A commentary on the interpretation of the International Code of Nomenclature of Bacteria

Questions have been raised concerning the interpretation of the International Code of Nomenclature of Bacteria, in particular the way the rules of priority are applied. The purpose of this article is to clarify these issues.

In a recent publication, Whitman et al. (2015) have called into question the interpretation of the International Code of Nomenclature of Bacteria (Lapage et al., 1992) given by Tindall et al. (2014), especially with respect to the way the priority of names at the ranks of order and family are regulated. The major difference between the two interpretations is that while Tindall et al. (2014) invokes Rule 23a with reference to the priority of names, Whitman et al. (2015) make reference to Rule 51b, a rule that provides information on what the consequences are of not following Rule 23a. In making reference to Rule 23a the wording simply states:

‘Each taxon above species, up to and including order, with a given circumscription, position, and rank can bear only one correct name, that is, the earliest that is in accordance with the Rules of this Code.’

Subsequently Rule 23b states:

‘The date of a name or epithet is that of its valid publication. For purposes of priority, however, only legitimate names and epithets are taken into consideration.’

Rule 24b also deals with the issue of how the priority of names is determined.

The wording indicates that priority of names is determined by their date of valid publication in the International Journal of Systematic Bacteriology (IJSB)/International Journal of Systematic and Evolutionary Microbiology (IJSEM). While not explicitly stated, it should be evident that priority applies to taxa of the same rank since a family name would not compete for priority with a species epithet, etc. However, Whitman et al. (2015) claim that the name to be used at the rank of order or family is determined by the genus name that has the earliest date of valid publication and is included in that order or family. This interpretation is not consistent with the wording of Rules 23a, 23b or 24b, none of which are referred to by the authors.

Whitman et al. (2015) also refer to the example given in Rule 51b (1):

‘Example: if an author circumscribes a genus to include Bacillus subtilis, the type species of the genus Bacillus, then the circumscribed genus must be named Bacillus.’

Correctly indicating that this also applies to other ranks, for example:

If an author circumscribes a family to include the genus Acetobacter, type of the family Acetobacteraceae, then the circumscribed family must be named Acetobacteraceae. Or:

If an author circumscribes an order to include the genus Flavobacterium, type of the order Flavobacteriales, then the circumscribed order must be named Flavobacteriales.

At no point in the original note is any reference made to priority, but the importance of nomenclatural types in the circumscription of a taxon is indicated. In fact the wording should also be qualified because it implies that the circumscription includes only one nomenclatural type. A name that has not previously been based on a designated nomenclatural type cannot be taken into consideration.

In the case being discussed here, if we ignore the issue with the genus name, Nevskia, and the family name, Nevskiaceae, Saddler and Bradbury (2005) proposed that the genera Lysobacter & Xanthomonas be placed in the same family. As defined by the Code, the genus Lysobacter was the only nomenclatural type in that family and according to the note cited by Whitman et al. (2015) the name of the family is Lysobacteraceae. The genus Xanthomonas was not a nomenclatural type and so there is no cause to call the family Xanthomonadaceae. Even if the family name Xanthomonadaceae Saddler and Bradbury 2005 were to be created, when considering priority of names at the same rank based on their dates of valid publication the family name Lysobacteraceae Christensen and Cook 1978 (Approved Lists 1980) would have priority over the family name Xanthomonadaceae Saddler and Bradbury 2005 when the genera Lysobacter and Xanthomonas are included in the same family.

Rule 23b is also explicit. While extrapolation is justified, it is better to make reference to the Rules governing the designation of nomenclatural types. Rule 16 states:

‘After the date of publication of this Code, the type of a taxon must be designated by the author at the time the name of the taxon is published in the IJSB (see Rule 27).’

Rule 17 states:

‘The type determines the application of the name of a taxon if the taxon is subsequently divided or united with another taxon,’ indicating that the author of a new name selects the nomenclatural type, which determines the application of the name, with no mention being made of the date of valid publication of the name of the subordinate taxon that serves as the type determining priority. Where existing names are considered to be synonyms, priority is determined by the date associated with the name and not the date of the name of the nomenclatural type.

While in the majority of cases, family or order names are typified by the genus with the earliest validly published name in that taxonomic treatment, this is not always the case and can be illustrated by the example of the family name Veillonellaceae Rogosa 1971 (Approved Lists 1980). Originally proposed to include only the genera Veillonella Prevote 1933 (Approved Lists 1980), Acidaminococcus Rogosa 1969 (Approved Lists 1980) and Megasphaera Rogosa 1971 (Approved Lists 1980) (Rogosa, 1971) the circumscription has now changed with one interpretation...
(Rainey, 2009) adding, among others, the genus *Selenomonas* von Prowazek 1913 (Approved Lists 1980). However, because that circumscription of the family contains the genus *Veillonella* Prévot 1933 (Approved Lists 1980), the only designated type in the family, the family must be named *Veillonellaceae* Rogosa 1971 (Approved Lists 1980). The name of the family is not altered to *Selenomonadaceae* as Whitman *et al.* (2015) imply, and if such a name were to be created it would be covered by Rule 51b (1). A similar situation occurs in the family *Comamonadaceae* Willems *et al.* 1991, whose nomenclatural type is *Comamonas* (ex Davis and Park 1962) De Vos *et al.* 1985 (Willems *et al.*, 1991). Changing the circumscription to include the genus *Lampropedia* Schroeter 1886 (Approved Lists 1980) (Willems & Gillis, 2005) does not result in the family being renamed ‘*Lampropediaeaceae*’. There are also a number of order names that have as the type genus a genus that does not have the earliest validly published genus name included in the circumscription. The interpretation of Whitman *et al.* (2015) would directly contravene the first aspect of Principle 1, “aim at stability of names”, or “avoid the useless creation of names”, the latter of which Rule 51b (1) implements.

Whitman *et al.* (2015) also discuss the relevance of the wording of Rule 15 to the case of the synonymy of the genera *Sinobacter* and *Solimonas*, with *Sinobacter* being considered to be a later heterotypic synonym of *Solimonas*. The genus *Sinobacter* is the nomenclatural type of the family *Sinobacteraceae* and the wording of Rule 15, which was altered in 2011 (Garrity *et al.*, 2011) is:

“The nomenclatural type, referred to in this Code as “type”, is that element of the taxon with which the name is permanently associated, whether as a correct name or as a later heterotypic synonym.” is directly relevant to this case. The statement that it, “has no bearing on this issue” (Whitman *et al.*, 2015) misses the issue that the genus *Sinobacter* is both the nomenclatural type of the family *Sinobacteraceae* and is being treated as a later heterotypic synonym. In other words, Rule 15 has bearing on the issue and this situation is the exact reason why this wording was introduced to clarify the wording and interpretation of that Rule used in previous editions of the Code as elucidated by Tindall (2008, 2015).

In principle, there is no difference between such a situation and one where one species is considered to be a later heterotypic synonym of another, but neither are the type species of a genus.

In arguing in favour of the creation of the family name *Solimonadaceae*, Whitman *et al.* (2015) make reference to Rules 9, 15 and 51b (1). Rule 9 simply defines the ending to be added to the stem of the genus name that serves as the nomenclatural type, making no other statements about any other aspects relevant to the Code.

“The name of a taxon between subclass and genus is formed by the addition of the appropriate suffix to the stem of the name of the type genus (see Rule 15). These suffixes are as follows:”

The name *Sinobacteraceae* does not contravene Rule 9 since the type genus is *Sinobacter*. Rule 15 defines the purpose of nomenclatural types and significantly uses the term ‘permanently’ (see above). The genus *Sinobacter* is always the nomenclatural type of the family *Sinobacteraceae*. The name *Sinobacter* as the nomenclatural type of the family *Sinobacteraceae* does not contravene Rule 15. It is at this point that Whitman *et al.* (2015) conclude that later heterotypic synonyms are illegitimate, something that is not stated in the Code. Whitman *et al.* (2015) further appear to assume, as have others in the past, that the selection of a correct name automatically makes other synonyms illegitimate. This is not the case. Reference to Rule 51b (1) also seems to miss the point that the taxon, as circumscribed by Losey *et al.* (2013), does contain a nomenclatural type of a family, the genus *Sinobacter*, despite the fact that the species combination *Sinobacter flavus* (the type of the genus *Sinobacter*) is treated as a homotypic synonym of the combination *Solimonas flavus*, resulting from the fact that the genus name *Sinobacter* is treated as a later heterotypic synonym of the genus name *Solimonas*. There is no reason to ignore the nomenclatural type. This rule also does not determine priority. Rule 51a does seem to point to a case of conditional legitimacy, but is best explained by the fact that the name *Solimonas soli* Kim *et al.* 2007 is a legitimate name, but ‘*Sino- bacter soli*’ based on the same nomenclatural type would be illegitimate. Similarly

*Chromohalobacter salarius* Aguilera *et al.* 2007 is a legitimate name and based on the same nomenclatural type the name *Salinico- cola halophilus* de la Haba *et al.* 2010 must be used in the genus *Salinicola* because the epithet *saliarius* in *Salinicola salarius* (Kim *et al.* 2007) de la Haba *et al.* 2010 has priority (by pagination), indicating that the proposal of a second combination, *Salinicola salarius*, based on a different nomenclatural type would create a name in which the epithet is illegitimate. It would also be a homonym.

The Code also states:

Rule 3 “Names contrary to a Rule cannot be maintained...”

Illegitimate names (Rule 23a) are defined as being contrary to the Rules, i.e. illegitimate names cannot be maintained, where the only mechanism for such an action would appear to be that the Judicial Commission reject (Rule 56a) or replace them (Rule 54). However, Rule 23a (i) states:

“By rejected name (nomen rejiciendum) is meant a name which must not be used to designate any taxon.”

If the consequences are that illegitimate names are to be rejected and are not available for further use this would appear to be contrary to the recognition of the name *Sinobacter* as an illegitimate name when treated as a later heterotypic synonym of *Solimonas*, but allowing the reuse of the genus name *Sinobacter* if it is not treated as a synonym of *Solimonas* as suggested by Whitman *et al.* (2015). It would also create a problem if the basionym of *Solimonas flavus*, *Sinobacter flavus*, were to be declared illegitimate and rejected. The solution comes from the wording of Principle 6 and Principle 8:

Principle 6:

“The correct name of a taxon is based upon valid publication, legitimacy, and priority of publication”

Principle 8:

“Each order or taxon of a lower rank with a given circumscription, position, and rank can bear only one correct name, i.e., the earliest that is in accordance with the Rules of this Code.”

The selection of the correct name, as in the case of *Solimonas flavus*, allows both that combination and *Sinobacter flavus* to remain as legitimate and validly published names,
but in any one circumscription (classification/taxonomy) only one is the correct name. Similarly, the selection of the genus name *Solimonas* as the earlier heterotypic synonym over *Sinobacter* as the correct name of the taxon also does not affect the fact that the genus name *Sinobacter* remains both legitimate and validly published, even if it is treated as a later heterotypic synonym. This construct also allows the two genus names to be used together if they are not treated as synonyms. It also allows the genus *Sinobacter* to remain the nomenclatural type of the family *Sinobacteraceae*.

It is understandable that Whitman et al. (2015) conclude that Tindall et al. (2014) fails to recognize the importance of taxonomy in nomenclature. While taxonomy and nomenclature are portrayed as being distinct, taxonomy comprises nomenclature, classification and characterization, making it impossible to separate nomenclature from taxonomy as emphasized by Tindall et al. (2010). This is also implicit in the title of the paper (Tindall et al. 2014). Secondly, Tindall et al. (2014) only uses the term taxonomy in the text of the abstract, using instead the Code-relevant terms “with a given circumscription, position and rank” (i.e. the classification or taxonomy used). The latter part of the publication refers indirectly to various taxonomic treatments by other authors, even if their classification (taxomy) is not always clearly expressed. Thirdly, General Consideration 4 states:

“Rules of nomenclature do not govern the delimitation of taxa nor determine their relations.”

It is wise to avoid the use of the term taxonomy in the Code, otherwise further misunderstandings may arise relating to the fact that the Code may also govern taxonomy or classification, which it does not. This is also evident in the use of incorrect terms such as “validly described species” when authors mean validly published species name (combination), as do Whitman et al. (2015). The wording implies two different aspects that should not be confused with one another.

The treatments of Tindall et al. (2014) and Whitman et al. (2015) are both based on exactly the same text, but seem to come to completely different conclusions. A case such as this permits one to take a closer look at the wording and either to identify the ambiguities, or to suggest clarification of the differences in interpretation. It is hoped that this commentary provides clarification.

Declaration of a potential conflict of interest:

The author is employed by an organization that offers commercially both taxonomic services as well as biological material to the scientific community. This may be perceived as a potential conflict of interest.

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References


Tindall, B. J. (2014). The family name *Solimonadaceae* Losey 2013 is illegitimate, proposals to create the names ‘*Sinobacter soli*’ comb. nov. and ‘*Sinobacter variicolori*’ contravene the Code, the family name *Xanthomonadaceae* Saddler and Bradbury 2005 and the order name *Xanthomonadales* Saddler and Bradbury 2005 are illegitimate and notes on the application of the family names *Solibacteraceae* Zhou et al., 2008, *Nevskiaceae* Henrici and Johnson 1935 (Approved Lists 1980) and *Lysobacteraceae* Christensen and Cook 1978 (Approved Lists 1980) and order name *Lysobacteriales* Christensen and Cook 1978 (Approved Lists 1980) with respect to the classification of the corresponding type genera *Solibacter* Zhou et al. 2008, *Nevskia* Famintzin 1892 (Approved Lists 1980) and *Lysobacter* Christensen and Cook 1978 (Approved Lists 1980) and importance of accurately expressing the link between a taxonomic name, its authors and the corresponding description/circumscription/ emulation. Int J Syst Evol Microbiol 64: 293–297.


