Prorocentrinen*’).

(275) Add a new paragraph to Art. 45 with a new Example:

“45.n1. If a taxon originally assigned to a group not covered by this *Code* is treated as belonging to the algae or fungi, but when published its name did not meet the requirements of the relevant other *Code* for status equivalent to valid publication, the name has no standing under this *Code* despite satisfying the other requirements of this *Code* for valid publication.”

“Ex. n3. *Hystrichosphaera* Wetzel (in Palaeontographica, Abt. A, Paläozool. 78: 33. 1933), originally published as a fossil protist genus under the *International Code of Zoological Nomenclature* without designation (fixation) of the type and thereby unavailable (*ICZN* Art. 13.3), was therefore not a validly published name under this *Code* despite satisfying the other requirements of this *Code* for valid publication. Deflandre (in Ann. Paléontol. 26: 61. 1937) validly published the name by providing a description together with fixation of the type, and therefore *Hystrichosphaera* Wetzel ex Deflandre (l.c.) is treated as validly published under both the *ICZN* and this *Code* from 1937, not from the publication by Wetzel in 1933.”

This new Article and Example are introduced to avoid the acceptance of originally unavailable zoological names upon their later treatment as algae. Under the editions of the *International Code of Botanical Nomenclature* in operation in the past, numerous generic names, published originally for zoological taxa but with infringement of the *ICZN* requirements, and therefore unavailable under zoological nomenclature rules, were nevertheless accepted as validly published in botanical nomenclature due to different requirements for type fixation/indication of generic names between *ICZN* Art. 13.3 (where required from 1930) and the *ICN* Art. 40.1 (required from 1958). Hence “dual” nomenclature was produced in the Example provided: *Hystrichosphaera* Wetzel (in Palaeontographica, Abt. A, Paläozool. 78: 33. 1933), now correct under the *ICN*, but *Hystrichosphaera* Wetzel ex Deflandre (in Ann. Paléontol. 26: 61. 1937) correct under the *ICZN*. Furthermore, the type citation of this “ambiregnal” genus differs under both *Codes*, viz. *H. furcata* (Ehrenb.) Wetzel (l.c.: 34. 1933) under the *ICN* (see Index Nominum Algarum: <http://ucjeps.berkeley.edu/cgi-bin/porp.cgi.pl?575967>), but *H. furcata* (Ehrenb.) Wetzel ex Deflandre (l.c.: 61. 1937) under the *ICZN*. This Example illustrates the necessity to amend *ICN* Art. 45 so as not to accept names unavailable under the relevant other *Code*. Such a new regulation will harmonize treatment of the names under both *Codes*, and

resolve difficulties for indexing centres, when the same name would otherwise have two different places of validation depending on the *Code*, which is absurd.

(276) Add a second new paragraph to Art. 45 with two new Examples:

“45.n2. If a taxon originally assigned to a group not covered by this *Code* is treated as belonging to the algae or fungi and its name was originally published with status equivalent to valid publication under the relevant other *Code*, the name retains its original authorship and date of publication, especially for the purposes of homonymy, even though this *Code* might have later starting-points for some groups of algae or fungi.”

“Ex. n4. *Gyrogonites* Lam. (Syst. Anim. Sans Vertèbr.: 401. 1801) was originally published and available under the *International Code of Zoological Nomenclature* for a genus of fossil molluscs, but later shown to apply to remains of the reproductive organs of charophycean algae. It nonetheless retains its original authorship and date of publication from 1801 for the purposes of homonymy despite not being considered as validly published under this *Code* until after 1820, the starting-point for plant fossils (*Gyrogonites* Lam. ex Bowdich, Man. Conchol.: 16. 1822).”

“Ex. n5. *Pirea* Vavrdová (in Věstn. Ustředn. Ústavu Geol. 47: 82. 1972), originally published as a microfossil of *Acritarcha*, which is treated simultaneously under the rules of the *International Code of Zoological Nomenclature* and this *Code*, is a later homonym of *Pirea* T. Durand (Index Gen. Phan.: 494. 1888), a genus of *Brassicaceae*. *Pirea* Vavrdová is correct in zoological nomenclature, since no senior zoological homonym exists, but not under this *Code*, so it was proposed for conservation against its earlier homonym to avoid the existence of different correct names for the same organism under two different *Codes* (see Doweld in Taxon 67: 452. 2018 and Taxon 70: 670. 2021).”

The case of *Gyrogonites* Lam. (1801) (see Doweld in Taxon 66: 180–188. 2017) illustrates the situation where a fossil-genus name now applied to a fossil charophycean alga was originally described as a fossil animal prior to the starting-point of palaeobotanical nomenclature (1820, the starting-point for fossil nomenclature in the *ICN*, Art. 13.1(f)). *Gyrogonites* continued to be considered as a fossil animal (not plant or algae) until Bowdich (Man. Conchol.: 16. 1822). If this later publication date (1822), where the name is in reality a later isonym and has no standing in zoological nomenclature where this taxon has been established, is taken as its date of valid publication for the purposes of the *ICN*, we will have a conflict in nomenclature: accepting what is considered a later isonym under the *ICZN* (with no standing) as the validly published name under the *ICN*. The current Art. 45.1 imposes the need to “satisfy only the requirements of the relevant other *Code*”, which in this case automatically disregarded later isonyms as such. To accept what was a later isonym under the *ICZN* would contradict Art. 45.1. Therefore, I can see no serious disadvantage for the *ICN* to accept the original date of availability under the *ICZN* of names formerly applied to animal fossils when this precedes the 1820 starting-point for some algal fossils. In order to clarify such exceptional situations, where valid publication of taxon names might precede the starting-points of nomenclature under the *ICN* for some groups of algae and possibly fungi, a new Article and Example are proposed.

(277) Amend Art. 45.1 as follows (deleted text in strikethrough) and add a third new paragraph to Art. 45 with two new Examples:

“45.1. If a taxon originally assigned to a group not covered by this *Code* is treated as belonging to the algae or fungi, any of its names need satisfy only the requirements of the relevant other *Code* that the author was using for status equivalent to valid publication under this *Code* (but see Art. 54 and F.6.1, regarding homonymy). The *Code* used by the author is determined through internal evidence, irrespective of any claim by the author as to the group of organisms to which the taxon is assigned. ~~However, a name generated in zoological nomenclature in accordance with the Principle of Coordination is not validly published under this *Code* unless and until it actually appears in a publication as the accepted name of a taxon.~~”

“45.n3. If a taxon originally assigned to a group not covered by this *Code* is treated as belonging to the algae or fungi and its name was originally generated in zoological nomenclature in accordance with the Principle of Coordination, the name is not validly published under this *Code* unless and until it actually appears in a publication as the accepted name of a taxon. An exception is made for the names of taxa simultaneously and continuously assigned to traditional groups covered by different *Codes*, i.e. Myxomycetes/Mycetozoa (Amoeboae) and Protista, where the authorship and date of publication established by the Principle of Coordination overrides that determined by the rules of this *Code*.”

“Ex. n6. *Arcyriini* Rostaf. (Vers. Syst. Mycetoz.: 15. 1873, ‘*Arcyriaceae*’) was originally published for a tribe of Mycetozoa under the *International Code of Zoological Nomenclature*. When Rostaf. later established the mycetozoan family *Arcyriidae* Rostaf. (in Pamiętn. Towarz. Nauk Ścisłych Paryżu 5(4): 70, 87. 1874), in accordance with the Principle of Coordination of the *ICZN* (Art. 36.1) the authorship and date of publication of family-group names at every rank should be Rostaf. (l.c. 1873). Under this *Code*, the family name *Arcyriaceae* and tribal name *Arcyriae* are considered as validly published for Myxomycetes, but retain their original authorship and date in accordance with the Principle of Coordination: *Arcyriae* Rostaf. (l.c. 1873) and *Arcyriaceae* Rostaf. (l.c. 1873, not *Arcyriaceae* Rostaf., l.c. 1874), but with their original terminations changed in accordance with Art. 18.4, 19.7, and 32.2. The subfamily name *Arcyrioideae* J. Schröt. (in Cohn, Krypt.-Fl. Schlesien 3(1): 108. 1885, ‘*Arcyrii*’), although published for a fungal taxon of Myxomycetes, in accordance with the Principle of Coordination has authorship and date of publication from Rostaf. (l.c. 1873), but with the original termination changed in accordance with Art. 19.7 and 32.2.”

“Ex. n7. *Physaroideae* Fr. (Syst. Orb. Veg.: 139. 1825, ‘*Physarei*’) was originally published for a fungal taxon at the rank of subfamily (“Subord[o naturalis].”) of the family (“Ord[o naturalis].”) ‘*Trichospermi*’ Fr. Although Chevallier later established the family name *Physaraceae* Chevall. (Fl. Gén. Env. Paris 1: 332. 1826, ‘*Physarieae*’) as a fungal taxon, since the organisms are now considered as Mycetozoa, in accordance with the Principle of Coordination of the *International Code of Zoological Nomenclature* (Art. 36.1), the authorship and date of publication of family-group names at every rank should be Fries (l.c. 1825). Later established tribal (*Physareae* Grev., Scott. Crypt. Fl. 6(Synops.): 13. 1828, ‘*Physarei*’) and subtribal (*Physarinae* Tul. in Durieu de Maissoneuve, Explor. Sci. Algérie 1: 406. 1848–1849, ‘*Physarei*’) suprageneric names retain the original authorship and date (Fries, l.c. 1825) in accordance with the

Principle of Coordination, but with their original terminations changed in accordance with Art. 19.7 and 32.2.”

The progress in molecular phylogenetic systematics in the last years dramatically changed the affiliation of some groups of microorganisms which were traditionally treated under the *ICN*, namely Myxomycetes, Algae (flagellates) and Oomycetes. These groups were also continuously covered by the *ICZN* under different suprageneric designations, Mycetozoa, Flagellata and Chromista. Myxomycetes are now deeply embedded in the amoeboid kingdom or phylum, or even partially interspaced between single amoeboid phylads, and as a consequence, the nomenclature of this group should be made easily understandable for the users. But contradictions between the *ICN* and *ICZN* are mainly visible for suprageneric nomenclature. The Principle of Coordination, basic to zoological nomenclature, is not recognized under the *ICN*, and this is a basic conflict in the authorship and places of valid publication for suprageneric names in particular groups of microorganisms governed by both *Codes*. Proof of the deep affiliation of Myxomycetes with protistan amoebas in recent molecular trees necessitates building a uniform nomenclatural approach to the systematic treatment of this group by overcoming these contradictions. In this connection, because Art. 45.1 currently provides for the valid publication of names originating in accordance with the Principle of Coordination only after they are accepted in a publication, I am proposing to recognize, in only those groups traditionally covered by both *Codes*, their valid publication as determined by the Principle of Coordination. This necessitates the proposal of a new Article and two Examples, to show the treatment of suprageneric names in particular, and elimination of the final sentence from the current Art. 45.1, which is converted into a newly proposed Article.

(278) Add a fourth new paragraph to Art. 45 with a new Example and revise Art. 41.5 to add a special exception (new text in bold, deleted text in strikethrough):

“45.n4. For a taxon originally assigned to a group not covered by this *Code* that is treated as belonging to the algae or fungi, any new combination, name at new rank, or replacement name published with status equivalent to valid publication under the relevant other *Code* is considered as validly published under this *Code* even if its basionym or replaced synonym was not clearly indicated and a full and direct reference was not given to its author and place of valid publication, with page or plate reference and date (see Art. 41.5).”

“Ex. n8. The new combination *Baltisphaeridium longispinosum* (Eisenack) Eisenack (in Neues Jahrb. Geol. Paläontol., Abh. 106: 398. 1958), originally published as a fossil protist of dinoflagellates (not algae) and available under the *International Code of Zoological Nomenclature*, is validly published under this *Code* also, although it was not accompanied by a full and direct reference to its basionym author and place of valid publication with page or plate reference and date (*Ovum hispidum* subsp. *longispinosum* Eisenack in Paläontol. Z. 13: 110. 1931). Its republication by Eisenack (in Palaeontographica, Abt. A, Paläozool. 112: 194. 1959), previously considered necessary for valid publication under earlier editions of this *Code*, should be considered as creating an isonym.”

“41.5. On or after 1 January 1953, a new combination, name at new rank, or replacement name is not validly published unless its basionym or replaced synonym is clearly indicated and a full and direct reference given to its author and place of valid publication, with page or plate reference and date (but see Art. 41.6, ~~and 41.8, and 45.n4~~). On or after 1 January 2007, a new combination, name at new rank,

or replacement name is not validly published unless its basionym or replaced synonym is cited **(except as provided in Art. 45.n4).**”

The contradiction between both *Codes*, the *ICN* and the *ICZN*, also lies in the necessity to provide references to the basionym or replaced synonym for valid publication of new combinations, names at new rank, or replacement names in the *ICN* on or after 1 January 1953. No comparable provision exists in the *ICZN*. Numerous such names were treated as available under the *ICZN* without fully referenced basionyms or replaced synonyms, in contradiction to the requirement of *ICN* Art. 41.5, and were later independently validated under the *ICN*. As a result, when these identical nomenclatural novelties are produced under the more liberal provisions of the *ICZN*, it has created an absurd “dual” nomenclature for the same taxon. In order to permit valid publication under this *Code* of such nomenclatural novelties where they originated under zoological nomenclature, it is proposed to revise Art. 41.5 and add a new paragraph to Art. 45 with an Example.

(279) Add a fifth new paragraph to Art. 45 with a new Example and revise Art. 20.2 to add a special exception (new text in bold):

“45.n5. For a taxon originally assigned to a group not covered by this *Code* that is treated as belonging to the algae or fungi, a generic name published with status equivalent to valid publication under the relevant other *Code* is considered as validly published under this *Code* even if it coincides with a Latin technical term that is not permissible under Art. 20.2.”

“Ex. n9. *Ovulum* Jankauskas (in *Paleontol. Zhurn.* 1975(1): 96. 1975), originally published as a microfossil of the artificial problematic group Acritarcha, which is treated simultaneously under the rules of the *International Code of Zoological Nomenclature* and this *Code*, is considered validly published under this *Code* although coinciding with a Latin technical term.”

“20.2. The name of a genus may not coincide with a Latin technical term in use in morphology at the time of publication unless it was published before 1 January 1912 and was accompanied by a species name published in accordance with the binary system of Linnaeus, **except for names originally assigned to a group not covered by this *Code* (see Art. 45.n5 and Ex. n9).**”

The *Ovulum* case is a further illustration of the difference between the *ICN* and the *ICZN*. Since such names may coincide with

a Latin technical term in use in morphology in zoological nomenclature, in order to not require substitute names under the *ICN*, which would be treated as superfluous and illegitimate in zoological nomenclature in those groups of microorganisms governed traditionally by both *Codes*, it is proposed to modify Art. 20.2 with an exception and add a new paragraph to Article 45 with a new Example.

(280) Add a sixth new paragraph to Art. 45 with a new Example and revise the final sentence of Art. 60.8 to add a special exception (new text in bold):

“45.n6. For a taxon originally assigned to a group not covered by this *Code* that is treated as belonging to the algae or fungi, the original spelling of the epithet in its name, which is considered correct under the relevant other *Code* but is correctable under Art. 60.8, is retained under this *Code* as the correct spelling.”

“Ex. n10. *Hystriosphera schindewolfi* G. Alberti (in *Palaeontographica*, Abt. A, Paläozool. 116: 38. 1961), with the epithet spelled as originally established under the *International Code of Zoological Nomenclature*, is retained as the correct spelling under this *Code* although ‘*schindewolfi*’ is correctable to ‘*schindewolfii*’ under Art. 60.8.”

“60.8. [...] Terminations contrary to the above standards are treated as errors to be corrected to *[i]i*, *[i]ae*, *[i]ana*, *[i]anus*, *[i]anum*, *[i]arum*, or *[i]orum*, as appropriate (see also Art. 32.2). However, epithets formed in accordance with Rec. 60C.1 **and Art. 45.n6** are not correctable (see also Art. 60.9).”

The difference in spelling of epithets, formed under the different rules of the *ICZN* and *ICN*, is a permanent headache of the IFPNI and indexing centres of other microorganisms. Although a correction of spelling is permissible now under Art. 60.8, the initial form, generated in zoological nomenclature, nevertheless remains correct under the *ICZN*. This schism might not be bridged at present, since traditions of spelling in both nomenclatures are different. In IFPNI we recorded both spellings, and users could find names either by spelling *Hystriosphera schindewolfi* and *H. schindewolfii*. But I suggest that it is rational in “ambiregna” groups to allow both types of spelling terminations, so one correct under a different *Code* should not be treated as an error to be corrected under the *ICN*. This allows indexing centres compiling names of such microorganisms governed by two *Codes* to record only a single correct spelling.