Proposals to address the way the *Cyanobacteria* should be treated under the International Code of Nomenclature of Prokaryotes.

To be open for discussion in the period November 1, 2020 – January 31, 2021, with replies from the authors of the proposals to be received in the period February 1 – March 31, 2021; the ICSP ballot will open on April 1, ending no later than June 30, 2021.

Background information:

1. *Cyanobacteria* are prokaryotes but their nomenclature is traditionally regulated by the rules of the International Code of Botanical Nomenclature (ICBN)/International Code of Nomenclature for algae, fungi, and plants (ICN).

2. In 1978, Stanier *et al.* proposed that the nomenclature of the *Cyanobacteria* should be governed by the provisions of the International Code of Nomenclature of Bacteria (ICNB), today the International Code of Nomenclature of Prokaryotes (ICNP).

   Stanier *et al*. Proposal to place the nomenclature of the cyanobacteria (blue-green algae) under the rules of the International Code of Nomenclature of bacteria. *Int J Syst Bacteriol* 1978;28:335–336.

3. This proposal led to long discussions by the ICSB/ICSP, its Subcommittee on the taxonomy of phototrophic bacteria, and different *ad hoc* committees. The history of these discussions was summarized by Oren and Ventura (2017) and full information can be found in the references cited therein.

   Oren A, Ventura S. The current status of cyanobacterial nomenclature under the “prokaryotic” and the “botanical” code. *Antonie van Leeuwenhoek* 2017;110:1257–1269.

4. Prior to 2000, there was no explicit statement in the ICNB to show that the nomenclature of the *Cyanobacteria* was covered by its Rules. The older version of General Consideration 5 reads: “This *Code of Nomenclature of Bacteria* applies to all bacteria. The nomenclature of certain other microbial groups is provided for by other Codes: fungi and algae by the Botanical Code, …”

   Tindall (1999) proposed adding the following note: ‘The term “bacteria” covers those organisms variously recognized as prokaryotes, Bacteria, Archaea, Eubacteria and Archaeobacteria. Due consideration has been given to including cyanobacteria, which are traditionally covered by the International Code of Botanical Nomenclature, and has been discussed elsewhere’. However, during their meetings in Sydney in 2000, the JC and the ICSB changed this note to read: “Prokaryotes” covers those organisms that are variously recognized as e.g. Schizomycetes, Bacteria, Eubacteria, Archaebacteria, Archaeobacteria, Archaea, Schizophycetes, Cyanophyceae and Cyanobacteria.” This is the current wording of the *Note* to General Consideration 5 in the ICNP (2008 Revision; Parker et al. 2019).

Tindall BJ. Proposals to update and make changes to the Bacteriological Code. Int J Syst Bacteriol 1999;49:1309-1312.

De Vos P, Trüper HG. Judicial Commission of the International Committee on Systematic Bacteriology. IXth International (IUMS) Congress of Bacteriology and Applied Microbiology. Minutes of the meetings, 14, 15 and 18 August 1999, Sydney, Australia. *Int J Syst Evol Microbiol*;2000:2239–2244.

5. A few relevant aspects in which the ICNP and the ICN differ:
   (1) The nature of the type material permitted – live cultures (ICNP) or dead or preserved type material (ICN).
   (2) Dating of priority of names: 1980 for the ICNP; 1753, 1886 or 1892 for different groups of cyanobacteria/cyanophyta for the ICN.
   (3) The version of Principle 2 of the ICNP adopted in Sydney in 1999, as stated in the current ICNP (2008 revision), highlights that the nomenclature of prokaryotes is **not** independent of botanical nomenclature. Thus, generic names in use under the ICN cannot be used for new generic names under the ICNP and a genus name with a botanical type species cannot be used to describe new species under the ICNP.

6. The number of names of cyanobacterial taxa that have standing under the ICNP is currently very small: the family *Prochlorotrichaceae* and the genera *Halospirulina*, *Planktotricoides*, *Prochlorothrix* and *Rubidibacter*, each with a single species.

7. Three alternative proposals to solve the issue of the cyanobacteria under the ICNP were published in the IJSEM between 2014 and 2020; none of these proposals was yet discussed by the ICSP. These proposals are now open for discussion, and according to the statutes of the ICSP, a decision must be finalized no later than the end of June 2021.

PROPOSAL NO. 1

Oren and Garrity (2014) proposed restoring the text of the Note to General Consideration 5 to a version resembling the one originally proposed by Tindall in 1999. This means that nomenclature of the cyanobacteria will be regulated by the ICN as in the past. The names mentioned above (section 6) will remain validly published under the ICNP and they also have standing in the botanical nomenclature based on Article 45.1 of the ICN (see below for Proposal no. 3). The proposed version of the Note to General Consideration 5 is as follows:

Note. ‘Prokaryotes’ covers those organisms that are variously recognized as e.g. *Schizomycetes*, *Bacteria*, *Eubacteria*, *Archaebacteria*, *Archaeobacteria* and *Archaea*. This Code does not cover the nomenclature of the *Cyanobacteria*/*Cyanophyceae*/*Cyanophyta*, which traditionally is covered by the International Code of Botanical Nomenclature/International Code of Nomenclature for algae, fungi, and plants. However, names of cyanobacterial genera and species validly published in the past under the provisions of the ICNP will retain standing in the nomenclature.

Oren A, Garrity GM. Proposal to change General Consideration 5 and Principle 2 of the International Code of Nomenclature of Prokaryotes. *Int J Syst Evol Microbiol* 2014;64:309–310.

This proposal was discussed by the ICSP Subcommittee on the taxonomy of phototrophic bacteria and met with considerable opposition.

Imhoff JF. International Committee on Systematics of Prokaryotes. Subcommittee on the taxonomy of phototrophic bacteria. Minutes of the closed online meeting, 10–30 June 2014. *Int J Syst Evol Microbiol*;2014:3910–3912.

PROPOSAL NO. 2

The proposal by Pinevich (2015) to consistently apply the ICNP to names of the *Cyanobacteria* by changing the text of Principle 2 of the ICNP is directly opposed to Proposal 1.

The nomenclature of prokaryotes is not independent of zoological nomenclature, as well as nomenclature of algae, fungi and plants. The only exception applies to names of the oxygenic photosynthetic bacteria (cyanobacteria) validly published, as names of algae, under the International Code of Botanical Nomenclature/International Code of Nomenclature for algae, fungi and plants.

***Supplementary note:* 'independent' means that the same name may be validly used for a taxon of bacteria as well as a taxon of algae, fungi, plants and animals.**

If this proposal were to be accepted by the ICSP, further modifications of the code will be necessary, as the proposal does not address aspects such as of priority of names and the treatment of homonyms under the two codes. The term 'valid use' of names is not found in the ICNP.

Pinevich AV. Proposal to consistently apply the International Code of Nomenclature of Prokaryotes (ICNP) to names of the oxygenic photosynthetic bacteria (cyanobacteria), including those validly published under the International Code of Botanical Nomenclature (ICBN)/International Code of Nomenclature for algae, fungi and plants (ICN), and proposal to change Principle 2 of the ICNP. *Int J Syst Evol Microbiol* 2015;65:1070–1074.

PROPOSAL NO. 3

In this new proposal (Oren, 2020), reciprocation of Article 45.1 of the ICN (previously Article 45.4 of the ICBN) will enable the valid publication under the ICNP of names of *Cyanobacteria* previously validly published under the ICN/ICBN. In the ICN, this Article reads as follows: '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* (…). 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. …'

Based on reciprocation of this Article of the ICN, Proposal no. 3 includes the following emendations of the ICNP (new text highlighted):

> General consideration 5
>
> This *Code of Nomenclature of Prokaryotes* applies to all Prokaryotes. The nomenclature of eukaryotic microbial groups is provided for by other Codes: fungi and algae by the International Code of Nomenclature for algae, fungi, and plants; protozoa by the International Code of Zoological Nomenclature. The nomenclature of viruses is provided for by the International Code of Virus Classification and Nomenclature (see Appendix 1).
>
> *Note*. 'Prokaryotes' covers those organisms that are variously recognized as e.g. *Schizomycetes*, *Bacteria*, *Eubacteria*, *Archaebacteria*, *Archaeobacteria*, *Archaea*, *Schizophycetes*, *Cyanophyceae* and *Cyanobacteria*.
>
> **If a taxon originally assigned to the *Cyanophyceae*/*Cyanobacteria* was named under the provisions of the International Code of Nomenclature for algae, fungi, and plants, any of its names need satisfy only the requirements of that *Code* for status equivalent to valid publication under this *Code*.**

Note that this the first time that special arrangements are proposed in the ICNP to regulate the nomenclature of a specific group of prokaryotes; this in contrast to the ICN, which includes numerous special provisions for different groups of plants.

> Rule 18a – *Type of a Species or Subspecies*
>
> The following paragraph must be added:
>
> **(3) For species (or subspecies) of *Cyanobacteria* described under the provisions of the International Code of Nomenclature for algae, fungi, and plants, the type designated under that Code is also recognized as the type under the International Code of Nomenclature of Prokaryotes. In cases of homonymy where a name of a cyanobacterial taxon was published under both codes, the oldest name has priority.**
>
> **Example: *Prochlorococcus* Chisholm *et al.* 1992 and not *Prochlorococcus* Chisholm *et al.* 2001).**
>
> Rule 24a
>
> …
> Priority of publication dates from 1 January 1980. On that date all names published prior to 1 January 1980 and included in the Approved Lists of Bacterial Names are treated for all nomenclatural purposes as though they had been validly published for the first time on that date, the existing types being retained (but see Rule 24b).

For names of *Cyanobacteria* validly published under the provisions of the International Code of Nomenclature for algae, fungi, and plants, priority of publication is determined by Article 13.1 of that Code.

Rule 30

For the name of a species to be validly published, it must conform with the following conditions.

…

(4) Names of taxa of *Cyanobacteria* validly published in conformity with the Rules of the International Code of Nomenclature for algae, fungi, and plants are also validly published in conformity with the Rules of this Code (see General Consideration 5).

Oren A. Three alternative proposals to emend the Rules of the International Code of Nomenclature of Prokaryotes to resolve the status of the *Cyanobacteria* in the prokaryotic nomenclature. *Int. J. Syst. Evol. Microbiol.* 2020;70:4406–4408.

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