International Journal of Systematic and Evolutionary Microbiology

International Code of Nomenclature of Prokaryotes

--Manuscript Draft--

Manuscript Number:	IJSEM-D-15-00747R1
Full Title:	International Code of Nomenclature of Prokaryotes
Short Title:	ICNP (2008 Revision)
Article Type:	ICSP Minutes
Section/Category:	ICSP Matters
Keywords:	International Code of Prokaryotic Nomenclature; Rules; principles; general considerations; Judicial Commission; prokaryotic names
Corresponding Author:	George M Garrity, Sc.D. Michigan State University East Lansing, MI UNITED STATES
First Author:	Charles T Parker, B.Sc.
Order of Authors:	Charles T Parker, B.Sc.
	Brian J Tindall, Ph.D.
	George M Garrity, Sc.D.
Manuscript Region of Origin:	UNITED STATES
Abstract:	This volume contains the edition of the International Code of Nomenclature of Prokaryotes that was presented in draft form and available for comment at the Plenary Session of the Fourteenth International Congress of Bacteriology and Applied Microbiology (BAM), Montréal, 2014, together with updated lists of conserved and rejected bacterial names and of Opinions issued by the Judicial Commission. As in the past it brings together those changes accepted, published and documented by the ICSP and the Judicial Commission since the last revision was published. Several new appendices have been added to this edition. Appendix 11 addresses the appropriate application of the Candidatus concept, Appendix 12 contains the history of the van Niel Prize, and Appendix 13 contains the summaries of Congresses.

International Code of Nomenclature of Prokaryotes

Prokaryotic Code (2008 Revision)

Charles T. Parker[1], Brian J. Tindall[2] and George M. Garrity[3] (Editors)
[1]NamesforLife, LLC (East Lansing, Michigan, United States)
[2]Leibniz-Institut DSMZ-Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH, (Braunschweig, Germany)
[3]Michigan State University (East Lansing, Michigan, United States)

Corresponding Author: George M. Garrity (garrity@msu.edu)
Running title: Prokaryotic Code (2008 Revision)
Section: ICSP Matters

Preface to the Current Edition

It is now 22 years since the 1990 Revision of the Bacteriological Code was published in 1992. This revision of the Code now takes on the name The International Code of Nomenclature of Prokaryotes (ICSP), in order to reflect the fact that it governs a larger group of organisms than the Bacteria. The term "prokaryote" is used as defined in General Consideration 5. The wording of the Code reflects those changes approved by Plenary Sessions of the ICSB and ICSP up to and including the XIIth International Congress of the Bacteriology and Applied Microbiology (BAM) Division of the International Union of Microbiological Societies (IUMS) in Istanbul (2008), together with updated lists of conserved and rejected names, and of Judicial Opinions. The statutes governing BAM, which until 1987 was the Bacteriology Section of the IUMS are no longer included, and will be published separately.

In the 22 years since the last complete edition was published and 34 years since the implementation of a new starting date for prokaryotic nomenclature was introduced, the Code has served the community of prokaryotic systematics well. This revision of the Code would not be complete without honoring the editors of the 1975 and 1990 revisions. Their words can be found in the earlier prefaces, which we include in this volume, and every volume, in order to preserve our institutional history and to record their efforts. The Code would not exist in its present state (or perhaps at all) without their significant contributions. This code is a living document, revised by nearly every Congress as methods and technology advance in our field, and as the needs of the scientific community change. In principle this code of nomenclature retains a stable foundation that, from time to time, requires fine tuning rather than major revision. That the Code has stood the test of time is a tribute to those who undertook the task of maintaining it and are now deceased.

Stephen P. Lapage (1990)
Peter H. A. Sneath (2011)
Victor B. D. Skerman (1993)
Heinz P. R. Seeliger (1997)
William A. Clark (2011)
Erwin F. Lessel (2012)

While the Code regulates nomenclature, one of its main goals is to maintain stability in names, which itself is linked to the classification of organisms and the way the data gathered on organisms is interpreted. The names of taxonomic concepts have taken on a new significance in an increasingly electronic age, where the information in databases, online publications and other resources may be linked. Nomenclature and the associated classifications play a fundamental role in maintaining the identity of the organisms when their names appear out of their usual contexts.

While the Code does not attempt to interfere with the process of classification it does lay down clear rules that stipulate that taxa must be distinguishable, that types must be properly designated and (where appropriate) authentic strains must be made available without restriction, and that data on which descriptions are based must be included. The Code provides the critical links between nomenclature, classification, and characterization; past, present and future. It provides the foundation on which we can reliably compare physiological, biochemical, genetic and structural data collected in the past with current and future findings based on contemporary 'omics based methods and future methods that are yet to be defined. The Code allows us to make assertions and to propose hypotheses that are supported by a wealth of experimental data that are directly comparable. It is important to also remember that nomenclature is one step in an information management system, the scope of which is only limited by the bounds of the methods available for studying the organisms themselves and our ability to interpret and comprehend that information.

In the preface to the 1990 Revision of the Code, P. H. A. Sneath indicated the influential role that the Code has had on developments in botany and zoology, which continues to be the case today. In his review of the preparation of the Approved List, Sneath (2005) cited the late V. B. D. Skerman, who with reference to developments in other areas of nomenclature simply said "We started something!"

This volume contains the revision of the International Code of Nomenclature of Prokaryotes that was presented in draft form and available for comment at the Plenary Session of the Fourteenth International Congress of Bacteriology and Applied Microbiology (BAM), Montréal, 2014, together with updated lists of conserved and rejected names of prokaryotes and of Opinions issued by the Judicial Commission. As in the past it brings together those changes accepted, published and documented by the ICSP and the Judicial Commission since the last revision was published, up to and including the XIIth International Congress of the Bacteriology and Applied Microbiology (BAM) Division of the International Union of Microbiological Societies (IUMS) in Istanbul (2008). Some minor editorial changes have been made where the 1990 Revision referred to actions in the future, or where references required updating.

At the close of the IUMS meeting in 1999, the name of the *International Committee on Systematics of Bacteria* (ICSB) was changed to the *International Committee on Systematics of Prokaryotes* (ICSP). In 2000, the name of the *International Journal of Systematic Bacteriology* was changed to the *International Journal of Systematic and Evolutionary Microbiology*. With the adoption of the minutes of the 1999 ICSB meeting, this Code of Nomenclature was officially renamed from the *International Code of Nomenclature of Bacteria* to the *International Code of Nomenclature of Prokaryotes*.

Several new appendices have been added to this edition. Appendix 11 addresses the appropriate application of the Candidatus concept, Appendix 12 contains the history of the van Niel Prize, and Appendix 13 contains the summaries of Congresses.

Much of the development and history of this code of nomenclature is written in the pages of the minutes of the congresses. After several editions, the summaries of congress activities had accumulated in several forewords and prefaces, resulting in large bibliographies at the beginning of the book that were impairing readability. The congress summaries have been rearranged and placed in a new Appendix 13 to improve the readability of the front matter and to clarify the bibliographic references pertaining to each congress. The authorship of the summaries of the First International Congress for Microbiology (Paris, 1930) through the Sixth International Congress for Microbiology (Rome, 1953) are attributed to the Editorial Board, June 1958; those of the Seventh International Congress for Microbiology (Stockholm, 1958) through the Tenth International Congress for Microbiology (Mexico City, 1970) and including the First International Congress of Bacteriology (Jerusalem, 1973) and Special Meeting of the Judicial Commission (Leicester, 1968) are attributed to P. H. A. Sneath, Leicester, England, January 1975; those of the Third International Congress of Bacteriology and Applied Microbiology (Munich, 1978) through the Fifth International Congress of Bacteriology and Applied Microbiology (Osaka, 1990) are attributed to P. H. A. Sneath, Leicester, England, May 1991. In this edition, the bibliographic references have been rearranged to immediately follow the congress to which they pertain.

During this editorial process, we encountered Buchanan's well-worn personal copy of the 1958 Code. Inside the back cover, he had taped in a reprint of the 1966 update to the Code, and inside the front cover, he had an official reprint of the 1948 draft of the Code. In the margin of page 115 of the 1958 Code, he had written "*Do not change numbers*". We have taken this into consideration when accommodating the renumbering of Rule 46 to Rule 40d by leaving a placeholder for Rule 46, so as to ensure that any citations of rules are compatible back to the 1975 Revision (the last major rewrite of the Code).

A new edition of the complete Code has been long overdue. It is hoped that this attempt to produce the Code in both electronic and print format greatly reduces the burden of future editors while retaining the original vision of Buchanan.

Chapter 1. General Considerations

General Consideration 1

The progress of bacteriology can be furthered by a precise system of nomenclature accepted by the majority of bacteriologists of all nations.

General Consideration 2

To achieve order in nomenclature, it is essential that scientific names be regulated by internationally accepted Rules.

General Consideration 3

The Rules which govern the scientific nomenclature used in the biological sciences are embodied in International Codes of Nomenclature (see Appendix 1 for a list of these Codes).

General Consideration 4

Rules of nomenclature do not govern the delimitation of taxa nor determine their relations. The Rules are primarily for assessing the correctness of the names applied to defined taxa; they also prescribe the procedures for creating and proposing new names.

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*.

General Consideration 6

This Code is divided into Principles, Rules, and Recommendations.

(1) The *Principles* (Chapter 2) form the basis of the Code, and the Rules and Recommendations are derived from them.
(2) The *Rules* (Chapter 3) are designed to make effective the Principles, to put the nomenclature of the past in order, and to provide for the nomenclature of the future.
(3) The *Recommendations* (Chapter 3) deal with subsidiary points and are appended to the Rules which they supplement. Recommendations do not have the force of Rules; they are

intended to be guides to desirable practice in the future. Names contrary to a Recommendation cannot be rejected for this reason.

(4) Provisions for emendations of Rules, for special exceptions to Rules, and for interpretation of the Rules in doubtful cases have been made by the establishment of the International Committee on Systematics of Prokaryotes (ICSP) and its Judicial Commission, which acts on behalf of the ICSP (see Rule 1b and Statutes of the International Committee on the Systematics of Prokaryotes). Opinions issued by the Judicial Commission become effective after receipt of ten or more favorable votes from Commissioners, but may be rescinded by the ICSP as provided in the ICSP Statutes. The official journal of the ICSP is the *International Journal of Systematic and Evolutionary Microbiology* (IJSEM), formerly *International Journal of Systematic Bacteriology* (IJSB), formerly the *International Bulletin of Bacteriological Nomenclature and Taxonomy* (IBBNT). (Some other journal could be specified by the ICSP if required. Such possible future specification is implicit in the use of "*International Journal of Systematic and Evolutionary Microbiology"* or "IJSEM" throughout this Code, but is not always repeated at each mention.)

(5) *Appendices* are added to assist in the application of this Code (see Contents).

(6) Reference is given in the *Index* to clauses in which Definitions of certain words used in the Code are provided. Such words are indicated in boldface type in the clause concerned and in the index, and they may be printed in boldface type elsewhere in this Code.

General Consideration 7

Nomenclature deals with the following:

(1) Terms used to denote the **taxonomic categories**, e.g., "species," "genus," and "family."

(2) Relative rank of the categories (see Rule 5).

(3) Names applied to individual taxa. A taxonomic group is referred to throughout this Code as a **taxon**, plural **taxa**. "**Taxonomic group**" is used in this Code to refer to any group of organisms treated as a named group in a formal taxonomy; it may or may not correspond to a category.
Examples: Name of a species, *Pseudomonas* (generic name) *aeruginosa* (specific epithet); name of a genus, *Pseudomonas*; name of a family, *Pseudomonadaceae*; name of an order; *Pseudomonadales*.

General Consideration 8

The International Code of Nomenclature of Prokaryotes is an instrument of scientific communication. Names have meaning only in the context in which they were formed and used.

Editorial Note. In the Bacteriological Code (1975 Revision) many examples were taken from names that lost their standing in nomenclature on publication of the *Approved Lists of Bacterial Names* (Skerman *et al.*, 1980). These examples were retained in the Bacteriological Code (1990 Revision), but the majority of these examples have now been replaced (see minute 7, topic 2 ii of the San Francisco minutes of the Judicial Commission), although some have been retained because they illustrate nomenclatural problems which have occurred in the past and may occur

again, but which cannot always be illustrated by names that currently have standing under the present Code.

Chapter 2. Principles

Principle 1

The essential points in nomenclature are as follows.

1. Aim at stability of names.
2. Avoid or reject the use of names which may cause error or confusion.
3. Avoid the useless creation of names.
4. Nothing in this Code may be construed to restrict the freedom of taxonomic thought or action.

Note. "**Name**" in this Code is used to refer to scientific names applied to prokaryotes (see Chapter 3, Section 3).

Principle 2

The nomenclature of prokaryotes is not independent of botanical and zoological nomenclature When naming new taxa in the rank of genus or higher, due consideration is to be given to avoiding names which are regulated by the International Code of Zoological Nomenclature and the International Code of Nomenclature for algae, fungi and plants.

Note. This principle takes effect with publication of acceptance of this change by the ICSP (from November 2000) and is not retroactive. Although not complete, an extensive list of names of zoological taxa is maintained by the Zoological Record, a list of botanical taxa, including higher plants, algae and cyanobacteria, botanical protists and fungi is maintained by the *Index Nominum Genericorum* (ING), the Names in Current Use and the International Mycological Institute (Bioscience index of fungi).

Principle 3

The scientific names of all taxa are Latin or latinized words treated as Latin regardless of their origin. They are usually taken from Latin or Greek (see Chapter 3, Section 9, and Appendix 9).

Principle 4

The primary purpose of giving a name to a taxon is to supply a means of referring to it rather than to indicate the characters or the history of the taxon.

Principle 5

The application of the names of taxa is determined by means of nomenclatural types, referred to in this Code as types (see Chapter 3, Section 4).

Principle 6

The correct name of a taxon is based upon **valid publication**, **legitimacy,** and **priority of publication** (see Chapter 3, Section 5).

Principle 7

A name of a taxon has no status under the Rules and no claim to recognition unless it is validly published (see Chapter 3, Section 5).

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. Provision has been made for exceptions to this Principle (see Rules 23a and 23b and the Statutes of the ICSP.

Note 1. The name of a species is a binary combination of generic name and specific epithet.

Note 2. (i) By **circumscription** is meant an indication of the limits of a taxon, (ii) by **position** is meant the higher taxon in which a taxon is placed when there may be alternatives (see also Rule 23a), and (iii) by **rank** is meant level in the hierarchial sequence of taxonomic categories.

Principle 9

The name of a taxon should not be changed without sufficient reason based either on further taxonomic studies or on the necessity of giving up a nomenclature that is contrary to the Rules of this Code.

Chapter 3. Rules of Nomenclature with Recommendations

Section 1. General

Rule la

This revision of the International Code of Nomenclature of Bacteria supersedes all previous revisions of the *Bacteriological Code* and shall be known as the *International Code of Nomenclature of Prokaryotes* (see Appendix 1). It shall be cited as the *Prokaryotic Code* (2008 Revision) and will apply from the date of publication (2016).

Rule 1b

Alterations to this Code can only be made by the ICSP at one of its plenary sessions. Proposals for modifications should be made in sufficient time to allow publication in the IJSEM before the next International Congress of Bacteriology and Applied Microbiology. For this and other Provisions, see the Statutes of the ICSP.

Rule 2

The Rules of this Code are retroactive, except where exceptions are specified.

Examples: Rule 18a, Rule 30.

Rule 3

Names contrary to a Rule cannot be maintained, except that the International Committee on Systematics of Prokaryotes, on the recommendation of the Judicial Commission, may make exceptions to the Rules (see Rule 23a and the Statutes of the ICSP).

Rule 4

In the absence of a relevant Rule or where the consequences of a Rule are uncertain, a summary in which all pertinent facts are outlined should be submitted to the Judicial Commission for consideration (see Appendix 8 for preparation of a Request for an Opinion).

Section 2. Ranks of Taxa

Rule 5a

Definitions of the taxonomic categories will inevitably vary with individual opinion, but the relative order of these categories may not be altered in any classification.

Rule 5b

The taxonomic categories above and including species which are covered by these Rules are given below in ascending taxonomic rank. Those in the left-hand column should he recognized

where pertinent; those in the right-hand column are optional. The Latin equivalents are given in parentheses.

Species (*Species*)	
	Subgenus (*Subgenus*)
Genus (*Genus*)	
	Subtribe (*Subtribus*)
	Tribe (*Tribus*)
	Subfamily (*Subfamilia*)
Family (*Familia*)	
	Suborder (*Subordo*)
Order (*Ordo*)	
	Subclass (*Subclassis*)
Class (*Classis*)	

Rule 5c

A species may be divided into subspecies, which are dealt with by the Rules of this Code (see Rules 13a–d). **Variety** is a synonym of subspecies; its use is not encouraged as it leads to confusion, and after publication of this Code the use of the term variety for new names will have no standing in nomenclature.

Rule 5d

Taxa below the rank of subspecies (**infrasubspecific subdivisions**) are not covered by the Rules of this Code, but see Rule 14a and Appendix 10.

Section 3. Naming of Taxa

General

Rule 6

The scientific names of all taxa must be treated as Latin; names of taxa above the rank of species are single words.

Recommendation 6

To form new prokaryotic names and epithets, authors are advised as follows.

(1) Avoid names or epithets that are very long or difficult to pronounce.
(2) Make names or epithets that have an agreeable form that is easy to pronounce when latinized.

(3) Words from languages other than Latin or Greek should be avoided as long as equivalents exist in Latin or Greek or can be constructed by combining word elements from these two languages. Exceptions: names derived from typical local items such as foods, drinks or geographical localities for which no Latin or Greek names exist.
(4) Do not adopt unpublished names or epithets found in authors' notes, attributing them to the authors of such notes, unless these authors have approved publication.
(5) Give the etymology of new generic names and of new epithets.
(6) Determine that the name or epithet which they propose is in accordance with the Rules.
(7) The Greek K and Z and the Medieval Latin J (for consonantic I) should be maintained to avoid confusion.
Examples: *Akinetobacter* instead of *Acinetobacter*, *Acidijanus* instead of *Acidianus*.
(8) The abbreviation M.L. stands for 'Medieval Latin' not 'Modern Latin'. For the latter, N.L. ('Neo Latin') is to be used.
(9) When arbitrary names (see Rules 10a and 12c) are formed, this has to be indicated and such names have to be easy in spelling and pronunciation.
(10) Authors should not name organisms after themselves or after co-authors. If genus names or specific epithets are formed from personal names they should contain only the untruncated family (rarely the first) name of one person.

Names of Taxa above the Rank of Genus up to and including Order

Rule 7

The name of a taxon above the rank of genus up to and including order is a substantive or an adjective used as a substantive of Latin or Greek origin, or a latinized word. It is in the feminine gender, the plural number, and written with an initial capital letter.

Example: Family *Pseudomonadaceae*.

Historically, all these names were feminine plural adjectives qualifying the word "*plantae*," plants; in modern prokaryotic nomenclature they qualify the word "*procaryotae*."

Example: *Plantae pseudomonadaceae*; *Procaryotae pseudomonadaceae*.

In practice, such names are used alone and as substantives.

Example: A member of the *Pseudomonadaceae*.

Names of Taxa above the Rank of Order

Rule 8

The name of each taxon (covered by the Code) above the rank of order is a Latin or latinized word. The name of a class is in the neuter gender, the plural number and written with an initial capital letter. The name is formed by the addition of the suffix *–ia* to the stem of the name of the type genus of the type order of the class. The name of a subclass is in the feminine gender, the

plural number and written with an initial capital letter. The name is formed by the addition of the suffix *–idae* to the stem of the name of the type genus of the type order of the subclass.

Example: Kingdom—*Procaryotae*; Class—*Clostridia*.

Names of Taxa between Subclass and Genus (Order, Suborder, Family, Subfamily, Tribe, Subtribe)

Rule 9

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 presented in Table 1.

Table 1: *Suffixes for Categories*

Rank	Suffix	Example
Order	*-ales*	*Pseudomonadales*
Suborder	*-ineae*	*Pseudomonadineae*
Family	*-aceae*	*Pseudomonadaceae*
Subfamily	*-oideae*	*Pseudomonadoideae*
Tribe	*-eae*	*Pseudomonadeae*
Subtribe	*-inae*	*Pseudomonadinae*

Names of Genera and Subgenera

Rule 10a

The name of a genus or subgenus is a substantive, or an adjective used as a substantive, in the singular number and written with an initial capital letter. The name may be taken from any source and may even be composed in an arbitrary manner. It is treated as a Latin substantive.

Examples: Single Greek stem, *Clostridium*; two Greek stems, *Haemophilus*; single Latin stem, *Spirillum*; two Latin stems, *Lactobacillus*; hybrid name, Latin-Greek stems, *Flavobacterium*; latinized personal name, *Shigella*; arbitrary name, *Afipia*, *Desemzia*, *Waddlia*, or *Cedecea*.

Recommendation 10a

The following Recommendations apply when forming new generic or subgeneric names.

(1) Refrain from naming genera and subgenera after persons quite unconnected with bacteriology or at least with natural science.
(2) Give a feminine form to all personal generic and subgeneric names whether they commemorate a man or a woman (see Rule 64).
(3) Avoid introducing into bacteriology as generic names such names as are in use in botany or zoology, in particular well-known names.

Rule 10b

Generic and subgeneric names are subject to the same Rules and Recommendations, except that Rule 10c applies only to subgeneric names.

Rule 10c

The name of a subgenus, when included with the name of a species, is placed in parentheses along with the abbreviation "subgen." between the generic name and specific epithet. When included, the citation should be inserted before closure of the parentheses.

Example: *Moraxella* (subgen. *Moraxella* Lwoff 1939, 173) *lacunata*; *Moraxella* (subgen. *Branhamella* Catlin 1970, 157) *catarrhalis* (see Rules 43 and 46).

Names of Taxa between Subgenus and Species

Rule 11

The taxonomic categories *section, subsection, series,* and *subseries* are informal categories not regulated by the Rules of this Code. Their designations do not compete with the names of genera and subgenera as to **priority** and **homonymy**.

Note. **Priority** (see Section 5) means that the name or epithet first published in accordance with the Rules is the correct name, or epithet, for a taxon (see Rule 23a). **Homonymy** is the term applied when the same name is given to two or more different taxa of the same rank based on different types. The first published name is known as the **earlier homonym**[1] and any later published name as a **later homonym**[2].

Names of Species

Rule 12a

The name of a species is a **binary combination** consisting of the name of the genus followed by a single **specific epithet**.

If a specific epithet is formed from two or more words, then the words are to be joined. If the words were not joined in the effective publication, then the epithet is not to be rejected but the form is to be corrected by joining the words, which can be done by any author. If an epithet has been hyphenated, its parts should be joined. The name is considered to have been validly published and retains its standing in nomenclature.

Example: *Nocardia otitidis-caviarum* has been corrected to *Nocardia otitidiscaviarum*, or *Propionibacterium acidi-propionici* has been corrected to *Propionibacterium acidipropionici*, or *Treponema paraluis-cuniculi* has been corrected to *Treponema paraluiscuniculi*.

[1] Earlier homonyms were previously referred to as senior homonyms.
[2] Later homonyms were previously referred to as junior homonyms.

Rule 12b

No specific or subspecific epithets within the same genus may be the same if based on different types (see Rules 13c, 40d and Section 9).

Example: *Corynebacterium helvolum* (Zimmermann 1890) Kisskalt and Berend 1918 is based on the type of *Bacillus helvolus* Zimmermann 1890; the specific epithet *helvolum* cannot be used for *Corynebacterium helvolum* Jensen 1934, another bacterium whose name is based on a different type.

Rule 12c

A specific epithet may be taken from any source and may even be composed arbitrarily.

Example: *thetaiotaomicron* in *Bacteroides thetaiotaomicron* derived from a combination of the Greek letters *theta*, *iota* and *omicron*.

A specific epithet must be treated in one of the three following ways.

(1) As an adjective that must agree in gender with the generic name.

Example: *aureus* in *Staphylococcus aureus*.

(2) As a substantive (noun) in apposition in the nominative case.

Example: *Desulfovibrio gigas* or other names cited in Trüper and De'Clari (1997).

(3) As a substantive (noun) in the genitive case.

Example: *coli* in *Escherichia coli*.

Recommendation 12c

Authors should attend to the following Recommendations, and those of Recommendation 6, when forming specific epithets.

(1) Choose a specific epithet that, in general, gives some indication of a property or of the source of the species.
(2) Avoid those that express a character common to all, or nearly all, the species of a genus.
(3) Ensure that, if taken from the name of a person, it recalls the name of one who discovered or described it, or was in some way connected with it, and possesses the appropriate gender (see Appendix 9A).
(4) Avoid in the same genus epithets which are very much alike, especially those that differ only in their last letters (see Rule 56a(4)).
(5) Avoid the use of the genitive and the adjectival forms of the same specific epithet to refer to two different species of the same genus (see Rule 63).

(6) If an ordinal adjective used for enumeration is chosen then they may include numbers up to ten.

Example: *primus*, *secundus*.

Names of Subspecies

Rule 13a

The name of a subspecies is a **ternary combination** consisting of the name of a genus followed by a specific epithet, the abbreviation "subsp." (*subspecies*), and finally the **subspecific epithet**.

Example: *Bacillus subtilis* subsp. *spizizenii* Nakamura *et al.* 1999.

For "**variety**" see Rule 5c.

Rule 13b

A subspecific epithet is formed in the same way as a specific epithet. When adjectival in form, it agrees in gender with the generic name.

Rule 13c

No two subspecies within the same species or within the same genus may bear the same subspecific epithet (see also Rules 12b and 40d).

Rule 13d

A subspecies that includes the type of the species must bear the same epithet as the species (see also Rules 40d and 45).

Names of Infrasubspecific Subdivisions

Rule 14a

The designations of the various taxa below the rank of subspecies are not subject to the Rules and Recommendations of this Code. (For advice on their nomenclature, see Appendix 10.)

Rule 14b

A Latin or latinized infrasubspecific designation may be elevated by a subsequent author to the status of a subspecies or species name providing that the resulting name is in conformity with the Rules. If so elevated, it ranks for purposes of priority from its date of elevation and is attributed to the author by whom it was elevated, provided that the author who elevates it observes Rule 27.

Example: *Pseudomonas cannabina* (*ex* Šutič and Dowson 1959) Gardan *et al.* 1999; elevation of *Pseudomonas syringae* pathovar Cannabina of (Šutič and Dowson 1959) Young *et al.* 1978 by Gardan *et al.* (1999).

Section 4. Nomenclatural types and Their Designation

General

Rule 15

A taxon consists of one or more elements. For each named taxon of the various taxonomic categories (listed below), there shall be designated a **nomenclatural type**. 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. The nomenclatural type is not necessarily the most typical or representative element of the taxon. The types are dealt with in Rules 16–22.

Types of the various taxonomic categories are presented in Table 2.

Table 2: *Taxonomic Categories*

Taxonomic category	Type
Subspecies Species	Designated strain; in special cases the place of the type strain may be taken by a description, preserved specimen, or an illustration (see Rule 18a(1))
Subgenus Genus	Designated species
Subtribe Tribe Subfamily Family Suborder Order	Genus on whose name the name of the higher taxon is based
Subclass Class	One of the contained orders

Rule 16

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 IJSEM (see Rules 15, 18a, b, f, 20a-c, 21a, 22, 27(3)).

Note. Authors who intend to publish the name in the IJSEM with reference to a previous effectively published description under Rule 27(2) are advised also to designate the type when publishing that description.

Note. If a previous effective publication does not designate a type then the type must be designated at the time of valid publication in IJSEM, in accordance with the Rules of this Code.

Rule 17

The type determines the application of the name of a taxon if the taxon is subsequently divided or united with another taxon.

Example: Ash *et al.* (1994) proposed that the genus *Bacillus* be divided into the genera *Bacillus* and *Paenibacillus*, and the genus which contained the type species *Bacillus subtilis* must be named *Bacillus*.

Type of a Species or Subspecies

Rule 18a

Whenever possible, the type of a species or subspecies is a designated strain.

The type strain is made up of living cultures of an organism, which are descended from a strain designated as the nomenclatural type. The strain should have been maintained in pure culture and should agree closely to its characters with those in the original description (see Chapter 4C). The type strain may be designated in various ways (see Rules 18b, 18c, and 18d).

(1) Until 31 December 2000, for a species (or subspecies) which has not so far been maintained in laboratory cultures or for which a type does not exist, a description, preserved specimen, or illustration (see also Rule 18f) may serve as the type. Example: Non-cultivated, *Oscillospira guilliermondii* Chatton and Perard 1913.
(2) As from 1 January 2001, a description, preserved (non-viable) specimen, or illustration may not serve as the type.

Rule 18b *Designation by original author*

If the author in the effective publication of the name of a species or subspecies definitely designated a type strain, then this strain shall be accepted as the type strain and may be referred to as the **holotype**.

Rule 18c *Designation as neotype*

If a strain on which the original description was based cannot be found, a **neotype** strain may be proposed.

A **neotype** strain must be proposed (**proposed neotype**) in the IJSEM, together with citation of the author(s) of the name, a description or reference to an effectively published description, and a record of the permanently established culture collection(s) where the strain is deposited (see also Note 1 to Rule 24a).

The author should show that a careful search for the strains used in the original description has been made and that none of them can be found. The author should also demonstrate that the proposed neotype agrees closely with the description given by the original author.

The neotype becomes established (**established neotype**) two years after the date of its publication in the IJSEM, provided that there are no objections, which must be referred within the first year of the publication of the neotype to the Judicial Commission for consideration.

Note. The term "**strain**" refers to the culture or subcultures of it, described in the original description. This is not restricted to the strain bearing the culture collection number mentioned in the valid publication, but refers to any culture knowingly derived from the original strain.

Example: Roop *et al.* 1986 proposed a neotype strain (strain VPI S-17 =ATCC 35980) for *Campylobacter sputorum* (Prévot 1940) Véron and Chatelain 1973 (Approved Lists 1980) because the type strain Forsyth ER33 was no longer extant. Any objection has been referred and the neotype strain of *Campylobacter sputorum* is the strain VPI S-17 =ATCC 35980.

Rule 18d

A strain suggested as a neotype but not formally proposed in accordance with the requirements of Rule 18c (suggested neotype) has no standing in nomenclature until formally proposed and established.

Rule 18e

If an original strain that should constitute the type of a species is discovered subsequent to the formal proposal or establishment of a neotype for that species, the matter shall be referred immediately to the Judicial Commission.

Rule 18f

If a description or illustration constitutes, or a dead preserved specimen has been designated the type of a species (Rule 18a(1)) and later a strain of this species is cultivated, then the type strain may be designated by the person who isolated the strain or by a subsequent author. This type strain shall then replace the description, illustration or preserved specimen as the nomenclatural type. The designation of a type strain in this manner must be published in the IJSEM, the authorship and date of priority of publication being determined by the effective and valid publication of the name by the original authors (Rule 24b).

Rule 18g *Change in characters of type and neotype strains*

If a type or neotype strain has become unsuitable owing to changes in its characters or for other reasons, then the matter should be referred to the Judicial Commission, which may decide to take action leading to replacement of the strain.

Rule 19 *Reference strains*

A **reference strain** is a strain that is neither a type nor a neotype strain but a strain used in comparative studies, e.g. taxonomic or serological, or for chemical assay.

A **reference strain** has no standing in nomenclature, but it may, by subsequent action, be made a neotype.

Type of a Genus

Rule 20a

The nomenclatural type (see Rule 15) of a genus or subgenus is the type species, that is, the single species or one of the species included when the name was originally validly published. Only species whose names are legitimate may serve as types.

Rule 20b *Designation by original author*

If the author of the effective or valid publication of a generic or subgeneric name designated a type species, that species shall be accepted as the type species.

Rule 20c *Genus with only one species*

If the genus when originally published included only one species, then that species is the type species.

Rule 20d *Designation by a subsequent author*

The type species shall be selected from one of the species included when the genus was originally published.

Recommendation 20d

Authors are recommended to exclude the following species from consideration in selecting the type.

(1) Doubtfully identified or inadequately characterized species.
Example: *Lactobacillus caucasicus* Beijerinck 1901 (Opinion 38; Judicial Commission, 1971a).

(2) Species doubtfully referred to the genus.
Example: No example yet found.
(3) Species which definitely disagree with the generic description.
Example: *Halococcus litoralis* (Poulsen) Schoop 1935.
(4) Species mentioned as in any way exceptional, including species which possess characters stated in the generic description as rare or unusual.
Example: *Pseudomonas mallei* (Zopf) Redfearn *et al.* 1966 (Approved Lists 1980).

Rule 20e *Designation by international agreement*

(1) If none of the species named by an author in the effective or valid publication of a generic name can be recognized, i.e. if no identifiable type species can be selected in accordance with the Rules, the Judicial Commission may issue an Opinion declaring such generic name to be a **rejected name** (*nomen rejiciendum*) and without standing in nomenclature (see Rule 23a, Note 4).
Example: Rejection of the generic name *Gaffkya* Trevisan 1885 (Opinion 39; Judicial Commission, 1971b).
(2) However, a generic name for which no identifiable type species can be selected in accordance with the Rules might have come into use for identifiable species which were subsequently named. In this case, one of these later species may be selected as the type species and established as such by an Opinion of the Judicial Commission. The generic name is then ascribed to the author of the name of the species selected as the type species.
Example: *Vibrio* Pacini 1854 and its type species *Vibrio cholera* Pacini 1854 (Approved Lists 1980) (Opinion 31; Judicial Commission, 1965).

Rule 20f *Retention of type species on publication of a new generic name*

The valid publication of a new generic name as a deliberate substitute for an earlier one does not change the type species of the genus.

Example: The deliberate creation of *Xanthomonas* as a substitute for the name *Phytomonas* (not available, as it was already in use as the name of a protozoan genus) does not change the type species, which was *Phytomonas compestris* and which became *Xanthomonas campestris*.

Type of a Subgenus

Rule 20g

A genus and its type subgenus share the same type species.

Example: *Moraxella lacunata* is the type species of the genus *Moraxella* and of its type subgenus, *Moraxella*.

Type of a Taxon from Genus to Order (Subtribe, Tribe, Subfamily, Family, Suborder, and Order)

Rule 21a

The nomenclatural type (see Rule 15) of a taxon above genus, up to and including order, is the legitimate name of the included genus on whose name genus on whose name the name of the relevant taxon is based. One taxon of each category must include the type genus. The names of the taxa which include the type genus must be formed by the addition of the appropriate suffix to the stem of the name of the type genus (see Rule 9).

Example: Order, *Pseudomonadales*; suborder, *Pseudomonadineae*; family, *Pseudomonadaceae*; tribe, *Pseudomonadeae*; type genus, *Pseudomonas*.

Rule 21b

If the name of a family was not made in conformity with Rule 21a but its name has been conserved, then the type genus may be fixed by an Opinion of the Judicial Commission.

Example: The genus *Escherichia* is the type genus of the family *Enterobacteriaceae* (Opinion 15; Judicial Commission, 1958a).

Type of a Taxon Higher than Order

Rule 22

The type (see Rule 15) of a taxon higher than order is one of the contained orders, and if there is only one order this becomes the type. If there are two or more orders the type shall be designated by the author at the time of the proposal of the name.

Example: The order *Bacillales* of the class *Firmibacteria*, or the order *Verrucomicrobiales* of the class *Verrucomicrobiae*.

If not designated, the type of a taxon higher than order may be later designated by an Opinion of the Judicial Commission.

Example: None of the Opinions so far issued (1–96) has dealt with this subject.

Section 5. Priority, Effective and Valid Publication of Names

Rule 23a

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.

The name of a species is a binary combination of a generic name and specific epithet (see Rule 12a). In a given **position**, a species can bear only one correct epithet, that is, the earliest that is in accordance with the Rules of this Code.

Example: The species *Haemophilus pleuropneumoniae* bears this name in the genus *Haemophilus*. When placed in the genus *Actinobacillus*, it bears the name *Actinobacillus pleuropneumoniae*.

Note 1. In the case of a species, Rule 23a must be applied independently to the generic name and the specific epithet. The specific epithet remains the same on transfer of a species from one genus to another unless the specific epithet has been previously used in the name of another species or subspecies in the genus to which the species is to be transferred (see Rule 41a).

Note 2. The name of a subspecies is a ternary combination of a generic name, a specific epithet, and a subspecific epithet (see Rule 13c). In a given position a subspecies can bear only one correct subspecific epithet, that is, the earliest that is in accordance with the Rules of this Code. In the case of a subspecies, Rule 23a must be applied independently to the specific and subspecific epithets. The subspecific epithet remains the same on transfer of a subspecies from one species to another, unless the subspecific epithet has been previously used in the name of another species or subspecies in the genus to which the subspecies is to be transferred (see Rule 41a).

Note 3. The date from which all priorities were determined under the previous revisions of the Code was 1 May 1753. After 1 January 1980, under Rule 24a all priorities date from 1 January 1980 (see also Rule 24b).

Note 4. The Judicial Commission may make exceptions to Rule 23a by the addition of names to the list of **conserved names** (*nomina conservanda*) or to the list of **rejected names** (*nomina rejicienda*) (see Appendix 4). The Judicial Commission may correct the Approved Lists (see Rule 24a).

(i) By **conserved name** (*nomen conservandum*) is meant a name which must be used instead of all earlier **synonyms** and **homonyms**. By **rejected name** (*nomen rejiciendum*) is meant a name which must not be used to designate any taxon. Only the Judicial Commission can conserve or reject names (see also Rules 56a and 56b).
(ii) **Opinions** on the conservation or rejection of names, issued by the Judicial Commission, are published with other Opinions in the IJSEM. Opinions are now numbered serially.

Note 5. Names and epithets may be:

legitimate—in accordance with the Rules;
illegitimate—contrary to the Rules;
effectively published—in printed and/or electronic matter made generally available to the scientific community (see Rule 25);
validly published—effectively published and accompanied by a description of the taxon or a reference to a description and certain other requirements (see Rules 27–32);
correct—the name which must be adopted for a taxon under the Rules.

Rule 23b

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 (see Rules 32b and 54).

Rule 24a

Valid publication of names (or epithets) which are in accordance with the Rules of this Code dates from the date of publication of the Code.

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).

Note 1. Names of prokaryotes in the various taxonomic categories published up to 31 December 1977 were assessed by the Judicial Commission with the assistance of taxonomic experts. Lists of names were prepared together with the names of the authors who originally proposed the names. These Approved Lists of Bacterial Names were approved by the ICSB and published in the IJSB on 1 January 1980. Names validly published between 1 January 1978 and 1 January 1980 were included in the Approved Lists of Bacterial Names.

No further names will be added to the Approved Lists. Those names validly published prior to 1 January 1980 but not included in the Approved Lists have no further standing in nomenclature. They were not added to the lists of *nomina rejicienda* and are thus available for reuse in the naming of new taxa. The reuse of a particular name cannot be recommended if such reuse is likely to result in confusion due to previous or continuing use of the name as a synonym, a strain designation, or for other reasons.

The Approved Lists of Bacterial Names contain for each name a reference to an effectively published description and the type whenever possible. In the case of species or subspecies, if a type strain is available it is listed by its designation and the culture collection(s) from which it may be obtained is indicated. If such a strain is not available, a reference strain or reference material is listed if possible. Neotypes may be proposed in conformity with Rule 18c on such lists. (For citation of names on the Approved Lists, see Rules 33b and 34a.)

Note 2. These Approved Lists may contain more than one name attached to the same type (**homotypic synonyms**[3]) since the names on the list represent those names which are considered reasonable in the present state of bacteriological nomenclature and taxonomy and represent the views of many bacteriologists who may hold different taxonomic opinions.

Note 3. Synonyms may be **homotypic synonyms** (i.e., more than one name has been associated with the same type) or **heterotypic synonyms**[4] (i.e., different names have been associated with different types that in the opinion of the bacteriologist concerned belong to the same taxon). The

[3] Homotypic synonyms were previously referred to as objective synonyms.
[4] Heterotypic synonyms were previously referred to as subjective synonyms.

synonym first published is known as the **earlier synonym**[5], and later synonyms are known as **later synonyms**[6].

Publication of **homotypic synonyms** in the Approved Lists does not affect prokaryotic nomenclature any more than does the valid publication of homotypic synonyms in different works in the bacteriological literature at present.

Examples: **Homotypic synonyms** – *Pseudomonas mallei* (Zopf 1885) Redfearn *et al.* 1966 (Approved Lists 1980) and *Burkholderia mallei* (Zopf 1885) Yabuuchi *et al.* 1993 are based on the same type. **Heterotypic synonyms** – Kelly and Wood (2000) regard *Thiobacillus concretivorus* Parker 1945 as a heterotypic synonym of *Thiobacillus thiooxidans* Waksman and Joffe 1922. These two species have different types.

Rule 24b

(1) If two names compete for priority and if both names date from 1 January 1980 on an Approved List, the priority shall be determined by the date of the effective publication of the name before 1 January 1980.

Should the two names bear the same date, then priority shall be determined by page number. If this fails to determine priority then it shall be determined by the order of publication in the effective publication.
Example: *Caulobacter halobacteroides* (Poindexter 1964) and *Caulobacter maris* (Poindexter 1964) were described on the same page.

(2) If two names published after 1 January 1980 (and therefore not included on the Approved Lists, 1980, or the Corrigenda, 1984) compete for priority, priority is determined by the date of the valid publication or announcement of the name in the IJSEM. Where the two names appear in the same issue of IJSEM, priority is determined by page number; a name appearing on a lower page number of the same issue is deemed to be the earlier. Should the page number not determine priority, this shall be determined by the order of valid publication of the names in original articles in IJSEM. Where two names effectively published in other journals, are validly published by announcement on the same Validation List in IJSEM, priority is established by the sequence number on the list.

Note 1. In order to implement Rule 24b(2) in the fairest manner, names submitted for inclusion in the Validation List will include a sequence number that reflects the date of receipt of the validation request in the form that is accepted for publication.

Example: Koch et al. 1995 consider *Rhodococcus erythropolis* (Gray and Thornton 1928) Goodfellow and Alderson 1979 (Approved Lists 1980) to be an earlier heterotypic synonym of *Arthrobacter picolinophilus* Tate and Ensign 1974 (Approved Lists 1980).

[5] Earlier synonyms were previously referred to as senior synonyms.
[6] Later synonyms were previously referred to as junior synonyms.

Example: Sly *et al.* (1997) regard *Streptococcus caprinus* Brooker *et al.* 1996 as a subjective synonym of *Streptococcus gallolyticus* Osawa *et al.* 1996. *Streptococcus gallolyticus* (Validation List no. 56, priority number 2) having priority over *Streptococcus caprinus* (Validation List no. 56, priority number 7).

Rule 24c

The Judicial Commission may place on the list of **rejected names** (*nomina rejicienda*) a name previously published in an Approved List.

Rule 25a *Effective publication*

Effective publication is effected under this Code by making generally available, by sale or distribution, to the scientific community, printed and/or electronic material for the purpose of providing a permanent record.

When a name of a new taxon is published in a work written in a language unfamiliar to the majority of workers in bacteriology, it is recommended that the author(s) include in the publication a description in English.

Note. Electronic publication should follow the tradition of publication of printed matter acceptable to this Code.

Rule 25b

No other kind of publication than that cited in Rule 25a is accepted as effective, nor are the following.

(1) Communication of new names at a meeting, in minutes of a meeting, or, after 1950, in abstracts of papers presented at meetings.
(2) Placing of names on specimens in collections or in listings or catalogues of collections.
(3) Distribution of microfilm, microcards, or matter reproduced by similar methods.
(4) Reports in ephemeral publications, newsletters, newspapers after 1900, or non-scientific periodicals.
(5) Inclusion of a name of a new taxon of prokaryote in a published patent application or issued patent.
(6) Making available electronic material in advance of publication (e.g. papers in press, or otherwise making unpublished manuscripts available in electronic format).

Rule 26a *Date of publication*

The date of publication of a scientific work is the date of publication of the printed and/or electronic matter. The date given to the work containing the name or epithet must be regarded as correct in the absence of proof to the contrary.

Rule 26b

The date of acceptance of an article for publication if given in a publication does not indicate the effective date of publication and has no significance in the determination of the priority of publication of names.

Valid and Invalid Publication

Rule 27

A name of a new taxon, or a **new combination** for an existing taxon, is not validly published unless the following criteria are met.

(1) The name is published in the IJSB/IJSEM.
(2) The publication of the name in the IJSB/IJSEM is accompanied by a description of the taxon or by a reference to a previous effectively published description of the taxon (see Rules 16, 25a and 25b and, for genus and species, Rules 29–32). As of 1 January 2001 the following criteria also apply:
    (a) The new name or new combination should be clearly stated and indicated as such (i.e. fam. nov., gen. nov., sp. nov., comb. nov., etc.).
    (b) The derivation (etymology) of a new name (and if necessary of a new combination) must be given.
    (c) The properties of the taxon being described must be given directly after (a) and (b). This may include reference to tables or figures in the same publication, or reference to previously effectively published work.
    (d) All information contained in (c) should be accessible.
(3) The type of the taxon must be designated (see Rules 15, 16, 18a, b, f, 20a-c, 21a and 22). In the case of species or subspecies including new combinations, the type strains must be deposited according to Rule 30.

Note 1. Valid publication of the name of a taxon requires publication in the IJSB/IJSEM of the name of the taxon and reference to an effectively published description whether in the IJSB/IJSEM or in another publication. The date of valid publication is that of publication in the IJSB/IJSEM. The name may be mentioned in a previously published description, but the name is not validly published until its publication in the IJSB/IJSEM.

If the initial proposal of the new name or new combination is not effectively published in the IJSB/IJSEM, valid publication (**announcement** in a **Validation List**) of the name in the IJSB/IJSEM is primarily the responsibility of the author of the name or combination together with the requirements of Rule 27(2) and (3) above. However, other individuals may also submit a new name or new combination for valid publication provided it conforms to the Rules of this Code.

At the request of the Judicial Commission, the IJSB/IJSEM provides a Notification List which lists all nomenclatural changes as well as listing changes in taxonomic opinion that have occurred in an issue of the journal. This list has no formal status in prokaryote nomenclature except to allow for orthographic corrections to be made.

In the case of a name of a new taxon (rather than a new combination for a taxon already described), a type must be designated in the effective or valid publication. It is recommended that the type of a species or subspecies be deposited in a recognized culture collection (see Rule 30 (3a) and Rule 30 (3b)) and that the description of the taxon conform to minimal standards (see Recommendation 30b).

Note 2. When a new species or a new combination results in the proposal of a new genus, both the genus name and the new species name or new combination must be validly published. Valid publication of the new species or new combination alone does not constitute valid publication of the new genus.

Rule 28a

An author validly publishing a new name after 1 January 1980 may revive a name published prior to 1 January 1980 (see Rule 24a) but not listed in one of the Approved Lists of Bacterial Names unless the name is a *nomen rejiciendum*. The name may be used whether or not the new taxon is related in any way to the taxon to which the name was originally applied.

Authority for the name must be claimed by the new author. However, if the author wishes to indicate that the name is a revived name and is used to describe a taxon with the same circumscription, position, and rank as that given by the original author, this may be done by appending the abbreviation "nom. rev." (**revived name**) to the name (see Rule 33c).

The proposal must contain a brief diagnosis, i.e. a statement or list of those features that led the author to conclude that the proposed taxon is sufficiently different from other recognized taxa to justify its revival. The data included in the statement may be taken from the earlier description and may include newer data, when appropriate. The description of the taxon and derivation of the name must conform to the requirements of Rule 27(2). The type must also be designated [see Rule 27(3)].

Note 1. A new name which was previously published before 1 January 1980 is only considered to be already validly published if the name was included in the Approved Lists of Bacterial Names.

Note 2. Since revived names are treated as new names, they require valid publication, and the date of priority of publication of a revived name is that of the publication in the IJSEM (see Rule 27).

Note 3. Search for publication of names and effectively published descriptions prior to 1 January 1980 is no longer required. The Approved Lists of Bacterial Names form the foundation of a new prokaryotic nomenclature and taxonomy.

Rule 28b

A name or epithet is not validly published in the following circumstances.

(1) It was not accepted at the time of publication by the author who published it.
Example: *Muellerina* de Petschenko 1910 (Opinion 10; Judicial Commission, 1954a).
Names or epithets published with a question mark or other indication of taxonomic doubt yet accepted by the author are not validly published.
(2) It was merely proposed in anticipation of the future acceptance of the taxon concerned or the acceptance of a particular circumscription, position, or rank for the taxon which is being named or in anticipation of the future discovery of some hypothetical taxon.
Examples: (a) *Clostridium* Fischer 1895 (Opinion 20; Judicial Commission, 1958b); (b) *Corynebactenum hemophilum* Svendsen *et al.* (1947). "Its haemophilic properties might be used in coining a name, and the name *Corynebacterium hemophilum* is suggested in case further investigation should justify its rank as a species".
(3) It was mentioned incidentally. **Incidental mention** of a new name means mention by an author who does not clearly state or indicate that he is proposing a new name or combination.
Examples: (a) *Pseudobacterium* Trevisan 1888. (b) Raj (1970) stated: "Also, recently another organism tentatively named as *Microcyclus marinus* was isolated from the ocean."

Valid Publication of the Name of a Genus or Subgenus, including a Monotypic Genus

Rule 29

For a generic or subgeneric name to be validly published it must comply with the following conditions.

(1) It must be published in conformity with Rules 27 and 28b.
(2) The genus or subgenus named must include one or more described or previously described species.

Instead of a new description of the genus or subgenus, a citation to a previously and effectively published description of the genus as a subgenus (or subgenus as a genus) may be given.

Example: Not yet found.

In the case of a genus containing a single species, a combined generic and specific description may be given.

Example: *Jonesia denitrificans* (Prévot 1961) Rocourt *et al.* 1987 or *Lamprocystis roseopersicina* (Kützing 1849) Schroeter 1886 (Approved Lists 1980).

Recommendation 29

A description of a genus or subgenus should mention the points in which the genus or subgenus differs from related genera or subgenera. Where possible, the family to which it belongs should be mentioned.

Valid Publication of the Name of a Species

Rule 30

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

(1) It must be published in conformity with Rules 27 and 28b.
(2) It must be published as a binary combination consisting of a genus name followed by a single species epithet (see Rule 12a).
(3) (a) Up to 31 December 2000, before publication of the name of a new species, a culture of the type strain (or, if the species is non-cultivable, type material, a photograph or an illustration, see Rule 18a) should be deposited in at least one of the permanently established culture collections from which it would be readily available. The designation allotted to the strain by the culture collections should be quoted in the published description.

(b) As of 1 January 2001, the description of a new species, or new combinations previously represented by viable cultures must include the designation of a type strain (see Rule 18a), and a viable culture of that strain must be deposited in at least two publicly accessible culture collections in different countries from which subcultures must be available. The designations allotted to the strain by the culture collections should be quoted in the published description. Evidence must be presented that the cultures are present, viable, and available at the time of publication.

(4) Organisms deposited in such a fashion that access is restricted, such as safe deposits or strains deposited solely for current patent purposes, may not serve as type strains.

Note. In exceptional cases, such as organisms requiring specialized facilities (e.g. Risk Group/Biological Safety Level 3, high pressure requirements, etc.), exceptions may be made to this Rule. Exceptions will be considered on an individual basis by a committee consisting of the Chairman of the ICSP, the Chairman of the Judicial Commission and the Editor of the IJSEM. Exceptions will be made known at the time of publication.

Recommendation 30

Before publication of the name and description of a new species, the examination and description should conform at least to the **minimal standards** (if available) required for the relevant taxon of prokaryote.

Note 1. Lists of **minimal standards** are being prepared for each group of prokaryotes by experts at the request of the Judicial Commission for consideration by the Judicial Commission and the ICSP for publication in the IJSEM (see Appendix 6). Such standards include tests for the establishment of generic identity and for the diagnosis of the species, i.e. an indication of characters which would distinguish the species from others.

Note 2. It is the aim of minimal standards to provide guidance on the description of taxa for taxonomists seeking such advice. However, these standards are not to be applied in such a way as to contradict Principle 1(4).

Rule 31a

The name of a species or a subspecies is not validly published if the description is demonstrably ambiguous and cannot be critically identified for purposes of the precise application of the name of a taxon.

Examples: (a) '*Methanobacillus omelianskii*' Bryant *et al.* 1967, whose description included all component species, was treated as a single species and was thus illegitimate; (b) *Syntrophobacter wolinii* Boone and Bryant 1984 is legitimate, because the species description applies to one member of the syntrophic association with a hydrogen-producing organism.

Rule 31b

The name of a **consortium** is not regulated by this Code, and such a name has no standing in nomenclature.

Example: *Cylindrogloea bacterifera* Perfiliev 1914.

Note. A **consortium** is an aggregate or association of two or more organisms.

Valid Publication of the Name of a Subspecies

Rule 32a

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

(1) It must be published in conformity with Rules 27 and 28b.
(2) It must be published as a **ternary combination** consisting of the generic name followed by a single specific epithet and this in turn by a single subspecific epithet, with the abbreviation "subsp." between the two epithets to indicate the rank (see Rule 13a). Example: *Bacillus subtilis* subsp. *subtilis*.
(3) The author must clearly indicate that a subspecies is being named.

Recommendation 32a

Recommendations 30a and 30b apply to the name of a subspecies with replacement of the word "species" by the word "subspecies".

Publication of a Specific or Subspecific Epithet

Rule 32b

A specific (or subspecific) epithet is not rendered illegitimate by publication in a species (or subspecies) name in which the generic name is illegitimate (see also Chapter 3, Section 8, and example for Rule 20f).

Section 6. Citation of Authors and Names

Proposal and Subsequent Citation of the Name of a New Taxon

Rule 33a

An author should indicate that a name is being proposed for a new taxon by the addition of the appropriate abbreviation for the category to which the taxon belongs.

Note 1. Appropriate abbreviations are: "**ord. nov.**" for *ordo novus*, "**gen. nov.**" for *genus novum*, "**sp. nov.**" for *species nova*, "**comb. nov.**" for *combinatio nova*. Similar abbreviations may be formed as required.

Note 2. Although words or abbreviations in Latin are usually printed in italics, such abbreviations as the above are frequently printed in Roman or boldface type when they follow a Latin scientific name in order to differentiate them from the name and draw attention to the abbreviation.

Examples: Order, *Actinomycetales* ord. nov.; family, *Actinomycetaceae* fam. nov.; genus, *Actinomyces* gen. nov.; species, *Actinomyces bovis* sp. nov.

Rule 33b

The citation of the name of a taxon that has been previously proposed should include both the name of the author(s) who first published the name and the year of publication. If there are more than two authors of the name, the citation includes only the first author followed by "*et al*." and the year.

Examples: *Actinomyces bovis* Harz 1877 (Approved Lists 1980); *Acetobacterium woodii* Balch *et al.* 1977 (Approved Lists 1980).

Note 1. Correct citation of a name enables the date of publication to be verified, the original description to be found, and the use of the name by different authors for different organisms to be distinguished.

Example: *Mycobacterium terrae* Wayne 1966 (Approved Lists 1980), not *Mycobacterium terrae* Tsukamura 1966.

Note 2. Full citation of the publication should include reference to the page number(s) in the main text of the scientific work in which the name was proposed, not to the summary or abstract of that text even if proposal of the name is mentioned in that summary or abstract.

Example: *Bacillus subtilis* (Ehrenberg 1835) Cohn 1872, 174. The page number "174" is the page in Cohn's publication (Cohn 1872) on which the proposal of the new combination occurs.

Note 3. (i) The citation of a name which is included in an Approved List can include the name of the original author and date of publication followed by the words "Approved Lists 1980" in parentheses.

Example: *Bacillus cereus* Frankland and Frankland 1887 (Approved Lists 1980); *Bacillus subtilis* (Ehrenberg 1835) Cohn 1872 (Approved Lists 1980).

(ii) Alternatively, a name which is included in an Approved List may be cited simply by the addition of the words "Approved Lists 1980" in parentheses.

Examples: *Bacillus cereus* (Approved Lists 1980); *Bacillus subtilis* (Approved Lists 1980).

(iii) If indication is given that a name is included in an Approved List without specification of that list, the abbreviation "**nom. approb.**" (*nomen approbatum*) may be appended to the name of the taxon.

Example: *Bacillus subtilis* nom. approb.

Rule 33c

If a name or epithet which was published prior to 1 January 1980 but not included in an Approved List is proposed by an author for a different or for the same taxon, the name or epithet must be attributed to the author of the proposal (Rule 28a), and the citation should be made according to Rules 33a, 33b, 34a and 34b.

Note 1. If a name or epithet is revived for the same taxon (in the author's opinion), the author may indicate the fact by addition of the abbreviation "**nom. rev.**" (*nomen revictum*) after the correct abbreviation (Rule 33a) for the category concerned.

Example: *Actinobacillus seminis* sp. nov., nom. rev., or *Leptothrix discophora* sp. nov., nom. rev.

Note 2. If an author wishes to indicate the names of the original authors of a revived name, he may do so by citation of the name of the taxon, followed by the word "**ex**" and the name of the original author and the year of publication, in parentheses, followed by the abbreviation "nom. rev."

Example: *Leptothrix discophora* (*ex* Schwers 1912) nom. rev. A subsequent author citing this revived name would use the citation *Leptothrix discophora* Spring *et al.* 1997, or *Leptothrix discophora* (*ex* Schwers 1912) Spring *et al.* 1997.

Note 3. If an author wishes to indicate that a reused name has been used for a different taxon, indication is made by citation of the name and the author and year of publication followed by the

word "**non**" (or "not") and the name and year of the publication of the author who first used the name.

Example: *Achromobacter* Yabuuchi and Yano 1981 non *Achromobacter* Bergey *et al.* 1923.

Rule 33c

If a name is revived under Rule 33c it may be revived in a new combination; that is, the revived species may be transferred to another genus, or the revived subspecies may be transferred to another species, at the time the name is revived. It is not necessary first to revive the name in the original combination.

Example: "*Actinobacterium meyeri*" has been revived by Cato *et al.* as a species of the genus *Actinomyces* as *Actinomyces meyeri* (*ex* Prévot 1938) Cato *et al.* 1984 nom. rev., comb. nov. A subsequent author can cite it as *Actinomyces meyeri* (*ex* Prévot 1938) Cato *et al.* 1984.

Proposal and Subsequent Citation of a New Combination

Rule 34a

When an author transfers a species to another genus (Rule 41), or a subspecies to another species, then the author who makes the transfer should indicate the formation of the **new combination** by the addition to the citation of the abbreviation "**comb. nov.**" (*combinatio nova*).

This form of citation should be used when the author retains the original specific epithet in the new combination; however; if an author is obliged to substitute a new specific epithet as a result of homonymy, the abbreviation "**nom. nov.**" (*nomen novum*) should be used [see Rule 41a(1)]. The original name is referred to as the **basonym**.

Example: *Anaerovibrio glycerini* Schauder and Schink 1996; *Anaerosinus glycerini* (Schauder and Schink 1996) Strömpl *et al.* 1999.

Note 1. If an author transfers a species which has been included in the Approved Lists to another genus, the proposal of the **new combination** should be made by the addition of the abbreviation "**comb. nov.**" (*combinatio nova*) followed in parentheses by the name under which it appeared in the Approved Lists.

Example: If *Bordetella parapertussis* appears in the Approved Lists (1980) and is transferred by Smith in 1983 to the genus *Moraxella,* the citation by Smith may be as follows: *Moraxella parapertussis* (Eldering and Kendrick 1938) comb. nov. (*Bordetella parapertussis* Approved Lists 1980). Another author citing this proposal would then use the citation: *Moraxella parapertussis* (Eldering and Kendrick 1938) Smith 1983 (*Bordetella parapertussis* Approved Lists 1980).

Rule 34b

The citation of a **new combination** which has been previously proposed should include the name of the original author in parentheses followed by the name of the author(s) who proposed the new combination and the year of publication of the new combination.

Example: *Microbacterium oxydans* (Chatelain and Second) Schumann *et al.* 1999 or *Microbacterium oxydans* (Chatelain and Second 1966) Schumann *et al.* 1999.

Note 1. The inclusion of the date of the publication of the original author of the name is to be preferred, although it is sometimes omitted since the date can be expected to be found in the publication of the author(s) who proposed the new combination.

Example: *Microbacterium oxydans* (Chatelain and Second 1966) Schumann *et al.* 1999 is to be preferred to *Microbacterium oxydans* (Chatelain and Second) Schumann *et al.* 1999.

Note 2. When, however, the author who formed the new combination was obliged to substitute a new specific epithet to avoid homonymy [see Rule 41a(1)], the name of the author of the original specific epithet is omitted.

Example: *Flavobacterium hydatis* Bernardet *et al.* 1996 is correct, **not** *Flavobacterium hydatis* (Strohl and Tait 1978) Bernardet *et al.* 1996 [see Example to Rule 41a(1) for an explanation].

Rule 34c

When a taxon from subspecies to genus is altered in rank but retains its name or epithet, the original author(s) must be cited in parentheses followed by the name of the author(s) who effected the alteration and the year of publication.

Example: *Bifidobacterium globosum* (*ex* Scardovi *et al.* 1969) Biavati *et al.* 1982 to *Bifidobacterium pseudolongum* subsp. *globosum* (Biavati *et al.* 1982) Yaeshima *et al.* 1992.

Citation of the Name of a Taxon whose Circumscription Has Been Emended

Rule 35

If an alteration of the diagnostic characters or of the circumscription of a taxon modifies the nature of the taxon, the author responsible may be indicated by the addition to the author citation of the abbreviation "**emend.**" (*emendavit*) followed by the name of the author responsible for the change.

Example: *Rhodopseudomonas* Czurda and Maresch 1937 emend. van Niel 1944 (see Opinion 49; Judicial Commission, 1974).

Citation of a Name Conserved so as to Exclude the Type

Rule 36

A name conserved so as to exclude the type is not to be ascribed to the original author, but the author whose concept of the name is conserved must be cited as authority.

Example: *Aeromonas liquefaciens*, the original type species of the genus *Aeromonas*, has been excluded from *Aeromonas* (Opinion 48; Judicial Commission, 1973). The generic name *Aeromonas* is now attributed to Stanier 1943, not to Kluyver and van Niel 1936, and with a new type species, *A. hydrophila*.

Section 7. Changes in Names of Taxa as a Result of Transference, Union, or Change in Rank

Rule 37a

(1) The name of a taxon must be changed if the nomenclatural type of the taxon is excluded. Example: On transferring the type species of the genus *Micropolyspora* Lechevalier *et al.* 1961, *Micropolyspora brevicatena* Lechevalier *et al.* 1961 to the genus *Nocardia*, Goodfellow and Pirouz (1982) did not provide a solution for the taxonomic position of *Micropolyspora angiospora* Zhukova *et al.* 1968, *Micropolyspora faeni* Cross *et al.* 1968 *Micropolyspora internatus* Agre *et al.* 1974 and *Micropolyspora rectivirgula* (Krasil'nikov and Agre 1964) Prauser and Momirova 1970, which they should have removed from the genus *Micropolyspora*.
(2) Retention of a name in a sense which excludes the type can only be effected by conservation and only by the Judicial Commission (see also Rule 23a). At the time of conservation, the new type is established by the Judicial Commission.

Rule 37b

A change in the name of a taxon is not warranted by an alteration of the diagnostic characters or of the circumscription. A change in its name may be required by one of the following.

(1) An Opinion of the Judicial Commission (see Rule 37a(2) above).
(2) Transfer of the taxon (see Rule 41).
(3) Union with another taxon (Rules 42–44, 47a, and 47b).
(4) Change of its rank (Rules 48, 49, 50a, 50b).

Rule 38

When two or more taxa of the same rank are united, then the name of the taxon under which they are united (and therefore the type of the taxon) is chosen by the rule of priority of publication.

Example: White 1930 united *Eberthella* Bergey *et al.* 1923 with *Salmonella* Lignières 1900 and retained the earlier name, *Salmonella*.

Note. Eberthella was raised by Bergey *et al.* 1923 to a genus from the subgeneric name, *Eberthella* Buchanan 1918.

If, however, this choice would lead to confusion in bacteriology, the author should refer this matter to the Judicial Commission. (For taxa above the rank of species, see also Rule 47a).

Example: Not yet found.

Division of a Genus into Genera or Subgenera, and of a Subgenus into Subgenera

Rule 39a

If a genus is divided into two or more genera or subgenera, the generic name must be retained for one of these. If the name has not been retained (in a previous publication), it must be reestablished under Rule 39b. (See Rule 49 when a subgenus is raised to genus).

Example: If the genus *Bacillus* is divided into the two subgenera *Bacillus* and *Aerobacillus*, the subgenus which includes the type species *Bacillus subtilis* must be named *Bacillus*.

Rule 39b

When a particular species has been designated as the type, the generic name must be retained for the genus which includes that species. When no type was designated a type must be chosen (*Editorial Note*: should not be needed in the future; see Rule 27).

Rule 39c

The principles of Rules 39a and 39b apply when a subgenus is divided into two or more subgenera, the original subgeneric name being retained for that subgenus which contains the type species.

Division of a Species into Species or Subspecies, and of a Subspecies into Subspecies

Rule 40a

When a species is divided into two or more species or subspecies, the specific epithet of the original species must be retained for one of the taxa into which the species is divided or, if the epithet has not been retained (in a previous publication), it must be reestablished. (See Rule 50a when a subspecies is elevated to a species).

Example: Ash *et al.* (1994) proposed that the genus *Bacillus* be divided into the genera *Bacillus* and *Paenibacillus*, and the genus which contained the type species *Bacillus subtilis* must be named *Bacillus*.

Rule 40b

The specific epithet must be retained for the species or subspecies which includes the type strain. When no type was designated, one must be chosen (see Note to Rule 39b).

Example: If the species *Bacillus subtilis* is divided into subspecies, the subspecies containing the type strain must be named *Bacillus subtilis* subsp. *subtilis*.

Rule 40c

The principles of Rules 40a and 40b apply when a subspecies is divided into two or more subspecies, the original subspecies name being retained for that subspecies which contains the type strain.

Note. Although the specific and subspecific epithets in the name of a type subspecies are the same, they do not contravene Rule 12b because they are based on the same type.

Rule 40d

The valid publication of a subspecific name which excludes the type of the species automatically creates another subspecies which includes the type and whose name bears the same specific and subspecific epithets as the name of the type.

Example: Publication of *Bacillus subtilis* subsp. *spizizenii* Nakamura *et al.* 1999 automatically created a new subspecies *Bacillus subtilis* subsp. *subtilis*.

The author of the species name is to be cited as the author of such an automatically created subspecific name.

Example: *Vibrio subtilis* Ehrenberg to *Bacillus subtilis* comb. nov. Cohn to *Bacillus subtilis* subsp. *subtilis* subsp. nov. Nakamura. The correct authorship of the subspecies is *Bacillus subtilis* subsp. *subtilis* (Ehrenberg) Nakamura [Ehrenberg for the epithet and Nakamura for the new subspecies].

Transfer of a Species to Another Genus

Rule 41a

When a species is transferred to another genus without any change of rank, the specific epithet must be retained, or if it has not been retained (in a previous publication), it must be reestablished, unless (see Rule 23a Note 1):

(1) The resulting binary combination would be a **later homonym**.
Example: Bernardet *et al.* 1996 proposed *Flavobacterium hydatis* for *Cytophaga aquatilis* Strohl and Tait 1978 (Approved Lists 1980) on transfer to *Flavobacterium* because in that genus the name *Flavobacterium aquatile* already existed.
(2) There is available an earlier validly published and legitimate specific or subspecific epithet.
Example: Not yet found.

Rule 41b

When the name of a genus is changed, the specific epithets of the species included under the original generic name must be retained for the same species if they are transferred to the new genus.

Union of Taxa of Equal Rank

Rule 42

In the case of subspecies, species, subgenera, and genera, if two or more of those taxa of the same rank are united, the oldest legitimate name or epithet is retained.

If the names or epithets are of the same date, the author who first unites the taxa has the right to choose one of them, and his choice must be followed.

Recommendation 42

Authors who have to choose between two generic names of the same date should note the following:

(1) Prefer the one which is better known.
(2) Prefer the one which was first accompanied by the description of a species.
(3) If both are accompanied by descriptions of species, prefer the one which includes the larger number of species.
(4) In cases of equality from these points of view, prefer the more appropriate name.

Union of Genera as Subgenera

Rule 43

When several genera are united as subgenera of one genus, the subgenus which includes the type species of the genus under which union takes place must bear the same name as that genus.

Example: The subgenus name *Lactobacillus* Beijerinck 1901 must be used instead of *Thermobacterium* for the subgenus that contains the type species *Lactobacillus delbrueckii* [see *Bergey's Manual*, 7th edn, p. 543 (Pederson, 1957), and Opinion 38 (Judicial Commission, 1971a)].

Union of Species of Two or More Genera as a Single Genus

Rule 44

If two or more species of different genera are brought together to form a genus, and if these species include the type species of one or more genera, the name of the genus is that associated with the type species having the earliest legitimate generic name.

If no type species is placed in the genus, a new generic name must be proposed and a type species selected.

Example: *Brevibacterium* Breed 1953. None of the included species was a type species of the genera from which the species were transferred, so a new name, *Brevibacterium*, was proposed, with *Brevibacterium linens* as the type species.

Union of Species as Subspecies

Rule 45

When several species are united as subspecies under one species, the subspecies which includes the type strain of the species under whose name they are united must be designated by the same epithet as the species.

Example: *Streptomyces griseus* subsp. *griseus* [see pp. 214 and 224 in Pridham *et al.* (1965)].

Rule 46

Editorial Note. The former Rule 46 has been relocated as Rule 40d. This rule only remains here only as a placeholder in order to avoid renumbering Rules 47 and above. Rule 46 should not be cited.

Union of Taxa above Species under a *Higher Taxon*

Rule 47a

When two or more taxa of the same rank from subtribe to family inclusive are united under a taxon of higher rank, the higher-ranking taxon should derive its name from the name of the earliest legitimate genus that is a type genus of one of the lower-ranking taxa.

If, however; the use of this generic name would lead to conclusion in bacteriology, then the author may choose as type a genus which, in his opinion, leads to the least confusion and, if in doubt, should refer the matter to the Judicial Commission.

Note. The type of a taxon above the rank of genus is one of the contained genera (Rule 15). The name of the type subgenus is the same as that of the type genus; therefore, only the names of genera need to be considered.

Example: Buchanan in Breed *et al.* (1957) followed the law of priority in combining the families *Beggiatoaceae* Migula 1894 and *Vitreoscillaceae* Pringsheim 1949 into the new order *Beggiatoales*, whose type is *Beggiatoa* Trevisan 1842, which has priority over *Vitreoscilla* Pringsheim 1949. In contrast, Breed *et al.* (1957) chose *Pseudomonas* Migula 1894 over *Spirillum* Ehrenberg 1832 and *Nitrobacter* Winogradsky 1892 to form the name of a new suborder; *Pseudomonadineae* Breed *et al.* 1957.

Rule 47b

If no type genera were placed in the taxon, a new name based on the selected type must be proposed for the taxon.

Example: *Peptococcaceae* Rogosa 1971 [see p. 235 in Rogosa (1971)].

Change in Rank

Rule 48

When the rank of a taxon between subgenus and order is changed, the stem of the name must be retained and only the suffix altered unless the resulting name must be rejected under the Rules (see Rule 9).

Example: Elevation of the tribe *Pseudomonadeae* to the family *Pseudomonadaceae*.

Rule 49

When a genus is lowered in rank to subgenus, the original name must be retained unless it is rejected under the Rules. This also applies when a subgenus is elevated to a genus.

Example: If the genus *Aerobacillus* is lowered in rank to subgenus, the name of the subgenus is *Aerobacillus*.

Example: Bøvre (1979) lowered the genus *Branhamella* Catlin 1970 in rank to subgenus, the name of the subgenus is *Branhamella* (Catlin 1970) Bøvre 1979.

Rule 50a

When a subspecies is elevated in rank to a species, the subspecific epithet in the name of the subspecies must be used as the specific epithet of the name of the species unless the resulting combination is illegitimate.

Example: *Campylobacter pylori* subsp. *mustelae* Fox *et al.* 1988 becomes *Campylobacter mustelae* (Fox *et al.* 1988) Fox *et al.* 1989.

Rule 50b

When a species is lowered in rank to a subspecies, the specific epithet in the name of the species must be used as the subspecific epithet of the name of the subspecies unless the resulting combination is illegitimate.

Example: *Bifidobacterium globosum* (*ex* Scardovi *et al.* 1969) Biavati *et al.* 1982 becomes *Bifidobacterium pseudolongum* subsp. *globosum* (Biavati *et al.* 1982) Yaeshima *et al.* 1992.

Section 8. Illegitimate Names and Epithets: Replacement, Rejection, and Conservation of Names and Epithets

Illegitimate Names

Rule 51a

A name contrary to a Rule is illegitimate and may not be used. However, a name of a taxon which is illegitimate when the taxon is in one taxonomic position is not necessarily illegitimate when the taxon is in another taxonomic position.

Example: If the genus *Diplococcus* Weichselbaum 1886 is combined with the genus *Streptococcus* Rosenbach 1884, *Diplococcus* is illegitimate as the name of the combined genus because it is not the earlier name. If the genus *Diplococcus* Weichselbaum is accepted as separate and distinct, then the name *Diplococcus* is legitimate.

Rule 51b

Among the reasons for which a name may be illegitimate are the following.

(1) If the taxon to which the name was applied, as circumscribed by the author, included the nomenclatural type of a name which the author ought to have adopted under one or more of the Rules.
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*.
(2) If the author did not adopt for a binary or ternary combination the earliest legitimate generic name, specific epithet, or subspecific epithet available for the taxon with its particular **circumscription**, **position**, and **rank**.
Example: The name *Bacillus whitmori* Bergey *et al.* 1930 was illegitimate as Whitmore had named the organism *Bacillus pseudomallei* in 1913.
(3) If its specific epithet must be rejected under Rules 52 or 53.
(4) If it is a **later homonym** of a name of a taxon of prokaryotes, fungi, algae, protozoa, or viruses.
Example: *Phytomonas* Donovan 1909, a genus of flagellates, antedates *Phytomonas* Bergey *et al.* 1923, a genus of prokaryote (Opinion 14; Judicial Commission, 1954b).

Names of prokaryotes validly published under this revision of the Code are not to be rejected as **homonyms** of names of prokaryotes published before 1980 and omitted from the Approved Lists.

Illegitimate Epithets

Rule 52

The following are not to be regarded as specific or subspecific epithets.

(1) A word or phrase which is not intended as a specific epithet.
Example: *Bacillus nova species* Matzuschita.
(2) A word which is an ordinal adjective higher than ten used for enumeration.
Example: *undecimus, duodecimus* etc.
(3) A number or letter.
Example: α in *Bacillus α* von Freudenreich.

Rule 53

An epithet is illegitimate if it duplicates a specific or subspecific epithet previously validly published for a species or subspecies of the same genus but which is a different bacterium whose name is based upon another type.

Example: *Corynebacterium helvolum* (Zimmermann 1890) Kisskalt and Berend 1918 is based on the type of *Bacillus helvolus* Zimmermann 1890; the specific epithet *helvolum* cannot be used for *Corynebacterium helvolum* Jensen 1934, which is a different bacterium whose name is based upon another type.

Replacement of Names

Rule 54

A name or epithet illegitimate according to Rules 51b, 53, or 56a is replaced by the oldest legitimate name or epithet in a **binary** or **ternary combination** which in the new position will be in accordance with the Rules.

If no legitimate name or epithet exists, one must be chosen. Since a specific epithet is not rendered illegitimate by publication in a species name in which the generic name is illegitimate (Rule 32b), an author may use such an epithet if he wishes, provided that there is no obstacle to its employment in the new position or sense; the resultant combination is treated as a new name and is to be ascribed to the author of the combination. The epithet is, however, ascribed to the original author.

Example: *Pfeifferella pseudomallei* (Whitmore 1913) Ford 1928 is an illegitimate combination since *Pfeifferella* is a homonym of a protozoan generic name (Opinion 14; Judicial Commission, 1954b). The epithet *pseudomallei* can be used for this organism in another genus, *Pseudomonas pseudomallei* (Whitmore 1913) Haynes 1957.

Rule 55

A legitimate name or epithet may not be replaced merely because of the following.

1. It is inappropriate.
   Example: *Bacteroides melaninogenicus* does not produce melanin [see Schwabacher *et al.* (1947)].
2. It is disagreeable.
   Example: *Miyagawanella lymphogranulomatis*.
3. Another name is preferable.
   Example: Not yet found.
4. Another name is better known.
   Example: *Corynebacterium pseudodiphtheriticum* cannot be rejected because the synonym *Corynebacterium hofmannii* is better known.

5. It no longer describes the organism.
   Example: *Haemophilus influenzae* (does not cause influenza).
6. It has been cited incorrectly; an incorrect citation can be rectified by a later author.
   Example: *Proteus morganii* Yale 1939 (see Lessel, 1971).

Rejection of Names

Rule 56a

Only the Judicial Commission can place names on the list of **rejected names** (*nomina rejicienda*) (see Rule 23a, Note 4, and Appendix 4). A name may be placed on this list for various reasons, including the following.

(1) An **ambiguous name** (*nomen ambiguum*), i.e. a name which has been used with different meanings and thus has become a source of error.
   Example: *Aerobacter* Beijerinck 1900 (Opinion 46; Judicial Commission, 1971d).
(2) **A doubtful name** (*nomen dubium*), i.e. a name whose application is uncertain.
   Example: *Leuconostoc citrovoium* (Opinion 45; Judicial Commission, 1971c).
(3) A **name causing confusion** (*nomen confusum*), i.e. a name based upon a mixed culture.
   Example: *Malleomyces* Hallier 1870.
(4) A **perplexing name** (*nomen perplexum*), a name whose application is known but which causes uncertainty in bacteriology (see Rule 57c).
   Example: *Bacillus limnophilus* Bredemann and Stürck *in* Stürck 1935 (Greek–Greek, marsh loving) and *Bacillus limophilus* Migula 1900 (Latin–Greek, mud loving); see *Index Bergeyana*, p. 196.
(5) A **perilous name** (*nomen periculosum*), i.e. a name whose application is likely to lead to accidents endangering health or life or both or of serious economic consequences.
   Example: *Yersinia pseudotuberculosis* subsp. *pestis* (Opinion 60; Judicial Commission, 1985) is to be rejected as a *nomen periculosum*.

Note 1. This application is restricted to a proposed change in the specific epithet of a nomenspecies which is widely recognized as contagious, virulent, or highly toxigenic, for example, to that of a subspecies of a species having a different host range or a degree of contagiousness or virulence. If the Judicial Commission recognizes a high order of risk to health, or of serious economic consequences, an Opinion may be issued that the taxon be maintained as a separate nomenspecies, without prejudice to the recognition or acceptance of its genetic relatedness to another taxon.

Conservation of Names

Rule 56b

A **conserved name** (*nomen conservandum*) is a name which must be used instead of all earlier synonyms and homonyms.

Note 1. A conserved name (*nomen conservandum*) is conserved against all other names for the taxon, whether these are cited in the corresponding list of rejected names or not, so long as the

taxon concerned is not united with another taxon bearing a legitimate name. In the event of union or reunion with another taxon, the earlier of the two competing names is adopted in accordance with Rules 23a and 23b.

Note 2. Only the Judicial Commission can place names on the list of **conserved names** (*nomina conservanda*) (see also Rule 23a, Note 4, and Appendix 4).

Section 9. Orthography

Rule 57a

Any name or epithet should be written in conformity with the spelling of the word from which it is derived and in strict accordance with the rules of Latin and latinization. Exceptions are provided for typographic and orthographic errors in Rule 61 and orthographic variants in Rules 62a and 62b (see also Appendix 9).

Rule 57b

In this Code, **orthographic variant** means a name (or epithet) which differs from another name only in transliteration into Latin of the same word from a language other than Latin or in its grammatical correctness.

Example: *Haemophilus*, *Hemophilus*.

Rule 57c

When two or more generic names or two or more epithets in the same genus are so similar (although the words are from different sources) as to cause uncertainty they may be treated as **perplexing names** (*nomina perplexa*) and the matter referred to the Judicial Commission [see Rule 56a(4)].

Example: *Bacillus limnophilus* and *Bacillus limophilus* [see Rule 56a(4)].

Note 1. **Orthographic variants** may be corrected by any author.

Note 2. **Perplexing names** may be placed on the list of rejected names only by the Judicial Commission, because decisions on the status of names derived from different sources differing in one or more letters affect many well-known names in bacteriology.

Examples: *Salmonella gamaba* and *Salmonella gambaga*.

Rule 58

When there is doubt about different spellings of the same name or epithet, or where two spellings are sufficiently alike to be confused, the question should be referred to the Judicial Commission,

which may issue an **Opinion** as seems fit. If one of the spellings is preferred by the Judicial Commission, this spelling should be used by succeeding authors.

Example: The epithet "*megaterium*" (over "*megatherium*") in the species name *Bacillus megaterium* de Bary 1884 (Opinion 1; Judicial Commission, 1951).

Rule 59

An epithet, even one derived from the name of a person, should not be written with an initial capital letter.

Example: *Shigella flexneri* (named after Flexner).

Rule 60

Intentional latinizations involving changes in orthography of personal names, particularly those of earlier authors, must be preserved.

Example: Chauveau has been latinized as Chauvoe, and *Clostridium chauvoei* is derived from Chauvoe.

Typographic and Orthographic Errors

Rule 61

The **original spelling** of a name or epithet must be retained, except typographic or orthographic errors. Original spelling does not refer to the use of an initial capital letter or to diacritic signs.

Example: The original spelling was *Bacillus megaterium*, not *megatherium* (Opinion 1; Judicial Commission, 1951).

An unintentional typographical or orthographic error later corrected by the author is to be accepted in its corrected form without affecting the status and date of valid publication. It can also be corrected by a subsequent author who may or may not mention that the spelling is corrected, but the abbreviation "**corrig.**" (*corrigendum*) may be appended to the name if an author wishes to draw attention to the correction. Succeeding authors may be unaware that the original usage was incorrect and use the spelling of the original author(s). Other succeeding authors may follow the correction of a previous author or may independently correct the spelling themselves, but in no case is the use of corrig. regarded as obligatory. None of these corrections affects the status and date of valid publication.

Example: *Pasteurella mairi* (sic) Sneath and Stevens 1990. Typographic error later corrected by Sneath to *Pasteurella mairii*; this may be cited as *Pasteurella mairii* corrig.

Note. The liberty of correcting a name or epithet under Rules 61, 62a, and 62b must be used with reserve especially if the change affects the first syllable and above all the first letter of the name

or epithet. Except for changes of gender in specific epithets when species are transferred to other genera (comb. nov.) no grammatical or orthographic corrections will be accepted for names on the Approved Lists of Bacterial Names, the Validation Lists and the Notification Lists.

Orthographic Variants by Transliteration

Rule 62a

Words differing only in transliteration into Latin from other languages which do not use the Latin alphabet are to be treated as **orthographic variants** unless they are used as the names of taxa based upon different types, when they are to be treated as **homonyms**. For an account of possible orthographic variants, see Appendix 9.

Example: *Haemophilus* and *Hemophilus*.

Rule 62b

When there are orthographic variants based on the same type, and there is no clear indication that one is correct, then an author has the right of choice.

Personal Names

Rule 63

The genitive and adjectival forms of a personal name are treated as different epithets and not as orthographic variants unless they are so similar as to cause confusion. For the latinization of personal names, see Appendix 9.

Example: The epithets *pasteurii* (genitive noun) and *pasteurianum* (adjective) are treated as different epithets.

Diacritic Signs

Rule 64

Diacritic signs are not used in names or epithets in bacteriology.

In names or epithets derived from words with such signs, the signs must be suppressed and the letters transcribed as follows: (1) *ä*, *ö*; and *ü* become *ae*, *oe*, and *ue*; (2) *é*; *è*; and *ê* become *e*; (3) *ø*, *æ*, and *å* become *oe*, *ae*, and *aa*, respectively.

Gender of Names

Rule 65

The gender of generic names is governed by the following.

(1) A Latin or Greek word adopted as a generic name retains the classical gender of its language of origin. Authors are recommended to give the gender of any proposed generic name.
Example: *Sarcina* (Latin feminine noun, a package).
In cases where the classical gender varies, the author has the right of choice between the alternatives (but see Opinion 3 for the masculine gender of *-bacter*).
Example: *-incola* the gender may be masculine or feminine.
Doubtful cases should be referred to the Judicial Commission.
Example: Not yet found.

(2) Generic or subgeneric names which are modern compounds from two or more Latin or Greek words take the gender of the last component of the compound word.
Example: *Lactobacillus* (masculine) milk rodlet from Latin: *lac*, *lactis* (neuter), milk; and *bacillus* (masculine), little staff.
If the ending is altered, the gender is that of the new ending in the language of origin.
Example: Not yet found.

(3) Arbitrarily formed generic names or vernacular names used as generic names take the gender assigned to them by their authors. When the original author failed to indicate the gender; a subsequent author has the right of choice.
Example: *Desemzia* Stackebrandt *et al.* 1999, who assigned the feminine gender; *Waddlia* Rurangirwa *et al.* 1999; *Afipia* Brenner *et al.* 1992; *Cedecea* Grimont *et al.* 1981.

Chapter 4. Advisory Notes

A. Suggestions for Authors and Publishers

Publishers of periodicals and books are requested to indicate the year, month, and day of publication either on the publication itself or, in the case of a periodical, on the succeeding number. This information, as well as the title of the periodical or book from which the paper is reproduced, should also be printed on separates, tear sheets, or reprints.

Separates or reprints should always bear the pagination of the periodical of which they form a part.

An author who describes and names a new taxon should indicate the rank of the taxon concerned and where possible the rank and name of the next higher taxon (e.g., the name of the family to which a new genus is allocated or the name of the order in which a new family is placed). The title of the work concerned should indicate that a new name is published even if the name itself is not quoted in the title.

Note. Valid publication of a new name or combination requires announcement in the IJSEM (Rule 27).

It is important that descriptions and illustrations of new species be as complete as possible and conform to the minimal standards when available (see Recommendation 30b and Appendix 6).

For scientific names of taxa, conventions shall be used which are appropriate to the language of the country and to the relevant journal and publishing house concerned. These should preferably indicate scientific names by a different type face, e.g., italic, or by some other device to distinguish them from the rest of the text.

The name of a genus should be spelled without abbreviation the first time it is used with a specific epithet in a publication and in the summary of that publication.

Example: *Bacillus subtilis*.

In a series of species names all belonging to the same genus, it is customary to abbreviate the name of the genus in all but the first species, even if it is the first mention of the succeeding species.

Example: *Bacillus subtilis, B. polymyxa*.

Later use of the name of the species previously cited usually has the name of the genus abbreviated, commonly to the first letter of the generic name.

Example: *B. subtilis*.

If, however, species are listed belonging to two or more genera which have the same initial letter, the generic name should he used in full.

B. Quotations of Authors and Names

(1) *Multiple authorship* (**et al.**). When the new name of a taxon is published under two authors, both are cited; when there are more than two authors and when there is no definite designation of a single individual as the author of the name, the citation may be made by listing the names of all the authors or by giving the name of the first author, followed by the abbreviation "*et al.*" (*et alii*).

(2) *Publication in the work of another author* (**in**). When a new name or combination by one author is published in a work of another author, the word "*in*" should be used in the literature cited to connect the names of the two authors. The name of the author of the name of the taxon precedes the name of the author in whose work it is contained.
Example: *Streptomyces reticuli* Waksman, S. A., and A. T. Henrici *in* Breed, R. S., *et al.*, *Bergey's Manual of Determinative Bacteriology*, 6th ed., 1948, The Williams & Wilkins Co., Baltimore.

(3) Use of "**pro synon.**," "**ex**, " "**non**, " and "**sic**. "

(a) When citing a name published as a synonym, the words "as synonym" or "**pro synon.** " should be added to the citation. (For types of **synonym,** see Rule 24a.)
Example: *Pseudomonas pyocyanea* pro synon. *Pseudomonas aeruginosa.*

(b) When an author publishes a name from a manuscript of another author, or revives another author's name (Rule 33c, Note 2), whether as a synonym or not, the word "*ex*" should be used to connect the names of the two authors. The name of the author who publishes the name precedes that of the original author.
Example: *Achromobacter xylosoxidans* (*ex* Yabuuchi and Ohyama 1971) Yabuuchi and Yano 1981 nom. rev. A subsequent author citing this revived name would use the citation *Achromobacter xylosoxidans* (*ex* Yabuuchi and Ohyama 1971) Yabuuchi and Yano 1981 or *Achromobacter xylosoxidans* Yabuuchi and Yano 1981.

(c) When citing in synonymy a name invalidated by an earlier homonym, the citation should be followed by the name of the author of the earlier homonym preceded by the word "*non*," preferably with the date of publication added.
Example: *Achromobacter* Yabuuchi and Yano 1981 (non "Achromobacter" Bergey *et al*. 1923)

(d) If a name or epithet is adopted with alterations from the form as originally published, including the use of a corrected spelling, the original spelling should be cited in any list of synonyms of the corrected name. The original spelling is followed by the term "*sic*" in parentheses to indicate that the original spelling is accurately cited.
Example: *Bacillus pantothenticus* (sic).

(4) *Nomen nudum.* In the citation of a **bare name** (*nomen nudum*), the status of the name should be indicated by adding "nom. nud. "
Note. A **bare name** (*nomen nudum*) means a name published without a description or a reference to a previously published description.
Example: Not yet found.

(5) *Nomen conservandum*. A **conserved name** (*nomen conservandum*) shall be indicated by the addition of the abbreviation "nom. cons." to the citation.
Example: *Pseudomonas* Migula 1894 nom. cons. (Opinion 5).

C. Maintenance of Type Strains

The utmost importance should be given to the preservation of the original "type" material on which the description of a new species or subspecies is based (see Rules 18a, 27 and 30).

Preserved and living specimens should be maintained in a bacteriological laboratory, more particularly in one of the permanently established culture collections, and a record of this fact should be included in the publication (see Rule 30).

Maintenance may be by a variety of methods, e.g., in a medium, in a host by passage, in cells or exudates, or in the frozen or dried state.

Every precaution should be taken to maintain such cultures with a minimum amount of change. Repeated subculture may lead to phenotypic or genotypic changes.

References

Andersen B. M., Steigerwalt A. G., O'Connor S. P., Hollis D. G., Weyant R. S., Weaver R. E., Brenner D. J. (1993). *Neisseria weaveri* sp. nov. In *Validation of the Publication of New Names and New Combinations Previously Effectively Published Outside the IJSB*, List no. 47. *Int J Syst Bacteriol* **43**, 864–865. [doi:10.1099/00207713-43-4-864]

Approved Lists (1980). *Approved Lists of Bacterial Names*. Edited by Skerman V. B. D., McGowan V., Sneath P. H. A. Washington, DC: American Society for Microbiology.

Ash C., Priest F. G., Collins M. D. (1994). *Paenibacillus* gen. nov. In *Validation of the Publication of New Names and New Combinations Previously Effectively Published Outside the IJSB*, List no. 51. *Int J Syst Bacteriol* **44**, 852. [doi:10.1099/00207713-44-4-852]

Balch W. E., Schoberth S., Tanner R. S., Wolfe R. S. (1977). *Acetobacterium*, a new genus of hydrogen-oxidizing, carbon dioxide-reducing, anaerobic bacteria. *Int J Syst Bacteriol* **27**, 355–361. [doi:10.1099/00207713-27-4-355]

Beijerinck M. W. (1900). Schwefelwasserstoffbildung in den Stadtgraben und Aufstellung der Gattung *Aerobacter*. *Zentralbl Bakteriol Parasitenkd Infektionskr Hyg Abt* **6**, 193–206 (in German).

Beijerinck M. W. (1901). Sur les ferments lactiques de l'industrie. *Arch Neerl Sci Exactes Nat* **6**, 212–243 (in French).

Bergey D. H., Harrison F. C., Breed R. S., Hammer B. W., Huntoon F. M. (1923). *Bergey's Manual of Determinative Bacteriology*, 1st edn. Washington, DC: Society of American Bacteriologists.

Bergey D. H., Harrison F. C., Breed R. S., Hammer B. W., Huntoon F. M. (1930). *Bergey's Manual of Determinative Bacteriology*, 3rd edn. Washington, DC: Society of American Bacteriologists.

Bernardet J. F., Segers P., Vancanneyt M., Berthe F., Kersters K., Vandamme P. (1996). Cutting a Gordian knot: emended classification and description of the genus *Flavobacterium*, emended description of the family *Flavobacteriaceae*, and proposal of *Flavobacterium hydatis* nom. nov. (basonym, *Cytophaga aquatilis* Strohl and Tait 1978). *Int J Syst Bacteriol* **46**, 128–148. [doi:10.1099/00207713-46-1-128]

Biavati B., Scardovi V., Moore W. E. C. (1982). Electrophoretic patterns of proteins in the genus *Bifidobacterium* and proposal of four new species. *Int J Syst Bacteriol* **32**, 358–373. [doi:10.1099/00207713-32-3-358]

Boone D. R., Bryant M. P. (1984). *Syntrophobacter wolinii* sp. nov., gen. nov. In *Validation of the Publication of New Names and New Combinations Previously Effectively Published Outside the IJSB*, List no. 15. *Int J Syst Bacteriol* **34**, 355–357. [doi:10.1099/00207713-34-3-355]

Bøvre K. (1979). Proposal to divide the genus *Moraxella* Lwoff 1939 emend. Henriksen and Bøvre 1968 into two subgenera – subgenus *Moraxella* (Lwoff 1939) Bøvre 1979 and subgenus *Branhamella* (Catlin 1970) Bøvre 1979. *Int J Syst Bacteriol* **29**, 403–406. [doi:10.1099/00207713-29-4-403]

Breed R. S. (1953). The *Brevibacteriaceae* fam. nov. of order *Eubacteriales. R Comm VI Congr Int Microbiol Roma* **1**, 13–14.

Breed R. S., Murray E. G. D., Smith N. R. (editors) (1957). *Bergey's Manual of Determinative Bacteriology*, 7th edn. Baltimore: Williams & Wilkins.

Brenner D. J., Hollis D. G., Moss C. W., English C. K., Hall G. S., Vincent J., Radosevic J., Birkness K. A., Bibb W. F., *et al.* (1992). *Afipia* gen. nov. In *Validation of the Publication of New Names and New Combinations Previously Effectively Published Outside the IJSB*, List no. 41. *Int J Syst Bacteriol* **42**, 327–328. [doi:10.1099/00207713-42-2-327]

Brooker J. D., O'Donovan L. A., Skene I., Clarke K., Blackall L., Muslera P. (1996). *Streptococcus caprinus* sp. nov. In *Validation of the Publication of New Names and New Combinations Previously Effectively Published Outside the IJSB*, List no. 56. *Int J Syst Bacteriol* **46**, 362–363. [doi:10.1099/00207713-46-1-362]

Bryant M. P., Wolin E. A., Wolin M. J., Wolfe R. S. (1967). *Methanobacillus omelianskii*, a symbiotic association of two species of bacteria. *Archiv für Mikrobiologie* **59**, 20-31. [doi:10.1007/BF00406313]

Buchanan R. E. (1918). Studies in the nomenclature and classification of the bacteria: V. Subgroups and genera of the *Bacteriaceae*. *J Bacteriol* **3**, 27–61. [pmid:16558776]

Catlin B. W. (1970). Transfer of the organism named *Neisseria catarrhalis* to *Branhamella* gen. nov. *Int J Syst Bacteriol* **20**, 155–159. [doi:10.1099/00207713-20-2-155]

Cato E. P., Moore W. E. C., Nygaard G., Holdeman L. V. (1984). *Actinomyces meyeri* sp. nov., specific epithet rev. *Int J Syst Bacteriol* **34**, 487–489. [doi:10.1099/00207713-34-4-487]

Chatelain R., Second L. (1966). Taxonomie numérique de quelques *Brevibacterium*. *Ann Inst Pasteur (Paris)* **111**, 630–644 (in French).

Chatton E., Perard C. (1913). Schizophytes du caecum du cobaye. I. *Oscillospira guilliermondi* n.g., n.sp. *C R Seances Soc Biol (Paris)* **74**, 1159–1162 (in French).

Cohn F. (1872). Untersuchungen über Bakterien. *Beitrage Biol Pflanz* **1**, 127–224 (in German).

Collins M. D., Jones D. (1983). *Actinomyces pyogenes* comb. nov. In *Validation of the Publication of New Names and New Combinations Previously Effectively Published Outside the IJSB*, List no. 10. *Int J Syst Bacteriol* **33**, 438–440. [doi:10.1099/00207713-33-2-438]

Czurda V., Maresch E. (1937). Beitrag zur Kenntnis der Athiorhodobakterien-Gesellschaften. *Arch Mikrobiol* **8**, 99–124 (in German). [doi:10.1007/BF00407193]

de Bary A. (1884). *Vergleichende Morphologie und Biologie der Pilze, Mycetozoen und Bakterien*. Leipzig: Wilhelm Engelmann.

de Petschenko B. (1910). Contributions à l'étude de l'immunisé chez les protozoaires. *Zentralbl Bakteriol Abt I Orig* **56**, 90–92 (in French).

Donovan C. (1909). Kala-azar in Madras, especially with regard to its connection with the dog and the bug (*Conorrhinus*). *Lancet* **174**, 1495–1496. [doi:10.1016/S0140-6736(01)11628-4]

Ehrenberg C. G. (1832). Beiträge zur Kenntnis der Organization der Infusorien und ihrer geographischen Verbreitung besonders in Sibirien. In *Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin aus den Jahren 1830*, pp. 1–88. Berlin: Königlichen Akademie der Wissenschaften zu Berlin (in German).

Ehrenberg C. G. (1835). Dritter Beitrag zur Erkenntniss grosser Organisation in der Richtung des kleinsten Raumes. In *Physikalische Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin aus den Jahren 1833–1835, 1835*, pp. 143–336. Berlin: Königlichen Akademie der Wissenschaften zu Berlin (in German).

Eldering G., Kendrick P. (1938). *Bacillus parapertussis*: A species resembling both *Bacillus pertussis* and *Bacillus bronchisepticus* but identical with neither. *J Bacteriol* **35**, 561–572. [pmid:16560129]

Fischer A. (1895). Untersuchungen über Bakterien. *Jahrb Wissensch Bot* **27**, 1–163 (in German).

Fox J. G., Taylor N. S., Edmonds P., Brenner D. J. (1988). *Campylobacter pylori* subsp. *mustelae* subsp. nov. isolated from the gastric mucosa of ferrets (*Mustela putorius furo*), and an emended description of *Campylobacter pylori*. *Int J Syst Bacteriol* **38**, 367–370. [doi:10.1099/00207713-38-4-367]

Fox J. G., Chilvers T., Goodwin C. S., Taylor N. S., Edmonds P., Sly L. I., Brenner D. J. (1989). *Campylobacter mustelae*, a new species resulting from the elevation of *Campylobacter pylori* subsp. *mustelae* to species status. *Int J Syst Bacteriol* **39**, 301–303. [doi:10.1099/00207713-39-3-301]

Frankland G. C., Frankland P. F. (1887). Studies on some new microorganisms obtained from air. *R Soc Lond Philos Trans B Biol Sci* **178**, 257–287. [doi:10.1098/rstb.1887.0011]

Gardan L., Shafik H., Belouin S., Broch R., Grimont F., Grimont P. A. D. (1999). DNA relatedness among the pathovars of *Pseudomonas syringae* and description of *Pseudomonas tremae* sp. nov. and *Pseudomonas cannabina* sp. nov. (*ex* Šutič and Dowson 1959). *Int J Syst Bacteriol* **49**, 469–478. [doi:10.1099/00207713-49-2-469] [pmid:10319466]

Glage F. (1903). Über den *Bazillus pyogenes suis* Grips, den *Bazillus pyogenes bovis* Kunneman und den Bakteriologischen Befund bei den chronischen abszedierenden Euterenzundungen der Milchkuhe. *Z Fleisch Milchhyg* **13**, 166–175 (in German).

Goodfellow M. and Pirouz T. (1982). Numerical Classification of Sporoactinomycetes Containing meso-Diaminopimelic Acid in the Cell Wall. *Microbiology* **128**, 503–527 [doi:10.1099/00221287-128-3-503]

Grimont P. A. D., Grimont F., Farmer J. J., Asbury M. A. (1981). *Cedecea davisae* gen. nov., sp. nov. and *Cedecea lapagei* sp. nov., new *Enterobacteriaceae* from clinical specimens. *Int J Syst Bacteriol* **31**, 317–326. [doi:10.1099/00207713-31-3-317]

Hallier E. (1870). Die Parasiten der Infectionskrankheiten. *Zentralbl Parasitenkd* **2**, 113–132 (in German).

Harz C. O. (1877). *Actinomyces bovis* ein neuer schimmel in den geweben des rindes. *Dtsch Z Thiermed* **5**, 125–140 (in German).

Haynes W. C. (1957). Genus I. *Pseudomonas* Migula 1894. In *Bergey's Manual of Determinative Bacteriology*, 7th edn, pp. 89–152. Edited by Breed R. S., Murray E. G. D., Smith N. R. Baltimore: Williams & Wilkins.

Holmes B., Costas M., On S. L. W., Vandamme P., Falsen E., Kersters K. (1993). *Neisseria weaveri* sp. nov. (formerly CDC group M-5), from dog bite wounds of humans. *Int J Syst Bacteriol* **43**, 687–693. [doi:10.1099/00207713-43-4-687] [pmid:8240951]

Jensen H. L. (1934). Studies of nitrogen fixing bacteria. *Proc Linn Soc N S W* **59**, 37.

Judicial Commission (1951). Opinion 1. The correct spelling of the specific epithet in the species name *Bacillus megaterium* de Bary 1884. *Int Bull Bacteriol Nomencl Taxon* **1**, 35–36. [doi:10.1099/0096266X-1-1-35]

Judicial Commission (1954a). Opinion 10. Invalidity of the bacterial generic name *Müllerina* de Petschenko 1910 and of the species name *Müllerina paramecii*. In *Opinions 4, 6, 7, 8, 9, 10, 11, 12, 13, 14. Int Bull Bacteriol Nomencl Taxon* **4**, 141–158.

Judicial Commission (1954b). Opinion 14. Names of bacterial genera to be rejected as later synonyms of names of genera of protozoa. In *Opinions 4, 6, 7, 8, 9, 10, 11, 12, 13, 14. Int Bull Bacteriol Nomencl Taxon* **4**, 141–158.

Judicial Commission (1958a). Opinion 15. Conservation of the family name *Enterobacteriaceae*, of the name of the type genus, and designation of the type species. *Int Bull Bacteriol Nomencl Taxon* **8**, 73–74. [doi:10.1099/0096266X-8-1-73]

Judicial Commission (1958b). Opinion 20. Status of new generic names of bacteria published without names of included species. *Int Bull Bacteriol Nomencl Taxon* **8**, 160–162. [doi:10.1099/0096266X-8-3-4-160]

Judicial Commission (1965). Opinion 31. Conservation of *Vibrio* Pacini 1854 as a bacterial generic name, conservation of *Vibrio cholerae* Pacini 1854 as the nomenclatural type species of the bacterial genus *Vibrio*, and designation of neotype strain of *Vibrio cholerae* Pacini. *Int Bull Bacteriol Nomencl Taxon* **15**, 185–186. [doi:10.1099/00207713-15-3-185]

Judicial Commission (1971a). Opinion 38. Conservation of the generic name *Lactobacillus* Beijerinck. *Int J Syst Bacteriol* **21**, 104. [doi:10.1099/00207713-21-1-104]

Judicial Commission (1971b). Opinion 39. Rejection of the generic name *Gaffkya* Trevisan. *Int J Syst Bacteriol* **21**, 104–105. [doi:10.1099/00207713-21-1-104a]

Judicial Commission (1971c). Opinion 45. Rejection of the name *Leuconostoc citrovorum* (Hammer) Hucker and Pederson. *Int J Syst Bacteriol* **21**, 109–110. [doi:10.1099/00207713-21-1-109a]

Judicial Commission (1971d). Opinion 46. Rejection of the generic name *Aerobacter* Beijerinck. *Int J Syst Bacteriol* **21**, 110. [doi:10.1099/00207713-21-1-110]

Judicial Commission (1973). Opinion 48. Rejection of the name *Aerobacter liquefaciens* Beijerinck and conservation of the name *Aeromonas* Stanier with *Aeromonas hydrophila* as the type species. *Int J Syst Bacteriol* **23**, 473–474. [doi:10.1099/00207713-23-4-473]

Judicial Commission (1974). Opinion 49. Conservation of the generic name *Rhodopseudomonas* Czurda and Maresch emend. van Niel. *Int J Syst Bacteriol* **24**, 551. [doi:10.1099/00207713-24-4-551]

Judicial Commission (1985). Opinion 60. Rejection of the name *Yersinia pseudotuberculosis* subsp. *pestis* (van Loghem) Bercovier *et al.* 1981 and conservation of the name *Yersinia pestis* (Lehmann and Neumann) van Loghem 1944 for the plague bacillus. *Int J Syst Bacteriol* **35**, 540. [doi:10.1099/00207713-35-4-540]

Kelly D. P., Wood A. P. (2000). Reclassification of some species of *Thiobacillus* to the newly designated genera *Acidithiobacillus* gen. nov., *Halothiobacillus* gen. nov. and *Thermithiobacillus* gen. nov. *Int J Syst Evol Microbiol* **50**, 511–516. [doi:10.1099/00207713-50-2-511] [pmid:10758854]

Kisskalt K., Berend E. (1918). Untersuchungen über die Gruppe der Diphtherdiden (Corynbakterien). *Zentralbl Bakteriol I Abt Orig* **81**, 446 (in German).

Kluyver A. J., van Niel C. B. (1936). Prospects for a natural system of classification of bacteria. *Zentralbl Bakteriol Parasitenkd Infektionskr Hyg Abt (II)* **94**, 369–403.

Koch C., Klatte S., Schumann P., Burghardt J., Kroppenstedt R. M., Stackebrandt E. (1995). Transfer of Arthrobacter picolinophilus Tate and Ensign 1974 to Rhodococcus erythropolis. *Int J Syst Evol Microbiol* **45**, 576–577 [doi:10.1099/00207713-45-3-576]

Kützing F. T. (1849). *Species Algarum*. Linz: F. A. Brockhaus (in Latin).

Labeda D. P. (1997). International Committee on Systematic Bacteriology VIIth International Congress of Microbiology and Applied Bacteriology: Minutes of the Meetings, 17, 18, and 22 August 1996, Jerusalem, Israel. *Int J Syst Bacteriol* **47**, 597–600. [doi:10.1099/00207713-47-2-597]

Lessel E. F. (1971). Status of the name *Proteus morganii* and designation of the neotype strain. *Int J Syst Bacteriol* **21**, 55–57. [doi:10.1099/00207713-21-1-55]

Lignières J. (1900). Maladies du porc. *Bull Soc Central Med Vet* **18**, 389–431 (in French).

Lwoff A. (1939). Révision et démembrement des *Hemophilae*, le genre *Moraxella* nov. gen. *Ann Inst Pasteur (Paris)* **62**, 168–176 (in French).

Migula W. (1894). Über ein neues system der bakterien. *Arb Bakteriol Inst Tech Hochsch Karlsruhe* **1**, 235–238 (in German).

Migula**,** W. (1900). System der Bakterien, vol. 2. Jena: Gustav Fischer (in German).

Nakamura L. K., Roberts M. S., Cohan F. M. (1999). Relationship of *Bacillus subtilis* clades associated with strains 168 and W23: a proposal for *Bacillus subtilis* subsp. *subtilis* subsp. nov. and *Bacillus subtilis* subsp. *spizizenii* subsp. nov. *Int J Syst Bacteriol* **49**, 1211–1215. [doi:10.1099/00207713-49-3-1211] [pmid:10425781]

Osawa R., Fujisawa T., Sly L. L. (1996). *Streptococcus gallolyticus* sp. nov. In *Validation of the Publication of New Names and New Combinations Previously Effectively Published Outside the IJSB*, List no. 56. *Int J Syst Bacteriol* **46**, 362–363. [doi:10.1099/00207713-46-1-362]

Pacini F. (1854). Osservazione microscopiche e deduzioni patologiche sul cholera asiatico. *Gaz Med Ital Toscano Firenze* **6**, 405–412 (in Italian).

Parker C. D. (1945). The corrosion of concrete. I. The isolation of a species of bacterium associated with the corrosion of concrete exposed to atmosphere containing hydrogen sulphide. *Aust J Exp Biol Med Sci* **23**, 81–90. [doi:10.1038/icb.1945.13]

Pederson C. S. (1957). Genus *Lactobacillus* Beijerinck, 1901. In *Bergey's Manual of Determinative Bacteriology*, 7th edn, pp. 542–552. Edited by Breed R. S., Murray E. G. D., Smith N. R. Baltimore: Williams & Wilkins.

Perfiliev B. V. (1914). On the theory of symbiosis of *Chlorochromatium aggregatum* Lauterb. (*Chloronium mirabile* Buder) and *Cylindrogloea bacterifera* nov. gen., nov. spec. *J Mikrobiol* **1**, 223 (in Russian).

Poindexter J. S. (1964). Biological properties and classification of the *Caulobacter* group. *Bacteriol Rev* **28**, 231–295. [pmid:14220656]

Prévot A. R. (1938). Études de systématique bactérienne. *Ann Inst Pasteur (Paris)* **60**, 285–307 (in French).

Prévot A. R. (1940). Etude de la systématique bactérienne. V - Essai de classification des vibrions anaérobies. *Ann Inst Pasteur (Paris)* **64**, 117–125 (in French).

Prévot A. R. (1961). *Traité de Systématique Bactérienne*, vol. 2. Paris: Dunod.

Pridham T. G., Lyons A. J., Seckinger H. L. (1965). Comparison of some dried holotype and neotype specimens of streptomycetes with their living counterparts. *Int Bull Bacteriol Nomencl Taxon* **15**, 191–237. [doi:10.1099/00207713-15-4-191]

Pringsheim E. G. (1949). The relationship between bacteria and *Myxophyceae*. *Bacteriol Rev* **13**, 47–98.

Raj H. D. (1970). A new species – *Microcyclus flavus*. *Int J Syst Bacteriol* **20**, 61–81. [doi:10.1099/00207713-20-1-61]

Reddy C. A., Cornell C. P., Fraga A. M. (1982). Transfer of *Corynebacterium pyogenes* (Glage) Eberson to the genus *Actinomyces* as *Actinomyces pyogenes* (Glage) comb. nov. *Int J Syst Bacteriol* **32**, 419–429. [doi:10.1099/00207713-32-4-419]

Redfearn M. S., Palleroni N. J., Stanier R. Y. (1966). A comparative study of *Pseudomonas pseudomallei* and *Bacillus mallei*. *J Gen Microbiol* **43**, 293–313. [pmid:5962362]

Rocourt J., Wehmeyer U., Stackebrandt E. (1987). Transfer of *Listeria denitrificans* to a new genus, *Jonesia* gen. nov., as *Jonesia denitrificans* comb. nov. *Int J Syst Bacteriol* **37**, 266–270. [doi:10.1099/00207713-37-3-266]

Rogosa M. (1971). *Peptococcaceae*, a new family to include the gram-positive, anaerobic cocci of the genera *Peptococcus*, *Peptostreptococcus*, and *Ruminococcus*. *Int J Syst Bacteriol* **21**, 234–237. [doi:10.1099/00207713-21-3-234]

Roop R. M., Smibert R. M., Johnson J. L., Krieg N. R. (1986). Designation of the neotype strain for *Campylobacter sputorum* (Prévot) Véron and Chatelain 1973. *Int J Syst Bacteriol* **36**, 348. [doi:10.1099/00207713-36-2-348]

Rosenbach**,** F. J. (1884). Microorganismen bei den Wund-Infections-Krankheiten des Menschen. Wiesbaden: J. F. Bergmann (in German).

Rurangirwa F. R., Dilbeck P. M., Crawford T. B., McGuire T. C., McElwain T. F. (1999). Analysis of the 16S rRNA gene of micro-organism WSU 86-1044 from an aborted bovine foetus reveals that it is a member of the order *Chlamydiales*: proposal of *Waddliaceae* fam. nov., *Waddlia chondrophila* gen. nov., sp. nov. *Int J Syst Bacteriol* **49**, 577–581. [doi:10.1099/00207713-49-2-577] [pmid:10319478]

Scardovi V., Trovatelli L. D., Crociani F., Sgorbati B. (1969). Bifid bacteria in bovine rumen. New species of the genus *Bifidobacterium*: *B. globosum* n.sp. and *B. ruminale* n.sp. *Arch Mikrobiol* **68**, 278–294. [doi:10.1007/BF00409919] [pmid:5393670]

Schauder R., Schink B. (1996). *Anaerovibrio glycerini* sp. nov. In *Validation of the Publication of New Names and New Combinations Previously Effectively Published Outside the IJSB*, List no. 57. *Int J Syst Bacteriol* **46**, 625–626. [doi:10.1099/00207713-46-2-625] [pmid:8934914]

Schoop G. (1935). *Halococcus litoralis*, ein obligat halphiler Farbstoffbildner. *Dtsch Tierarztl Wochenschr* **43**, 817–820 (in German).

Schroeter J. (1886). In Kryptogamenflora von Schlesien, Band 3, Heft 3. Edited by F. Cohn. Breslau: Pilze J. U. Kern's Verlag (in German).

Schumann P., Rainey F. A., Burghardt J., Stackebrandt E., Weiss N. (1999). Reclassification of *Brevibacterium oxydans* (Chatelain and Second 1966) as *Microbacterium oxydans* comb. nov. *Int J Syst Bacteriol* **49**, 175–177. [doi:10.1099/00207713-49-1-175] [pmid:10028259]

Schwabacher H., Lucas D. R., Rimington C. (1947). *Bacterium melaninogenicum*; a misnomer. *J Gen Microbiol* **1**, 109–120. [pmid:20251272]

Schwers H. (1912). *Megalothrix discophora*, eine neue Eisen-bakterie. *Zentralbl Bakteriol II Abt* **33**, 273-276 (in German).

Sly L. I., Cahill M. M., Osawa R., Fujisawa T. (1997). The tannin-degrading species *Streptococcus gallolyticus* and *Streptococcus caprinus* are subjective synonyms. *Int J Syst Bacteriol* **47**, 893–894. [doi:10.1099/00207713-47-3-893] [pmid:9226925]

Sneath P. H. A., Stevens M. (1990). *Actinobacillus rossii* sp. nov., *Actinobacillus seminis* sp. nov., nom. rev., *Pasteurella bettii* sp. nov., *Pasteurella lymphangitidis* sp. nov., *Pasteurella mairi* sp. nov., and *Pasteurella trehalosi* sp. nov. *Int J Syst Bacteriol* **40**, 148–153. [doi:10.1099/00207713-40-2-148] [pmid:2223608]

Sneath, P. H. A (1992) Preface to the present edition In: Lapage, S. P., Sneath, P. H. A., Lessel, E. F., Skerman, V. B. D., Seeliger, H. P. R. & Clark, W. A. (editors) p. xxxvii. International Code of Nomenclature of Bacteria (1990 Revision). Bacteriological Code. Washington, DC: American Society for Microbiology.

Sneath, P. H. A. (2005) Letter to the Editor. The preparation of the Approved Lists of Bacterial Names. *Int J Syst Evol Microbiol* **55**, 2247–2249 [doi:10.1099/ijs.0.64137-0]

Spring S., Kämpfer P., Ludwig W., Schleifer K. H. (1997). *Leptothrix discophora* sp. nov. nom. rev. In *Validation of the Publication of New Names and New Combinations Previously Effectively Published Outside the IJSB*, List no. 61. *Int J Syst Bacteriol* **47**, 601–602. [doi:10.1099/00207713-47-2-601]

Stackebrandt E., Schumann P., Swiderski J., Weiss N. (1999). Reclassification of *Brevibacterium incertum* (Breed 1953) as *Desemzia incerta* gen. nov., comb. nov. *Int J Syst Bacteriol* **49**, 185–188. [doi:10.1099/00207713-49-1-185] [pmid:10028261]

Stackebrandt E., Frederiksen W., Garrity G. M., Grimont P. A. D., Kämpfer P., Maiden M. C. J., Nesme X., Rosselló-Mora R., Swings J., *et al.* (2002). Report of the ad hoc committee for the re-evaluation of the species definition in bacteriology. *Int J Syst Evol Microbiol* **52**, 1043–1047. [doi:10.1099/ijs.0.02360-0] [pmid:12054223]

Stanier R. Y. (1943). A note on the taxonomy of *Proteus hydrophilus*. *J Bacteriol* **46**, 213–214. [pmid:16560691]

Strohl W. R., Tait L. R. (1978). *Cytophaga aquatilis* sp. nov., a facultative anaerobe isolated from the gills of freshwater fish. *Int J Syst Bacteriol* **28**, 293–303. [doi:10.1099/00207713-28-2-293]

Strömpl C., Tindall B. J., Jarvis G. N., Lünsdorf H., Moore E. R. B., Hippe H. A. (1999). A re-evaluation of the taxonomy of the genus *Anaerovibrio*, with the reclassification of *Anaerovibrio glycerini* as *Anaerosinus glycerini* gen. nov., comb. nov., and *Anaerovibrio burkinabensis* as *Anaeroarcus burkinensis* [corrig.] gen. nov., comb. nov. *Int J Syst Bacteriol* **49**, 1861–1872. [doi:10.1099/00207713-49-4-1861] [pmid:10555370]

Šutič D., Dowson W. J. (1959). An investigation of a serious disease of hemp (*Cannabis sativa* L.) in Jugoslavia. *J Phytopathol* **34**, 307-314. [doi:10.1111/j.1439-0434.1959.tb01818.x]

Svendsen M., Amlie R., Henriksen S. D. (1947). Hemophilic Gram-positive rods. *J Bacteriol* **53**, 755–758.

Takeuchi M., Hamana K., Hiraishi A. (2001). Proposal of the genus *Sphingomonas sensu stricto* and three new genera, *Sphingobium*, *Novosphingobium* and *Sphingopyxis*, on the basis of phylogenetic and chemotaxonomic analyses. *Int J Syst Evol Microbiol* **51**, 1405–1417. [pmid:11491340]

Tindall B. J., De Vos P., Trüper H. G. (2008). Judicial Commission of the International Committee on Systematics of Prokaryotes; XIth International (IUMS) Congress of Bacteriology and Applied Microbiology. *Int J Syst Evol Microbiol* **58**, 1737-1745, [doi:10.1099/ijs.0.2008/005074-0]

Trevisan**,** V. (1842). Prospetto della Flora Euganea. Padova: Coi Tipi Del Seminario (in Italian).

Trevisan V. (1885). Caratteri di alcuni nuovi generi de Battericaee. *Atti Acad Fis-Med-Stat Milano Ser* **4**, 92–106 (in Italian).

Trevisan V. (1888). Sui Batteri spettani al genere *Klebsiella*. *R R Ist Lombardo Sci Ser II* **20**, 88–105 (in Italian).

Trüper H. G., De'Clari L. (1997). Taxonomic note: necessary correction of specific epithets formed as substantives (nouns) "in apposition". *Int J Syst Bacteriol* **47**, 908–909. [doi:10.1099/00207713-47-3-908]

Tsukamura M. (1966). [Further notes on *Mycobacterium terrae*, a new species. A method for isolating slowly growing mycobacteria from the soil]. *Igaku To Seibutsugaku* **72**, 292–295 (in Japanese). [pmid:5333125]

van Niel C. B. (1944). The culture, general physiology, morphology and classification of the non-sulfur purple and brown bacteria. *Bacteriol Rev* **8**, 1–118. [pmid:16350090]

Véron M., Chatelain R. (1973). Taxonomic study of the genus *Campylobacter* Sebald and Véron and designation of the neotype strain for the type species, *Campylobacter fetus* (Smith and Taylor) Sebald and Véron. *Int J Syst Bacteriol* **23**, 122–134. [doi:10.1099/00207713-23-2-122]

Waksman S. A., Joffe J. S. (1922). Microorganisms concerned in the oxidation of sulfur in the soil: II. *Thiobacillus thiooxidans*, a new sulfur-oxidizing organism isolated from the soil. *J Bacteriol* **7**, 239–256. [pmid:16558952]

Wayne L. G. (1966). Classification and identification of mycobacteria. III. Species within group III. *Am Rev Respir Dis* **93**, 919–928. [pmid:5942239]

Weichselbaum A. (1886). Über Tuberkelbacillen im Blut bei allgemeiner acuter Miliartuberculose. *Wein Med Jahrb* **82**, 483 (in German).

White P. B. (1930). Notes on organisms serologically related to *S. enteritidis* Gärtner: I. The Dublin and Tokyo types of *Salmonella*. *J Hyg (Lond)* **29**, 443–445. [doi:10.1017/S0022172400010184] [pmid:20475046]

Whitmore A. (1913). An account of a glanders-like disease occurring in Rangoon. *J Hyg (Lond)* **13**, 1–34. [doi:10.1017/S0022172400005234] [pmid:20474526]

Winogradsky S. (1892). Contributions à la morphologie des organismes de la nitrification. *Arkh Biol Nauk St Petersbourg* **1**, 87–137 (in French).

Yabuuchi E., Yano I. (1981). *Achromobacter* gen. nov. and *Achromobacter xylosoxidans* (*ex* Yabuuchi and Ohyama 1971) nom. rev. *Int J Syst Bacteriol* **31**, 477–478. [doi:10.1099/00207713-31-4-477]

Yabuuchi E., Kosako Y., Oyaizu H., Yano I., Hotta H., Hashimoto Y., Ezaki T., Arakawa M. (1992). Proposal of *Burkholderia* gen. nov. and transfer of seven species of the genus *Pseudomonas* homology group II to the new genus, with the type species *Burkholderia cepacia* (Palleroni and Holmes 1981) comb. nov. *Microbiol Immunol* **36**, 1251–1275.

Yabuuchi E., Kosako Y., Fujiwara N., Naka T., Matsunaga I., Ogura H., Kobayashi K. (2002). Emendation of the genus *Sphingomonas* Yabuuchi *et al.* 1990 and junior objective synonymy of the species of three genera, *Sphingobium*, *Novosphingobium* and *Sphingopyxis*, in conjunction with *Blastomonas ursincola*. *Int J Syst Evol Microbiol* **52**, 1485–1496. [doi:10.1099/ijs.0.01868-0] [pmid:12361250]

Yaeshima T., Fujisawa T., Mitsuoka T. (1992). *Bifidobacterium globosum*, subjective synonym of *Bifidobacterium pseudolongum*, and description of *Bifidobacterium pseudolongum* subsp. *pseudolongum* comb. nov. and *Bifidobacterium pseudolongum* subsp. *globosum* comb. nov. *Syst Appl Microbiol* **15**, 380–385.

Yale M. W. (1939). Genus VI. *Proteus* Hauser. In *Bergey's Manual of Determinative Bacteriology*, 5th edn, pp. 430–436. Edited by Bergey D. H., Breed R. S., Murray E. G. D., Hitchens A. P. Baltimore: Williams & Wilkins.

Young J. M., Dye D. W., Bradbury J. F., Panagopoulos C. G., Robbs C. F. (1978). A proposed nomenclature and classification for plant pathogenic bacteria. *N Z J Agric Res* **21**, 153–177.

Young J. M., Kuykendall L. D., Martínez-Romero E., Kerr A., Sawada H. (2001). A revision of *Rhizobium* Frank 1889, with an emended description of the genus, and the inclusion of all species of *Agrobacterium* Conn 1942 and *Allorhizobium undicola* de Lajudie *et al.* 1998 as new combinations: *Rhizobium radiobacter*, *R. rhizogenes*, *R. rubi*, *R. undicola* and *R. vitis*. *Int J Syst Evol Microbiol* **51**, 89–103. [pmid:11211278]

Zimmermann O. E. R. (1890). Die Bakterien unserer Trink- und Nutzwasser, insbesondere des Wassers der Chemnitzer Wasserleitung. In Elfter Bericht der naturwissenschaftlichen Gesellschaft Chemnitz, pp. 53–154 (in German).

Table 3. Index to the Supplementary Material.

S01_Foreword_1958_Edition.pdf	Foreword to the First Edition.
S02_Preface_1958_Edition.pdf	Preface to the First Edition.
S03_Preface_1975_Edition.pdf	Preface to the 1975 Edition.
S04_Preface_1990_Edition.pdf	Preface to the 1990 Edition.
S05_Memorial_Buchanan.pdf	Memorial to Professor R. E. Buchanan.
S06_Appendix_1.pdf	Appendix 1. Codes of Nomenclature.
S07_Appendix_2.pdf	Appendix 2. Approved Lists of Bacterial Names.
S08_Appendix_3.pdf	Appendix 3. Published Sources for Names of Prokaryotic, Algal, Protozoal, Fungal, and Viral Taxa.
S09_Appendix_4.pdf	Appendix 4. Conserved and Rejected Names of Prokaryotic Taxa.
S10_Appendix_5.pdf	Appendix 5. Opinions Relating to the Nomenclature of Prokaryotes.
S11_Appendix_6.pdf	Appendix 6. Published Sources for Recommended Minimal Descriptions.
S12_Appendix_7.pdf	Appendix 7. Publication of a New Name.
S13_Appendix_8.pdf	Appendix 8. Preparation of a Request for an Opinion.
S14_Appendix_9.pdf	Appendix 9. Orthography.
S15_Appendix_10.pdf	Appendix 10. Infrasubspecific Subdivisions.
S16_Appendix_11.pdf	Appendix 11. The Provisional Status *Candidatus*.
S17_Appendix_12.pdf	Appendix 12. The van Niel International Prize.
S18_Appendix_13.pdf	Appendix 13. Activities of the Congresses.

Three new appendices have been added to this edition. Appendix 11 addresses the appropriate application of the *Candidatus* concept, Appendix 12 contains the history of the van Niel International Prize, and Appendix 13 contains the summaries of Congresses.

FOREWORD TO THE FIRST EDITION

Microbiologists who have occasion to use the scientific names of the microorganisms with which they deal generally prefer to use *correct* names and to use them *correctly*. Relatively few authors have special or direct interest in the problems of nomenclature as such, but there is general recognition that acceptance of the same names by various authors is essential in a field such as microbiology which has probably more economic implications than any other subdivision of biology. One is confronted with the fact that the names given to microorganisms have been proposed by individuals whose major interest has been the organisms themselves, not their names. Their economic significance has commonly been stressed. These minute organisms were found in some cases to produce disease in man, animals or plants; their study became basic to the professions of medicine and veterinary medicine; other microorganisms produced fermentation, decay and spoilage; it was found that fundamental studies of cellular physiology and metabolism, cell structure, inheritance, enzymology, photosynthesis, production of antibiotics, preservation of foods and feeds, public health, sanitation, soil fertility, plant pathology, and other fields required some basic knowledge of bacteriology. Those who discovered and worked with these organisms recognized the need of giving names to them, but frequently had little or no experience in scientific nomenclature. What rules should be followed in the coining of these names? Precedents to be followed were not clearly formulated in the early days of bacteriology.

Carl von Linné (Linnaeus) in the latter part of the eighteenth century proposed certain nomenclatural principles which were adopted with surprising unanimity by biologists of his day. Later the botanists and zoologists in separate international meetings and congresses developed two codes of nomenclature, which agreed in most points but differed in some. Many bacteriologists followed the Botanical Code, some the Zoological Code, and others named the organisms which they discovered with scant attention to established rules. It became evident that rules in Botany formulated primarily by those interested in the taxonomy of flowering plants, ferns and mosses did not fit too well with the needs of the bacteriologist.

Editorial Board
June 1958

PREFACE TO THE FIRST EDITION

The history of the development of the 1958 Revised Edition of the International Code of Nomenclature of Bacteria and Viruses has been given in the Foreword. Here it is fitting that there be acknowledgement of the generous assistance given by many individuals and organizations in the preparation and editing of this Code.

The task of developing a wholly satisfactory Bacteriological Code is not complete. New problems involving nomenclature of the bacteria will arise and will require solutions. There have as yet been no final recommendations and no conclusions as to what special Rules and Recommendations will be needed to make functional any proposals to be made by the International Subcommittee on Taxonomy of the Viruses relative to virus nomenclature. The increasing use of terminologies applicable to strains and groups of bacteria of infrasubspecific rank makes necessary careful study of the best methods for preventing confusion, even some degree of nomenclatural chaos, in the naming of taxa of lower rank than subspecies. The growing recognition of the value of the type concept in standardization of names may mean the incorporation into the Code of a definition of Type Culture Collections and their functions in stabilization of bacteriological nomenclature.

A reading of the Annotations of the several Rules and Recommendations of the Bacteriological Code reveals a variance in terminology (sometimes in basic concepts) in the three Biological Codes of Nomenclature (Botanical, Zoological and Bacteriological). These differences have come about through the peculiarly independent development and history of Botany and of Zoology. The organization which can facilitate any attempt to reconcile these interdisciplinary differences must represent biology as a whole and on an international basis. The International Union of Biological Sciences would seem to be the agency able in some effective manner to develop fruitful consultations among the nomenclatural commissions of the three disciplines.

The Editorial Board and the Judicial Commission are most grateful for the generous subventions that have made possible publication of this revised Bacteriological Code. Organizations particularly helpful have been the International Union of Biological Sciences, the Society of American Bacteriologists, and the Society for General Microbiology. The Iowa State College has likewise been most generous in its provision of office facilities.

The Editorial Board is grateful also for permission given by the Commissions concerned to quote from the International Code of Botanical Nomenclature and from the International Code of Zoological Nomenclature where it has been desirable to compare resemblances and differences between these Codes and the text of the revised International Code of Nomenclature of Bacteria and Viruses. However, the final text of the International Code of Zoological Nomenclature had not been adopted in final form at the time of publication of the International Code of Nomenclature of Bacteria and Viruses (June, 1958). In consequence some quotations may not represent final action by the 1958 Zoological Congress. If there are here included unintentional misinterpretations, they will be corrected in later editions of the Bacteriological Code.

The manuscript for the Code in original draft form, including annotations and appendices, was submitted for editorial suggestions to all members of the Judicial Commission and to about thirty other bacteriologists experienced in nomenclature and taxonomy. The suggestions received were reviewed by the Judicial Commission. The Code represents a high degree of international cooperation. The Editorial Board wishes to express its real appreciation for the helpful cooperation received.

The Editorial Board

R. E. BUCHANAN, *Chairman*
T. WIKÉN, *Secretary*
(resigned 1 April 1957)

S. T. COWAN, *Secretary*
W. A. CLARK, *Secretary*
(appointed 8 October 1957)

June 1958

PREFACE TO THE 1975 EDITION

This volume contains the edition of the *International Code of Nomenclature of Bacteria* approved by the Plenary Session of the First Congress for Bacteriology, Jerusalem, 1973. The volume also contains the *Lists of Conserved and Rejected Names of Bacterial Taxa* together with the *Opinions issued by the Judicial Commission*, and the *Statutes of the International Committee on Systematic Bacteriology* (ICSB), formerly the International Committee on Nomenclature of Bacteria (ICNB)[1]. These Statutes, which deal with the administration of the ICSB, were developed from Provisions 4 and 5 of the earlier Codes. The *Statutes of the Bacteriology Section of the International Association of Microbiological Societies* (IAMS)[2] are also included.

A revision of the International Code of Nomenclature of Bacteria (1966) has been undertaken in an attempt to simplify the rules of nomenclature, thus encouraging wider use of the Code, and to provide a sound basis for bacterial systematics. This edition supersedes all previous editions of the International Code of Nomenclature of Bacteria.

To achieve these aims, certain principles were recently approved by the ICSB (Lessel, 1971), and these have been incorporated into the present edition.

A new starting date (1 January 1980 rather than 1 May 1753) for the nomenclature of bacteria is proposed so as to put into practice more meaningful requirements for the valid publication of names. New names and combinations must be published in the *International Journal of Systematic Bacteriology* (IJSB) or, if published previously elsewhere, an announcement of such publication must be made in the IJSB; a description or a reference to a previously and effectively published description of the named taxon must also be given in the IJSB and the type of a named taxon must be designated.

The ICSB is requesting its taxonomic subcommittees and other experts to propose lists of characteristics which will constitute the minimal standards for the description of various taxa. When these have been approved by the ICSB, the Code recommends that the description of each named taxon contain at least those characteristics specified in the minimal standards. In addition the Code recommends that, in the case of cultivable organisms, cultures of the type strains of newly named species and subspecies be deposited in culture collections from which they would be available.

For names published prior to 1 January 1980, Approved Lists of Bacterial Names will be compiled by the members of the taxonomic subcommittees and by other experts for approval by the Judicial Commission and the ICSB. Only the names of bacteria which are adequately described and for which there is a type or neotype strain, if the organism is cultivable, will be placed on the approved lists. In determinations of priority after 1 January 1980, then, only those names which appear on the approved lists of names or which are validated by publication in the IJSB after 1 January 1980 need be taken into consideration. Thus it will no longer be necessary to conduct extensive, frequently difficult literature searches merely for the purpose of determining the earliest name that was used for a bacterial taxon. Most important, however, will be the fact that after 1 January 1980 all of the validly published names for the bacteria will have clear and precise applications because the names will be associated with adequate descriptions and with type or neotype strains.

For this edition of the Code, the Drafting Committee prepared several revisions which were circulated to members of the Judicial Commission and to the ICSB for their comments. The work was begun in 1968, approved in principle by the Judicial Commission in 1970 (at the Xth International Congress of Microbiology, Mexico City), and culminated in publication as a proposed Revision in 1973 (Lapage *et al.*, 1973) for comment by the scientific community prior to presentation to the Judicial Commission, the ICSB, and the Plenary Session of the Bacteriology Section of IAMS at its Congress in Jerusalem, 1973. There, the published text was approved (with minor changes) and approval was also given for publication in book form of the text contained in this volume. The date on which this edition of the Code becomes effective is the date of publication of this volume.

Examples have been included in the Code where they were thought helpful to illustrate clauses, but in a few instances examples from bacteriology have not so far been found. These cases have been indicated, as the use of hypothetical examples or those taken from botany would appear to be misleading. In a few cases, however, hypothetical examples have been used to illustrate orthography in Appendix 9. On the authority of the Judicial Commission and the ICSB, some of the earlier Opinions of the Judicial Commission have been edited to remove minor inconsistencies.

A memorial to Professor R. E. Buchanan is included in the volume as a tribute to the debt that all microbiologists owe to him for the earlier editions of the International Code of Nomenclature of Bacteria and Viruses. We thank the editors of the *Journal of General Microbiology* and the Cambridge University Press for permission to reproduce the photograph and obituary to Professor Buchanan, which originally appeared in the *Journal of General Microbiology* (Cowan, 1973) and which is also published in this

[1] Now the International Code of Nomenclature of Prokaryotes (ICNP).
[2] Now the International Union of Microbiological Societies (IUMS).

volume by courtesy of Dr. S. T. Cowan, whose work on bacterial nomenclature is widely appreciated. (*Editorial Note*. The photograph in the present volume is included by permission of the *Special Collections Department* at the Iowa State University Library.)

It would not be possible to list all the many individuals who helped with the revision of the Bacteriological Code. Apart from the members of the Judicial Commission and ICSB whose many comments are gratefully acknowledged, we would especially like to thank Dr. S. T. Cowan, Dr. N. E. Gibbons, Professor Helen Heise, Mr. L. R. Hill, and Sir Graham Wilson for their help and advice. In particular we must mention Professor V. B. D. Skerman whose alternative versions provided us with much valuable material for passages of the text and for his help and advice throughout and, as Chairman of the ICSB, for his assistance in circulating copies of drafts and guiding this Code through the many problems that arose.

The Drafting Committee

S. P. LAPAGE, *Chairman, Drafting Committee, and Editor for the International Code of Nomenclature of Bacteria*

P. H. A. SNEATH, *Chairman, Judicial Commission*

E. F. LESSEL, *Editor, International Journal of Systematic Bacteriology*

H. P. R. SEELIGER, *Secretary for Subcommittees, International Committee on Systematic Bacteriology* **now** *President-Elect of the International Association of Microbiological Societies*

W. A. CLARK, **then** *Executive Secretary, International Committee on Systematic Bacteriology*

January 1975

REFERENCES

COWAN, S. T. 1973. Obituary: Robert E. Buchanan, 1883–1973. J. Gen. Microbiol. **77**:1–4.

International Code of Nomenclature of Bacteria. 1966. Int. J. Syst. Bacteriol. **16**:459–490.

LAPAGE, S. P., W. A. CLARK, E. F. LESSEL, H. P. R. SEELIGER, and P. H. A. SNEATH. 1973. Proposed revision of the International Code of Nomenclature of Bacteria. Int. J. Syst. Bacteriol. **23**:83–108.

LESSEL, E. F. 1971. Minutes of the Judicial Commission of the International Committee on Nomenclature of Bacteria. Int. J. Syst. Bacteriol. **21**:100–103.

PREFACE TO THE 1990 EDITION

This volume contains the edition of the *International Code of Nomenclature of Bacteria* approved by the Plenary Session of the Fifteenth International Congress of Microbiology, Osaka, 1990, together with lists of conserved and rejected bacterial names and of Opinions issued by the Judicial Commission. The *Statutes of the International Committee on Systematic Bacteriology* (ICSB) and the *Statutes of the Bacteriology and Applied Microbiology Division of the International Union of Microbiological Societies* (IUMS), formerly the Bacteriology Section of the International Association of Microbiological Societies (IAMS), are also included. Some minor editorial changes have been required where the 1975 edition referred to actions in the future.

Three important reforms were introduced by the revision of the Code published in 1975:

(1) A new starting document and starting date were achieved with the publication of the Approved Lists of Bacterial Names on 1 January 1980 (Skerman *et al.*, 1980), containing about 2,300 names. Names not on those lists lost their standing in nomenclature, thus clearing away many thousands of useless names. The old names are, nevertheless, available for revival individually if the provisions for doing so are met.

(2) All new names are validly published only in the *International Journal of Systematic Bacteriology* (IJSB), although they may be effectively published elsewhere and then validated by announcement in Validation Lists in the IJSB.

(3) For valid publication, nomenclatural types must be designated.

This new system of nomenclature came fully into force on 1 January 1980, and the reaction of the bacteriological community was awaited with some trepidation. In the event, it has worked remarkably well and has fully justified the foresight of the two individuals who contributed the bulk of the effort toward it, Professor V. B. D. Skerman and the late Dr. S. P. Lapage. A historical account of these developments has recently been given (Sneath, 1986). The evident success of such a system in bacteriology has led workers in botany and zoology to take a keen interest and to consider whether similar changes should be introduced in their own fields. This is a heartening development, for imitation is the sincerest form of flattery; recent steps here are reviewed by Hawksworth (1988), Ride (1988), and Hawksworth and Greuter (1989).

The new system led to a considerable number of requests to the Judicial Commission in the first few years to adjudicate on cases that required further attention, and progress reports were therefore made on these (for example, Wayne, 1982; 1986). New advances, particularly in molecular biology, have led to the need to compare older and newer approaches to taxonomy, and inevitably these advances have implications for nomenclature; reports on these (Wayne *et al.*, 1987; Murray *et al.*, 1990) are an important new activity of the ICSB.

P. H. A. SNEATH
Leicester, England
May 1991

REFERENCES

HAWKSWORTH, D. L. 1988. Improved stability for biological nomenclature. *Nature (London)* **334**:301.

HAWKSWORTH, D. L., and W. GREUTER. 1989. Report of the first meeting of a working group on Lists of Names in Current Use. *Taxon*. **38**:142–148.

MURRAY, R. G. E., D. J. BRENNER, R. R. COLWELL, P. DE VOS, M. GOODFELLOW, P. A. D. GRIMONT, N. PFENNIG, E. STACKEBRANDT, and G. A. ZAVARZIN. 1990. Report of the Ad Hoc Committee on Approaches to Taxonomy within the Proteobacteria. *Int. J. Syst. Bacteriol.* **40**:213–215.

RIDE, W. D. L. 1988. Towards a unified system of biological nomenclature, pp. 332–353. *In* D. L. Hawksworth (ed), *Prospects in Systematics*. Clarendon Press, Oxford.

SKERMAN, V. B. D., V. MCGOWAN, and P. H. A. SNEATH (eds). 1980. Approved Lists of Bacterial Names. *Int. J. Syst. Bacteriol.* **30**:225–420.

SNEATH, P. H. A. 1986. Nomenclature of bacteria, pp. 36–48. *In* W. D. L. Ride and T. Younès (eds), *Biological Nomenclature Today*. IUBS Monograph Series, No. 2. IRL Press, Eynsham, Oxford.

WAYNE, L. G. 1982. Actions of the Judicial Commission of the International Committee on Systematic Bacteriology on Requests for Opinions Published Between July 1979 and April 1981. *Int. J. Syst. Bacteriol.* **32**:464–465.

WAYNE, L. G. 1986. Actions of the Judicial Commission of the International Committee on Systematic Bacteriology on Requests for Opinions Published in 1983 and 1984. *Int. J. Syst. Bacteriol.* **36**:357–358.

WAYNE, L. G., D. J. BRENNER, R. R. COLWELL, P. A. D. GRIMONT, O. KANDLER, M. I. KRICHEVSKY, L. H. MOORE, W. E. C. MOORE, R. G. E. MURRAY, E. STACKEBRANDT, M. P. STARR, and H. G. TRÜPER. 1987. Report of the Ad Hoc Committee on Reconciliation of Approaches to Bacterial Systematics. *Int. J. Syst. Bacteriol.* **37**:463–464.

MEMORIAL TO PROFESSOR R. E. BUCHANAN

Robert Earle Buchanan, 1883-1973

Photograph provided by the *Special Collections Department* at the Iowa State University Library.

ROBERT E. BUCHANAN, 1883–1973

In his love for Latin and Greek, and of the etymology of names, Buchanan was a microbiologist extraordinary; that he had been an able administrator and an advisor to national and international bodies, a conservationist, and a benefactor of Iowa State University are aspects of his life that we, in this country, are apt to overlook.

Several members of the Buchanan family migrated from a village near Glasgow in the early 1800s; from New York they worked their way up the rivers to Chicago and were granted land in the state of Iowa. Buchanan's grandmother was a Chase whose family (best known for banking) went to America soon after the *Mayflower*. Robert Earle Buchanan was born in Cedar Rapids in 1883 and his interest in nature study was aroused at the age of nine, while attending a one-room country school near Rochester. Like most American boys, he worked during school holidays and saved to go to Iowa State College (ISC), which he entered in 1900. As a freshman, "Buchanan studied Latin under football coach Edgar Clinton" (Anon., 1965) and became a student laboratory assistant at 15 cents an hour to a botanist, L. H. Pammel, at ISC. He graduated in botany in 1904 and completed his master's degree in 1906. He spent some time in the medical school of the Northwestern University at Chicago and obtained his Ph.D. (majoring in bacteriology, with a minor in botany) in 1908.

At Iowa State College (ISC)

In 1910 Buchanan was appointed first head of bacteriology at ISC, and the same year married a botanist, Estelle Fogel, with whom he collaborated in writing the well-known Buchanan & Buchanan's *Bacteriology*. From 1914 to 1919 Buchanan was the first Dean of the Division of Industrial Sciences; from 1919 to 1948 he was the first Dean of the Graduate College, and from 1933 to 1948 Director of the Agricultural Experiment Station. When he retired officially in 1948 Buchanan was made 'Emeritus' and continued to have an office in the bacteriology department until his death; from this, and another office he had in Curtiss Hall, he kept a watchful eye on what went on in ISC, and he never hesitated to express his views forcibly when things displeased him. Throughout his life he took a great interest in Iowa State College (later University) and the Agricultural Experiment Station, and even after retirement his opinions were sought, respected, and sometimes feared.

In the summer vacations he would retire to the shores of Birch Lake in Minnesota, where he owned some land. There were two cabins (one belonged to his brother) built by their own hands, and over his boathouse Earle had a large office from which he sent a steady flow of dictaphone sleeves to his staff in Ames. His only relaxations were fishing and telling long tales of his travels, particularly of those in Arab countries.

In the cabin he was able to cook his fish by electricity (he was a good cook) for the cabin had all "mod. cons." except internal doors, for which curtains substituted.

Nearly twenty years after he retired, Iowa State University built and named after him a hall of residence for 400 graduate students.

The Scientific Side of the Dean

To his students Buchanan was always known as the Dean, and undoubtedly administration had been his forte in the prime of his life. It is hard to think of him working at a bench, but in 1918 he published a paper on the various phases of growing cultures. Most of his work was concerned with nomenclature and he was happiest delving into old books and holding forth about names. Between 1916 and 1918 he published a series of ten papers with the general title (subject to some variation) of "Studies in [on] the nomenclature and classification of [the] bacteria." In 1918 he was President of the SAB (Society of American Bacteriologists) and was a member of the Winslow Committee whose two reports (Winslow *et al.*, 1917, 1920) completely changed ideas on the classification and nomenclature of bacteria.

Of his other early publications, Buchanan's *General Systematic Bacteriology* (1925) is best known; it is a book of about 600 pages and gives a reasoned account of the names of bacterial genera and higher ranks. This book has become a classic and, because it is accurate and informative, it is still consulted.

International Committees and Congresses

In addition to being one of America's best-known bacteriologists at the age of 35, Buchanan became an international figure; he was sent by U.S. government departments and by FAO to several countries in the Middle East and to India to advise on agricultural matters. In a series of articles on past Presidents of the SAB, it was said of Buchanan that he was as well known a figure in Piccadilly as on the Ames campus.

In 1930 Buchanan presided over the bacteriology section of the Botanical Congress in Cambridge, and attended the first International Congress of Microbiology in Paris, where he became one of the founders of the Nomenclature Committee. During the second Congress an American-Canadian Committee was set up to draft a code of bacteriological

nomenclature and, of course, Buchanan became its chairman. He prepared a mimeographed document of 119 pages showing, in parallel columns, the International Rules of Botanical Nomenclature and the suggested wording for a bacteriological code based on the Botanical Code. A revised version was considered at the third Congress, when Buchanan was made the first chairman of the newly formed Judicial Commission. Further revision of the draft code followed and a Proposed Bacteriological Code (Buchanan and St. John-Brooks, 1947) was printed at Ames by ISC Press and circulated to members of the Nomenclature Committee for discussion at the fourth Congress. After amendment this Code was approved and published (Buchanan, St. John-Brooks and Breed, 1948).

The object for which Buchanan had worked for so long had been achieved (or so it seemed) when an annotated version of the Code was published (Buchanan, Wikén, Cowan and Clark, 1958); the useful annotations were entirely Buchanan's work, though he insisted that the names of the other members of the Editorial Board should be included. Tinkering with the Code continued at each congress, for, like most editors, Buchanan could not forgo the pleasure of making alterations and amendments. At the end of the ninth Congress Buchanan resigned the chairmanship of the Judicial Commission, and he was made a Life Member of the Nomenclature Committee. The Society for General Microbiology made him an Honorary Member in 1957.

Buchanan established a unique position as the only person who attended all the International Congresses on Microbiology (of Microbiologists, of Microbiological Societies): 1930, Paris; 1936, London; 1939, New York; 1947, Copenhagen; 1950, Rio de Janeiro; 1953, Rome; 1958, Stockholm; 1962, Montreal; 1966, Moscow; 1970, Mexico City.

A minor but troublesome commitment Buchanan undertook was the setting up of an official publication for the Nomenclature Committee and the Judicial Commission. It had no financial backing but Buchanan secured help (a few hundred dollars) from UNESCO, encouragement from Iowa State College Press, and some printing from a small press about a hundred miles from Ames. But the world's most cumbersomely titled journal (*The International Bulletin of Bacteriological Nomenclature and Taxonomy*) was born and later, with a glossy cover, achieved respectability as the *International Journal of Systematic Bacteriology*, which Buchanan edited until 1970.

Index Bergeyana and Bergey's Manual

After Bergey's death his *Manual* was carried on by R. S. Breed, E. D. G. Murray, and others, who made tentative plans for *Index Bergeyana*, an annotated list of names of bacterial taxa. Before this could be started Breed died, and Buchanan was invited to become Chairman of the Bergey's Manual Trust, an office he held until his death. All his life Buchanan had collected names of bacteria of all ranks and the record cards occupied a whole room in the office suite at Curtiss Hall; this collection became the major part of *Index Bergeyana* (Buchanan *et al.*, 1966) which could more appropriately have been named *Index Buchananensis*. There were many errors in the Index, some of fact, some of opinion on legitimacy, but it was a remarkable achievement. It was the work of a lifetime, but unfortunately it was published when the responsibilities of such a huge task pressed too heavily on an ageing man.

For the remaining years of his life preparations and plans for the eighth edition of *Bergey's Manual* occupied Buchanan's attention. He built up a team of strong-minded individualists who battled for several years with the problems leading to a new edition, and authors were chosen and invited to become contributors. Though he was interested primarily in the nomenclature, Buchanan never yielded a point and sometimes had authors and trustees tearing their hair at his insistence on a strict adherence to his beloved Code. With his attention focused on the names to be used in the *Manual*, his energies were dissipated on trivia; priority was always paramount, he was not concerned with usage or with the confusion that could arise when names were changed to conform with a strict application of the rules of nomenclature. As he aged and his judgments became less reliable, he became inconsistent and dogmatic; he found it difficult to understand numerical and computer approaches to bacterial classification, but this did not unduly concern him except when it might involve nomenclature, and then it might puzzle or even anger him.

Buchanan the Man

R. E. Buchanan was friendly, kind, and generous. As an American he was untypical, for even at his cabin in Minnesota he was formal and he never used Christian names when talking to or about colleagues. He was a man of strong character and liked to dominate a situation—and generally succeeded. His views were rigid and he was inflexible. In this he resembled Robert Breed, and when these two tough characters clashed the sparks would fly, often to the delight of the onlookers who took a less serious view of nomenclatural irregularities.

Buchanan could never understand why anyone should make light of his work, or be flippant about bacteriology, and worse, about its nomenclature. On one occasion he complained bitterly about the jocular attitude of Fred Bawden to virus names; he found Christopher Andrewes incomprehensible,

for he, too, treated virus nomenclature in a cavalier manner. And, of course, he never saw the reasoning behind heretical taxonomy, which made its debut at a seminar in Ames.

In his intense interest in names and the meaning of words, and, during the later years of his life, an almost complete indifference to the biological aspects of bacteria, Buchanan was an unusual scientist. But without his uninhibited support for the importance of names, bacterial nomenclature will never be quite the same again.

S. T. COWAN
Queen Camel
Yeovil, England
June 1973

REFERENCES

ANONYMOUS (1965). He looks to the future [a biographical note about Robert Earle Buchanan]. *News of Iowa State* **17**, no. 3 (pages not numbered).

BUCHANAN, R. E. (1918). Life phases in a bacterial culture. *Journal of Infectious Diseases* **23**, 109–125.

BUCHANAN, R. E. (1925). *General Systematic Bacteriology*. Baltimore: Williams and Wilkins.

BUCHANAN, R. E., HOLT, J. G. & LESSEL, E. F., JUN. (1966). *Index Bergeyana*. Baltimore: Williams and Wilkins.

BUCHANAN, R. E. & ST. JOHN-BROOKS, R. (1947). *Proposed Bacteriological Code of Nomenclature*. Ames: Iowa State College Press. (Privately printed and of limited circulation.)

BUCHANAN, R. E., ST. JOHN-BROOKS, R. & BREED, R. S. (1948). International bacteriological code of nomenclature. *Journal of Bacteriology* **55**, 287–306. Reprinted 1949, *Journal of General Microbiology* **3**, 444–462.

BUCHANAN, R. E., WIKÉN, T., COWAN, S. T. & CLARK, W. A. (1958). *International Code of Nomenclature of Bacteria and Viruses: Bacteriological Code*. Ames: Iowa State College Press.

WINSLOW, C.-E. A., BROADHURST, J., BUCHANAN, R. E., KRUMWIEDE, C., JUN., ROGERS, L. A. & SMITH, G. H. (1917). The families and genera of the bacteria: preliminary report of the Committee of the Society of American Bacteriologists on characterization and classification of bacterial types. *Journal of Bacteriology* **2**, 505–566.

WINSLOW, C.-E. A., BROADHURST, J., BUCHANAN, R. E., KRUMWIEDE, C., JUN., ROGERS, L. A. & SMITH, G. H. (1920). The families and genera of bacteria. Final report of the Committee of the Society of American Bacteriologists on characterization and classification of bacterial types. *Journal of Bacteriology* **5**, 191–229.

Appendix 1. Codes of Nomenclature

International Code of Nomenclature of Prokaryotes (ICNP)[1]

Early drafts of the International Bacteriological Code of Nomenclature were published in 1947 and reprinted in the Journal of Bacteriology in 1948. The first edition of the code approved by the Judicial Commission was published as an annotated book in 1958 as the International Code of Nomenclature of Bacteria and Viruses. The 1966 revision was published in article form only, as an update to Chapters 1–4. Subsequent editions were published as books in 1975 (1976 Revision) and 1992 (1990 Revision).

Buchanan, R. E., St. John-Brooks, R., and R. S. Breed. 1947. International Bacteriological Code of Nomenclature *in* 4th International Congress for Microbiology, Report of Proceedings, July 20–26 1947, Copenhagen. pp. 587–606.

Buchanan, R. E., St. John-Brooks, R., and R. S. Breed. 1947. International Bacteriological Code of Nomenclature. J. Bacteriol. 1948, **55**(3):287–306.

International Code of Nomenclature of Bacteria and Viruses. 1958. Iowa State College Press, Ames, Iowa, 186 pp.

Editorial Board. 1966. International Code of Nomenclature of Bacteria (1966 Revision). Int. J. Syst. Bacteriol. **16**:459–490.

Lapage, S. P., P. H. A. Sneath, E. F. Lessel, V. B. D. Skerman, H. P. R. Seeliger, and W. A. Clark (eds). 1975. International Code of Nomenclature of Bacteria and Statutes of the International Committee on Systematic Bacteriology and Statutes of the Bacteriology Section of the International Association of Microbiological Societies (1976 Revision). American Society for Microbiology, Washington, D.C., 180 pp. (Russian translation published 1978 by USSR Academy of Sciences, Moscow; Japanese translation published 1982 by Center for Academic Publications, Tokyo; Chinese translation published 1989 by Science Press, Beijing.)

P. H. A. Sneath (ed). 1992. International Code of Nomenclature of Bacteria and Statutes of the International Committee on Systematic Bacteriology and Statutes of the Bacteriology and Applied Microbiology Section of the International Union of Microbiological Societies (1990 Revision). American Society for Microbiology, Washington, D.C., 189 pp.

[1] Formerly the International Code of Nomenclature of Procaryotes (sic), the International Code of Nomenclature of Bacteria (ICNB), and earlier, the International Code of Nomenclature of Bacteria and Viruses. Also known informally as the Prokaryotic Code, formerly the Bacteriological Code (BC).

International Code of Nomenclature for algae, fungi, and plants (ICN)[2]

The first international rules governing botanical nomenclature were established in 1867 at the Fourth International Botanical Congress in Paris.

Conflicting rules of botanical nomenclature were published in 1906 (the "Vienna Rules") and 1907 (the *American Code of Botanical Nomenclature*). These were later reconciled in the "Cambridge Rules" of 1935.

de Candolle, A. 1867. Actes du Congrès international de botanique tenu a Paris en août 1867, sous les auspices de la Société botanique de France.

Briquet, J. 1906. Règles internationales de la Nomenclature botanique adoptées par le Congrès International de Botanique de Vienne 1905. Jena G. Fischer.

American Code of Botanical Nomenclature. Bull. Torrey Club. Vol. 34, No. 4, April 1907. doi:10.2307/2479237

Briquet, J. 1935. International Rules of Botanical Nomenclature adopted by the International Botanical Congresses of Vienna 1905 and Brussels 1910 revised by the International Botanical Congress of Cambridge 1930. Jena, Germany. Gustav Fischer.

Lanjouw, J., Baehni, C., Merrill, E. D., Rickett, H. W., Robyns, W., Sprague, T. A., and F. A. Stafleu. 1952. International code of botanical nomenclature (Stockholm Code), adopted by the Seventh International Botanical Congress, Stockholm, July 1950. Regnum Vegetabile vol. 3.

Lanjouw, J., Baehni, C., Robyns, W., Rollins, R. C., Ross, R., Rousseau, J., Schulze, G. M., Smith, A. C., Vilmorin, R. de, and F. A. Stafleu. 1956. International code of botanical nomenclature (Paris Code), adopted by the Eighth International Botanical Congress, Paris, July 1954. Regnum Vegetabile vol. 8.

Lanjouw, J., Baehni, C., Robyns, W., Ross, R., Rousseau, J., Schopf, J. M., Schulze, G. M., Smith, A. C., Vilmorin, R. de, and F. A. Stafleu. 1961. International code of botanical nomenclature (Montreal Code), adopted by the Ninth International Botanical Congress, Montreal, August 1959. Regnum Vegetabile vol. 23.

Lanjouw, J., Mamay, S. H., McVaugh, R., Robyns, W., Rollins, R. C., Ross, R., Rousseau, J., Schulze, G. M., Smith, A. C., Vilmorin, R. de, and F. A. Stafleu. 1966. International code of botanical nomenclature, adopted by the Tenth International Botanical Congress, Edinburgh, August 1964. Regnum Vegetabile vol. 46.

Stafleu, F. A., Bonner, C. E. B., McVaugh, R., Meikle, R. D., Rollins, R. C., Ross, R., Schopf, J. M., Schulze, G. M., Vilmorin, R. de, and E. G.

[2] Formerly the International Code of Botanical Nomenclature (ICBN) and earlier, the International Rules of Botanical Nomenclature. Also known informally as the Botanical Code.

Voss. 1972. International code of botanical nomenclature (Seattle Code), adopted by the Eleventh International Botanical Congress, Seattle, August 1969. Regnum Vegetabile vol. 82.

Stafleu, F. A., Demoulin, V., Greuter, W., Hiepko, P., Linczevski, I. A., McVaugh, R., Meikle, R. D., Rollins, R. C., Ross, R., Schopf, J. M., and E. G. Voss. 1978. International code of botanical nomenclature (Leningrad Code), adopted by the Twelfth International Botanical Congress, Leningrad, July 1975. Regnum Vegetabile vol. 97.

Voss, E. G., Burdet, H. M., Chaloner, W. G., Demoulin, V., Hiepko, P., McNeill, J., Meikle, R. D., Nicolson, D. H., Rollins, R. C., Silva, P. C., and W. Greuter. 1983. International code of botanical nomenclature (Sydney Code), adopted by the Thirteenth International Botanical Congress, Sydney, August 1981. Regnum Vegetabile vol. 111.

Greuter, W., Burdet, H. M., Chaloner, W. G., Demoulin, V., Nicolson, D. H., and P. C. Silva. 1988. International code of botanical nomenclature (Berlin Code) adopted by the Fourteenth International Botanical Congress, Berlin July–August 1987. Regnum Vegetabile vol. 118.

Greuter, W., Barrie, F. R., Burdet, H. M., Chaloner, W. G., Demoulin, V., Hawksworth, D. L., Jürgensen, P. M., Nicolson, D. H., Silva, P. C., Trehane, P., and J. McNeill. 1994. International code of botanical nomenclature (Tokyo Code) adopted by the Fifteenth International Botanical Congress, Yokohama, August–September 1993. Regnum Vegetabile vol. 131.

Greuter, W., McNeill, J., Barrie, R., Burdet, H.-M., Demoulin, V., Filguerias, T. S., Nicolson, D. H., Silva, P. C., Skog, E., Trehane, P., Turland, N. J., and D. L. Hawksworth. (editors & compilers): International Code of Botanical Nomenclature (Saint Louis Code, The Black Code) adopted by the Sixteenth International Botanical Congress St. Louis, Missouri, July–August 1999. Regnum Vegetabile vol. 138.

McNeill, J., Barrie, F. R., Burdet, H. M., Demoulin, V., Hawksworth, D. L., Marhold, K., Nicolson, D. H., Prado, J., Silva, P. C., Skog, J. E., Wiersema, J. H., and N. J. Turland (eds.) 2006. International Code of Botanical Nomenclature (Vienna Code) adopted by the Seventeenth International Botanical Congress Vienna, Austria, July 2005. Gantner Verlag, Ruggell, Liechtenstein. Regnum Vegetabile vol. 146.

McNeill, J., Barrie, F.R., Buck, W.R., Demoulin, V., Greuter, W., Hawksworth, D. L., Herendeen, P. S., Knapp, S., Marhold, K., Prado, J., Prud'homme van Reine, W.F., Smith, G. F., Wiersema, J.H., and N. J. Turland (editors & compilers) 2012. International Code of Nomenclature for algae, fungi, and plants (Melbourne Code), adopted by the Eighteenth International Botanical Congress Melbourne, Australia, July 2011. Koeltz Scientific Books, Königstein. Regnum Vegetabile vol. 154.

International Code of Nomenclature for Cultivated Plants (ICNCP)[3]

The first edition of the ICNCP was formally proposed in 1952, although the original concept for this code may date back to the International Horticultural Congress of Brussels in 1864. The first edition of this code was published in 1953, followed by later revisions.

Stearn, William T. 1952. *Proposed International Code of Nomenclature for Cultivated Plants. Historical Introduction*. Journal of the Royal Horticultural Society **77**:157–173.

Fletcher, H. R., J. S. L., Gilmour, G. H. M., Lawrence, E. L., Little, G. Nilsson-Leissner, and R. de Vilmorin. 1958. International Code of Nomenclature for Cultivated Plants. Formulated and adopted by the International Commission for the Nomenclature of Cultivated Plants of the International Union of Biological Sciences (1958 Utrecht). Regnum Vegetabile vol. 10.

Fletcher, H. R., Gilmour, J. S. L., Lawrence, G. H. M., Matthews, J. D., Nilsson-Leissner, G., and R. de Vilmorin. 1961. International code of nomenclature for cultivated plants. Formulated and adopted by the International Commission for the Nomenclature of Cultivated Plants of the International Union of Biological Sciences (1961). Regnum Vegetabile vol. 22.

Gilmour, J. S. L., Horne, F. R., Little, E. L., Stafleu, F. A., and R. H. Richens. 1969. International code of nomenclature for cultivated plants (1969 Edinburgh). Regnum Vegetabile vol. 64.

Brickell, C. D., Voss, E. G., Kelly, A. F., Schneider, F., and R. H. Richens. 1980. International code of nomenclature for cultivated plants (1980 Seattle). Regnum Vegetabile vol. 104.

Trehane, P., Brickell, C. D., Baum, B. R., Hetterscheid, W. L. A., Leslie, A. C., McNeill, J., Spongberg, S. A., and F. Vrugtman. 1995. International code of nomenclature for cultivated plants. 1995 (ICNCP or Cultivated Plant Code) adopted by the International Commission for the Nomenclature of Cultivated Plants. Regnum Vegetabile vol. 133.

Brickell, C. D., Baum, B. R., Hetterscheid, W. L. A., Leslie, A.C., McNeill, J., Trehane, P., Vrugtman, F., and J. H. Wiersema. (eds.) 2005. International Code of Nomenclature for Cultivated Plants, 7th ed. Regnum Vegetabile vol. 144.

Brickell, C.D., Alexander, C., David, J.C., Hetterscheid, W.L.A., Leslie, A.C., Malecot, V., Jin, X., and J.J Cubey. 2009 International Code of Nomenclature for Cultivated Plants, 8th ed. Scripta Horticulturae 10. Leuven: ISHS. Regnum Vegetabile vol. 151.

[3] Also known informally as the Cultivated Plant Code.

International Code of Zoological Nomenclature (ICZN Code)[4]

Several sets of rules of zoological nomenclature from the 19th century predate the first internationally accepted rules. The first International Rules on Zoological Nomenclature were published in 1905 and amended by the zoological congresses of Boston 1907, Graz 1910, Monaco 1913, Budapest 1927, Padova 1930, Paris 1948, Copenhagen 1953, and London 1958 (refer to the proceedings of these congresses). A major revision of these rules was published as the first edition of the ICZN Code in 1961.

Strickland, H. E. 1878. Rules for Zoological Nomenclature. John Murray, London.

Allen, J. A. 1897. The Merton Rules. Science **6**(131):9–19. doi:10.1126/science.6.131.9. PMID 17819182

Blanchard, R., von Maehrenthal, F., and C. W. Stiles. 1905. Règles internationales de la nomenclature zoologique adoptées par les Congrès International de Zoologie. International Rules of Zoological Nomenclature. Internationale Regeln der Zoologischen Nomenklatur. Paris, F.R. De Rudeval.

International Code of Zoological Nomenclature. 1961. The International Trust for Zoological Nomenclature, London, UK. 176 pp.

International Code of Zoological Nomenclature, Second Edition. 1964. The International Trust for Zoological Nomenclature, London, UK. 176 pp.

International Code of Zoological Nomenclature, Third Edition. 1985. International Trust for Zoological Nomenclature and British Museum (National History), London, 338 pp.

ICZN 1999. International Code of Zoological Nomenclature. Fourth Edition. The International Trust for Zoological Nomenclature, London, UK. 306 pp.

International Code of Virus Classification and Nomenclature

The nomenclature of viruses was covered under the International Code of Nomenclature of Bacteria and Viruses until 1966, when an independent code was proposed for viruses.

Ratified changes to the International Code of Nomenclature of Viruses will be published in Virology Division News in Archives of Virology, and in subsequent ICTV Reports. Also refer to the Minutes of the Meetings of the International Committee on Taxonomy of Viruses for actions on proposals to change the code.

International Code of Nomenclature of Bacteria and Viruses. 1958. Iowa State College Press, Ames, Iowa, 186 pp.

The International Code of Nomenclature of Viruses (proposed). Minutes of the First Meeting of the ICNV[5] held at Academy of Medical Sciences of the USSR, Moscow, 22 July 1966.

Wildy, P. (ed). 1971. Classification and Nomenclature of Viruses *in* First Report of the International Committee on Nomenclature of Viruses. S. Karger, Basel, 81 pp.

The Rules of Nomenclature of Viruses in *Intervirology* 1982 **17**:23–25; doi:10.1159/000149283

Minutes of the Third Meeting of the ICTV, Madrid, 12 and 16 September 1975.

Minutes of the Fifth Meeting of the ICTV, Strasbourg, 4 August 1981.

Minutes of the 8th Plenary Meeting of the ICTV, Berlin, 29 August 1990.

Classification and Nomenclature of Virus *in* 5th Report of the ICTV, ed. Francki *et al.*, Springer, Wien New York; Archives of Virology, Supplementum 2, pp 48–51, 1991.

BioCode

In March 1994, a meeting was held in Egham, United Kingdom, to investigate the feasibility of harmonizing the five major Codes of Nomenclature. The project originally had an implementation goal of January 1, 2000, but failed to receive support from the individual codes of nomenclature. A revised draft of the BioCode was published in 2011 and continues to seek support.

Hawksworth, D. L., McNeill, J., Sneath, P. H. A., Trehane, R. P., and P. K. Tubbs. 1994a. Towards a harmonized bionomenclature for life on earth. *Biology International*. Special Issue **30**:1–44.

Hawksworth, D. L., Chaloner, W. G., Krauss, O., McNeill, J., Mayo, M. A., Nicolson, D. H., Sneath, P. H. A., Trehane, R. P. and P. K. Tubbs. 1994b. A draft Glossary of terms used in Bionomenclature. (IUBS Monogr. 9) International Union of Biological Sciences, Paris. 74 pp.

Hawksworth, D. L. 1995. Steps along the road to a harmonized bionomenclature. *Taxon* **44**:447–456.

Greuter, W., Hawksworth, D. L., McNeill, J., Mayo, M. A., Minelli, A., Sneath, P. H. A., Tindall, B. J., Trehane, P. and P. Tubbs (the IUBS/IUMS International Committee for Bionomenclature) (eds.). 1996. Draft BioCode:

[4] Also known informally as the Zoological Code. ICZN stands for the International Commission on Zoological Nomenclature.

[5] Prior to 1975, ICNV referred to the International Committee on Nomenclature of Viruses. This was later renamed the International Committee on Taxonomy of Viruses (ICTV).

the prospective international rules for the scientific names of organisms. *Taxon* **45**:349–372.

Orchard, A. F., Anderson, W. R., Gilbert, M. G., Sebsebe, D., Stearn, W. T., and E. G. Voss. 1996. Harmonized bionomenclature - a recipe for disharmony. *Taxon* **45**:287–290.

Greuter, W. and D. H. Nicolson. 1996. Introductory comments on the Draft BioCode, from a botanical point of view. *Taxon* **45**:343–348.

Hawksworth, D. L. (2011). Introducing the Draft BioCode (2011). *Taxon*. **60**(1):199–200.

Greuter, W., Garrity, G., Hawksworth, D. L., Jahn, R., Kirk, P. M., Knapp, S., McNeill, J., Michel, E., Patterson, D. J., Pyle, R., and B. J. Tindall. (2011). Draft BioCode (2011): Principles and rules regulating the naming of organisms. *Taxon*. **60**:201–212.

Plant Associations

In 1976, the International Society for Vegetation Science[6] published a formal code of nomenclature for communities of plant species, the International Code of Phytosociological Nomenclature (ICPN). The third edition of the code was jointly prepared by the IAVS and the Fédération Internationale de Phytosociologie (FIP).

Barkman, J. J., Moravec, J., and S. Rauschert. 1976. Code of Phytosociological Nomenclature. *Vegetatio* **32**(3):131–185.

Barkman, J.J., Moravec, J. and S. Rauschert. 1986. Code of Phytosociological Nomenclature, 2nd Edition. *Vegetatio* **67**:145–195.

Weber, H. E., Moravec, J., and Theurillat, J.-P. 2000. International Code of Phytosociological Nomenclature. 3rd edition. *Journal of Vegetation Science* **11**:739–768. doi:10.2307/3236580

General

The various Codes of Nomenclature are compared in: Jeffrey, C. 1989. Biological Nomenclature, 3rd ed. Edward Arnold, London, 86 pp.

Cyanobacteria continue to be covered by both the Botanical Code and Prokaryotic Code. An effort to reconcile the status of this group of bacteria has been underway for several decades. Although some progress has been made, a final decision has not yet been reached between the ICN and ICSP.

Oren, A. 2004. A proposal for further integration of the cyanobacteria under the Bacteriological Code. *Int. J. Syst. Evol. Microbiol.* **54**:1895–1902. doi:10.1099/ijs.0.03008-0. PMID 15388760

[6] Now the International Association for Vegetation Science (IAVS).

Appendix 2. Approved Lists of Bacterial Names

The Approved Lists of Bacterial Names consist of two Lists which were published on 1 January 1980 in the IJSB (**30**:225–420 [1980]):

Approved List 1. Names of taxa above the rank of genus, pp. 231–238.

Approved List 2. Names of genera, species, and subspecies, pp. 239–420.

See also the Corrigenda (1984) and the reprint of the Approved Lists (1989), whose bibliographic references are given in Appendix 3. Names validly published since 1 January 1980 are included in Moore *et al.* (1985) and Moore and Moore (1989) (see Appendix 3).

Appendix 3. Published Sources for Names of Prokaryotic, Algal, Protozoal, Fungal, and Viral Taxa

The following publications are among the major sources for names of bacterial, algal, protozoal, fungal, and viral taxa.

Prokaryotes

Due to the introduction of the Approved Lists of Bacterial Names in 1980, names published prior to 1980 that did not appear on either of the Approved Lists or the Corrigenda to the Approved Lists no longer have standing in nomenclature.

Prokaryotic names validly published since 1980 can be found in the IJSEM as articles, Notification Lists and Validation Lists. A comprehensive list of prokaryotic names, their status and their complete bibliographic history has been published as the Taxonomic Outline of Bacteria and Archaea.

Buchanan, R. E., J. G. Holt, and E. F. Lessel. 1966. Index Bergeyana. The Williams & Wilkins Co., Baltimore, 1472 pp.

Skerman, V. B. D., V. McGowan, and P. H. A. Sneath (eds). 1980. Approved Lists of Bacterial Names. *Int. J. Syst. Bacteriol.* **30**:225–420.

Gibbons, N. E., K. B. Pattee, and J. G. Holt. 1982. Supplement to Index Bergeyana. The Williams & Wilkins Co., Baltimore, 442 pp.

Hill, L. R., V. B. D. Skerman, and P. H. A. Sneath (eds). 1984. Corrigenda to the Approved Lists of Bacterial Names. *Int. J. Syst. Bacteriol.* **34**:508–511.Moore, W. E. C., E. P. Cato, and L. V. H. Moore (eds). 1985. Index of the Bacterial and Yeast Nomenclatural Changes Published in the International Journal of Systematic Bacteriology since the 1980 Approved Lists of Bacterial Names (1 January 1980 to 1 January 1985). *Int. J. Syst. Bacteriol.* **35**:382–407.

Skerman, V. B. D., V. McGowan, and P. H. A. Sneath (eds). 1989. Approved Lists of Bacterial Names (Amended Edition). American Society for Microbiology, Washington, D.C., 188 pp.

Moore, W. E. C., and L. V. H. Moore (eds). 1989. Index of the Bacterial and Yeast Nomenclatural Changes Published in the International Journal of Systematic Bacteriology since the 1980 Approved Lists of Bacterial Names (1 January 1980 to 1 January 1989). American Society for Microbiology, Washington, D.C., 72 pp.

Dye, D. W., J. F. Bradbury, M. Goto, A. C. Hayward, R. A Lelliott, and M. N. Schroth. 1980. Standards for naming pathovars of phytopathogenic bacteria and a list of pathovar names and pathotype strains. *Rev. Plant Pathol.* **59**:153–168.

Garrity, G. M., Lilburn, T. G., Cole, J. R., Harrison, S. H., Euzeby, J., and B. J. Tindall. 2007. The Taxonomic Outline of Bacteria and Archaea, Release 7.7. Michigan State University Board of Trustees. http://doi.org/10.1601/toba7.7

Cyanobacteria

Komárek, J. and T. Hauer. 2013. CyanoDB.cz: On-line database of cyanobacterial genera. Word-wide electronic publication, Univ. of South Bohemia & Inst. of Botany AS CR, http://www.cyanodb.cz

Algae

Silva, P. C. 1980. Names of classes and families of living algae with special reference to their use in the Index Nominum Genericorum (Plantarum). Bohn, Scheltema & Holkema, Utrecht, 156 pp. (Regnum Vegetabile vol. 103.)

Farr, E. R., J. A. Leussink, and F. A. Stafleu (eds). 1979. Index Nominum Genericorum (Plantarum). 3 vols. Bohn, Scheltema & Holkema, Utrecht, 1896 pp. (Regnum Vegetabile vol. 100–102.)

Farr, E. R., J. A. Leussink, and G. Zijlstra (eds). 1986. Index Nominum Genericorum (Plantarum). Supplementum I. Bohn, Scheltema & Holkema, Utrecht, 126 pp. (Regnum Vegetabile vol. 113.)

Guiry, M. D. and G. M. Guiry. AlgaeBase. World-wide electronic publication, National University of Ireland, Galway. http://www.algaebase.org

Kusber, W.-H. and R. Jahn. 2003. Annotated list of diatom names by Horst Lange-Bertalot and co-workers. Version 3.0. http://www.algaterra.org/Names_Version3_0.pdf

Catalogue of Diatom Names, California Academy of Sciences. Fourtanier, E. and J. P. Kociolek (comps.). Available online at http://research.calacademy.org/research/diatoms/names/index.asp

Protozoa

Neave, S. A. (ed). 1939. Nomenclator Zoologicus, 1758–1935. 4 vols, 3 suppls. Zoological Society, London.

Sharpe, D. (ed). 1902. Index Zoologicus, 1800–1900. Zoological Society, London.

Levine, N. D., Corliss, J. O., Cox, F. E., Deroux, G., Grain, J., Honigberg, B. M., Leedale, G. F., Loeblich, A. R., Lom, J., Lynn, D., Merinfeld, E. G., Page, F. C., Poljansky, G., Sprague, V., Vavra, J., and F. G. Wallace. A newly revised classification of the protozoa. J Protozool. 1980 **27**(1):37–58.

Aescht, E. 2001. Catalogue of the generic names of ciliates (Protozoa, Ciliophora). Oberoesterreichisches Landesmuseum, Linz, Austria.

Index Zoologicus. 1902–present. Zoological Society, London.

Fungi

Hawksworth, D. L., B. C. Sutton, and G. C. Ainsworth. 1983. Ainsworth & Bisby's Dictionary of the Fungi, 7th ed. Commonwealth Mycological Institute, Kew, 445 pp.

Index to Fungi. 1940–present (semi-annual). CAB International, Wallingford.

See also Farr *et al.*, 1979, 1986, above.

Kurtzman, C. P. and J. W. Fell (eds). 1998. The Yeasts: A Taxonomic Study (4th edition). Elsevier.

Kirk, P. M., Cannon, P. F., and J. C. David. 2001 Ainsworth and Bisby's Dictionary of the Fungi (9th edition). CAB International.

Robert, V., Stegehuis, G. and J. Stalpers. 2005. The MycoBank engine and related databases. http://www.mycobank.org

Dictionary of the Fungi. Kirk, P., Cannon, P., Stalpers, J., and D. Minter (eds). 2008. 784 pages.

Viruses

Wildy, P. (ed). 1971. Classification and Nomenclature of Viruses. First Report of the International Committee on Nomenclature of Viruses. S. Karger, Basel, 81 pp.

Matthews, R. E. F. 1982. Classification and Nomenclature of Viruses. Fourth Report of the International Committee on Taxonomy of Viruses. Intervirology **17**:1–200.

Granoff, A. and R. G. Webster. 1999. Encyclopedia of Virology. Academic Press, San Diego.

Virus Taxonomy: 2013 Release. International Committee on Taxonomy of Viruses. EC 45, Edinburgh. http://ictvonline.org/virusTaxonomy.asp

General (non-authoritative)

Roskov Y., Kunze T., Orrell T., Abucay L., Paglinawan L., Culham A., Bailly N., Kirk P., Bourgoin T., Baillargeon G., Decock W., De Wever A., Didžiulis V., eds. (2014). Species 2000 & ITIS Catalogue of Life, 2014 Annual Checklist. Digital resource at www.catalogueoflife.org/annual-checklist/2014. Species 2000: Naturalis, Leiden, the Netherlands.

Appendix 4. Conserved and Rejected Names of Prokaryotic Taxa

(Nomina taxorum conservanda et rejicienda)

The citations are (unless otherwise indicated) to the volumes, pages, and dates of the *International Bulletin of Bacteriological Nomenclature and Taxonomy* up to vol. 15 (1965). From vol. 16 (1966) through vol. 49 (1999) the citations are for the *International Journal of Systematic Bacteriology* and thereafter of the *International Journal of Systematic and Evolutionary Microbiology*.

LIST 1. *Conserved and rejected family names (nomina familiarum conservanda et rejicienda)*

Conserved name (*nomen conservandum*)	Name of type genus of conserved family	Rejected name (*nomen rejiciendum*)	Opinion no.	Citations
Enterobacteriaceae	*Escherichia* Castellani and Chalmers 1919, p. 841	*Bacteriaceae* (see Opinion 4, **4**:142 [1954])	15	**8**:73–74 (1958) **32**:464–465 (1982) **35**:272–273 (1985) **36**:577–578 (1986)

LIST 2. *Conserved names of genera of prokaryotes (nomina generum conservanda)*

Conserved generic names (*nomina generum conservanda*)	Name of type species of conserved genus	Opinion no.	Citations
Aeromonas Stanier 1943	*Aeromonas hydrophila* (Chester) Stanier 1943	48	**23**:473–474 (1973)
Agrobacterium Conn 1942	*Agrobacterium tumefaciens* (Smith and Townsend) Conn 1942	33	**20**:10 (1970)
Arthrobacter Conn and Dimmick 1947	*Arthrobacter globiformis* (Conn) Conn and Dimmick 1947	24	**8**:171–172 (1958)
Bacillus Cohn 1872	*Bacillus subtilis* Cohn 1872	A. (1936)	Proc. 2nd Internatl. Congr. Microbiol. London, 1936; Journal of Bacteriology, **33**:445 (1937); International Code of Nomenclature of Bacteria and Viruses (1958), p. 148
Beggiatoa Trevisan 1842	*Beggiatoa alba* (Vaucher) Trevisan 1845, *Oscillatoria alba* Vaucher 1803	13	**4**:151–156 (1954)
Chlorobacterium Lauterborn 1916	*Chlorobacterium symbioticum* Lauterborn 1916	6	**4**:143 (1954)
Chromobacterium Bergonzini 1880	*Chromobacterium violaceum* Bergonzini 1880	16	**8**:151–152 (1958)
Enterobacter Hormaeche and Edwards 1960	*Enterobacter cloacae* (Jordan) Hormaeche and Edwards 1960	28	**13**:38 (1963)
Escherichia Castellani and	*Escherichia coli* Castellani and	15	**8**:73–74 (1958)

LIST 2. *Conserved names of genera of prokaryotes (nomina generum conservanda)*

Conserved generic names (*nomina generum conservanda*)	Name of type species of conserved genus	Opinion no.	Citations
Chalmers 1919	Chalmers 1919 (basonym *Bacillus coli* Migula 1895, hyponym *Bacterium coli commune* Escherich 1885)		
Gallionella Ehrenberg 1838	*Gallionella ferruginea* Ehrenberg 1838	9	**4**:146–147 (1954)
Klebsiella Trevisan 1885	*Klebsiella pneumoniae* (Schroeter) Trevisan 1887 (*Bacterium pneumoniae-crouposae* Zopf 1885)	13	**4**:151–156 (1954)
Kurthia Trevisan 1885	*Kurthia zopfii* (Kurth) Trevisan 1885 (*Bacterium zopfii* Kurth 1883)	13	**4**:151–156 (1954)
Lactobacillus Beijerinck 1901	*Lactobacillus delbrueckii* Beijerinck 1901 (not *Lactobacillus caucasicus* Beijerinck 1901)	38	**21**:104 (1971)
Leptotrichia Trevisan 1879	*Leptotrichia buccalis* (Robin) Trevisan 1879 (*Leptothrix buccalis* Robin 1853)	13	**4**:151–156 (1954)
Listeria Pirie 1940	*Listeria monocytogenes* (Murray, Webb, and Swann) Pirie 1940 (*Bacterium monocytogenes* Murray *et al.* 1926)	12	**4**:150–151 (1954)
Methanococcus (Approved Lists 1980) emend. Mah and Kuhn 1984	*Methanococcus vannielii* Stadtman and Barker 1951 (Approved Lists 1980)	62	**36**:491 (1986)
Methanosarcina (Approved Lists 1980) emend. Mah and Kuhn 1984	*Methanosarcina barkeri* (Approved Lists 1980) emend. Mah and Kuhn 1984	63	**36**:492 (1986)
Moraxella Lwoff 1939	*Moraxella lacunata* (Eyre) Lwoff 1939	41	**21**:106 (1971)
Mycoplasma Nowak 1929	*Mycoplasma mycoides* (Borrel *et al.*) Freundt 1955	22	**8**:166–168 (1958)
Neisseria Trevisan 1885	*Neisseria gonorrhoeae* (Zopf) Trevisan 1885 (*Merismopedia gonorrhoeae* Zopf 1885)	13	**4**:151–156 (1954)
Nitrobacter Winogradsky 1892	*Nitrobacter winogradskyi* Winslow *et al.* 1917	23	**8**:169–170 (1958)
Nitrosococcus Winogradsky 1892	*Nitrosococcus nitrosus* (Migula) Buchanan 1925	23	**8**:169–170 (1958)
Nitrosomonas Winogradsky 1892	*Nitrosomonas europaea* Winogradsky 1892	23	**8**:169–170 (1958)
Nocardia Trevisan 1889	*Nocardia asteroides* (Eppinger 1891) Blanchard 1896 (replacing *Nocardia farcinica* Trevisan 1889 [see Opinion 58])	13 58	**3**:87–100 (1953) **3**:141–154 (1953) **4**:151–156 (1954) **35**:538 (1985)
Pasteurella Trevisan 1887	*Pasteurella multocida* (Lehmann and Neumann 1899)	13 58	**4**:151–156 (1954) **35**:538 (1985)

LIST 2. *Conserved names of genera of prokaryotes (nomina generum conservanda)*

Conserved generic names (*nomina generum conservanda*)	Name of type species of conserved genus	Opinion no.	Citations
	Rosenbusch and Marchant 1939 (replacing *Pasteurella choleraegallinarum* Trevisan 1887 [see Opinion 58])		
Pediococcus Claussen 1903	*Pediococcus damnosus* Claussen 1903	52	**26**:292 (1976)
Pseudomonas Migula 1894	*Pseudomonas aeruginosa* (Schroeter) Migula 1900 (*Bacterium aeruginosum* Schroeter 1872)	5	**2**:121–122 (1952)
Rhizobium Frank 1889	*Rhizobium leguminosarum* (Frank) Frank 1889 (*Schinzia leguminosarum* Frank 1879)	34	**20**:11–12 (1970)
Rickettsia da Rocha-Lima 1916	*Rickettsia prowazekii* da Rocha-Lima 1916	19	**8**:158–159 (1958)
Rhodopseudomonas Czurda and Maresch emend. van Niel 1944	*Rhodopseudomonas palustris* (Molisch) van Niel 1944 (*Rhodobacillus palustris* Molisch 1907)	49	**24**:551 (1974)
Selenomonas von Prowazek 1913	*Selenomonas sputigena* (Flügge) Boskamp 1922 (basonym *Spirillum sputigenum* Flügge 1886)	21	**8**:163–165 (1958)
Staphylococcus Rosenbach 1884	*Staphylococcus aureus* Rosenbach 1884	17	**8**:153–154 (1958)
Vibrio Pacini 1854	*Vibrio cholerae* Pacini 1854	31	**15**:185–186 (1965)

LIST 3. *Conserved specific epithets in names of species of prokaryotes (epitheta specifica conservanda)*

Conserved specific epithets (*epitheta specifica conservanda*)	Name of species in which specific epithet is conserved	Opinion no.	Citations
acidilactici	*Pediococcus acidilactici* Lindner 1887	68	**46**:835 (1996)
agalactiae	*Streptococcus agalactiae* Lehmann and Neumann 1896 (*Streptococcus agalactiae contagiosae* Kitt 1893)	8	**4**:145–146 (1954)
avium	*Mycobacterium avium* Chester 1901	47	**23**:472 (1973)
boydii	*Shigella boydii* Ewing 1949	11	**4**:148–150 (1954)
cholerae	*Vibrio cholerae* Pacini 1854	31	**15**:185–186 (1965)
enterica	*Salmonella enterica* (*ex* Kauffmann and Edwards 1952) Le Minor and Popoff 1987	80	**55**:519–520 (2005)
faecalis	*Streptococcus faecalis* Andrewes and Horder 1906	30	**13**:167 (1963)
fermentum	*Lactobacillus fermentum* Beijerinck 1901	50	**24**:551–552 (1974)
flexneri	*Shigella flexneri* Castellani and Chalmers 1919 (*Bacillus dysenteriae* Flexner 1900)	11	**4**:148–150 (1954)
forsythia	*Tannerella forsythia* Sakamoto *et al.* 2002	85	**58**:1974 (2011)
fortuitum	*Mycobacterium fortuitum* da Costa Cruz 1938	51	**24**:552 (1974)
meningitidis	The meningococcus (*Diplococcus intracellularis*	35	**20**:13–14 (1970)

LIST 3. *Conserved specific epithets in names of species of prokaryotes (epitheta specifica conservanda)*

Conserved specific epithets (*epitheta specifica conservanda*)	Name of species in which specific epithet is conserved	Opinion no.	Citations
	meningitidis Weichselbaum 1887)		
pestis	*Yersinia pestis* (Lehmann and Neumann 1899) van Loghem 1944	60	**35**:540 (1985)
phenylpyruvica	*Moraxella phenylpyruvica* Bøvre and Henriksen 1967	42	**21**:107 (1971)
putrificum	*Clostridium putrificum* (Trevisan 1889) Reddish and Rettger 1922	69	**49**:339 (1999)
prowazekii	*Rickettsia prowazekii* da Rocha-Lima 1916	19	**8**:158–159 (1958)
ramosa	*Pasteuria ramosa* Metchnikoff 1888 emend. Starr *et al.* 1983	61	**36**:119 (1986)
rhusiopathiae	*Erysipelothrix rhusiopathiae* (Migula) Buchanan 1918	32	**20**:9 (1970)
sonnei	*Shigella sonnei* (Levine) Weldin 1927 (*Bacterium sonnei* Levine 1920)	11	**4**:148–150 (1954)
sphaeroides	*Rhodopseudomonas sphaeroides* van Niel 1944	43	**21**:108 (1971)
typhi	*Salmonella typhi* (Schroeter) Warren and Scott 1930 (*Bacillus typhi* Schroeter 1886)	18	**13**:31–33 (1963) see also **8**:155–156 (1958)

LIST 4. *Rejected names of genera and subgenera of prokaryotes (nomina generum et subgenerum rejicienda)*

Rejected generic or subgeneric names (*nomina generum et subgenerum rejicienda*)	Names of type species of rejected genera or subgenera	Notes	Opinion no.	Citations
Aerobacter Beijerinck 1900	*Aerobacter aerogenes* (Kruse) Beijerinck 1900	*Nomen ambiguum*	46	**21**:110 (1971)
Astasia Meyer 1897	*Astasia asterospora* Meyer 1897	Later homonym of *Astasia* Ehrenberg 1830 (*Protozoa*)	14	**4**:156–158 (1954)
Astasia Pribram 1929	None named. No species listed.	Later homonym of protozoan generic name *Astasia* Ehrenberg 1830	14	**4**:156–158 (1954)
Babesia Trevisan 1889	*Babesia xanthopyrethica* (sic) Trevisan 1880 (*Streptococcus xanthopyreticus* Trevisan 1887)	The later homonym *Babesia* Starcovici 1893 is in common use as the name of a protozoan genus. *Nomen confusum*.	13	**4**:151–156 (1954)
Bacteriopsis Trevisan 1885 (subgenus)	*Bacteriopsis rasmussenii* Trevisan 1885 (*Leptothrix* I Rasmussen 1883)	*Nomen confusum*	13	**4:**151–156 (1954)
Bacterium Ehrenberg 1828	*Bacterium triloculare* Ehrenberg 1828	*Nomen dubium*	4 (revised)	**4**:142 (1954) see also **1**:145–146 (1951) and

LIST 4. *Rejected names of genera and subgenera of prokaryotes (nomina generum et subgenerum rejicienda)*

Rejected generic or subgeneric names (*nomina generum et subgenerum rejicienda*)	Names of type species of rejected genera or subgenera	Notes	Opinion no.	Citations
				3:141–154 (1953)
Billetia Trevisan 1889	*Billetia laminariae* (Billet) Trevisan 1889 (*Bacterium laminariae* Billet 1888)	*Nomen dubium*	13	**4**:151–156 (1954)
Castellanella Pacheco and Rodrigues 1930	*Castellanella alcalescens* (Andrewes) Pacheco and Rodrigues 1930 (*Bacillus alkalescens* Andrewes 1918)	Illegitimate later homonym of *Castellanella* Chalmers 1918 (*Protozoa*)	14	**4**:156–158 (1954)
Cenomesia Trevisan 1889	*Cenomesia albida* Trevisan 1889	*Nomen dubium*	13	**4**:151–156 (1954)
Chlorobacterium Guillebeau 1890	*Chlorobacterium lactis* Guillebeau 1890		6	**4**:143 (1954)
Chromobacterium Bergonzini 1879	None designated		16	**8**:151–152 (1958)
Cloaca Castellani and Chalmers 1919	*Cloaca cloacae* (Jordan) Castellani and Chalmers 1919		28	**13**:38 (1963)
Coccomonas Orla-Jensen 1921	None. No species included.	Later illegitimate homonym of *Coccomonas* Stein	14	**4**:156–158 (1954)

LIST 4. *Rejected names of genera and subgenera of prokaryotes (nomina generum et subgenerum rejicienda)*

Rejected generic or subgeneric names (*nomina generum et subgenerum rejicienda*)	Names of type species of rejected genera or subgenera	Notes	Opinion no.	Citations
		1878 (*Protozoa*)		
Cornilia Trevisan 1889	*Cornilia alvei* (Cheshire and Cheyne) Trevisan 1889 (*Bacillus alvei* Cheshire and Cheyne 1885)		13	**4**:151–156 (1954)
Dicoccia Trevisan 1889	*Dicoccia glossophila* Trevisan 1889		13	**4**:151–156 (1954)
Eucornilia Trevisan 1889 (subgenus)	*Cornilia* (*Eucornilia*) *alvei* (Cheshire and Cheyne) Trevisan 1889 (*Bacillus alvei* Cheshire and Cheyne 1885)		13	**4**:151–156 (1954)
Eumantegazzaea Trevisan 1889 (subgenus)	*Mantegazzaea* (*Eumantegazzaea*) *cienkowskii* Trevisan 1889	*Nomen dubium*	13	**4**:151–156 (1954)
Eupacinia Trevisan 1889 (subgenus)	*Pacinia* (*Eupacinia*) *putrifica* Trevisan 1889 (*Bacillus putrificus coli* Flügge 1886)	*Nomen confusum*	13	**4**:151–156 (1954)
Euspirillum Trevisan 1889 (subgenus)	*Spirillum* (*Euspirillum*) *undula* (Mueller) Ehrenberg 1830 (*Vibrio undula* Mueller 1773)		13	**4**:151–156 (1954)
Gaffkya Trevisan 1885	*Gaffkya tetragena* (Gaffky) Trevisan 1885		39	**21**:104–105 (1971)
Herellea De Bord 1942	*Herellea vaginicola* De Bord 1942		40	**21**:105–106 (1971)
Leptotrichiella Trevisan 1889 (subgenus)	*Leptotrichia* (*Leptotrichiella*) *amphibola* Trevisan 1889	*Nomen dubium*	13	**4**:151–156 (1954)
Listerella Pirie 1927	*Listerella hepatolytica* Pirie 1927 (*Bacterium monocytogenes* Murray *et al.* 1926)	Illegitimate later homonym of *Listerella* Jahn 1906 (*Myxomycetes*)	14	**4**:156–158 (1954)
Mantegazzaea Trevisan 1879	*Mantegazzaea cienkowskii* Trevisan 1879	*Nomen dubium*	13	**4**:151–156 (1954)
~~*Methanothrix* Huser et al. 1983~~	~~*Methanothrix soehngenii* Huser *et al.* 1983~~[‡]	~~*nomen confusum* (type species)~~	~~75~~	~~**58**:1753–1754 (2008)~~
Mima De Bord 1939, 1942	*Mima polymorpha* De Bord 1939, 1942		40	**21**:105–106 (1971)
Nitromonas Winogradsky 1890	None designated		23	**8**:169–170 (1958)
Nitromonas Orla-Jensen 1909	None designated		23	**8**:169–170 (1958)

LIST 4. *Rejected names of genera and subgenera of prokaryotes (nomina generum et subgenerum rejicienda)*

[1] This opinion was reconsidered in 2014 by Opinion 75 Supplementary (**64**:3597–3598) and *Methanothrix* Huser *et al.* 1983 is not to be considered as a rejected name.

LIST 4. *Rejected names of genera and subgenera of prokaryotes (nomina generum et subgenerum rejicienda)*

Rejected generic or subgeneric names (*nomina generum et subgenerum rejicienda*)	Names of type species of rejected genera or subgenera	Notes	Opinion no.	Citations
Octopsis Trevisan 1885	*Octopsis cholerae-gallinarium* Trevisan 1885 (*Micrococcus cholerae-gallinarum* Zopf 1885)		13	**4**:151–156 (1954)
Palmula Prévot 1938	*Palmula spermoides* (Ninni) Prévot 1938	Illegitimate later homonym of *Palmula* Lea 1833 (*Protozoa*)	14	**4**:156–158 (1954)
Pelczaria Poston 1994	*Pelczaria aurantia* Poston 1994		78	**55**:515 (2005)
Perroncitoa Trevisan 1889	*Perroncitoa scarlatinosa* (Trevisan) Trevisan 1889 (*Micrococcus scarlatinosus* Trevisan 1879)	*Nomen dubium*	13	**4**:151–156 (1954)
Pfeifferella Buchanan 1918	*Pfeifferella mallei* (Zopf) Buchanan 1918 (*Bacillus mallei* Zopf 1885)	Illegitimate later homonym of *Pfeifferella* Labbé 1899 (*Protozoa*)	14	**4**:156–158 (1954)
Phytomonas Bergey *et al.* 1923	*Phytomonas campestris* (Pammel) Bergey *et al.* 1923 (*Bacillus campestris* Pammel 1895)	Illegitimate later homonym of *Phytomonas* Donovan 1909 (*Protozoa*)	14	**4**:156–158 (1954)
Pleurospora Trevisan 1889	*Cornilia* (*Pleurospora*)	*Nomen dubium*	13	**4**:151–156

LIST 4. *Rejected names of genera and subgenera of prokaryotes (nomina generum et subgenerum rejicienda)*

Rejected generic or subgeneric names (*nomina generum et subgenerum rejicienda*)	Names of type species of rejected genera or subgenera	Notes	Opinion no.	Citations
(subgenus)	*tremula* (Koch) Trevisan 1889 (*Bacillus tremulus* Koch 1877)			(1954)
Polymonas Lieske 1928	*Polymonas tumefaciens* (Smith and Townsend) Lieske 1928 (*Bacterium tumefaciens* Smith and Townsend 1907)		33	**20**:10 (1970)
Pseudospira Trevisan 1889 (subgenus)	*Pacinia* (*Pseudospira*) *cholerae-asiaticae* Trevisan 1889		13	**4**:151–156 (1954)
Pseudospirillum Trevisan 1889 (subgenus)	*Spirillum* (*Pseudospirillum*) *amphibolum* Trevisan 1889	*Nomen dubium*	13	**4**:151–156 (1954)
Rhizomonas Orla-Jensen 1909	None. No species included	Later homonym of *Rhizomonas* Kent 1880 (*Protozoa*)	14	**4**:156–158 (1954)
Rhizomonas (Van Bruggen *et al.* 1990)		Reaffirmed by Judicial Commission 1999		**50**:2242 (2000)
Rhodosphaera Buchanan 1918	*Rhodosphaera capsulata* (Molisch) Buchanan 1918 (*Rhodococcus capsulatus* Molisch 1907)	Later homonym of *Rhodosphaera* Haeckel 188l (*Protozoa*)	14	**4**:156–158 (1954)

LIST 5. *Rejected specific and subspecific epithets in names of species and subspecies of prokaryotes (epitheta specifica et subspecifica rejicienda)*

Rejected specific and subspecific epithets (*epitheta specifica et subspecifica rejicienda*)	Name of species in which specific or subspecific epithet is rejected	Opinion no.	Citations
anaerobius	*Peptococcus anaerobius* (Hamm) Douglas 1957	56	**32**:468 (1982)
aquae	*Mycobacterium aquae* Jenkins *et al.* 1972	55	**32**:467 (1982)
aurantia	*Pelczaria aurantia* Poston 1994	78	**55**:515 (2005)
botulinum	*Clostridium botulinum* (van Ermengem 1896) Bergey, Harrison, Breed, Hammer and Huntoon 1923	69	**49**:339 (1999)
caucasicus	*Lactobacillus caucasicus* Beijerinck 1901	38	**21**:104 (1971)
citrovorum	*Leuconostoc citrovorum* (Hammer) Hucker and Pederson 1931	45	**21**:109–110 (1971)
denitrificans	*Pseudomonas denitrificans* (Christensen) Bergey *et al.* 1923	54	**32**:466 (1982)
diversus	*Citrobacter diversus* Werkman and Gillen 1932	67	**43**:392 (1993)
gallicida	*Pasteurella gallicida* (Burrill 1883) Buchanan 1925	58	**35**:538 (1985)
liquefaciens	*Aerobacter liquefaciens* Beijerinck 1901	48	**23**:473–474 (1973)
marianum	*Mycobacterium marianum* Penso 1953	53	**28**:334 (1978)
methanica	*Methanosarcina methanica* (Approved Lists 1980)	63	**36**:492 (1986)
pestis	*Yersinia pseudotuberculosis* subsp. *pestis* (van Loghem) Bercovier *et al.* 1981	60	**35**:540 (1985)
polymorpha	*Mima polymorpha* De Bord 1939, 1942	40	**21**:105–106 (1971)
~~*soehngenii*~~	~~*Methanothrix soehngenii* Huser *et al.* 1983~~[2]	~~75~~	~~**58**:1753–1754 (2008)~~
sporogenes	*Clostridium sporogenes* (Mechnikoff 1908) Bergey, Harrison, Breed, Hammer and Huntoon 1923	69	**49**:339 (1999)
thermophila	*Methanothrix thermophila* Kamagata *et al.* 1992	75 (suppl.)	**64**:3597–3598 (2014)
vaginicola	*Herellea vaginicola* De Bord 1942	40	**21**:105–106 (1971)
variabilis	*Halomonas variabilis* (Fendrich 1989)	93	**64**:3588–3589 (2014)

[2] This opinion was reconsidered in 2014 by Opinion 75 Supplementary (**64**:3597–3598) and *Methanothrix soehngenii* Huser *et al.* 1983 is not to be considered as a rejected name.

LIST 6. *Rejected names of classes of prokaryotes (nomina classis rejicienda)*

Rejected class names (*nomina classis rejicienda*)	Opinion no.	Citations
Acidobacteria Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Alphabacteria Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Arabobacteria Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Archaeoglobea Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Arthrobacteria Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Chlamydiae Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Chlorobacteria Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Chlorobea Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Chromatibacteria Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Chroobacteria Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Crenarchaeota Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Deltabacteria Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Epsilobacteria Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Ferrobacteria Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Flavobacteria Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Gloeobacteria Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Hadobacteria Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Halomebacteria Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Hormogoneae Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Methanothermea Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Picrophilea Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Planctomycea Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Protoarchaea Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Spirochaetes Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Streptomycetes Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Teichobacteria Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Protoarchaea Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Crenarchaeota Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Togobacteria Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)

LIST 7. *Rejected names of orders of prokaryotes (nomina ordo rejicienda)*

Rejected class names (*nomina ordo rejicienda*)	Opinion no.	Citations
Acidobacteriales Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Actinoplanales Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Cenarchaeales Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Chroococcales Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Geovibriales Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Gloeobacterales Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Nostocales Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Oscillatoriales Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Picrophilales Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Pleurocapsales Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Stigonematales (*ex* Geitler 1925) Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)
Streptomycetales Cavalier-Smith 2002	79 (suppl.)	**64**:3599-3602 (2014)

Appendix 5. Opinions Relating to the Nomenclature of Prokaryotes

LIST OF OPINIONS

Opinions issued by the International Committee on Bacteriological Nomenclature at the Second International Congress for Microbiology, London, 1936

Opinion	Title	Reference and notes	Result
A	Conservation of the generic name *Bacillus* Cohn 1872, designation of the type species, and of the type strain of the species	Journal of Bacteriology **33**:445–447 (1937), and International Code of Nomenclature of Bacteria and Viruses (1958), p. 148	(a) It was agreed that *Bacillus* Cohn 1872 should be designated as a *genus conservandum*. (b) It was agreed that the type species of *Bacillus* should be designated as *Bacillus subtilis* Cohn 1872 *emendavit* Prazmowski 1880. (c) It was agreed that the type (or standard) strain should be the Marburg strain. (d) It was agreed that cultures of the type (or standard) strain of *Bacillus subtilis* together with complete description should be maintained at each of the recognized Type Culture Collections. (e) It was agreed that the genus *Bacillus* should be so defined as to exclude bacterial species which do not produce endospores. (f) It was agreed that the term *Bacillus* should be used as a generic name and that it should be differentiated from the terms "bacillus," "bacille," and "Bazillus" used as morphological designations.
B	Generic homonyms in the group *Protista*	Journal of Bacteriology **33**:445–447 (1937), and International Code of Nomenclature of Bacteria and Viruses (1958), p. 148	(a) It was agreed that generic homonyms are not permitted in the group *Protista*. (b) It was agreed that it is advisable to avoid homonyms amongst *Protista* on the one hand, and a plant or animal on the other.
C	Capitalization of specific epithets derived from names of persons	Journal of Bacteriology **33**:445–447 (1937), and International Code of Nomenclature of Bacteria and Viruses (1958), p. 148	It was agreed that while specific substantive names derived from names of persons may be written with a capital initial letter, all other specific names are to be written with a small initial letter. *Note*. This Opinion is revoked by Rule 59 of this Code, and Recommendation 27h of the 1958 and 1966 editions of the *International Code of Nomenclature of Bacteria (and Viruses)* stated: "A specific epithet, even one derived from the name of a person, should not be written with an initial capital letter."

LIST OF OPINIONS

Opinions issued by the International Committee on Bacteriological Nomenclature at the Second International Congress for Microbiology, London, 1936

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
1	The correct spelling of the specific epithet in the species name *Bacillus megaterium* de Bary 1884	**1** (Part 1):35–36 (1951)	The spelling *megaterium* of the specific epithet in *Bacillus megaterium* de Bary is to be preferred to the spelling *megatherium*.
2	The combining forms (stems) of compound bacterial generic names ending in *-bacterium*, *-bacter*, or *-bactrum* (*-bactron*)	**1** (Part 1):37–38 (1951)	The combining form or stem of the last component of names ending in *-bacterium* is *-bacteri*, of those ending in *-bactrum* or *bactron* is *-bactr*, and of those ending in *-bacter* is *-bacter*. Family names derived from such generic names have, respectively, the endings *-bacteriaceae*, *-bactraceae*, and *-bacteraceae*.
3	Gender of bacterial names ending in *-bacter*	**1** (Part 2):36–37 (1951); **1**:84–85 in re-issue of volume (1951)	The names of bacterial genera which end in *-bacter* should be regarded as having the masculine gender.
4 (revised)	Rejection of generic name *Bacterium* Ehrenberg	**4**:142 (1954), see also **1**:145–146 (1951) and **3**:141–154 Minute 9	1. The bacterial generic name *Bacterium* Ehrenberg 1828 is to be recognized as a *nomen generum rejiciendum* (rejected generic name).

[1] The references are to volumes and pages in the *International Bulletin of Bacteriological Nomenclature and Taxonomy*, to vol. 15 (1965), from vol. 16 to vol. 49 (1999) the *International Journal of Systematic Bacteriology*, and thereafter the *International Journal of Systematic and Evolutionary Microbiology*, and date.

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
		(1953)	2. The bacterial family name *Bacteriaceae* is to be recognized as a *nomen familiae rejiciendum* (rejected family name).
5	Conservation of the generic name *Pseudomonas* Migula 1894 and designation of *Pseudomonas aeruginosa* (Schroeter) Migula 1900 as type species	**2**:121–122 (1952)	1. The generic name *Pseudomonas* Migula 1894 is to be conserved and placed in the list of *nomina generum conservanda*. 2. The generic name *Pseudomonas* Migula 1894 is to be associated with the species designated and described by Migula 1895. 3. The type species of the genus *Pseudomonas* Migula 1894 is *Pseudomonas aeruginosa* (Schroeter) Migula 1900 (*Bacterium aeruginosum* Schroeter 1872, *Bacillus pyocyaneus* Gessard 1882, *Pseudomonas pyocyanea* Migula 1895).
6	Conservation of the generic name *Chlorobacterium* Lauterborn 1916 against *Chlorobacterium* Guillebeau 1890	**4**:143 (1954)	The bacterial generic name *Chlorobacterium* Lauterborn 1916 is conserved against the earlier homonym *Chlorobacterium* Guillebeau 1890. The generic name *Chlorobacterium* Guillebeau 1890 is placed in the list of *nomina generum rejicienda.*
7	Nomenclature of the organism associated with granuloma	**4**:144 (1954), synonymy of	The bacterial species names *Encapsulatus inguinalis* Bergey *et al.* 1923, *Klebsiella granulomatis* Bergey *et*

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	venereum	*Calymmatobacterium granulomatis* Aragão and Vianna 1913	*al.* 1925, *Donovania granulomatis* Anderson, de Monbreun, and Goodpasture 1944 are later synonyms of *Calymmatobacterium granulomatis* Aragão and Vianna 1913.
8	The correct species name of the streptococcus of bovine mastitis	**4**:145–146 (1954), conservation of the specific epithet *agalactiae* in the combination *Streptococcus agalactiae* Lehmann and Neumann 1896	The species name *Streptococcus agalactiae* Lehmann and Neumann 1896 is conserved against all synonyms having priority.
9	Conservation of the bacterial generic name *Gallionella*	**4**:146–147 (1954), conservation of *Gallionella* Ehrenberg 1838, with type species *Gallionella ferruginea* Ehrenberg	*Gallionella* Ehrenberg is placed in the list of conserved names of bacterial genera (*nomina generum conservanda*) with the type species *Gallionella ferruginea* Ehrenberg.
10	Invalidity of the bacterial generic name *Müllerina* de Petschenko 1910 and of the	**4**:147–148 (1954), and status of *Drepanospira* de	The generic name *Müllerina* de Petschenko 1910 and the species name *Müllerina paramecii* de Petschenko 1910 were not accepted by the author, hence were not

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	species name *Müllerina paramecii*	Petschenko 1911 and *Drepanospira muelleri* de Petschenko 1911	validly published and are without standing in nomenclature. The later names *Drepanospira* de Petschenko 1911 and *Drepanospira muelleri* de Petschenko 1911 were validly published and are not later synonyms.
11	Nomenclature of species in the bacterial genus *Shigella*	**4**:148–150 (1954), validity of publication of the names *Shigella dysenteriae* (Shiga) Castellani and Chalmers 1919, and conservation of the specific epithets *flexneri, boydii,* and *sonnei* in, respectively, the species names *Shigella flexneri* Castellani and Chalmers 1919, *Shigella boydii* Ewing 1949, and *Shigella*	1. *Shigella dysenteriae* (Shiga) Castellani and Chalmers 1919 was validly published and is legitimate as the name of the dysentery bacterium described by Shiga (1898). 2. The specific epithet *flexneri* in the species name *Shigella flexneri* Castellani and Chalmers 1919 is designated as a conserved specific epithet (*epitheton specificum conservandum*) for the species first described as *Bacillus dysenteriae* Flexner 1900. 3. The species name *Shigella boydii* Ewing 1949 was validly published and is legitimate. The specific epithet *boydii* in the species name *Shigella boydii* is to be conserved (*epitheton specificum conservandum*). 4. The species name *Shigella sonnei* (Levine) Weldin 1927 was validly published and is legitimate. The

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
		sonnei (Levine) Weldin 1927, and emendation **10**:85 (1960); **13**:31 (1963)	specific epithet *sonnei* in the species name *Shigella sonnei* is to be conserved (*epitheton specificum conservandum*). 5. A type or standard culture is to be designated by the *Enterobacteriaceae* Subcommittee on Bacteriological Nomenclature for each of the four species. Such cultures as far as possible shall be maintained in each of the national Type Culture Collections and in the International Shigella Center, Chamblee, Georgia, U.S.A. (*now in the Centers for Disease Control, Atlanta, Georgia*). 6. A culture belonging to the species *Shigella dysenteriae, Shigella flexneri, Shigella boydii,* or *Shigella sonnei* may be completely identified by appending the appropriate serotype number (arabic) to the name.
12	Conservation of *Listeria* Pirie 1940 as a generic name in bacteriology	**4**:150–151 (1954), type species *Listeria monocytogenes* (Murray, Webb, and Swann) Pirie 1940	*Listeria* Pirie 1940 (type species *Listeria monocytogenes* (Murray, Webb, and Swann) Pirie 1940) shall be placed in the list of conserved names of bacterial genera (*nomina generum conservanda*).
13	Conservation and rejection of names of genera of bacteria proposed by Trevisan 1842–1890	**4**:151–156 (1954), conservation of generic names *Beggiatoa, Klebsiella, Kurthia, Leptotrichia, Neisseria, Nocardia, Pasteurella*; rejection of generic names *Babesia, Bacteriopsis, Billetia, Cenomesia, Cornilia, Dicoccia, Eucornilia, Eumantegazzaea, Eupacinia, Euspirillum, Leptotrichiella, Mantegazzaea, Octopsis, Perroncitoa, Pleurospora, Pseudospira, Pseudospirillum*; illegitimate generic names *Bollingera, Rasmussenia,*	1. Generic names proposed by Trevisan placed in the list of conserved generic names (*nomina generum conservanda*). Names of genera and subgenera — Type species *Beggiatoa* Trevisan 1842 (p. 56) — *Beggiatoa alba* (Vaucher) Trevisan 1845 (*Oscillatoria alba* Vaucher 1803) *Klebsiella* Trevisan 1885 (p. 105) — *Klebsiella pneumoniae* (Schroeter) Trevisan 1887 (*Bacterium pneumoniae crouposae* Zopf 1885) *Kurthia* Trevisan 1885 (p. 92) — *Kurthia zopfii* (Kurth) Trevisan 1885 (*Bacterium zopfii* Kurth 1883) *Leptotrichia* Trevisan 1879 (p. 138) — *Leptotrichia buccalis* (Robin) Trevisan 1879 (*Leptothrix buccalis* Robin 1853) *Neisseria* Trevisan 1885 (p. 105) — *Neisseria gonorrhoeae* Trevisan 1885

Opinion	Title	Reference and notes[1]	Result	
		Schuetzia, Winogradskya; of indeterminate status, *Gaffkya, Pacinia*	*Nocardia* Trevisan 1889 (p. 9)	*Nocardia farcinica* Trevisan 1889 (but see Opinion 58)
			This generic name was omitted in error in the published Opinion and authority is **3**:141–154 (1953, Minute 7, File 56) and **3**:87–100 (1953).	
			Pasteurella Trevisan 1887 (p. 94)	*Pasteurella coleraegallinarum* Trevisan 1887 (but see Opinion 58)

2. Generic names proposed by Trevisan placed in the list of rejected generic names (*nomina generum rejicienda*).

Names of genera and subgenera	Type species
Babesia Trevisan 1889 (p. 29)	*Babesia xanthopyrethica* (sic) Trevisan 1889 (*Streptococcus xanthopyreticus* Trevisan 1887)
Bacteriopsis Trevisan	*Bacteriopsis rasmussenii*

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result	
			1885 (p. 103)	Trevisan 1885 (*Leptothrix* I Rasmussen 1883)
			Billetia Trevisan 1889 (p. 11)	*Billetia laminariae* (Billet) Trevisan 1889 (*Bacterium laminariae* Billet 1888)
			Cenomesia Trevisan 1889 (p. 1039)	*Cenomesia albida* Trevisan 1889
			Cornilia Trevisan 1889 (p. 21)	*Cornilia alvei* (Flügge) Trevisan 1889 (*Bacillus alvei* Flügge 1886)
			Dicoccia Trevisan 1889 (p. 26)	*Dicoccia glossophila* Trevisan 1889
			Eucornilia Trevisan 1889 (p. 21) (Subgenus)	*Cornilia (Eucornilia) alvei* Trevisan 1889 (*Bacillus alvei* Cheshire and Cheyne 1885)
			Eumantegazzaea Trevisan 1889 (p. 942) (Subgenus)	*Mantegazzaea (Eumantegazzaea)* I *cienkowskii* Trevisan 1879
			Eupacinia Trevisan	*Pacinia (Eupacinia)*

Opinion	Title	Reference and notes[1]	Result	
			1889 (p. 23) (Subgenus)	*putrifica* Trevisan 1889 (*Bacillus putrificus coli* Flügge 1886)
			Euspirillum Trevisan 1889 (p. 24) (Subgenus)	*Spirillum (Euspirillum) undula* (Mueller) Ehrenberg 1830 (*Vibrio undula* Mueller 1773)
			Leptotrichiella Trevisan 1889 (p. 935) (Subgenus)	*Leptotrichia (Leptotrichiella) amphibola* Trevisan 1889
			Mantegazzaea Trevisan 1879 (p. 137)	*Mantagazzaea cienkowskii* Trevisan 1879
			Octopsis Trevisan 1885 (p. 102)	*Octopsis cholerae-gallinarum* Trevisan 1885 (*Micrococcus cholerae-gallinarum* Zopf 1885)
			Perroncitoa Trevisan 1889 (p. 29)	*Perroncitoa scarlatinosa* (Trevisan) Trevisan 1889 (*Micrococcus scarlatinosus* Trevisan

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result	
				1879)
			Pleurospora Trevisan 1889 (p. 22) (Subgenus)	*Cornilia (Pleurospora) tremula* (Koch) Trevisan 1889 (*Bacillus tremulus* Koch 1877)
			Pseudospira Trevisan 1889 (p. 23) (Subgenus)	*Pacinia (Pseudospira) cholerae-asiaticae* Trevisan 1885 (*Vibrio cholerae* Pacini 1854)
			Pseudospirillum Trevisan 1889 (p. 25) (Subgenus)	*Spirillum (Pseudospirillum) amphibolum* Trevisan 1889

3. Trevisan's generic names which, as later homonyms or synonyms, are regarded as illegitimate.

Names of genera and subgenera	Type species
Bollingera Trevisan 1889 (p. 26)	*Bollingera equi* (Rivolta) Trevisan (1889) (*Zoogloea*

Opinion	Title	Reference and notes[1]	Result
			pulmonis equi Bollinger 1870)
			Rasmussenia Trevisan 1889 (p. 930) — *Rasmussenia buccalis* (Robin) Trevisan 1889 (*Leptothrix buccalis* Robin 1853)
			Schuetzia Trevisan 1889 (p. 29) — *Schuetzia poelsii* Trevisan 1889 (*Streptococcus equi* Sand and Jensen 1888)
			Winogradskya Trevisan 1889 (p. 12) — *Winogradskya ramigera* (Itzigsohn) Trevisan 1889 (*Zoogloea ramigera* Itzigsohn 1867)

4. Trevisan's generic names whose status is indeterminate.

Names of genera and subgenera	Type species
Gaffkya Trevisan 1885 (p. 105); but see Opinion 39	*Gaffkya tetragena* (Gaffky) Trevisan 1885 (*Micrococcus tetragenus* Gaffky 1883)
Pacinia Trevisan 1885 (p. 83); but see Opinion 31	*Pacinia cholerae-asiaticae* Trevisan 1885

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
14	Names of bacterial genera to be rejected as later synonyms of names of genera of protozoa	**4**:156–158 (1954), rejection of *Astasia* Meyer 1897, *Astasia* Pribram 1929, *Castellanella* Pacheco and Rodrigues 1930, *Charon* Holmes 1948, *Coccomonas* Orla-Jensen 1921, *Listerella* Pirie, 1927, *Palmula* Prévot 1938, *Pfeifferella* Buchanan 1918, *Phytomonas* Bergey *et al.* 1923, *Rhizomonas* Orla-Jensen 1909, *Rhodosphaera*	The following names proposed for bacterial genera are found to be later homonyms of names applied to genera of protozoa. Rule 24 of the *International Code of Nomenclature of Bacteria and Viruses* (new Rule 51b) states that such later homonyms are illegitimate in bacteriology. These names are to be placed in the list of names of bacterial genera to be rejected (*nomina generum bacteriorum rejicienda*).

Rejected names of bacterial genera	Names of protozoan genera having priority
Astasia Meyer 1897	*Astasia* Ehrenberg 1830
Astasia Pribram 1929	
Castellanella Pacheco and Rodrigues 1930	*Castellanella* Chalmers 1918
Charon Holmes 1948 (a genus of viruses)	*Charon* Karsch 1879
Coccomonas Orla-	*Coccomonas* Stein 1878

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
		Buchanan 1918	Jensen 1921 *Listerella* Pirie 1927 *Palmula* Prévot *Pfeifferella* Buchanan 1918 *Phytomonas* Bergey *et al.* 1923 *Rhizomonas* Orla-Jensen 1909 *Rhodosphaera* Buchanan 1918 *Listerella* Jahn 1906 *Palmula* Lea 1833 *Pfeifferella* Labbé 1899 *Phytomonas* Donovan 1909 *Rhizomonas* Kent 1880 *Rhodosphaera* Haeckel 1881
15	Conservation of the family name *Enterobacteriaceae,* of the name of the type genus, and designation of the type species	**8**:73–74 (1958), with type genus *Escherichia* Castellani and Chalmers 1919 as conserved generic name and type species *Escherichia coli* (Migula) Castellani and Chalmers 1919	1. The family name *Enterobacteriaceae* Rahn 1937 (p. 280) is placed in the list of conserved family names (*nomina conservanda familiarum*). 2. The genus *Escherichia* Castellani and Chalmers 1919 (p. 941) is designated as the type genus of the family *Enterobacteriaceae* Rahn 1937. 3. The generic name *Escherichia* Castellani and Chalmers 1919 (p. 941) is placed in the list of conserved generic names (*nomina generum conservanda*). 4. The type species of the genus *Escherichia*

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
			Castellani and Chalmers 1919 (p. 941 is *Escherichia coli* (Migula) Castellani and Chalmers 1919 p. 941), basonym *Bacillus coli* Migula 1895 (p. 27); hyponym *Bacterium coli commune* Escherich 1885 (p. 518).
16	Conservation of the generic name *Chromobacterium* Bergonzini 1880 and designation of the type species and the neotype culture of the type species	**8**:151–152 (1958), type species *Chromobacterium violaceum* Bergonzini 1880	1. The generic name *Chromobacterium* Bergonzini 1879 is rejected and placed in the list of *nomina generum rejicienda.* 2. The generic name *Chromobacterium* Bergonzini 1880 is conserved and placed in the list of *nomina generum conservanda.* 3. The type species of the genus *Chromobacterium* Bergonzini 1880 is *Chromobacterium violaceum* Bergonzini 1880. 4. A neotype strain of *Chromobacterium violaceum* Bergonzini 1880 is designated and has been deposited in the American Type Culture Collection, Washington, D.C. (ATCC 12472) and in the National Collection of Type Cultures, London (NCTC 9757).
17	Conservation of the generic name *Staphylococcus*	**8**:153–154 (1958)	1. The generic name *Staphylococcus* Rosenbach 1884 is conserved and placed in the list of *nomina*

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	Rosenbach, designation of *Staphylococcus aureus* as the nomenclatural type of the genus *Staphylococcus* Rosenbach, and designation of a neotype culture of *Staphylococcus aureus* Rosenbach		*generum conservanda.* 2. *Staphylococcus aureus* Rosenbach 1884 is recognized as the nomenclatural type species of the genus *Staphylococcus* Rosenbach 1884. 3. The strain labeled NCTC 8532 in the National Collection of Type Cultures, London, is designated as the neotype strain of the species *Staphylococcus aureus* Rosenbach 1884.
18	Conservation of *typhi* in the binary combination *Salmonella typhi*	**13**:31–33 (1963), see also **8**:155–156 (1958)	The specific epithet *typhi* in the name of the species *Salmonella typhi* (Schroeter) Warren and Scott is conserved over the specific epithet *typhosa* in the name of the species *Salmonella typhosa* (Zopf) White 1930, with the recognition *of Bacillus typhi* Schroeter 1886 as the basonym.
19	Conservation of the generic name *Rickettsia* da Rocha-Lima and of the species name *Rickettsia prowazekii* da Rocha-Lima	**8**:158–159 (1958)	The generic name *Rickettsia* da Rocha-Lima is conserved against *Stricheria* Stempell, and the specific epithet *prowazekii* in the species name *Rickettsia prowazekii* da Rocha-Lima is conserved against the specific epithet *jurgensi* first used in the species name *Stricheria jurgensi* Stempell.
20	Status of new generic names	**8**:160–162 (1958)	1. *Name of a hypothetical genus.* A hypothetical

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	of bacteria published without names of included species		genus is one in which no species is described, named, or cited; the existence of the genus is predicated upon the future discovery and description of species as yet unknown. A name applied to a hypothetical genus is not validly published and is to be placed in the list of *nomina rejicienda.* 2. *Name of a "temporary" genus.* A generic name proposed for a genus whose sole function is stated to be to serve as the temporary generic haven for insufficiently described species, which species may be allocated later to an appropriate genus or genera, is to be regarded as not validly published. Such a name may be placed in the list of *nomina rejicienda.* 3. *Name of a new genus with a described species which is neither named nor identified with a previously named species.* A new generic name published in a combined description of a genus and species, without the species being named, without citation of a previously and effectively published description of the species, and without subsequent acceptance of the generic name and

Opinion	Title	Reference and notes[1]	Result
			naming of the species by a later author, should be regarded as not validly published. Such a generic name may be placed in the list of *nomina rejicienda.* However, if a later author has recognized the generic name and has used it with a specific epithet in naming the species described by the first author, particularly if there has been later general acceptance of the name, there may be validation of the generic name as proposed by its author, with the name of the species ascribed to the later author who gave it. Proposals for such validations of names should be made to the Judicial Commission for appropriate action. 4. *Name of a new genus proposed to include one or more previously described and named species, but without simultaneous publication of the new binary combination of generic name and specific epithet*. A published generic name applied to a new genus in which the generic name is not used in a binary combination in naming any species, but in which there is citation of a previously and effectively published description of a species

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
			under another name, is to be regarded as validly published and the consequent *combinationes novae* ascribed likewise to the author of the generic name.
21	Conservation of the generic name *Selemonas* von Prowazek	**8**:163–165 (1958), with type species *Selenomonas sputigena* (Flügge) Boskamp 1922	1. The generic name *Selenomonas* von Prowazek 1913 was validly published with an accompanying description of the genus. 2. The species *Spirillum sputigenum* Flügge 1886 was characterized and adequate references to description given. The species was assigned to the genus *Selenomonas*. 3. *Selenomonas sputigena* (Flügge) Boskamp 1922 (basonym *Spirillum sputigenum* Flügge) is designated as the type species of *Selenomonas* von Prowazek. 4. The generic name *Selenomonas* von Prowazek 1913 is placed in the list of *nomina generum conservanda*.
22	Status of the generic name *Asterococcus* and conservation of the generic name *Mycoplasma*	**8**:166–168 (1958), illegitimacy of *Asterococcus* Borrel *et al.* 1910, conservation	1. The generic name *Asterococcus* Borrel, Dujardin-Beaumetz, Jeantet, and Jouan 1910 is a later homonym of *Asterococcus* Scherffel 1908 and hence illegitimate.

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
		of *Mycoplasma* Nowak 1929 with type species *Mycoplasma mycoides* (Borrel *et al.*) Freundt 1955	2. The generic name *Mycoplasma* Nowak 1929 is placed in the list of bacterial *nomina generum conservanda* as the first legitimate generic name proposed to replace *Asterococcus* Borrel *et al.* The type species is *Mycoplasma mycoides* (Borrel *et al.*) Freundt 1955 (basonym *Asterococcus mycoides* Borrel *et al.*).
23	Rejection of the generic names *Nitromonas* Winogradsky 1890 and *Nitromonas* Orla-Jensen 1909, conservation of the generic names *Nitrosomonas* Winogradsky 1892, *Nitrosococcus* Winogradsky 1892, and *Nitrobacter* Winogradsky 1892, and the designation of the type species of these genera	**8**:169–170 (1958), type species are respectively *Nitrosomonas europaea* Winogradsky 1892, *Nitrosococcus nitrosus* (Migula) Buchanan 1925, and *Nitrobacter winogradskyi* Winslow *et al.* 1917	1. The generic name *Nitromonas* Winogradsky 1890 is placed in the list of *nomina generum rejicienda.* 2. The generic name *Nitromonas* Orla-Jensen 1909 is a later homonym of *Nitromonas* Winogradsky 1890 and a later synonym of *Nitrobacter* Winogradsky (1892). It is placed in the list of *nomina generum rejicienda.* 3. The generic name *Nitrosomonas* Winogradsky 1892 is placed in the list of *nomina generum conservanda* with *Nitrosomonas europaea* Winogradsky 1892 as the nomenclatural type species. 4. The generic name *Nitrosococcus* Winogradsky 1892 is placed in the list of *nomina generum conservanda,* with the species described by

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
			Winogradsky and later named *Nitrosococcus nitrosus* (Migula) Buchanan 1925 as the nomenclatural type species. 5. The generic name *Nitrobacter* Winogradsky 1892 is placed in the list of *nomina generum conservanda,* with the species described by Winogradsky and later named *Nitrobacter winogradskyi* Winslow *et al.* 1917 as the nomenclatural type species.
24	Rejection of the generic name *Arthrobacter* Fischer 1895 and conservation of the generic name *Arthrobacter* Conn and Dimmick 1947	**8**:171–172 (1958), conservation was effected though its mention was mitted in the Opinion itself. The title of the Opinion explicitly states that *Arthrobacter* Conn and Dimmick is conserved.	1. The name *Arthrobacter* proposed by Fischer in 1895 as the name of a hypothetical genus of bacteria was not validly published and has no standing in nomenclature. 2. The generic name *Arthrobacter* Conn and Dimmick 1947 was validly published as a *nomen novum.* It is not an emendation of *Arthrobacter* Fischer 1895 nor a later homonym.
25	Rejection of names of bacteria in certain publications of Trécul, Hallier, Billroth, and	**13**:33–35 (1963)	1. The specific, subgeneric, generic or other names proposed in the several publications listed below were not validly published as names of taxa of

Opinion	Title	Reference and notes[1]	Result
	Ogston		bacteria and have no standing in bacteriological nomenclature. These publications are included in the list of Rejected Publications as authorized in Paragraph 8 under "Functions of the Judicial Commission," in Section IV of the *International Code of Nomenclature of Bacteria and Viruses:* (a) Trécul, A. 1865. Production de plantules amylifères dans les cellules végétales pendant la putréfaction. Chlorophylle cristallisée. C. R. Acad. Sci. Paris **61**:432–436. (b_1) Hallier, Ernst. 1866. Die pflanzlichen Parasiten des menschlichen Körpers für Aerzte, Botaniker und Studierende zugleich als Einleitung in das Stadium der niederen Organismen. Leipzig. (b_2) Hallier, Ernst. 1868. Mikroskopische Untersuchungen. Zwei neue Untersuchungen über den *Micrococcus.* Flora N.S. **26**:654–657.

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
			(b_3) Hallier, E. 1868. Mykologische Untersuchungen. III. Untersuchungen der Parasiten beim Tripper, beim weichen Schanker, bei der Syphilis und bei der Rotzkranheit der Pferde. Flora N.S. **26**:289–301. (b_4) Hallier, Ernst. 1870. Die Parasiten der Infektionskrankheiten. Z. Parasitenkd. **2**:113–132. (c) Billroth, C. A. T. 1874. Untersuchungen über die Vegetationsformen von *Coccobacteria septica.* Berlin. (d_1) Ogston, Alex. 1882. Micrococcus poisoning. J. Anat. Physiol. **16**:526–567. (d_2) Ogston, Alex. 1883. Micrococcus poisoning (cont.). J. Anat. Physiol. **17**:24–58. 2. Names proposed in the above-listed publications of Trécul, Hallier, Billroth, and Ogston have in some cases been adopted by later authors as the

Opinion	Title	Reference and notes[1]	Result
			names of bacterial taxa and one or other of the four authors named cited as author. In such cases the name of the taxon is to be ascribed to the first subsequent authors whose publication meets the requirements of valid publication as prescribed in the *International Code of Nomenclature of Bacteria and Viruses* (Rule 11 [now Rule 27]).
26	Designation of neotype strains (cultures) of type species of the bacterial genera *Salmonella, Shigella, Arizona, Escherichia, Citrobacter,* and *Proteus* of the family *Enterobacteriaceae*	**13**:35–36 (1963), and **14**:57 (1964)	Neotype cultures of *Salmonella cholerae-suis, S. typhi-murium, Shigella dysenteriae, Arizona arizonae, Escherichia coli, Citrobacter freundii,* and *Proteus vulgaris* were approved.

Name of species	Catalogue no. NCTC London	Catalogue no. ATCC Washington
Salmonella cholerae-suis (sic) (Smith) Weldin 1927. Type species of genus *Salmonella* Lignières 1900.	5735	13312
Salmonella typhi-murium (sic) (Loeffler) Castellani and Chalmers 1919	74	13311

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result

Shigella dysenteriae (Shiga) Castellani and Chalmers 1919. Type species of genus *Shigella* Castellani and Chalmers 1919.	4837	13313
Arizona arizonae Kauffmann and Edwards 1952. Type species of genus *Arizona* Kauffmann and Edwards 1952.	8297	13314
Escherichia coli (Migula) Castellani and Chalmers 1919. Type species of genus *Escherichia* Castellani and Chalmers 1919.	9001	11775
Citrobacter freundii (Braak) Werkman and Gillen 1932. Type species of genus *Citrobacter* Werkman and Gillen	9750	8090

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result		
			1932. *Proteus vulgaris* Hauser 1885. Type species of genus *Proteus* Hauser 1885.	4175	13315
27	Designation of the neotype strain of *Streptococcus agalactiae* Lehmann and Neumann	**13**:37 (1963)	The strain Stableforth G19 is designated as the neotype strain of *Streptococcus agalactiae* Lehmann and Neumann. This neotype strain is catalogued in the National Collection of Type Cultures as NCTC 8181 and in the American Type Culture Collection as ATCC 13813.		
28	Rejection of the bacterial generic name *Cloaca* Castellani and Chalmers and acceptance of *Enterobacter* Hormaeche and Edwards as a bacterial generic name with type species *Enterobacter cloacae.* (Jordan) Hormaeche and Edwards	**13**:38 (1963), conservation was effected by statement in the Summary though omitted in the title and in the Opinion itself.	The generic name *Cloaca* Castellani and Chalmers is rejected and replaced by the generic name *Enterobacter* Hormaeche and Edwards with the type species *Enterobacter cloacae* (Jordan) Hormaeche and Edwards: the basonym is *Bacillus cloacae* Jordan.		
29	Designation of strain ATCC 3004 (IMRU 3004) as the neotype strain of *Streptomyces albus* (Rossi Doria) Waksman and Henrici	**13**:123–124 (1963)	The strain labeled ATCC 3004 in the American Type Culture Collection, Washington, D.C., and also known as IMRU 3004 (Institute of Microbiology, Rutgers University) is designated as the neotype strain of *Streptomyces albus* (Rossi Doria) Waksman and Henrici 1943.		
30	Conservation of the specific epithet *faecalis* in the species name *Streptococcus faecalis* Andrewes and Horder 1906	**13**:167 (1963)	The specific epithet *faecalis* in the species name *Streptococcus faecalis* Andrewes and Horder 1906 is conserved against the specific epithets in *Streptococcus liquefaciens* Sternberg 1892, *S. zymogenes* McCallum and Hastings 1899, and all other earlier synonymous specific epithets in the genus *Streptococcus.*		
31	Conservation of *Vibrio* Pacini 1854 as a bacterial generic name, conservation of *Vibrio cholerae* Pacini 1854 as the nomenclatural type species of the bacterial genus *Vibrio*, and designation of neotype strain of *Vibrio cholerae* Pacini	**15**:185–186 (1965)	*Vibrio cholerae* Pacini 1854 is conserved as the name of the type species of the bacterial genus *Vibrio* Pacini 1854, the bacterial generic name *Vibrio* Pacini 1854 is placed in the list of conserved bacterial generic names (*nomina generum conservanda*), and National Collection of Type Cultures NCTC 8021 (American Type Culture Collection, ATCC 14035) is designated as the neotype of the species *Vibrio cholerae* Pacini 1854.		
32	Conservation of the specific	**20**:9 (1970)	The specific epithet *rhusiopathiae* in the scientific		

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	epithet *rhusiopathiae* in the scientific name of the organism known as *Erysipelothrix rhusiopathiae* (Migula 1900) Buchanan 1918		name of the organism known as *Erysipelothrix rhusiopathiae* (Migula 1900) Buchanan 1918 is conserved against the specific epithet *insidiosa* (basonym *Bacillus insidiosus* Trevisan 1885) and against all other specific epithets applied to this organism.
33	Conservation of the generic name *Agrobacterium* Conn 1942	**20**:10 (1970), type species *Agrobacterium tumefaciens* (Smith and Townsend) Conn 1942	The generic name *Agrobacterium* Conn 1942 is conserved against the name *Polymonas* Lieske 1928, which is placed in the list of *nomina generum rejicienda*. The type species, by original designation, is *Agrobacterium tumefaciens* (Smith and Townsend 1907) Conn 1942: the basonym is *Bacterium tumefaciens* Smith and Townsend 1907.
34	Conservation of the generic name *Rhizobium* Frank 1889	**20**:11–12 (1970), type species *Rhizobium leguminosarum* Frank 1889	The generic name *Rhizobium* Frank 1889 is conserved against *Phytomyxa* Schroeter 1886 and all earlier synonyms. The type species is *Rhizobium leguminosarum* (Frank 1879) Frank 1889; the basonym is *Schinzia leguminosarum* Frank 1879.
35	Conservation of the specific epithet *meningitidis* in the scientific name of the	**20**:13–14 (1970), and designation of neotype strain (genus is now	The specific epithet "*meningitidis*" is conserved in the scientific name of the meningococcus (*Diplococcus intracellularis meningitidis* Weichselbaum) against all

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	meningococcus	*Neisseria*)	earlier specific epithets. The neotype strain of this organism is ATCC 13077 (= Sara E. Branham M1027 = NCTC 10025).
36	Designation of strain ATCC 10145 as the neotype strain of *Pseudomonas aeruginosa* (Schroeter) Migula	**20**:15–16 (1970)	The neotype strain of *Pseudomonas aeruginosa* (Schroeter) Migula is ATCC 10145 = CCEB 481 = IBCS 277 = NCIB 8295 = NCTC 10332 = NRRL B-771 = RH 815.
37	Designation of strain ATCC 13525 as the neotype strain of *Pseudomonas fluorescens* Migula	**20**:17–18 (1970)	The neotype strain of *Pseudomonas fluorescens* Migula is ATCC 13525 = CCEB 546 = NCIB 9046 = NCTC 10038 = RH 818 = M. Rhodes 28/5.
38	Conservation of the generic name *Lactobacillus* Beijerinck	**21**:104 (1971), with new type species *Lactobacillus delbrueckii* Beijerinck 1901 and neotype strain	The generic name *Lactobacillus* Beijerinck 1901 is conserved over *Saccharobacillus* van Laer 1892 and all earlier objective synonyms. The type species of this genus is *Lactobacillus delbrueckii* Beijerinck 1901, the neotype strain of which is ATCC 9649 = NCDO 213. The name *Lactobacillus delbrueckii* Beijerinck 1901, although used by Beijerinck as a simplified version of the subspecific name "*Lactobacillus fermentum* var. *delbrucki*," shall be held to be validly published by Beijerinck as a species name. The name *Lactobacillus*

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
			caucasicus Beijerinck 1901 is placed in the list of rejected names, and *L. caucasicus* ceases to be the type species of *Lactobacillus* Beijerinck.
39	Rejection of the generic name *Gaffkya* Trevisan	**21**:104–105 (1971)	The generic name *Gaffkya* Trevisan 1885 is placed on the list of rejected names.
40	Rejection of the names *Mima* De Bord and *Herellea* De Bord and of the specific epithets *polymorpha* and *vaginicola* in *Mima polymorpha* De Bord and *Herellea vaginicola* De Bord, respectively	**21**:105–106 (1971), and loss of standing in nomenclature of the tribal name *Mimeae* De Bord 1939	The generic names *Mima* De Bord 1939, 1942 and *Herellea* De Bord 1942 are placed on the list of rejected names. The specific epithets *polymorpha* and *vaginicola* in *Mima polymorpha* De Bord 1939, 1942 and *Herellea vaginicola* De Bord 1942 respectively are placed on the list of rejected epithets. The tribal name *Mimeae* De Bord 1939, 1942 therefore loses its standing in nomenclature.
41	Conservation of the generic name *Moraxella* Lwoff	**21**:106 (1971), type species *Moraxella lacunata* (Eyre) Lwoff 1939, and neotype	The generic name *Moraxella* Lwoff 1939 is conserved over *Diplobacillus* McNab 1904 and over all earlier objective synonyms. The type species is *Moraxella lacunata* (Eyre) Lwoff 1939, and the neotype strain of

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
		strain	this species is Morax 260 = ATCC 17967.
42	Conservation of the specific epithet "*phenylpyruvica*" in the name *Moraxella phenylpyruvica* Bøvre and Henriksen	**21**:107 (1971), conservation over epithet *polymorpha* in the name *Moraxella polymorpha* Flamm 1957, and neotype strain	The specific epithet "*phenylpyruvica*" in the name *Moraxella phenylpyruvica* Bøvre and Henriksen 1967 is conserved against the specific epithet "*polymorpha*" in the name of the earlier objective synonym *Moraxella polymorpha* Flamm 1957 and against the specific epithets in all other earlier objective synonyms. The neotype strain of *Moraxella phenylpyruvica* is 2863 (= ATCC 23333 = NCTC 10526).
43	Conservation of the specific epithet "*sphaeroides*" in the name *Rhodopseudomonas sphaeroides* van Niel	**21**:108 (1971), and neotype strain	The specific epithet "*sphaeroides*" in the name *Rhodopseudomonas sphaeroides* van Niel 1944 is conserved against the specific epithet "*minor*" in the name of the earlier subjective synonym *Rhodococcus minor* and against the specific epithets in the names of all earlier objective synonyms of *Rhodopseudomonas sphaeroides*. The neotype strain is van Niel's ATH 2.4.1 (= ATCC 17023).
44	Validation of the generic name *Chloropseudomonas* Czurda and Maresch 1937 and designation of the type species	**21**:109 (1971), type species *Chloropseudomonas ethylica* Shaposhnikov	The generic name *Chloropseudomonas* is held to be validly published by Czurda and Maresch 1937. The type species is *Chloropseudomonas ethylica* Shaposhnikov, Kondratieva, and Fedorov 1960.

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
		et al. 1960	
45	Rejection of the name *Leuconostoc citrovorum* (Hammer) Hucker and Pederson	**21**:109–110 (1971)	The name *Leuconostoc citrovorum* (Hammer 1920) Hucker and Pederson 1931, together with its objective synonyms, is regarded as a *nomen dubium* and is placed on the list of rejected names.
46	Rejection of the generic name *Aerobacter* Beijerinck	**21**:110 (1971)	The generic name *Aerobacter* Beijerinck 1900 is regarded as a *nomen ambiguum* and is placed on the list of rejected generic names.
47	Conservation of the specific epithet *avium* in the scientific name of the agent of avian tuberculosis	**23**:472 (1973)	The specific epithet *avium* is conserved against the specific epithet *tuberculosis-gallinarum* and all earlier objective synonyms in the scientific name of the agent of avian tuberculosis. The name *Mycobacterium avium* shall be held to be validly published by Chester in 1901. The neotype strain of *M. avium* Chester is ATCC 25291.
48	Rejection of the name *Aerobacter liquefaciens* Beijerinck and conservation of the name *Aeromonas* Stanier with *Aeromonas hydrophila* as the type species	**23**:473–474 (1973)	The name *Aerobacter liquefaciens* Beijerinck 1900 is a *nomen dubium* and, together with all objective synonyms of this name, is placed on the list of rejected names. The generic name *Aeromonas* Stanier 1943, with type species *Aeromonas hydrophila* (Chester 1901) Stanier 1943, is conserved. The name

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
			Aeromonas is not to be attributed to Kluyver and van Niel. The neotype strain of *A. hydrophila* is ATCC 7966.
49	Conservation of the generic name *Rhodopseudomonas* Czurda and Maresch emend. van Niel	**24**:551 (1974)	The generic name *Rhodopseudomonas* Czurda and Maresch 1937 emend. van Niel 1944 is conserved over all earlier objective synonyms; the type species is *Rhodopseudomonas palustris* (Molisch 1907) van Niel 1944 (basonym *Rhodobacillus palustris* Molisch 1907).
50	Conservation of the epithet *fermentum* in the combination *Lactobacillus fermentum* Beijerinck	**24**:551–552 (1974)	The species name *Lactobacillus fermentum* Beijerinck 1901 shall be held to be validly published by Beijerinck 1901 as the name of a bacterial species, and the epithet *fermentum* in the combination *Lactobacillus fermentum* Beijerinck 1901 is conserved over the epithets in all other objective synonyms. The neotype strain of *Lactobacillus fermentum* is ATCC 14931.
51	Conservation of the epithet *fortuitum* in the combination *Mycobacterium fortuitum* da Costa Cruz	**24**:552 (1974)	The specific epithet *fortuitum* in the name *Mycobacterium fortuitum* da Costa Cruz 1938 is conserved against the epithet *ranae* in the subjective synonym *Mycobacterium ranae* Bergey *et al*. 1923 and against the specific epithets in the names of all

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
			objective synonyms of *Mycobacterium fortuitum* and *Mycobacterium ranae*. The type strain of *Mycobacterium fortuitum* is ATCC 6841.
52	Conservation of the generic name *Pediococcus* Claussen with the type species *Pediococcus damnosus* Claussen	**28**:292 (1976), replacement of type species *P. cerevisiae* by *P. damnosus*	The generic name *Pediococcus* Claussen 1903 is conserved over *Pediococcus* Balcke 1884 and all earlier objective synonyms. The type species is *Pediococcus damnosus* Claussen 1903, and the neotype strain is Be.1 (= NCDO 1832). *Pediococcus* Balcke 1884 and the species name *Pediococcus cerevisiae* Balcke 1884 are not validly published.
53	Rejection of the species name *Mycobacterium marianum* Penso 1953	**28**:334 (1978), confusion between the epithets *marianum* and *marinum*	The species name *Mycobacterium marianum Penso* 1953 is placed on the list of *nomina rejicienda* as a *nomen perplexum* because it is a source of confusion.
54	Rejection of the species name *Pseudomonas denitrificans* (Christensen) Bergey *et al*. 1923	**32**:466 (1982)	The species name *Pseudomonas denitrificans* (Christensen) Bergey *et al*. 1923 is placed on the list of *nomina rejicienda* as a *nomen ambiguum* because it is a source of confusion.
55	Rejection of the species name *Mycobacterium aquae* Jenkins *et al*. 1972	**32**:467 (1982)	The species name *Mycobacterium aquae* Jenkins *et al*. 1972 is placed on the list of *nomina rejicienda* as a *nomen ambiguum* because it is a source of confusion.

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
56	Rejection of the species name *Peptococcus anaerobius* (Hamm) Douglas 1957	**32**:468 (1982)	The species name *Peptococcus anaerobius* (Hamm) Douglas 1957 is placed on the list of *nomina rejicienda* as a *nomen dubium* and a *nomen perplexum* because it is a source of confusion.
57	Designation of *Eubacterium limosum* (Eggerth) Prévot 1938 as the type species of *Eubacterium*	**33**:434 (1983), replacement of type species *E. foedans* by *E. limosum*	The type species of the genus *Eubacterium* Prévot 1938 is designated *E. limosum* (Eggerth) Prévot 1938 (type strain, ATCC 8486).
58	Confirmation of the type species in the Approved Lists as nomenclatural types including recognition of *Nocardia asteroides* (Eppinger 1891) Blanchard 1896 and *Pasteurella multocida* (Lehmann and Neumann 1899) Rosenbusch and Marchant 1939 as the respective type species of the genera *Nocardia* and *Pasteurella* and rejection of the type species name	**35**:538 (1985), confirmation of new type species for *Nocardia* and *Pasteurella* (see Opinion 13) and rejection of *P. gallicida* as an objective synonym of *P. multocida* (*Editorial Note*. As stated in the title and summary, the Opinion also confirms the	The names (*Editorial Note*. This should read "The types.") of the bacterial taxa cited in the Approved Lists of Bacterial Names are formally and explicitly confirmed as correct and supersede any others in use before the appearance of the lists but without prejudice to the powers of the Judicial Commission to amend them. The species names *Nocardia asteroides* (Eppinger 1891) Blanchard 1896 and *Pasteurella multocida* (Lehmann and Neumann 1899) Rosenbusch and Marchant 1939 are the valid type species of their respective genera, thus reversing those elements of Opinion 13 that apply to these two genera. The species name *Pasteurella gallicida* (Burrill 1883) Buchanan 1925 is placed on the list of *nomina rejicienda*.

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	Pasteurella gallicida (Burrill 1883) Buchanan 1925	nomenclatural types in the Approved Lists, but without prejudice to the powers of the Judicial Commission to amend them.)	
59	Designation of NCIB 11664 in place of ATCC 23767 (NCIB 4112) as the type strain of *Acetobacter aceti* subsp. *xylinum* (sic) (Brown 1886) De Ley and Frateur 1974	**35**:539 (1985). The epithet *xylinum* should be spelt *xylinus* (see Opinion 3).	The type strain of *Acetobacter aceti* subsp. *xylinus* is NCIB 11664 (= NCIB 4112B) not ATCC 23767 (= NCIB 4112 = NCIB 11301 = CIP 57.14).
60	Rejection of the name *Yersinia pseudotuberculosis* subsp. *pestis* (van Loghem) Bercovier *et al*. 1981 and conservation of the name *Yersinia pestis* (Lehmann and Neumann) van Loghem 1944 for the plague bacillus	**35**:540 (1985), see also Rule 56a(5)	The name *Yersinia pseudotuberculosis* subsp. *pestis* (van Loghem) Bercovier *et al*. 1981 is placed on the list of *nomina rejicienda* because the use of the name could have serious consequences for human welfare and health. The name *Yersinia pestis* is conserved for the plague bacillus. The opinion does not challenge the scientific evidence, which indicates the taxonomic relatedness of bacteria named *Yersinia pestis* and *Yersinia pseudotuberculosis*.

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
61	Rejection of the type strain of *Pasteuria ramosa* (ATCC 27377) and conservation of the species *Pasteuria ramosa* Metchnikoff 1888 on the basis of the type descriptive material	**36**:119 (1986)	Strain ATCC 27377 is rejected as the type strain of the species *Pasteuria ramosa* Metchnikoff 1888 because it is quite different from the bacteria observed and described by Metchnikoff and to which he gave the name *Pasteuria ramosa: Pasteuria ramosa* is conserved with the description of Metchnikoff, as amended by Starr *et al*. 1983, serving as the type species. (*Editorial Note*. This should read "serving as the type.") In issuing this opinion the Judicial Commission declines to comment on the assignment of strain ATCC 27377 to another genus because this is a taxonomic matter and not one of nomenclature.
62	Transfer of the type species of the genus *Methanococcus* to the genus *Methanosarcina* as *Methanosarcina mazei* (Barker 1936) comb. nov. et emend. Mah and Kuhn 1984 and conservation of the genus *Methanococcus* (Approved Lists 1980) emend. Mah and	**36**:491 (1986)	*Methanococcus mazei*, the type species of the genus *Methanococcus*, is transferred to the genus *Methanosarcina* as *Methanosarcina mazei* (Barker 1936) comb. nov. et emend. Mah and Kuhn 1984. The genus *Methanococcus* (Approved Lists 1980) emend. Mah and Kuhn 1984 is conserved with *Methanococcus vannielii* Stadtman and Barker 1951 (Approved Lists 1980) as the type species.

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	Kuhn 1984 with *Methanococcus vannielii* (Approved Lists 1980) as the type species		
63	Rejection of the type species *Methanosarcina methanica* (Approved Lists 1980) and conservation of the genus *Methanosarcina* (Approved Lists 1980) emend. Mah and Kuhn 1984 with *Methanosarcina barkeri* (Approved Lists 1980) as the type species	**36**:492 (1986)	*Methanosarcina methanica* (Approved Lists 1980), the nomenclatural type species of the genus *Methanosarcina* (Approved Lists 1980), is placed on the list of *nomina rejicienda* as a *nomen dubium et confusum* because it is a source of doubt and confusion. The genus *Methanosarcina* (Approved Lists 1980) emend. Mah and Kuhn 1984 is conserved with *Methanosarcina barkeri* (Approved Lists 1980) as the type species.
64	Designation of Strain MF (DSM 1535) in Place of Strain M.o.H. (DSM 863) as the Type Strain of *Methanobacterium formicicum* Schnellen 1947, and Designation of Strain M.o.H. (DSM 863) as the	**42**:654 (1992) doi:10.1099/00207713-42-4-654	The type strain of *Methanobacterium formicicum* is strain MF (DSM 1535), replacing strain M.o.H. (DSM 863). *Methanobacterium bryantii* is reinstated with its type strain M.o.H. (DSM 863).

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	Type Strain of *Methanobacterium bryantii* (Balch and Wolfe in Balch, Fox, Magrum, Woese, and Wolfe 1979, 284) Boone 1987, 173		
65	Designation of Strain VPI D 19B-28 (ATCC 35185) in Place of Strain VPI 10068 (ATCC 33150) as the Type Strain of *Selenomonas sputigena* (Flügge 1886) Boskamp 1922	**42**:655 (1992) doi:10.1099/00207713-42-4-655	The type strain of *Selenomonas sputigena* is VPI D 19B-28 (ATCC 35185), replacing VPI 10068 (ATCC 33150). (NB VPI D 19B-28 is the correct number, not VPI D 19B-29, which is given in the ATCC catalog, 17th ed.)
66	Designation of Strain NS 51 (NCTC 12261) in Place of Strain NCTC 3165 as the Type Strain of *Streptococcus mitis* Andrewes and Horder 1906	**43**:391 (1993) doi:10.1099/00207713-43-2-391	The type strain of *Streptococcus mitis* is NS 51 (NCTC 12261), replacing NCTC 3165.
67	Rejection of the Name *Citrobacter diversus*	**43**:392 (1993) doi:10.1099/00207713	The name *Citrobacter diversus* Werkman and Gillen 1932 is placed on the list of *nomina rejicienda* because

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	Werkman and Gillen 1932	-43-2-392	it was incorrectly used by Ewing and Davis in 1972 as the name for a new species that cannot be considered identical to the organism described by Werkman and Gillen and thus is a *nomen dubium*.
68	Designation of Strain B213c (DSM 20284) in Place of Strain NCDO 1859 as the Type Strain of *Pediococcus acidilactici* Lindner 1887	**46**:835 (1996) doi:10.1099/00207713-46-3-835	*Pediococcus acidilactici* is conserved with neotype strain B213c (= DSM 20284), which replaces NCDO 1859.
69	Rejection of *Clostridium putrificum* and conservation of *Clostridium botulinum* and *Clostridium sporogenes*	**49**:339 (1999) doi:10.1099/00207713-49-1-339	The name *Clostridium putrificum* is rejected while *Clostridium botulinum* is conserved for toxigenic strains and *Clostridium sporogenes* is conserved for nontoxigenic strains.
70	Replacement of strain NCTC 4175, since 1963 the neotype strain of *Proteus vulgaris*, with strain ATCC 29905	**49**:1949 (1999) doi:10.1099/00207713-49-4-1949	The Judicial Commission decided that strain NCTC 4175, used as the neotype strain of *Proteus vurgaris* since 1963, be replaced by strain ATCC 29905.
71	Valid publication of the genus name *Thermodesulfobacterium* and the species names	**53**:927 (2003) doi:10.1099/ijs.0.02494-0	The Judicial Commission of the International Committee on Systematics of Prokaryotes decided that the date of valid publication of the genus name *Thermodesulfobacterium* and of the species names

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	Thermodesulfobacterium commune (Zeikus *et al.* 1983) and *Thermodesulfobacterium thermophilum* (ex *Desulfovibrio thermophilus* Rozanova and Khudyakova 1974).		*Thermodesulfobacterium commune* and *Thermodesulfobacterium thermophilum* is 1995. *Thermodesulfobacterium mobile* Rozanova and Pivovarova 1988 is an illegitimate, later synonym of *Thermodesulfobacterium thermophilum*.
72	Strain DSM 6035 is the type strain of *Lactobacillus panis* (Wiese et al. 1996).	**53**:929 (2003) doi:10.1099/ijs.0.02495-0	The Judicial Commission of the International Committee on Systematics of Prokaryotes decided that strain DSM 6035 is the type strain of *Lactobacillus panis* with the consequence that the name *Lactobacillus panis* has been validly published.
73	*Paenibacillus durus* (Collins *et al.* 1994, formerly *Clostridium durum* Smith and Cato 1974) has priority over *Paenibacillus azotofixans* (Seldin *et al.* 1984).	**53**:931 (2003) doi:10.1099/ijs.0.02496-0	The Judicial Commission adjusted the gender of the specific epithet to *durus* (masculine) and decided that the name *Paenibacillus durus* has priority over *Paenibacillus azotofixans*; furthermore, it was decided that the type strain of *Paenibacillus durus* is VPI 6563 (=ATCC 27763=DSM 1735), not P3L5 (=ATCC 35681). The name *Paenibacillus azotofixans* is a later synonym of *Paenibacillus durus*.
74	Strain NCIMB 13488 may	**53**:933 (2003)	The Judicial Commission decided that *Halorubrum*

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	serve as the type strain of Halorubrum trapanicum.	doi:10.1099/ijs.0.02497-0	*trapanicum* strain NCIMB 13488 will not be the neotype, but since it is derived from strain NRC 34021, which in turn is derived from Petter's original isolate, it is 'a strain on which the original description was based' [Rule 18c of the Bacteriological Code (1990 Revision); Lapage *et al.*, 1992], and may therefore also serve as the type strain of the species.
75	Rejection of the genus name *Methanothrix* with the species *Methanothrix soehngenii* Huser *et al.* 1983 and transfer of *Methanothrix thermophila* Kamagata *et al.* 1992 to the genus *Methanosaeta* as *Methanosaeta thermophila* comb. nov.	**58**:1753-1754 (2008) doi:10.1099/ijs.0.2008/005355-0	The Judicial Commission of the International Committee on Systematics of Prokaryotes has decided to place the genus *Methanothrix* with the species *Methanothrix soehngenii* Huser *et al.* 1983 on the list of *nomina rejicienda*, based on the fact that it is not represented by an axenic culture and contravenes Rule 31a of the International Code of Nomenclature of Bacteria. The species *Methanothrix thermophila* is transferred to the genus *Methanosaeta* as *Methanosaeta thermophila* (Kamagata *et al.* 1992) Boone and Kamagata 1998 comb. nov.
75 (suppl.)	The genus name *Methanothrix* Huser *et al.* 1983 and the species combination *Methanothrix soehngenii*	**64**:3597-3598 (2014) doi:10.1099/ijs.0.069252-0	The Judicial Commission affirms that the genus name *Methanothrix* Huser *et al.* 1983 and the species combination *Methanothrix soehngenii* Huser *et al.* 1983 do not contravene Rule 31a and are not to be

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	Huser *et al.* 1983 do not contravene Rule 31a and are not to be considered as rejected names, the genus name *Methanosaeta* Patel and Sprott 1990 refers to the same taxon as *Methanothrix soehngenii* Huser *et al.* 1983 and the species combination *Methanothrix thermophila* Kamagata *et al.* 1992 is rejected.		considered as rejected names. The genus name *Methanosaeta* Patel and Sprott 1990 applies to the same taxon as *Methanothrix* Huser *et al.* 1983 and is therefore a later heterotypic synonym. The combinations *Methanothrix thermoacetophila* corrig. Nozhevnikova and Chudina 1988 and *Methanothrix thermophila* Kamagata *et al.* 1992 are considered to refer to the same taxon, a consequence of which is that *Methanothrix thermophila* Kamagata *et al.* 1992 contravenes Rule 51b and is placed on the List of Rejected Names.
76	Strain NBRC (formerly IFO) 3782 is the type strain of *Streptomyces rameus* Shibata 1959.	**55**:511 (2005) doi:10.1099/ijs.0.63545-0	The Judicial Commission of the International Committee for Systematics of Prokaryotes decided that strain NBRC (formerly IFO) 3782 (=No. 43797), which was the originally designated type strain, has to replace ATCC 21273 as the type strain of *Streptomyces rameus*. ATCC 21273 was given as the type strain in the Approved Lists 1980.
77	The type species of the genus *Paenibacillus* Ash et al. 1994 is *Paenibacillus polymyxa*.	**55**:513 (2005) doi:10.1099/ijs.0.63546-0	The Judicial Commission of the International Committee for Systematics of Prokaryotes decided that the type species of the genus *Paenibacillus* is

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
			Paenibacillus polymyxa.
78	Rejection of the genus name *Pelczaria* with the species *Pelczaria aurantia* Poston 1994.	**55**:515 (2005) doi:10.1099/ijs.0.63547-0	The Judicial Commission of the International Committee for Systematics of Prokaryotes has decided to place the genus *Pelczaria* with the species *Pelczaria aurantia* on the list of *nomina rejicienda*, due to the lack of an authentic type or neotype strain.
79	The nomenclatural types of the orders *Acholeplasmatales*, *Halanaerobiales*, *Halobacteriales*, *Methanobacteriales*, *Methanococcales*, *Methanomicrobiales*, *Planctomycetales*, *Prochlorales*, *Sulfolobales*, *Thermococcales*, *Thermoproteales* and *Verrucomicrobiales* are the genera *Acholeplasma*, *Halanaerobium*, *Halobacterium*, *Methanobacterium*,	**55**:517-518 (2005) doi:10.1099/ijs.0.63548-0	The Judicial Commission corrected the nomenclatural types of twelve orders, for which, in violation of Rules 15 and 21a of the Bacteriological Code (1990 Revision), families instead of genera had been proposed as nomenclatural types. The following orders have the following genera as nomenclatural types: order *Acholeplasmatales* Freundt *et al.* 1984, genus *Acholeplasma* Edward and Freundt 1970 (Approved Lists 1980); *Halanaerobiales* Rainey and Zhilina 1995, *Halanaerobium* Zeikus *et al.* 1984; *Halobacteriales* Grant and Larsen 1989, *Halobacterium* Elazari-Volcani 1957 (Approved Lists 1980); *Methanobacteriales* Balch and Wolfe 1981, *Methanobacterium* Kluyver and van Niel 1936 (Approved Lists 1980); *Methanococcales* Balch and Wolfe 1981, *Methanococcus* Kluyver and van Niel 1936 emend.

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	Methanococcus, *Methanomicrobium*, *Planctomyces*, *Prochloron*, *Sulfolobus*, *Thermococcus*, *Thermoproteus* and *Verrucomicrobium*, respectively.		Barker 1936 (Approved Lists 1980); *Methanomicrobiales* Balch and Wolfe 1981, *Methanomicrobium* Balch and Wolfe 1981; *Planctomycetales* Schlesner and Stackebrandt 1987, *Planctomyces* Gimesi 1924 (Approved Lists 1980); *Prochlorales* (*ex* Lewin 1977) Florenzano *et al.* 1986, *Prochloron* (*ex* Lewin 1977) Florenzano *et al.* 1986; *Sulfolobales* Stetter 1989, *Sulfolobus* Brock *et al.* 1972 (Approved Lists 1980); *Thermococcales* Zillig *et al.* 1988, *Thermococcus* Zillig 1983; *Thermoproteales* Zillig and Stetter 1982, *Thermoproteus* Zillig and Stetter 1982; *Verrucomicrobiales* Ward-Rainey *et al.* 1996, *Verrucomicrobium* Schlesner 1988.
79 (suppl.)	Names at the rank of class, subclass and order, their typification and current status.	**64**:3599-3602 (2014) doi:10.1099/ijs.0.069310-0	The attention of the Judicial Commission was drawn to issues relating to the use of names at the rank of class, subclass and order and the nomenclatural type of names at the rank of class and subclass that were not covered by Opinion 79. The Judicial Commission ruled that names at the rank of class and order proposed by Cavalier-Smith (*Int. J. Syst. Evol. Microbiol.*, **52**, 7–76, 2002) are to be placed on the List of Rejected Names (*nomina rejicienda*) and the use of names proposed in

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
			that publication above the rank of class is to be actively discouraged. In addition a list of names at the rank of class, subclass and order is given where the nomenclatural type, description or circumscription is unclear or where they otherwise appear to be not in accordance with the Rules of the International Code of Nomenclature of Bacteria.
80	The type species of the genus *Salmonella* Lignieres 1900 is *Salmonella enterica* (*ex* Kauffmann and Edwards 1952) Le Minor and Popoff 1987, with the type strain LT2^T, and conservation of the epithet *enterica* in *Salmonella enterica* over all earlier epithets that may be applied to this species.	**55**:519-520 (2005) doi:10.1099/ijs.0.63579-0	The Judicial Commission of the International Committee for Systematics of Prokaryotes has decided that the type species of the genus *Salmonella* Lignieres 1900 is *Salmonella enterica* (*ex* Kauffmann and Edwards 1952) Le Minor and Popoff 1987 and that the type strain of this species is strain LT2^T. In addition, the epithet *enterica* in *Salmonella enterica* is conserved over all earlier epithets that may be applied to this species. The Judicial Commission is aware that this Opinion has consequences for the nomenclature and taxonomy of this group of organisms. Refer to accompanying commentary and references in the Opinion.
81	Status of strains that contravene Rules 27 (3) and	**58**:1755-1763 (2008) doi:10.1099/ijs.0.2008	Based on a list of 205 names proposed in original articles in the *International Journal of Systematic and*

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	30 of the International Code of Nomenclature of Bacteria.	/005264-0	*Evolutionary Microbiology* or cited in Validation Lists from January 2001 that are not in accordance with Rules 27(3) and 30 of the International Code of Nomenclature of Bacteria (the Code), the Judicial Commission rules that names contained in lists 2–4 are to be considered to be validly published and that deposit in more than one collection in different countries is documented. Names included in list 1 are only to be considered validly published if evidence is presented that the strains have been deposited in additional collections, as laid down by Rules 27(3) and 30 of the Code.
82	The type strain of *Lactobacillus casei* is ATCC 393, ATCC 334 cannot serve as the type because it represents a different taxon, the name *Lactobacillus paracasei* and its subspecies names are not rejected and the revival of the name '*Lactobacillus zeae*'	**58**:1764-1765 doi:10.1099/ijs.0.2008/005330-0	The Judicial Commission affirms that typification of *Lactobacillus casei* is based on ATCC 393, that ATCC 334 is a member of a different taxon and that the publication rejecting the name *Lactobacillus paracasei* (and its included subspecies) together with the revival of the name '*Lactobacillus zeae*' contravenes Rules 51b (1) and (2) of the International Code of Nomenclature of Bacteria.

Opinion	Title	Reference and notes[1]	Result
	contravenes Rules 51b (1) and (2) of the International Code of Nomenclature of Bacteria.		
83	The subgenus names *Moraxella* subgen. *Moraxella* and *Moraxella* subgen. *Branhamella* and the species names included within these taxa should have been included on the Approved Lists of Bacterial Names and a ruling on the proposal to make changes to Rule 34a.	**58**:1766-1767 (2008) doi:10.1099/ijs.0.2008/005272-0	The Judicial Commission of the International Committee for Systematics of Prokaryotes rules that the following names should have been included on the Approved Lists of Bacterial Names, *Moraxella* (subgen. *Branhamella* Bøvre 1979), *Moraxella* (subgen. *Moraxella* Lwoff 1939), *Moraxella* (subgen. *Branhamella* Bøvre 1979) *catarrhalis*, *Moraxella* (subgen. *Branhamella* Bøvre 1979) *caviae*, *Moraxella* (subgen. *Branhamella* Bøvre 1979) *ovis*, *Moraxella* (subgen. *Moraxella* Lwoff 1939) *atlantae*, *Moraxella* (subgen. *Moraxella* Lwoff 1939) *bovis*, *Moraxella* (subgen. *Moraxella* Lwoff 1939) *lacunata*, *Moraxella* (subgen. *Moraxella* Lwoff 1939) *nonliquefaciens*, *Moraxella* (subgen. *Moraxella* Lwoff 1939) *osloensis*, *Moraxella* (subgen. *Moraxella* Lwoff 1939) *phenylpyruvica*. Proposals to alter Rule 34a were rejected.
83 (suppl.)	The subgenus names *Moraxella* and *Branhamella*	**64**:3595-3596 (2014) doi:10.1099/ijs.0.0692	The publication of Opinion 83, which dealt with the valid publication of the subgenus names *Moraxella* and

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	(in the genus *Moraxella*) are not in accordance with the International Code of Nomenclature of Bacteria and are therefore not validly published.	45-0	*Branhamella* (in the genus *Moraxella*), has highlighted a problem relating to the absence of descriptions associated with these names at the time they were effectively published. This calls into question whether the ruling outlined in Opinion 83, that these names should have qualified for inclusion on the Approved Lists of Bacterial Names, and their inclusion on Validation List 15 are not in accordance with Rule 27 of the International Code of Nomenclature of Bacteria governing the valid publication of a name. The subgenus names *Moraxella* and *Branhamella* (in the genus *Moraxella*) are not to be considered to be included on the Approved Lists of Bacterial Names, nor are they to be considered to be validly published by inclusion on Validation List 15.
84	The genus name *Sinorhizobium* Chen *et al.* 1988 is a later synonym of *Ensifer* Casida 1982 and is not conserved over the latter genus name, and the species name '*Sinorhizobium*	**58**:1973 (2008) doi:10.1099/ijs.0.2008/005991-0	The Judicial Commission affirms that the genus name *Sinorhizobium* Chen *et al.* 1988 is a later synonym of *Ensifer* Casida 1982, and that the former genus name is not conserved over the latter genus name. The species name '*Sinorhizobium adhaerens*' is not validly published.

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	adhaerens' is not validly published.		
85	The adjectival form of the epithet in *Tannerella forsythensis* Sakamoto *et al.* 2002 is to be retained and the name is to be corrected to *Tannerella forsythia* Sakamoto *et al.* 2002	**58**:1974 (2008) doi:10.1099/ijs.0.2008/006007-0	The Judicial Commission rules that the adjectival form is to be conserved in the specific epithet *forsythia* in *Tannerella forsythia*.
86	Necessary corrections to the Approved Lists of Bacterial Names according to Rule 40d (formerly Rule 46).	**58**:1975 (2008) doi:10.1099/ijs.0.2008/006015-0	The Judicial Commission affirms that, according to Rule 40d, formerly Rule 46, of the Bacteriological Code, the authorship of a number of subspecies names included on the Approved Lists of Bacterial Names must be corrected. These names are *Acetobacter aceti* subsp. *aceti*, *Acetobacter pasteurianus* subsp. *pasteurianus*, *Bacteroides melaninogenicus* subsp. *melaninogenicus*, *Campylobacter fetus* subsp. *fetus*, *Mycobacterium chelonae* subsp. *chelonae*, *Propionibacterium freudenreichii* subsp. *freudenreichii*, *Selenomonas ruminantium* subsp. *ruminantium*, *Streptoverticillium fervens* subsp. *fervens*, *Veillonella parvula* subsp. *parvula* and

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
			Zymomonas mobilis subsp. *mobilis*.
87	*Corynebacterium ilicis* is typified by ICMP 2608 =ICPB CI144, *Arthrobacter ilicis* is typified by DSM 20138 =ATCC 14264 =NCPPB 1228 and the two are not homotypic synonyms, and clarification of the authorship of these two species.	**58**:1976-1978 (2008) doi:10.1099/ijs.0.2008/006221-0	The Judicial Commission rules that the name *Corynebacterium ilicis* Mandel *et al.* 1961 is represented by the type strain ICMP 2608 =ICPB CI144 and is reported to be a plantpathogenic species. *Arthrobacter ilicis* is represented by the type strain DSM 20138 =ATCC 14264 =NCPPB 1228 and is not a homotypic synonym of *Corynebacterium ilicis* Mandel *et al.* 1961, and is reported not to be a plant pathogen. The authorship is to be cited as *Arthrobacter ilicis* Collins *et al.* 1982 and typification and the description of this species are to be found in Collins *et al.* (1981) [Collins, M. D., Jones, D. & Kroppenstedt, R. M. (1981). *Zentralbl Bakteriol Parasitenkd Infektionskr Hyg Abt I Orig* **C2**, 318–323].
88	The status of the name *Lactobacillus rogosae* Holdeman and Moore 1974.	**64**: 3578-3579 (2014) doi:10.1099/ijs.0.069146-0	The Judicial Commission affirms that the combination *Lactobacillus rogosae* Holdeman and Moore 1974 represented by the type strain ATCC 27753 listed on the Approved Lists of Bacterial Names does not appear to be currently represented by an extant type strain. Further work is needed to determine whether a derivative of the original type can be found or whether

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
			a neotype can be designated.
89	The epithet *aurantiaca* in *Micromonospora aurantiaca* Sveshnikova *et al.* 1969 (Approved Lists 1980) is illegitimate and requires a replacement epithet.	**64**:3580-3581 (2014) doi:10.1099/ijs.0.069153-0	The Judicial Commission affirms that the combination *Micromonospora aurantiaca* Sveshnikova *et al.* 1969 (Approved Lists 1980) may not serve as the correct name of the taxon because Rule 12b states that no specific or subspecific epithets within the same genus may be the same if based on different types and the specific epithet *aurantiaca* in *Micromonospora aurantiaca* Sveshnikova *et al.* 1969 (Approved Lists 1980) is the same as the subspecific epithet *aurantiaca* in *Micromonospora carbonacea* subsp. *aurantiaca* Luedemann and Brodsky 1964 (Approved Lists 1980) and the latter has priority. According to Rule 53, the duplication of the same specific or subspecific epithet based on different types creates an illegitimate epithet with the principle of priority determining which is to be replaced as specified in Rule 54. The replacement of the specific epithet *aurantiaca* in *Micromonospora aurantiaca* Sveshnikova *et al.* 1969 (Approved Lists 1980) also requires that the authorship of the original authors is retained. However, action of this nature requires that the original epithet is maintained in the

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
			original combination. There currently appears to be no mechanisms where such action can be taken.
90	The combination *Enterobacter agglomerans* is to be cited as *Enterobacter agglomerans* (Beijerinck 1888) Ewing and Fife 1972 and the combination *Pantoea agglomerans* is to be cited as *Pantoea agglomerans* (Beijerinck 1888) Gavini *et al.* 1989.	**64**:3582-3583 (2014) doi:10.1099/ijs.0.069161-0	The Judicial Commission affirms that, according to information presented to it, the combination *Enterobacter agglomerans* is to be cited as *Enterobacter agglomerans* (Beijerinck 1888) Ewing and Fife 1972 and the combination *Pantoea agglomerans* is to be cited as *Pantoea agglomerans* (Beijerinck 1888) Gavini *et al.* 1989.
91	ATCC 43642 replaces ATCC 23581 as the type strain of *Leptospira interrogans* (Stimson 1907) Wenyon 1926.	**64**:3584-3585 (2014) doi:10.1099/ijs.0.069179-0	The Judicial Commission affirms that, according to information presented to it, the type strain of *Leptospira interrogans* (Stimson 1907) Wenyon 1926 designated on the Approved Lists of Bacterial Names (ATCC 23581) has been shown not to represent an authentic culture of strain RGA (a member of the serovar Icterohaemorrhagiae) and ATCC 43642, derived from an authentic strain of strain RGA, a member of the serovar Icterohaemorrhagiae, is designated the type strain of *Leptospira interrogans* (Stimson 1907) Wenyon 1926.

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
92	The Request for an Opinion that the current use of the genus name *Mycoplasma* be maintained and *Mycoplasma coccoides* be considered a legitimate name is denied.	**64**:3586-3587 (2014) doi:10.1099/ijs.0.069187-0	The Judicial Commission affirms that the request that the current use of the genus name *Mycoplasma* be maintained and *Mycoplasma coccoides* be considered a legitimate name is denied.
93	The designated type strain of *Pseudomonas halophila* Fendrich 1989 is DSM 3051, the designated type strain of *Halovibrio variabilis* Fendrich 1989 is DSM 3050, a new name *Halomonas utahensis* (Fendrich 1989) Sorokin and Tindall 2006 is created for DSM 3051 when treated as a member of the genus *Halomonas*, the combination *Halomonas variabilis* (Fendrich 1989) Dobson and Franzmann 1996 is rejected, the combination *Halovibrio*	**64**:3588-3589 (2014) doi:10.1099/ijs.0.069195-0	The Judicial Commission affirms that, according to information presented to it, the designated type strain of *Pseudomonas halophila* Fendrich 1989 is DSM 3051 (replacing DSM 3050) and the designated type strain of *Halovibrio variabilis* Fendrich 1989 is DSM 3050 (replacing DSM 3051). A new name, *Halomonas utahensis* (Fendrich 1989) Sorokin and Tindall 2006 *nom. nov.*, is created for the species represented by DSM 3051 when treated as a member of the genus *Halomonas*, because the combination *Halomonas halophila* (Quesada *et al.* 1984) Dobson and Franzmann 1996 has priority based on the fact that the epithet *halophila* in the combination *Halomonas halophila* (Quesada *et al.* 1984) Dobson and Franzmann 1996 (basoynm *Deleya halophila* Quesada *et al.* 1984) has priority over the epithet *halophila*

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	denitrificans Sorokin *et al.* 2006 is validly published with an emendation of the description of the genus *Halovibrio* Fendrich 1989 emend. Sorokin *et al.* 2006.		should the taxon *Pseudomonas halophila* Fendrich 1989 be treated as a member of the genus *Halomonas*. The combination *Halomonas variabilis* (Fendrich 1989) Dobson and Franzmann 1996 is rejected. The combination *Halovibrio denitrificans* Sorokin *et al.* 2006 is validly published with an emendation of the description of the genus *Halovibrio* Fendrich 1989 emend. Sorokin *et al.* 2006.
94	*Agrobacterium radiobacter* (Beijerinck and van Delden 1902) Conn 1942 has priority over *Agrobacterium tumefaciens* (Smith & Townsend 1907) Conn 1942 when the two are treated as members of the same species based on the principle of priority and Rule 23a Note 1 as applied to the corresponding specific epithets.	**64**:3590-3592 (2014) doi:10.1099/ijs.0.069203-0	The Judicial Commission affirms that, according to the Rules of the International Code of Nomenclature of Bacteria (including changes made to the wording), the combination *Agrobacterium radiobacter* (Beijerinck and van Delden 1902) Conn 1942 has priority over the combination *Agrobacterium tumefaciens* (Smith and Townsend 1907) Conn 1942 when the two are treated as members of the same species based on the principle of priority as applied to the corresponding specific epithets. The type species of the genus is *Agrobacterium tumefaciens* (Smith and Townsend 1907) Conn 1942, even if treated as a later heterotypic synonym of *Agrobacterium radiobacter* (Beijerinck and van Delden 1902) Conn 1942. *Agrobacterium*

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
			tumefaciens (Smith and Townsend 1907) Conn 1942 is typified by the strain defined on the Approved Lists of Bacterial Names and by strains known to be derived from the nomenclatural type.
95	The combinations *Lysobacter enzymogenes* subsp. *enzymogenes* Christensen and Cook 1978, *L. enzymogenes* subsp. *cookii* Christensen 1978 and *Streptococcus casseliflavus* (Mundt and Graham 1968) Vaughan *et al.* 1979 were in accordance with the International Code of Nomenclature of Bacteria at the time of publication in the International Journal of Systematic Bacteriology, but are not to be considered to be included on the Approved Lists of Bacterial Names.	**64**:3920-3921 (2014) doi:10.1099/ijs.0.069211-0	The Judicial Commission affirms that, according to information presented to it, the combination *Lysobacter enzymogenes* subsp. *enzymogenes* Christensen and Cook 1978, the combination *Lysobacter enzymogenes* subsp. *cookii* Christensen 1978 and the combination *Streptococcus casseliflavus* (Mundt and Graham 1968) Vaughan *et al.* 1979 were in accordance with the wording of the 1975 and 1990 revisions of the International Code of Nomenclature of Bacteria but they are not to be considered to be included on the Approved Lists of Bacterial Names.
96	The properties given at the	**64**:3593-3594 (2014)	The Judicial Commission affirms that, according to

LIST OF OPINIONS

Opinions issued by the Judicial Commission

Opinion	Title	Reference and notes[1]	Result
	time of publication for the designated type strain of *Leifsonia rubra* Reddy *et al.* 2003, CMS 76r does not correspond with those of MTCC 4210, DSM 15304, CIP 107783 and JCM 12471 that are deposited as representing the type strain.	doi:10.1099/ijs.0.069229-0	information presented to it, the type strain of *Leifsonia rubra* Reddy *et al.* 2003 designated in the original publication as strain CMS 76r and deposited as MTCC 4210, DSM 15304, CIP 107783 and JCM 12471 does not have properties corresponding with those of the strains held in those collections under those accession numbers. The species *Leifsonia rubra* Reddy *et al.* 2003 was not represented by an authentic deposit of a type strain at the time of effective publication in the pages of the *International Journal of Systematic and Evolutionary Microbiology*.

Appendix 6. Published Sources for Recommended Minimal Descriptions

Recommendations for minimal standards of description have been published in the IJSEM[1] for the following groups:

aerobic, endospore-forming bacteria	Logan, N. A., O. Berge, A. H. Bishop, H.-J. Busse, P. De Vos, D. Fritze, M. Heyndrickx, P. Kämpfer, L. Rabinovitch, M. S. Salkinoja-Salonen, L. Seldin, and A. Ventosa. 2009. IJSEM **59**:2114-2121; doi:10.1099/ijs.0.013649-0
Bifidobacterium, *Lactobacillus* and related genera	Mattarelli, P., W. Holzapfel, C. M. A. P. Franz, A. Endo, G. E. Felis, W. Hammes, B. Pot, L. Dicks, and F. Dellaglio. 2014. IJSEM **64**:1434-1451; doi:10.1099/ijs.0.060046-0
Brucella	Corbel, M. J., and W. J. Brinley Morgan, 1975, IJSB **25**:83–89. doi:10.1099/00207713-25-1-83 Also see Errata to the above article: Corbel, M. J., and W. J. Brinley Morgan, 1975, IJSB **25**:243; doi:10.1099/00207713-25-1-83
Campylobacteraceae	Ursing, J. B., Lior, H., and R. J. Owen, 1994 44:842-845; doi:10.1099/00207713-44-4-842
Flavobacteriaceae	Bernardet, J-F., Y. Nakagawa, B. Holmes, and Subcommittee on the taxonomy of Flavobacterium and Cytophaga-like bacteria of the International Committee on Systematics of Prokaryotes. 2002. IJSEM. **52**:1049-70; doi:10.1099/ijs.0.02136-0
Halobacteriales	Oren, A., A. Ventosa, and W. D. Grant. 1997. IJSB **47**:233-238; doi:10.1099/00207713-47-1-233
Halomonadaceae	Arahal, D. R., R. H. Vreeland, C. D. Litchfield, M. R. Mormile, B. J. Tindall, A. Oren, V. Bejar, E. Quesada, and A. Ventosa. 2007. IJSEM **57**:2436-2446; doi:10.1099/ijs.0.65430-0 Arahal, D. R., R. H. Vreeland, C. D. Litchfield, M. R. Mormile, B. J. Tindall, A. Oren, V. Bejar, E. Quesada, and A. Ventosa. 2008. IJSEM. **58**:2673.
Helicobacter	Dewhirst, F. E., J. G. Fox, and S. L. On. 2000. IJSEM. **50**:2231-7; doi:10.1099/00207713-50-6-2231
Methanogenic bacteria	Boone, D. R., and W. B. Whitman, 1988, IJSB **38**:212–219; doi:10.1099/00207713-38-2-212
Micrococcineae	Schumann, P., P. Kämpfer, H.-J. Busse, L. I. Evtushenko, and for the Subcommittee on the Taxonomy of the Suborder *Micrococcineae* of the International Committee on Systematics of Prokaryotes. 2009. IJSEM. **59**:1823-1849; published ahead of print June 19, 2009, doi:10.1099/ijs.0.012971-0
Mollicutes	International Subcommittee on *Mollicutes*, 1979, IJSB **29**:172–180; doi:10.1099/00207713-29-2-172 Brown, D. R., R. F. Whitcomb, and J. M. Bradbury. 2007. IJSEM **57**:2703-2719; doi:10.1099/ijs.0.64722-0 Whitcomb, R. F. 2007. IJSEM. **57**:201-206; doi:10.1099/ijs.0.64545-0
Moraxella and *Acinebacter*	Bøvre, K., and S. D. Henriksen, 1976, IJSB **26**:92–96; doi:10.1099/00207713-26-1-92
Mycobacterium	Lévy-Frébault, V. V., and F. Portaels, 1992, IJSB **42**:315–323; doi:10.1099/00207713-42-2-315
Mycoplasmatales	International Subcommittee on *Mycoplasmatales*, 1972, IJSB **22**:184–188; doi:10.1099/00207713-22-3-184 (largely superseded by recommendations on *Mollicutes* above).
Pasteurellaceae	Christensen, H., P. Kuhnert, H.-J. Busse, W. C. Frederiksen, and M. Bisgaard. 2007. IJSEM **57**:166-178; doi:10.1099/ijs.0.64838-0
Root- and Stem-Nodulating Bacteria	Graham, P. H., Sadowsky, M. J., Keyser, H. H., Barnet, Y. M., Bradley, R. S., Cooper, J. E., De Ley, D. J., W. Jarvis, B. D., Roslycky, E. B., Strijdom, B. W., and J. P. W. Young, 1991, IJSB **41**:582–587; doi:10.1099/00207713-41-4-582

[1] This list is current through July 2014.

Staphylococcus	J. Freney, W. E. Kloos, V. Hajek, J. A. Webster, M. Bes, Y. Brun, and C. Vernozy-Rozand. 1999. IJSB **49**:489-502; doi:10.1099/00207713-49-2-489
Xanthomonas	Young, J. M., Bradbury, J. F., Gardan, L., Gvozdyak, R. I., Stead, D. E., Takikawa, Y., and A. K. Vidaver, 1991, IJSB **41**:172–177; doi:10.1099/00207713-41-1-172

The subcommittees on the *Arthrobacter*, *Pseudomonas*, and *Bacillus* have drafted minimal descriptive standards, but they have not yet published.

Appendix 7. Publication of a New Name

Valid publication of the name of a taxon (including a new combination) requires publication in the *International Journal of Systematic and Evolutionary Microbiology* (IJSEM) of (a) the name of the taxon, (b) for new taxa the designation of a type, and (c) a description or a reference to an effectively published description of the taxon whether in the *International Journal of Systematic and Evolutionary Microbiology* or in another publication. Fuller details are given below.

(1) The name should be in the correct form. Generic and suprageneric names are single words in Latin form and spelled with an initial capital letter. Names of species are binary combinations of words in Latin form consisting of a generic name and a single, specific epithet, the latter spelled with an initial lowercase letter. Subspecific names are ternary combinations consisting of the name of a species followed by the term "subspecies" (ordinarily "subsp.") and this in turn by a single subspecific epithet. Names of taxa from the rank of order to tribe inclusive are formed by the addition of the appropriate suffix to the stem of the name of the type genus (see 5 below). The suffix for order is *-ales*, for suborder *-ineae*, for family *-aceae*, for subfamily *-oideae*, for tribe *-eae*, and for subtribe *-inae*.

Although not a requirement for the valid publication of a new name, the derivation of the name should be given.

Where possible, the title of the paper should include any new names or combinations that are proposed in the text.

(2) The name should be clearly proposed as a new name or combination and should be accepted by the author at the time of publication. New names are ordinarily proposed by an author appending the phrase "*species nova*" (abbreviation: sp. nov.), "*genus novum*" (abbreviation: gen. nov.), "*combinatio nova*" (abbreviation: comb. nov.), or the like after the name or combination that is being proposed as new; alternatively, the author may make a statement to the effect that a new name or combination is being introduced. Revival of names published prior to 1 January 1980 but not included in an Approved List may be effected by provisions in Rule 33; advice on this is also provided in a report by the Chairman of the Judicial Commission (IJSB [1981] **31**:678).

(3) The name should not be a later homonym of a previously validly published name of an alga, bacterium, fungus, protozoon, or virus. (See the IJSB/IJSEM from 1975 onward and Appendices 2 and 3 for published sources of names of prokaryotic, algal, protozoal, fungal, and viral taxa.)

(4) The name must be accompanied by a description of the taxon or by a reference to a previously published description of the taxon (see 6 below).

(5) The nomenclatural type of a new taxon should be designated. In the case of species and subspecies which can be cultivated, the type strain should be described by itself and should be designated by the author's strain number as well as the accession number under which it is held by at least one culture collection from which cultures of the strain are available.

A nomenclatural type is that constituent element of a taxon to which the name of a taxon is permanently attached. The type of a species or a subspecies is a strain, that of a genus is a species, and that of an order, family, subfamily, tribe, or subtribe is the genus on whose name the name of the higher taxon is based (see 1 above). The type of a taxon above the rank of order is one of the contained orders. For species and subspecies whose cells cannot be maintained in culture or for which cultures are not maintained, the type strain can be represented by the original description and by illustrations and specimens.

A type strain is one of the strains on which the author who first described a named organism based the description of the organism and which the author, or a subsequent author, definitely designated as a type.

A neotype strain replaces a type strain which can no longer be found. The neotype should possess the characteristics as given in the original description; any deviations should be explained. A neotype strain must be proposed by an author in the IJSEM (proposed neotype) together with a reference (or references) to the first description and name for the microorganism (or to an Approved List if appropriate), a description (or reference to a description) of the proposed neotype strain, and a record of the author's designation for the type strain and of at least one culture collection from which cultures of the strain are available. The neotype strain becomes established two years after the date of publication in the IJSEM (established neotype). Any objections should be referred to the Judicial Commission within the first year after publication of the proposal. A neotype strain shall be proposed only after a careful search for original strains. If an original strain is subsequently discovered, the matter shall be referred immediately to the Judicial Commission. Allowance is made for replacement of an unsuitable type strain.

(6) Descriptions of taxa should include the following information: (a) those characteristics which are essential for membership in the taxon, i.e., those characteristics which constitute the basic concept of the taxon; (b) those characteristics which qualify the taxon for membership in the next higher taxon; (c) the diagnostic characteristics, i.e., those characteristics which distinguish the taxon from closely related taxa; and (d) in the case of species, the total number of strains studied, the strain designations, and the number of strains which are either positive or negative for each characteristic. If the strains are not homogeneous in a characteristic, the

specific strain numbers for those strains which disagree with the majority should be given. From this information, the detailed results for each strain can be reconstructed without the full publication of the details for each strain. Where appropriate, suitable photomicrographs and, if necessary, electron photomicrographs should be included as part of the description to show morphological or anatomical characters that are pertinent to the classification. Descriptions should conform at least to such minimal descriptions as have been approved (see Appendix 6).

Appendix 8. Preparation of a Request for an Opinion

In those cases where strict adherence to the rules of nomenclature would produce confusion or would not result in nomenclatural stability, exceptions to the rules may be requested of the Judicial Commission of the ICSP. Requests for Opinions must be accompanied by a fully documented statement of the relevant facts. The Judicial Commission will consider all Requests for Opinions and should issue an Opinion in the IJSEM whether or not the proposal is accepted. The title of a manuscript should provide a concise statement of the contents of the manuscript. If an opinion of the Judicial Commission is requested in the text, “Request for an Opinion” should appear as a subtitle. When a request is not supported by adequate evidence, it will be returned to the author for revision. A Request for an Opinion submitted in an acceptable form will be published as soon as possible in the IJSEM, and microbiologists are invited to submit statements in support of or in opposition to the Request. When an Opinion is challenged, the basis of the challenge should be stated and supported by a documented statement of the relevant facts.

Requests for Opinions or challenges of such Requests or proposals for Opinions or of an issued Opinion should be submitted to the Editorial Secretary in a form suitable for publication without delay in the IJSEM.

Appendix 9. Orthography[1]

When naming an organism, authors should be aware of the fact that there is no guarantee that all strains of a newly named species or all species of a newly named genus possess the property or properties used for the formation of that name.

A. Formation of Compound Names

(1) Compound names are formed by combining two or more words or word elements of Latin and/or Greek origin into one generic name or specific epithet. In most cases two word elements are used (e.g. *Thio*/*bacillus*, *thio*/*parus*), but up to four elements may be found (e.g. *Ecto*/*thio*/*rhodo*/*spira*). The combination of word elements follows four basic rules:

(a) Except for the last word element only the word stems are to be used.

(b) The connecting vowel is -o- when the preceding word element is of Greek origin, it is -i- when the preceding word element is of Latin origin. Greek is more flexible than Latin about the connecting vowel, and other connecting vowels than -o- may be used if a precedent is found in Greek.

Example: *Corynebacterium*.

(c) A connecting vowel is dropped when the following word element starts with a vowel.

(d) Hyphens and diacritic signs are not allowed (see Rules 12a and 64, respectively).

(2) Exemptions from these regulations exist only for the following cases:

(a) When well-established word elements from chemistry or physics are used, their use in these sciences must be followed.

Examples: thio- for sulfur does not lose the -o- in combinations such as *Thioalkalibacter* and *thiooxidans* (following the usage in chemistry: thioether, thioester); likewise radio- would not lose the -o- in combinations such as '*Radioalkalibacter*' or '*radioegens*' (following the usage in physics: radioactive).

(b) As in inorganic chemistry the vowels -o and -i are used to indicate different oxidation levels of cations (e.g. ferro, ferri, cupro, cupri, etc.); they do not fall under the Greek/Latin ruling for connection vowels when used in prokaryote names.

Examples: *Ferroglobus* is an Fe2+ oxidizer, while *Ferrimonas* is an Fe3+ reducer.

(c) In word components like bio-, geo-, halo-, neo-, macro-, micro-, etc., the connecting vowel -o- may be kept when a component follows that begins with a vowel (for reasons of clarity or of previous usage).

B. Generic (and subgeneric) names

(1) The name of a genus (or subgenus) is a Latin noun (substantive) in the nominative case. If adjectives or participles are chosen to form generic names they have to be transformed into substantives (nouns) and handled as such. In some cases the substantivation has already happened in classical Latin (e.g. *Serpens*).

Examples: (i) genuine nouns: *Bacillus*, *Streptococcus*, *Escherichia*, *Azotobacter*; (ii) substantivated adjectives: *Ammoniphilus*, *Halorubrum*, *Methanosalsum*, *Rubritepida*; (iii) substantivated participles of the present: *Agarivorans*, *Myceligenerans*, *Serpens*; (iv) substantivated participles of the perfect: *Amycolata*, *Aquiflexum*, *Gemmata*, *Microlunatus*, *Pectinatus*.

(2) Both Latin and Greek know three genders, i.e. contain nouns of masculine, feminine and neuter gender. Adjectives associated with nouns

[1] This appendix is adapted from Trüper and Euzéby 2009.

follow these in gender. For the correct formation of specific epithets (as adjectives) it is therefore necessary to know the gender of the genus name or of its last component, as appropriate.

Examples for some last components in compound generic names are:

(i) of masculine gender: *-arcus*, *-bacillus*, *-bacter*, *-coccus*, *-ger*, *-globus*, *-myces*, *-philus*, *-planes*, *-sinus* and *-vibrio*;
(ii) of feminine gender: *-arcula*, *-cystis*, *-ella*, *-ia*, *-illa*, *-ina*, *-musa*, *-monas*, *-opsis*, *-phaga*, *-pila*, *-rhabdus*, *-sarcina*, *-sphaera*, *-spira*, *-spina*, *-spora*, *-thrix* and *-toga*;
(iii) of feminine or masculine gender: *-cola* (*-incola*);
(iv) of neuter gender: *-bacterium*, *-bactrum*, *-baculum*, *-filamentum*, *-filum*, *-genium*, *-microbium*, *-nema*, *-plasma*, *-spirillum*, *-sporangium* and *-tomaculum*;
(v) of masculine or feminine or neuter gender: *-ferax*, *-fex* and *-vorax*.

(3) The gender of a new genus must be indicated with the etymology given in the description.

C. Specific (and subspecific) epithets

(1) Rule 12c of the Code demands that specific (or subspecific) epithets must be treated in one of the three following ways:

(a) as an adjective that must agree in gender with the generic name;
(b) as a substantive (noun) in apposition in the nominative case;
(c) as a substantive (noun) in the genitive case.

Examples: (a) *Staphylococcus aureus* (adjective: 'golden'); (b) *Desulfovibrio gigas* (nominative noun: 'the giant'); (c) *Escherichia coli* (genitive noun: 'of the *colum*=colon').

(2) *Adjectives and participles as specific epithets*

(a) Latin adjectives belong to the 1st, 2nd or 3rd declension. Those of the 1st and 2nd declension have different endings in the three genders. In the 3rd declension the situation is more complicated, as there are adjectives that don't change with gender, others that do and some that are identical in the masculine and feminine gender and different in the neuter.

Table 1 gives some examples. Note that comparative adjectives are also listed. It is recommended always to look up an adjective in a dictionary before using it for the formation of a name.

(b) Participles are treated as if they are adjectives, i.e. they fall under Rule 12c (2) of the Code.

(c) Infinitive (also named 'present') participles in the singular do not change with gender. According to the four conjugations of Latin they end in *-ans* (first conjugation, e.g. *vorans* devouring, from *vorare* to devour, *voro* I devour), *-ens* (second conjugation, e.g. *inhibens* inhibiting, from *inhibere* to inhibit, *inhibeo* I inhibit), *-ens* (third conjugation, e.g. *exigens* demanding, from *exigere* to demand, *exigo* I demand), *-iens* (third conjugation, e.g. *faciens* making, from *facere* to make, *facio*, I make), *-iens* (fourth conjugation, e.g. *oboediens* obeying, from *oboedire* to obey, *oboedio* I obey).

Note. Knowledge of the ending of the first person singular in the present is decisive.

(d) Perfect participles change their endings with gender and are handled like adjectives of the first and second declension, e.g. *aggregatus* (masc.), *aggregata* (fem.), *aggregatum* (neut.) (aggregated, from *aggregare* to get together), *flexus*, *flexa*, *flexum* (bent, from *flectere* to bend), *latus*, *lata*, *latum* (carried, from the irregular verb *ferre* to carry), *diminutus*, *diminuta*, *diminutum* (smashed, from *diminuere* to smash).

TABLE 1. Examples of Latin adjectives.

Masculine	Feminine	Neuter	English translation
1st and 2nd declension			
*bonus**	*bona*	*bonum*	good
*aureus**	*aurea*	*aureum*	golden

miser	*misera*	*miserum*	wretched
piger	*pigra*	*pigrum*	fat, lazy
ruber	*rubra*	*rubrum*	red
pulcher	*pulchra*	*pulchrum*	beautiful
3rd declension			
puter	*putris*	*putre*	rotten
celer	*celeris*	*celere*	rapid
facilis[*]	*facilis*	*facile*	easy
facilior	*facilior*	*facilius*	easier
maior	*maior*	*maius*	more
minor	*minor*	*minus*	less
simplex	*simplex*	*simplex*	simple
egens[†]	*egens*	*egens*	needy

[*]Most common types.

[†]Infinitive participle used as adjective.

(3) *Nominative nouns in apposition as specific epithets*

(a) Nominative nouns in apposition must make sense to be acceptable. In grammar, apposition means 'the placing of a word or expression beside another so that the second explains and has the same grammatical construction as the first'; i.e. the added nominative noun has an explanatory specifying function for the generic name, thus, e.g. *Desulfovibrio gigas* may be understood as *Desulfovibrio dictus gigas* and translated as '*Desulfovibrio*, called the giant', which, with reference to the unusual cell size of this species, makes sense.

(b) All specific epithets ending with the Latin suffixes -*cola* (derived from *incola*, 'the inhabitant, dweller') and -*cida* ('the killer') fulfil the above-mentioned requirement.

(4) *Genitive nouns as specific epithets*

(a) The formation of specific epithets as genitive nouns does not pose problems, as the singular genitive of substantives (nouns) is usually given in dictionaries.

(b) If the plural genitive is preferred, as for example in *Lactobacillus plantarum* ('of plants'), one has to find out the declension of the noun, as plural genitives are different in different declensions [see F (3)].

Examples: *Curtobacterium plantarum* (first declension); *Staphylococcus equorum* (second declension); *Bifidobacterium dentium* (third declension); examples not yet found of the fourth and fifth declensions.

D. Formation of prokaryote names from personal names

(1) Persons may be honoured by using their name in forming a generic name or a specific epithet. The Code, however, strongly recommends refraining from naming genera (and subgenera) after persons that are not connected with bacteriology or at least with natural science (Recommendation 10a) and, in the case of specific epithets, to ensure that, if taken from the name of a person, it recalls the name of one who discovered or described it, or was in some way connected with it (Recommendation 12c).

(2) It is good practice to ask the person to be honoured by a scientific name for permission (as long as she/he is alive). Authors should refrain from naming bacteria after themselves or co-authors after each other in the same publication, as this is considered immodest by the majority of the scientific community [see Recommendation 6 (10)].

(3) *Personal names in generic names*

(a) The Code provides two ways to form a generic name from a personal name: either directly by adding the ending -a, -ea, -nia or -ia or as a diminutive by adding, usually, the ending -ella, -iella or -nella. Both kinds are always in the feminine gender. Examples are provided in Table 2.

(b) Some personal names in Europe were already Latinized before 1800 and kept since. If they end in -us, replace the ending by -a or -ella (diminutive) respectively (e.g. the name Bucerius would result in '*Buceria*' or '*Buceriella*'). Beware, however, of Lithuanian names like Didlaukus, Zeikus, etc. These are not Latinized but genuine forms and would receive the ending -ia according to Table 2.

(c) Not more than one person can be honoured in one generic name or epithet.

(d) If an organism is named after a person, the name cannot be shortened, e.g. '*Wigglesia*' after Wigglesworth, '*Stackia*' after Stackebrandt or '*Goodfellia*' after Goodfellow, etc., but must appear fully. Personal titles (Sir, Lord, Duke, Baron, Graf, Conte, etc.) are not included in prokaryote names, although they may belong to the name according to the laws of the respective country. Prefixes and particles should be treated as follows:

(i) The Scottish patronymic prefixes 'Mac', 'Mc' and 'M', meaning 'son of', should be written 'mac' and be united with the rest of the name (e.g. '*Macdonellia*' or '*macdonellii*' after *MacDonell*; *Macginleya* or *macginleyi* after McGinley).
(ii) The Irish patronymic prefix 'O' should be united with the rest of the name or omitted (e.g. '*Oconnoria*' or '*Connoria*' or '*oconnorii*' or '*connorii*' after O'Connor).
(iii) A prefix consisting of an article (e.g. le, la, l', les, el, il, lo, de), or containing an article (e.g. du, de la, des, del, della, do, da), may be omitted or united to the name (e.g. *Rochalimaea* after da Rocha-Lima; *Leclercia* or '*leclercii*' after Le Clerc; *Leminorella* or *leminorii* after Le Minor; '*Loprestia*' or '*loprestii*' after Lo Presti, *Deleya* or *deleyi* after de Ley, *Devosia* or '*devosii*' after De Vos).
(iv) The Dutch prefix 'van' and the German prefix 'von' may be omitted or united to the name (e.g. *Escherichia* after von Escherich; *Leeuwenhoekia* after van Leeuwenhoek, *itersonii* after van Iterson, *prowazekii* after von Prowazek, '*Vannielia*' or *vannielii* after van Niel; '*Vandertoornia*' or '*vandertoornii*' or '*Toornia*' or '*toornii*' after van der Toorn, '*Vandammella*'or '*vandammei*' after Vandamme).
(v) The adjective Saint (San, Sankt, Santo, -a, Sveti, etc.) as part of some family names may be omitted or united to the name (e.g. '*Exuperya*' or '*exuperyi*' after Saint-Exupéry, '*Sanmartinia*' or '*sanmartinii*' after San Martin).

(e) Rarely, generic names or specific epithets have been formed from forenames (first names, given names, Christian names), i.e. not from the family name.

Examples: *Erwinia* was named after Erwin F. Smith; the first name Arletta appears in *Staphylococcus arlettae* (N.L. gen. n. *arlettae* of Arletta, named after Arlette van de Kerckhove). First names may be chosen in order to avoid rather long family names or unusually long (hyphenated) double names.

(f) In cases of very frequent family names where the honoured person is not easily identifiable, first and family name may be contracted without connecting vowel or hyphenation, but otherwise treated like a single family name.

Examples: *Owenweeksia*, *Elizabethkingia*.

TABLE 2. Ways to form generic names from personal names.[2]

Personal name ending in	Person	Direct formation		Diminutive formation	
		Add ending	Example	Diminutive ending	Example
-a	da Rocha Lima	-ea	*Rochalimaea*	drop a, add -ella	*Rochalimella*
-e	Benecke	-a	*Beneckea*	-lla	*Beneckella*
	Burke	-ia	*Burkeia*	-lla	*Burkella*
-i	Nevski	-a	*Nevskia*	-ella	*Nevskiella*
-o	Beggiato	-a	*Beggiatoa*	-nella	*Beggiatonella*
	Cato	-nia	*Catonia*	-nella	*Catonella*
-u	Manescu	-ia	*Manescuia*	-ella	*Manescuella*
-y	Deley	-a	*Deleya*	-ella	*Deleyella*
-er	Buchner	-a	*Buchnera*	-ella	*Buchnerella*
	Lister	-ia	*Listeria*	-iella	*Listeriella*
Any consonant	Cabot	-ia	*Cabotia*	-(i)ella	*Cabot*(*i*)*ella*
	Wang	-ia	*Wangia*	-(i)ella	*Wang*(*i*)*ella*
	Salmon	-ia	*Salmonia*	-ella	*Salmonella*
	Escherich	-ia	*Escherichia*	-(i)ella	*Escherich*(*i*)*ella*
	Zeikus*	-ia	*Zeikusia*	-(i)ella	*Zeikus*(*i*)*ella*

[2] Some names may be hypothetical examples.

[*] This name of Lithuanian origin is not a genuine Latinized name. If it were, the genus names '*Zeikia*' or '*Zeik*(*i*)*ella*' might have been possible.

(4) *Personal names in specific epithets*

(a) To form specific epithets from personal names there are principally two possibilities: the adjective form and the genitive noun form. The adjective form has no means to recognize the sex of the honoured person, which, in principle, is not necessary for nomenclatural purposes. The personal names receive appropriate endings according to the gender of the generic name as indicated in Table 3. Thus an adjective epithet is formed that has the meaning of 'pertaining/relating/belonging to ... (the person)'.

(b) When the genitive of a Latinized personal name is formed for a specific epithet, the sex of the person to be honoured may be taken into consideration as indicated in Table 4.

On the basis of classical, medieval and Neo-Latin usage, any of the forms of Latinization listed in Table 4 may be chosen. As evident from Table 4, the formation of specific epithets from personal names as genitive nouns poses certain problems only with names ending in -a and -o.

(c) The recommendations and rules for genus names as given above [D (3), (c)–(f)] are also applicable for specific epithets. Appropriate examples are given there.

TABLE 3. Formation of specific epithets from personal names in the adjective form[3]

Ending of name	Example family name	Add the endings for gender		
		Masculine	Feminine	Neuter
consonant	Grant	-ianus	-iana	-ianum
-a	Kondratieva	-nus	-na	-num
-e	Lee	-anus	-ana	-anum
-i	Bianchi	-anus	-ana	-anum
-o	Guerrero	-anus	-ana	-anum
-u	Manescu	-anus	-ana	-anum
-y	Bergey	-anus	-ana	-anum

TABLE 4. Formation of specific epithets from personal names as genitive nouns.[4]

Ending of name	Add for female	Example female person	Add for male	Example male person
-a	-e (1st declension)	Catarina, *catarinae*	-e (classic)	Komagata, *komagatae* Volta, *voltae*
	–	–	-i	Thomalla, *thomallai*
	-ea	Julia, *juliaeae*	-ei	Poralla, *porallaei*
	-iae	Mateka, *matekaiae*	-ii	Ventosa, *ventosaii*
-e	-ae	Hesse, *hesseae*	-i	Stille, *stillei*
-i	-ae	Kinski, *kinskiae*	-i	Suzuki, *suzukii*
-o	-niae	Cleo, *cleoniae*	-nis	Otto, *ottonis*
-u	-iae	Feresu, *feresuiae*	-ii	Manescu, *manescuii*
-y	-ae	Macy, *macyae*	-i	Deley, *deleyi*
-as	drop -as, add -ae	Thomas, *thomae*	drop -as, add -ae	Cosmas, *cosmae*
	-iae	Thomas, *thomasiae*	-ii	Cosmas, *cosmasii*
-er	-ae	Miller, millerae	-i	Stutzer, stutzeri Stanier, stanieri
any other letter	-iae	Gordon, gordoniae	-ii	Pfennig, pfennigii Zeikus, zeikusii

[3] Some names may be hypothetical examples.

[4] Some names may be hypothetical examples.

E. Formation of prokaryote names from geographical names

(1) The formation of prokaryote names from geographical names has no geopolitical meaning, i.e. such names cannot be used to express geopolitical claims.

(2) Unlike epithets derived from personal names, epithets on the basis of geographical names cannot be formed as substantives in the genitive case. They must be adjectives and are usually constructed by adding the ending *-ensis* (masculine or feminine gender) or *-ense* (neuter gender) to the geographical name in agreement with the latter's gender. Only if the name of the locality ends in -a or -e or -en, these letters are dropped before adding *-ensis*/*-ense* (e.g. *jenensis* from Jena, *californiensis* from California, *drentensis* from Drente, *bremensis* from Bremen). If the locality's name ends in -o, the ending becomes *-nensis*/*-nense* (e.g. the name of the Japanese city Sapporo: *sapporonensis*, *sapporonense*).

(3) Quite a number of localities in the Old World (Europe, Asia, Africa) have classical Greek, Latin or medieval Latin names and adjectives derived from these: *aegyptius* (Egypt), *africanus* (Africa), *arabicus* (Arabia), *asiaticus* (Asia), *balticus* (Baltic Sea), *bavaricus* (Bavaria), *bretonicus* (Brittany), *britannicus* (Britain), *europaeus* (Europe), *frisius* (Friesland), *gallicus* (France), *germanicus* (Germany), *graecus* (Greece), *hellenicus* (Hellas, classical Greece), *helveticus* (Switzerland), *hibernicus* (Ireland), *hispanicus* (Spain), *hungaricus* (Hungary), *ibericus* (Spain/Portugal, the Iberian peninsula), *indicus* (India), *italicus* (Italy), *mediterraneus* (Mediterranean Sea), *persicus* (Persia, Iran), *polonus* (Poland), *rhenanus* (Rhineland), *romanus* (Rome), *saxonicus* (Saxony), etc. Later, Neo-Latin names were also given to many other non-European parts of the world, so adjectives like *americanus* (America), *antarcticus* (Antarctica), *australicus* (Australia), *cubanus* (Cuba), *mexicanus* (Mexico), *japonicus* (Japan), etc. were introduced. Wherever such older adjectives exist they may be used as specific epithets to indicate geographical origins.

(4) European and Mediterranean cities and places of classical times may have had quite different names than today, e.g. *Lucentum* (Alicante, Spain), *Argentoratum* (Strasbourg, France), *Lutetia* (Paris, France), *Traiectum* (Utrecht, Netherlands), *Ratisbona* (Regensburg, Germany), *Eboracum* (York, UK), *Londinium* (London, UK) and *Hafnia* (København, Denmark), which lead to the respective adjectives *lucentensis*, *argentoratensis*, *lutetiensis*, *traiectensis*, *ratisbonensis*, *eboracensis*, *londiniensis* and *hafniensis* but, alternatively, the Neo-Latin adjectives of the modern names may also be used: *alicantensis*, *strasbourgensis*, *parisensis*, *utrechtensis*, *regensburgensis*, *yorkensis*, *londonensis*, *kobenhavnensis*, respectively.

(5) Many localities (mostly lakes, rivers, seas, islands, capes, rocks, mountains or valleys, but also some cities and towns) have names that consist of two words, usually an adjective and a substantive (noun) (e.g. Deep Lake, Black Sea, Red River, Rio Grande, Long Island, Blue Mountain, Baton Rouge, Santa Cruz, Saint Germain, Sankt Georgen, etc.) or two substantives (e.g. Death Valley, Lake Windermere, Loch Ness, Martha's Vineyard, Ayers Rock, Woods Hole, Cape Cod, Monte Carlo, etc.). The formation of specific epithets from such localities' names may pose a problem, as the use of the adjectival suffix *-ensis*, *-ense* may lead to rather strange looking or awkward constructions, such as '*deeplakensis*' or '*bluemountainense*', although they would be formally correct. If a name of a locality lends itself to translation into Latin, specific epithets may as well be formed as genitive substantives of the two components and concatenating them without hyphenation, like the existing ones *lacusprofundi* (of Deep Lake), *marisnigri* (of the Black Sea), *marismortui* (of the Dead Sea) or, of two nouns, *vallismortis* (of Death Valley).

Note. In Latin the basic noun comes first, the determining word (adjective or noun) second.

(6) The inclusion of articles (such as *the*, *el*, *o*, *il*, *le*, *la*, *a*, *de*, *der*, *die*, *das*, *den*, *het* or their plurals *the*, *los*, *las*, *os*, *as*, *les*, *ils*, *gli*, *le*, *de*, *die*, *s*', etc.) as they are used for locations in several languages (e.g. La Paz, El Ferrol, El Alamein, Le Havre, The Netherlands, Die Schweiz, Den Haag, s'Hertogenbosch, Los Angeles, etc.) should be avoided. Articles would unnecessarily elongate names without adding information.

F. Formation of names for prokaryotes living in association or symbiosis with other biota

(1) For the formation of names for prokaryotes that live in association or symbiosis with plants, fungi, animals or other prokaryotes it is important to know the exact meaning of the nomenclatural name of such a partner and how it was formed (adjective, genitive noun, etc.).

(2) The easiest way of forming such specific epithets is the use of the genitive case of the generic name of the associated organism in question, e.g. *suis*, *equi*, *bovis*, *muscae*, *muris*, *aquilae*, *falconis*, *gypis*, *elephantis* (of the pig, horse, cow, fly, mouse, eagle, falcon, vulture, elephant), or *fagi*, *quercus* (4th declension genitive, spoken with long u), *castaneae*, *aesculi*, *rosae*, *liliae* (of the beech, oak, chestnut, horse chestnut, rose, lily).

(3) Alternatively the genitive of the plural is recommendable, especially if several species of the associated (usually) eukaryotic genus house the prokaryote species in question. To form the plural genitive one needs to know the stem and declension of the word.

The following examples may be of some assistance:

(i) 1st declension: *-arum* (*muscarum*, of flies, *rosarum*, of roses);
(ii) 2nd declension: *-orum* (*equorum*, of horses, *pinorum*, of pines);
(iii) 3rd declension (consonant stems): *-um* (*leonum*, of lions, *leguminum*, of legumes);
(iv) 3rd declension (vocal and mixed stems): *-ium* (*felium*, of cats, *ruminantium*, of ruminants);
(v) 4th declension: *-um* (*quercum*, of oaks);
(vi) 5th declension: *-rum* (*scabierum*, of different forms of scabies, a skin desease).

Note. Be aware of irregular forms such as *bos* (the cow), genitive *bovis*, plural genitive *boum*; *canis* (the dog), genitive *canis*, plural genitive *canum*. Use dictionaries.

G. Names originating from languages other than Latin or Greek

(1) As the Code defined Latin or, better, Neo-Latin as the language of prokaryote nomenclature, names should not be taken from other languages as long as they may be constructed from Latin or Greek word stems [Recommendation 6 (3)]. Only Latin gender endings are permitted. Greek endings must be transformed into Latin endings. Example: The formation of the epithet *simbae* from the East African Swahili word *simba*, lion, for a *Mycoplasma* species was not necessary because in this genus the corresponding Latin epithet *leonis* (of the lion) had not been used before.

(2) When it becomes unavoidable to use a word from another language the word stem must be identified before Latinization.

Example: The Arabic word ‘alkali’ (*al-qaliy*, the ashes of saltwort) from which the element kalium (K; English, potassium) received its name. As the -i at the end of the word belongs to the stem it is wrong to speak and write of alcalophilic instead of alkaliphilic microbes.

(3) Typical usages of the other language should not be carried over into Latin.

Example: The English suffix -philic (e.g. hydrophilic: friendly to water, water-loving) is an English transformation of the Latin *-philus*, *-a*, *-um* (originating from Greek *philos*, friendly). Therefore the ending *-philicus* must be avoided and *-philus* be used instead.

(4) National foods or fermentation products (e.g. sake, tofu, miso, yogurt, kvas, kefir, pombe, pulque, aiva, etc.) often do not have equivalent Latin names and if typical micro-organisms found in them or causing their fermentations are described, they may be named after them. These names cannot be used unaltered just as specific epithets in the form of nominative substantives in apposition. They are properly Latinized by forming a neuter substantive from them by adding *-um* (e.g. *sakeum*, *tofuum*, *kefirum*, *pombeum*, etc.) and the use of the genitive of that (ending *-i*) in the specific epithet (e.g. *sakei*, *tofui*, *kefiri*, *pombei*, etc.).

H. Formation of prokaryote names from names of elements and compounds used in chemistry and pharmacy

(1) The vast majority of names of chemicals are Latinized as neuter nouns of the 2nd declension with nominatives ending *-um*, genitives in *-i*. The following groups belong in this category:

(a) Most of the chemical elements with the exception of carbon (L. *carbo*, *carbonis*) phosphorus (L. *phosphorus*, *phosphori*) and sulfur (L. *sulfur*, *sulfuris*) have the ending *-(i)um* with the genitive ending in *-(i)i*; nitrogen may also be called *azotum* besides *nitrogenium*, calcium may also be called *calx* (genitive *calcis*).

(b) Names of chemical and biochemical compounds ending in *-ide* (including anions), *-in*, *-ane*, *-ene*, *-one*, *-ol* (only non-alcoholic compounds), *-ose* (sugars), *-an* (polysaccharides) and *-ase* (enzymes) are Latinized by adding the ending *-um* or by replacing the *-e* at the end by *-um* as appropriate.

(c) Acids are named by *acidum* (L. neuter noun, acid), followed by a descriptive neuter adjective, e.g. sulfurous acid *acidum sulfurosum*, sulfuric acid *acidum sulfuricum*, acetic acid *acidum aceticum*.

(2) The second largest category of chemicals are treated as neuter nouns of the 3rd declension: These are those ending in *-ol* (the alcohols), *-al* (aldehydes), *-er* (ethers, esters) and *-yl* (organic radicals); Latinization does not change their names at the end, whereas the genitive is formed by adding *-is*.

(3) Anions ending in *-ite* and *-ate* are treated as masculine nouns of the 3rd declension. The English ending *-ite* is Latinized to *-is*, with the genitive *-itis*, e.g. nitrite becomes *nitris*, *nitritis*. The English ending *-ate* is Latinized to *-as*, with the genitive *-atis*, e.g. nitrate becomes *nitras*, *nitratis*.

(4) Only a few chemicals have names that are Latinized in the 1st declension as feminine nouns, ending in *-a* with a genitive in *-ae*. Besides chemicals that always had names ending in *-a* (like *urea*), these are drugs found in classical and medieval Latin, such as gentian (*gentiana*) and camphor (*camphora*), and further modern drugs, whose Latin names were formed by adding *-a*, like the French *ergot* becoming *ergota* in Latin. An important group of this category are alkaloids and other organic bases, such as nucleic acid bases and amino acids with English names ending in *-ine*. In Neo-Latin this ending is *-ina*, with the genitive *-inae*.

Examples: *betaina*, *-ae*; *atropina*, *-ae*; *adenina*, *-ae*; *alanina*, *-ae*.

(5) Names of pharmaceutical and chemical products or their registered or unregistered trade names are Latinized following the instructions given above.

(6) For their use in prokaryote generic names and specific epithets, word stems and genitives of Latinized chemical names are the basis. In principle they are then treated like any other word elements.

I. Arbitrary names

(1) The bases for arbitrary names are Rules 10a and 12c of the Code: ‘genus names or specific epithets may be taken from any source and may even be composed in an arbitrary manner’. They must, however, be treated as Latin. Often they are vocalized abbreviations or contractions of names.

Examples: *Cedecea*, *Afipia*, *Kordia*, *Kribbella*, *Waddlia* and *Desemzia*, that were derived from the acronyms CDC (Centers for Disease Control), AFIP (Armed Forces Institute of Pathology), KORDI (Korea Ocean Research and Development Institute), KRIBB (Korean Research Institute of Bioscience and Biotechnology), WADDL (Washington Animal Disease Diagnostic Laboratory) and DSMZ (Deutsche Sammlung von Mikroorganismen und Zellkulturen), respectively. Another example is *Simkania* (contracted from the name Simona Kahane). Examples for arbitrary specific epithets are (*Burkholderia*) *unamae*, derived from the acronym UNAM (Universidad Nacional Autónoma de México), (*Brevundimonas*) *nasdae*, derived from the acronym NASDA (National Space Development Agency of Japan), and (*Flavobacterium*) *micromati* derived from the abbreviation MICROMAT (MICROMAT project ‘Biodiversity of Microbial Mats in Antarctica’).

(2) When proposing arbitrary names or epithets, authors should aim at short, elegant, easily spelled and pronounced ones.

Note. With arbitrary genus names the gender must also be indicated.

REFERENCES[5]

Buchanan, R. E. (1994). Chemical terminology and microbiological nomenclature. *Int J Syst Bacteriol* **44**:566–590.

MacAdoo, T. O. (1993). Nomenclatural literacy. In Handbook of New Bacterial Systematics, pp. 339–358. Edited by M. Goodfellow and A. G. O'Donnell. London: Academic Press.

Trüper, H. G. (1996). Help! Latin! How to avoid the most common mistakes while giving Latin names to newly discovered prokaryotes. *Microbiologia* **12**:473–475.

Trüper, H. G. (1999). How to name a prokaryote? Etymological considerations, proposals and practical advice in prokaryote nomenclature. *FEMS Microbiol Rev* **23**:231–249.

Trüper, H. G. (2001). Etymology in nomenclature of procaryotes. In Bergey's Manual of Systematic Bacteriology, 2nd edn, vol. 1, pp. 89–99. Edited by D. R. Boone, R. W. Castenholz and G. M. Garrity. New York: Springer.

Trüper, H. G. (2004). The use of Neolatin in biological nomenclature. *Neulateinisches Jahrb J Neo-Latin Lang Lit* **6**:318–327.

Trüper, H. G. (2005). Is 'localimania' becoming a fashion for prokaryote taxonomists? *Int J Syst Evol Microbiol* **55**:1753.

Trüper, H. G. (2007). Neo-Latinists worldwide willing to help microbiologists. *Int J Syst Evol Microbiol* **57**:1164–1166.

Trüper, H. G., and J. P. Euzéby. 2009. International Code of Nomenclature of Prokaryotes. Appendix 9: Orthography. *Int J Syst Evol Microbiol* **59**:2107-2113.

[5] This list of literature is intended to be informative and helpful, but is not an official part of Appendix 9.

Appendix 10. Infrasubspecific Subdivisions

The designations of these taxa are not covered by the Rules of this Code, but this Appendix is included to encourage conformity and to clarify the application of these designations (see Rule 14a, b).

A. Definitions

The term **infrasubspecific subdivision** (or division) has been used in two ways to denote both terms and taxa. It is preferable to distinguish them as given below. **Infrasubspecific "subdivision"** has been used rather than "division" to avoid any confusion with the taxonomic category "division" (*divisio*).

Note. Infrasubspecific subdivisions are not arranged in any order of rank, and may overlap one another.

(1) *Infrasubspecific taxa*. An **infrasubspecific taxon** is one strain or a set of strains showing the same or similar properties, and treated as a taxonomic group.

Example: *Staphylococcus aureus* phagovar 81.

The sets of properties used may be of a similar kind but are not necessarily the same.

Example: The susceptibility to a different phage may be used to define another phagovar of *Staphylococcus aureus*, e.g., phagovar 42D.

Infrasubspecific taxa based on different sets of properties may overlap; e.g., one serovar may contain strains belonging to different phagovars.

Example: *Salmonella typhi* serovars, phagovars, and biovars.

(2) *Infrasubspecific terms*. An **infrasubspecific term** is used to refer to the kinds of taxa below subspecies.

Examples: serovar, chemovar, *forma specialis*.

If a species has not been divided into subspecies, the infrasubspecific terms may be applied to other subdivisions within that species. The subdivisions so named would still be infrasubspecific subdivisions for nomenclatural purposes until such time as they may be raised to subspecific or specific rank.

Example: Serovars of *Erysipelothrix rhusiopathiae*.

(3) *Use of other terms*. **Infrasubspecific form** has been used to refer to a bacterial strain, but this use should be avoided.

A **culture** of bacteria is a population of bacterial cells in a given place at a given time, e.g., in this test tube or on that agar plate. It may have a longer duration, e.g., desiccated cultures.

A **clone** is a population of bacterial cells derived from a single parent cell.

A **strain** is made up of the descendants of a single isolation in pure culture. A strain is usually made up of a succession of cultures and is often derived from a single colony. The number of bacteria which gave rise to the original colony is often unknown. Most bacterial strains are not known to be clones.

Individual is a term with little meaning in bacteriology and has been applied to a single bacterial cell or to a bacterial strain; therefore, it is best to avoid the use of this term.

B. Infrasubspecific Terms

Table 5 contains some of the terms which are commonly used, and the preferred name appears in the first column. The introduction of the suffix "**-var**" or "**-form**" to replace "-type" is recommended to avoid confusion with the strict use of the term "type" to mean nomenclatural type (see Rule 15).

The term "**type**" in bacteriology should be used strictly for a nomenclatural type (Principle 5 and Chapter 3, Section 4). It should not be used to designate a division of a species nor to designate taxa based on antigenic characters.

The term "**group**" is informal and has no nomenclatural standing. It may prove useful to designate informally a set of organisms having certain characteristics in common, provided that it is used with care and exact definition to avoid ambiguity. It should not be used to avoid the use of the correct name of a taxon such as genus or species.

However, it may be useful when the bacteriologist does not wish to give a formal name to a set of bacteria until further studies have been made but wishes to publish his results and seek the opinion of others.

Example: "IID group," later named *Cardiobacterium hominis*.

TABLE 5. *Infrasubspecific terms*

Preferred name	Synonym(s)	Notes
Biovar	Biotype, physiological type	Biochemical or physiological properties.
Chemoform	Chemotype	Chemical constitution.
Chemovar		Production or amount of production of a particular chemical.
Cultivar		A cultivated strain with special properties.
forma specialis (abbreviation, f.sp.)	Special form	A parasitic, symbiotic, or commensal microorganism distinguished primarily by adaptation to a particular host or habitat. Named preferably by the scientific name of the host in the genitive.
Morphovar	Morphotype	Morphological characteristics.
Pathovar	Pathotype	Pathogenic reactions in one or more hosts. For recommendations on designating pathovars and use of designations when reviving names see Dye *et al.* (1980) in Appendix 3.
Phagovar	Phagotype, lysotype	Reactions to bacteriophage.
Phase		Restricted to well-defined stages of naturally occurring alternating variations.
Serovar	Serotype	Antigenic characteristics.
State		Colonial variants, e.g., rough, smooth, mucoid (may be defined antigenically).

C. Nomenclature of Infrasubspecific Taxa

An **infrasubspecific taxon** is designated or cited by the name of the species followed by the infrasubspecific term used to designate this infrasubspecific subdivision followed by the infrasubspecific designation.

Example: *Staphylococcus aureus* phagovar 81.

Reference strains of infrasubspecific taxa may be designated.

There are many ways that infrasubspecific taxa may be designated; among these are the following: latinized words, e.g., *cerealis* in *Xanthomonas translucens* f.sp. *cerealis*; vernacular names or words, e.g., rough phase; numbers, letters, or formulae, e.g., phagovar 42D in *Staphyloccocus aureus* phagovar 42D.

D. Nomenclature of Strains

A strain may be designated in any manner, e.g., by the name of an individual, by a locality, or by a number.

Appendix 11. The Provisional Status *Candidatus*[1]

(1) The provisional status "Candidatus" may be used to record the properties of putative taxa of prokaryotes.

This category should be used for describing prokaryotic entities for which more than a mere nucleic acid sequence is available but for which characteristics required for description according to the Code are lacking.

(2) The following information should be included in the description of a Candidatus:

(a) Genomic information, i. e. nucleic acid sequences apt to determine the phylogenetic position of the organism.

(b) All information so far available on

(i) structure and morphology (appropriate illustration)

(ii) physiology and metabolism

(iii) reproductive features

(iv) the natural environment, in which the organism can be identified by in situ hybridization or similar techniques for cell identification.

(c) Any other available and suitable information.

(3) A name of an organism in the status of Candidatus consists of the word Candidatus, followed by a "vernacular epithet" that consists of either a genus name with a specific epithet, or only a genus name, or only a specific epithet.

Examples: *Candidatus* Liberobacter asiaticum; *Candidatus* magnetobacterium; *Candidatus* intracellularis.

Note that the word Candidatus, but not the vernacular epithet is printed in italics.

(4) A Candidatus name is by definition a preliminary name and therefore has no standing in prokaryote nomenclature.

(5) A list in the form of a codified record of organisms of the status Candidatus is kept by the Judicial Commisssion of the ICSP in cooperation with the Editorial Board of the IJSEM and is published in that journal in appropriate intervals.

(6) The items for inclusion in the codified record are listed in Table1.

(7) When an organism of the status Candidatus is later on isolated and the pure culture sufficiently described, it has to be classified and named according to the Rules of the Code. The former Candidatus organism's name is deleted from the Candidatus list.

Recommendation: For more information, authors planning to describe a Candidatus are recommended to read the articles by Murray and Stackebrandt (1995, IJSB 45, 186-187 [doi:10.1099/00207713-45-1-186]) and Murray and Schleifer (1994, IJSB 44, 174-176 [doi:10.1099/00207713-44-1-174]).

TABLE 1. Items for inclusion in the codified record of a provisional taxon.[a]

Order of mention	Example responses
Status	*Candidatus*
Vernacular epithet	"another"
Phylogenetic lineage or possible genus	e.g., *Deltaproteobacteria*, possible (probable) *Desulfovibrio*
Cultivation	Cultivated or Not Cultivated
Gram reaction	G+, G-, Variable, or Not Applicable
Morphology	R (rod), C (coccus), F (filamentous), M (mycolial), O (other), U (unknown)
Basis of assignment	Nucleic Acid Sequence (data bank no.), morphology, etc.
Specific identification of morphotype	Probe identity
Habitat, association, or host	Symbiotic (name host and tissue), Free-Living (sea, etc.), etc.
Metabolism and unusual features	Aer., Anaer., Microaer., etc.
Growth temperature	M, P, T (meso-, psychro-, thermophilic)
Source	Natural environment
Author(s)	Essential reference

[a] Modified from Murray and Schleifer, 1994.

[1] This appendix is adapted from MURRARY, R. E., AND E. STACKEBRANDT. 1995. Taxonomic Note: Implementation of the Provisional Status *Candidatus* for Incompletely Described Procaryotes. *Int. J. Syst. Bacteriol.* **45**:186–187.

Example: "*Candidatus* magnetobacterium" [(new subclass of *Proteobacteria* or new lineage) NC; G-; R; NAS (EMBL number X71838), oligonucleotide sequence complementary to unique region of 16s rRNA 5'-GCCATCCCTCGCTTACT-3'; FL (freshwater lake sediment); microaer., magnetosomes, sulfur inclusions; M]. Spring et al., Appl. Environ. Microbiol. **59**:2397, 1993.

REFERENCES

Judicial Commission of the IJSB. 1995. Minutes of the meetings, 2 and 6 July 1994, Prague, Czech Republic. *Int. J. Syst. Bacteriol.* **45**:195–196.

MURRAY, R. G. E., AND K. H. SCHLEIFER. 1994. Taxonomic notes: a proposal for recording the properties of putative taxa of procaryotes. *Int. J. Syst. Bacteriol.* **44**:174–176.

Appendix 12. The van Niel International Prize

1986 *Establishment of the C. B. van Niel prize*

The van Niel International Prize, established in 1986 by Professor V. B. D. Skerman of The University of Queensland, honours the contribution of scholarship in the field of microbiology by Professor Cornelis Bernardus van Niel (Tindall 2011).

V. B. D. Skerman referred to his intention of establishing a prize for bacterial systematics, to be awarded at each Congress of the Bacteriology Division of the IUMS, and to be named in honor of Professor Cornelis Bernardus van Niel. He requested that the ICSB set up a prize-awarding committee. It was agreed that the Executive Secretary would write to Dr. Skerman to thank him, to invite him to become a member of a prize selection panel, and to obtain details of the finances available (Hill 1987).

R. G. E. Murray proposed a vote of appreciation by ICSB to V. B. D. Skerman for his vision, self-sacrifice, and generous financial support that underpins ICSB activities and that led to the establishment of the van Niel International Prize for Studies in Bacterial Systematics (carried unanimously with acclaim) (Goodfellow 1991).

Hill, L. R. 1987. International Committee on Systematic Bacteriology XIV International Congress of Microbiology, Minutes of the Meetings, 5, 6, and 9 September 1986, Manchester, United Kingdom. *Int J Sys Bacteriol* **37**:88-90; doi:10.1099/00207713-37-1-88

1986–1990 *van Niel Prize recipient,* **P. H. A. Sneath**

Congratulations were offered to P. H. A. Sneath, who was to be the first recipient of the van Niel International Prize for Studies in Bacterial Systematics.

Goodfellow, M. 1991. Matters Relating to the International Committee on Systematic Bacteriology International Committee on Systematic Bacteriology XVth International Congress of Microbiology: Minutes of the Meetings, 14, 15, and 18 September 1990, Osaka, Japan. *Int J Syst Bacteriol* **41**:188-189; doi:10.1099/00207713-41-1-188

1990–1994 *van Niel Prize recipient,* **J. de Ley**

Congratulations were offered to J. de Ley, who was to be the second recipient of the van Niel International Prize for Studies in Bacterial Systematics. The importance of the prize in helping raise the standing of bacterial systematics in the microbial community was acknowledged.

Goodfellow, M. 1995. International Committee on Systematic Bacteriology XVIth International Congress of Microbiology: Minutes of the Meetings, 2, 3, and 5 July 1994, Prague, Czech Republic *Int J Syst Bacteriol* **45**:613-615; doi:10.1099/00207713-45-3-613

1994–1996 (Not Awarded)

Nominations for the *van Niel Prize* were not solicited for this meeting because the original rules for this prize stated that it would be awarded every four years, and it was not certain if it were appropriate or legal to award it at this Congress because of the timing. The fiscal health of the prize was also in question, since Gaylen Bradley, the IUMS Treasurer, had informed me that the last award of the prize was partially funded from the trust funds for this prize. Lindsay Sly was able to take these concerns on behalf of ICSB to the administration of the University of Queensland, Australia, who actually administer this Prize. The University has advised that the prize money is derived from the income generated from the existing capital of the fund, and ICSB has no financial obligations in regard to the prize. It is estimated that the income available for the next prize, to be awarded in Sydney in 1999, will be around $4,000. The University of Queensland is altering the rules for the prize so that it will be awarded at the same time as the meeting of the IUMS Congress. The Executive Secretary-Treasurer for ICSB for the next triennial should therefore begin soliciting nominations from member societies next year, although the role of the ICSB in this prize is strictly advisory. The individual receiving this prize will be selected by the Head of the Department of Microbiology at the University of Queensland, upon consultation with a panel of exports nominated on behalf of the ICSB, as having made the most distinguished contribution in the field of bacterial systematics in the previous four years.

Labeda, D. P. 1997. International Committee on Systematic Bacteriology VIIth International Congress of Microbiology and Applied Bacteriology: Minutes of the Meetings, 17, 18, and 22 August 1996, Jerusalem, Israel. *Int J Syst Bacteriol* **47**:597-600; doi:10.1099/00207713-47-2-597

1996–1999 *van Niel Prize recipient,* **Professor K. Komagata**

Nominations for the *van Niel Prize* were once again solicited for this Congress because the rules for the Prize were altered by the University of Queensland's Legal Office to accommodate the change of the scheduling of IUMS Congress to a 3-year cycle. We had several outstanding candidates nominated and are pleased to have the Selection Committee recognize Professor K. Komagata's contributions to bacterial systematics with the award of this year's Prize.

Prior to nomination of a prize winner, the IUMS Executive Board indicated that travel funds would be paid to the prize recipient, although this was not part of the prize money.

Labeda, D. P. 2000. International Committee on Systematic Bacteriology. IXth International (IUMS) Congress of Bacteriology and Applied Microbiology, Minutes of the meetings, 14 and 17 August 1999, Sydney, Australia. *Int J Syst Evol Microbiol* **50**:2245–2247; doi: 10.1099/00207713-50-6-2245

International Union of Microbiological Societies Newsletter, July 1995. *World J Microbiol and Biotechnol* **11**(4):i-iv. doi:10.1007/BF00364611

1999–2002 *van Niel Prize recipient,* **L. Wayne**

The committee's nomination for this session was L. Wayne (USA) for his contribution to the biology of *Mycobacterium* and to bacterial systematics in general. L. Wayne was duly awarded The van Neil Prize. The announcement was made during the IUMS Congress, and the Committee extended their congratulations to L. Wayne on this much-deserved award.

Saddler, G.S. 2005. International Committee on Systematics of Prokaryotes. Xth International (IUMS) Congress of Bacteriology and Applied Microbiology, Minutes of the meetings, 28 and 30 July 2002, Paris, France. *Int J Syst Evol Microbiol* **55**:533–537; doi:10.1099/ijs.0.63589-0

2002–2005 (Not Awarded)

The University of Queensland did not provide notification to the Executive Secretary-Treasurer regarding the recommendation of a recipient for the van Niel Prize in time for this Congress.

The plenary approved a proposal that there should be no link between the travel expenses of the recipient of the van Niel Prize and the funds transferred to ICSP.

2005–2008 *van Niel Prize recipient,* **Matthew David Collins**

The Senate of the University of Queensland on the recommendation of the International Committee for Systematics of Prokaryotes is pleased to present the van Niel International Prize for Studies in Bacterial Systematics for the triennium 2006–2008 to Professor Matthew David Collins in recognition of the contributions made to the field of bacterial systematics.

Tindall, B. J. 2008. van Niel International Prize for Studies in Bacterial Systematics, awarded by the University of Queensland, Awarded in 2008 to Matthew David Collins. *Int J Syst Evol Microbiol* **58:**1972. doi:10.1099/ijs.0.2008/006312-0

2008–2011 *van Niel Prize recipient,* **George M. Garrity**

The Senate of The University of Queensland, on the recommendation of a panel of experts of the International Committee on Systematics of Prokaryotes, is pleased to present the van Niel International Prize for Studies in Bacterial Systematics for the triennium 2009–2011 to Professor George M. Garrity in recognition of his contribution made to the field of bacterial systematics.

Busse, H.-J., Labeda, D. P., Oren, A. and Tindall, B. J. 2011. The van Niel International Prize for Studies in Bacterial Systematics, awarded by The University of Queensland Awarded in 2011 to George M. Garrity. *Int J Syst Evol Microbiol.* **61**:2328-2329; doi:10.1099/ijs.0.035907-0

2011–2014 *van Niel Prize recipient,* **Nikos Krypides**

The Senate of the University of Queensland is pleased to present the van Niel International Prize for Studies in Bacterial Systematics for the triennium 2011–2014 to Dr. Nikos C. Kyrpides in recognition of the contributions made to the field of bacterial systematics. The award established by Professor V. B. D. Skerman of the University of Queensland honours the contribution of scholarship in the field of microbiology by Professor Cornelis Bernardus van Niel.

Tindall, B.J. and Garrity, G. M. 2015. The van Niel International Prize for Studies in Bacterial Systematics awarded in 2014 to Nikos C. Kyrpides. *Int J Syst Evol Microbiol*, **65**:2011-2012; doi:10.1099/ijs.0.000191

Appendix 13. Activities of the Congresses

The minutes of the meetings of the International Congress for Microbiology (and later, the International Congress of Bacteriology and Applied Microbiology) of the International Union of Microbiological Societies contain a detailed history of the evolution of this code of nomenclature. This appendix contains a summary of the activities of each congress and special meetings of the Judicial Commission. Following each summary is a bibliography of all references cited. Prior to the Sixth International Congress for Microbiology, the official record is contained here and in the first issue of the *International Bulletin on Bacterial Nomenclature and Taxonomy*. Conference proceedings have also been cited in retrospect, as they may contain more details on early unpublished work on the Code.

First International Congress for Microbiology

Paris, France 1930

The desire that special attention should be paid to the peculiar needs of bacteriology was voiced at the First International Congress of Microbiology convened in Paris in 1930 by the International Society for Microbiology under the auspices of the Pasteur Institute. As the result of recommendations made by several of the delegates to the Congress, a Commission on Nomenclature and Taxonomy was constituted to prepare and report recommendations to the Plenary Session of the Congress.

The members of this commission were E. Pribram, Chicago, U.S.A., *Chairman*; A. R. Prévot, Paris, France, *Secretary*; R. E. Buchanan, Ames, Iowa, U.S.A.; K. Kisskalt, Germany; J. C. G. Ledingham, London, England; Reiner Müller, Köln, Germany; R. St. John-Brooks, London, England; and I. Yamasaki, Fukuoka, Kyushu, Japan.

Several resolutions prepared by the Commission were approved unanimously by the Plenary Session. These resolutions (in their English text) were as follows:

I. The founding of the International Society for Microbiology and the establishment of Congresses of Microbiology make possible for the first time adequate international cooperation relative to certain problems of microbial nomenclature. It is clearly recognized that the living forms with which the microbiologists concern themselves are in part plants, in part animals, and in part primitive. It is further recognized that *insofar as they may be applicable and appropriate* the nomenclatural codes agreed upon by international Congresses of Botany and Zoology should be followed in the naming of microorganisms. Bearing in mind however the peculiarly independent course of development that Bacteriology has taken in the past fifty years and elaboration of special descriptive criteria which bacteriologists have of necessity developed, it is the opinion of the International Society for Microbiology that the bacteria constitute a group for which special arrangements are necessary. Therefore, the International Society for Microbiology has decided to consider the subject of Bacterial Nomenclature as part of its permanent programme.

II. The International Society for Microbiology is of the opinion that the interests of bacterial nomenclature will best be served by placing the subject in the hands of a single International Committee, under the aegis of the International Society for Microbiology, adequately representative of all departments of Bacteriology, on which experts

from all spheres of bacteriological research may work together. It is recognized that the subject of bacterial nomenclature is of so wide a nature that unless the personnel of an International Committee formed to deal with it is representative of all aspects of bacteriology, it is not likely to carry weight. Such a representative committee, to be called the Nomenclature Committee for the International Society for Microbiology, is hereby authorized and constituted.

III. The Nomenclature Committee for the International Society for Microbiology shall be constituted as follows:

a. Two permanent secretaries shall be elected: one primarily to represent medical and veterinary bacteriology, the other primarily to represent the other phases of bacteriology. The following individuals are hereby appointed secretaries.

(1) To represent primarily medical and veterinary bacteriology Dr. Ralph St. John-Brooks, Lister Institute, London, England.

(2) To represent primarily the other phases of bacteriology Dr. R. S. Breed, Geneva, New York, U.S.A.

Should a secretaryship become vacant, the position may be filled *pro tempore* by choice of the Committee. A permanent secretary should be chosen by action of the next succeeding International Congress for Microbiology.

b. The remaining members of the Committee shall be appointed by such National Committees of the International Society and by such of the various National Societies affiliated with the International Society as may desire representation thereon. Not more than three members may be thus chosen to represent a single nation. In addition, in order that the Committee shall be truly representative of all interests, the Committee is authorized to add such members as may be deemed desirable.

IV. The duties of the Nomenclature Committee shall include the following:

a. Through the secretaries the members of the Committee shall be circularized with reference to such problems of bacterial nomenclature as may arise, and shall endeavor to reach an agreement. No action relating to nomenclature shall be considered complete and operative until it has been considered by all members of the Committee, until adequate publicity has been given with respect to actions proposed, until approval has been given by a majority of two thirds of the members of the Committee, and until a report has been made to the next succeeding International Congress for Microbiology and opportunity thereby given for objection, modification or rejection by action of the Congress.

b. The Committee shall consider, among others, problems such as criteria to be employed in classification, adoption of names for *species* and *genera conservanda*, type species (including their identification and preservation), the encouragement of monographing of special groups or genera of bacteria by those best qualified to do the work, the enlargement of the scope and usefulness of the various type culture collections by more adequate support, and the preparation and publication of such Committee and Subcommittee reports as may be advisable.

V. Copies of these resolutions shall be submitted to the appropriate sections of the International Botanical Congress, Cambridge, 1930. It is the hope of the International Congress for Microbiology that the members of the International Botanical Congress who are interested in bacterial nomenclature will see the advisability of the special questions of nomenclature of bacteria being considered by a single international authority and that they will suggest names of members of the Botanical Congress willing to serve on the committee who, in their opinion, would add to its strength and authority.

VI. In view of the adequate provision made for special regulations relating to the bacteria, and the feasibility of designating *genera conservanda* among the bacteria by international agreement, it is believed that the greatest stability will be conferred by the adoption of the publication of *Species Plantarum* by Linnaeus in 1753 as the point of departure for bacterial nomenclature. The adoption of this date is recommended. It is further suggested that no present action be taken with reference to a list of *genera conservanda* for the bacteria.

VII. Among the most important agencies working toward satisfactory nomenclature and classification of bacteria are the several type culture collections. These constitute invaluable repositories and much of the future development of bacteriology will depend upon their adequate growth, support and utilization; in some cases at least they should develop into research institutes of high grade. It is urged that the coordination and cooperation existing among these institutions be extended the better to serve the interests of bacteriology in its theoretical, medical and other economic aspects. It is further urged that all bacteriologists publishing descriptions of new species or important

strains of bacteria deposit pure cultures of such with a culture collection that they may be made available to others interested. Particularly is it urged that the adequate financial support of these culture collections by official agencies, by educational and research institutions and by the research foundations constitutes an important and immediate need.

It will be noted that in the action of the Congress the development of an adequate Bacteriological Code was linked with the Botanical Code. The specific suggestion was made that members of the International Botanical Congress, 1930, be apprised of the resolutions passed by the First Microbiological Congress and that the Botanical Congress be asked to cooperate. This was done, and the two secretaries of the International Nomenclature Committee for Bacteriology (Dr. R. St. John-Brooks and Dr. R. S. Breed) were designated by the Botanical Congress as a special committee on the nomenclature of bacteria.

DUJARRIC DE LA RIVIÉRE, R. 1931. ler Congrés international de microbiologie Paris, 1930, documents recueillis et publiés, Masson, Paris.

Editorial Board. 1951. Forward. *Internatl. Bull. Bact. Nomenclature and Taxonomy.* **1**:1–3. Iowa State College Press, Ames, Iowa. U.S.A.

Second International Congress for Microbiology

London, England, United Kingdom 1936

The International Committee met during the sessions of the second International Congress for Microbiology in London in 1936. Proposals by R. E. Buchanan and H. J. Conn to conserve the generic name *Bacillus* Cohn 1872, to designate as the type species *Bacillus subtilis* Cohn 1872, and to fix the type or standard culture as the "Marburg strain" were approved by the Committee and by the Plenary Session of the Congress.

A further specific action of the Nomenclature Committee and of the London Congress had to do with the duplication of generic names in the *Protista*, the group ordinarily defined to include the protozoa, algae, fungi and bacteria. Inasmuch as bacteria are usually included among the plants, and subsequent plant homonyms are regarded as illegitimate, the principal interest is the suppression as illegitimate later homonyms in the protozoa and the bacteria. Prof. F. Mesnil proposed and the Nomenclature Committee and the Congress agreed that generic homonyms are not permitted in the group *Protista*; further that it is advisable to avoid homonymy amongst *Prostita* on the one hand, plants or animals (*Metazoa*) on the other.

The Committee and Congress also acted favorably on a proposal by Prof. R. S. Breed relative to non-capitalization of specific epithets in names of species of bacteria.

"Bacteriologists should accept Article 13 of the International Rules of Zoological Nomenclature, as follows:

'While specific substantive names derived from names of persons may be written with a capital initial letter, all other specific names are to be written with a small initial letter.'"

At this 1936 (London) meeting of the International Committee it was agreed that, before the convening of the third International Congress of Microbiology to be held three years later in New York, a tentative Code of Bacteriological Nomenclature should be drafted and presented for the consideration of the Committee. To facilitate easy conference an American (Canadian and U.S.A.) Subcommittee was constituted to prepare such a tentative code. The members of this Subcommittee were R. E. Buchanan, Chairman; Robert S. Breed; J. Howard Brown; I. C. Hall; W. L. Holman; E. G. D. Murray; and Otto Rahn.

The chairman was asked to assemble material for consideration by the members. A mimeographed brochure of 119 pages was prepared under the title "Rules of Nomenclature, Annotated." It consisted of two parallel columns. In the first column the International Rules of Botanical Nomenclature, including *Principles*, *Rules*, *Recommendations*, *Notes*, and

Examples, were printed. In the second column were listed suggestions for a code of Bacteriological Nomenclature formulated by making such minor modification of the Botanical Code as seemed desirable, as by dropping of inapplicable sections. In numerous footnotes were given the pertinent sections of the International Rules of Zoological Nomenclature and the American Code of Entomological Nomenclature. This material was sent to all members of the Subcommittee and to a large number of other bacteriologists, including members of the International Committee insofar as they could be reached. Criticisms and suggestions were invited. More than 30 sets of comments and suggestions were received. These comments were broken up into sections corresponding to those of the suggested code, and the proposed code and comments again submitted to the members of the Subcommittee in the form of a mimeographed booklet under the title "Suggestions and Comments on 'Rules of Nomenclature, Annotated'." A new series of comments and suggestions was secured from the numerous collaborators, tabulated and submitted once more to the Subcommittee. A final revision was prepared to present to the International Committee at its New York meeting in 1939. The text of this tentative code differed from the basic Botanical Code principally in the following.

a. A reorganization of the text of the code under the following headings.

   1. General Considerations; 2. General Principles; 3. Rules of Bacteriological Nomenclature with Recommendations; 4. Provisions for Interpretation and Modification of rules.

b. Elimination of items and sections of the Botanical Code which seemed inapplicable to bacteriology.

c. Simplification where possible through rephrasing.

d. Selection of examples where possible from bacteriology.

BUCHANAN, R. E. 1939. Suggestions and Comments on 'Rules of Nomenclature, Annotated'. 72pp.

Editorial Board. 1951. Forward. *Internatl. Bull. Bact. Nomenclature and Taxonomy.* **1**:1–3. Iowa State College Press, Ames, Iowa. U.S.A.

ST. JOHN-BROOKS, R. 1937. Second International Congress for Microbiology, London, 25 July–1 August, 1936. Report of Proceedings. International Society for Microbiology, London.

Third International Congress for Microbiology

New York, New York, United States 1939

The proposed tentative code (Buchanan 1939a, 1939b) was considered at some length by the International Committee for Bacteriological Nomenclature at its New York meeting (Dawson, 1940); many suggestions developed. The report was also presented to one of the sections of the Congress, and about one hundred copies of the "Annotated" and "Tentative" codes distributed.

Upon recommendation of the International Committee on Bacteriological Nomenclature the Plenary Session of the Third International Congress for Microbiology on Sept. 9, 1939 approved the following resolution:

1. That a recognized Bacteriological Code be developed.

2. That publication of such a proposed Code when developed be authorized with the proviso that it shall be regarded as wholly tentative, but in the hope that it shall be widely tested so that it may be brought up for further consideration and final disposition at the next Microbiological Congress which should normally take place in 1942.

3. That the Nomenclature Committee, as at present constituted, shall continue to function under the auspices of the International Association of Microbiologists[1] as it did under the International Society for Microbiology.

4. That the International Committee shall select from its membership a Judicial Commission consisting of twelve members, exclusive of members *ex officio*, and shall designate a Chairman from the membership of the Commission. The two Permanent Secretaries of the International Committee on Bacteriological Nomenclature shall be members *ex officio* of the Judicial Commission. The commissioners shall serve in three classes of four commissioners each for nine years, so that one class of four commissioners shall retire at every International Congress. In case of resignation or death of any commissioner, his place shall be filled for the unexpired term by the International Committee at its next meeting.

[1] The new name approved for the international organization sponsoring microbiological congresses.

The functions of the International Committee on Bacteriological Nomenclature were more accurately defined as follows:

a. To consider and pass upon all recommendations relating to the formation or modification of Rules of Nomenclature. The Committee will recommend such action as may be appropriate to the next Plenary Session of an International Congress for Microbiology.

b. To consider all Opinions rendered by the Judicial Commission. Such Opinions become final if not rejected at the meeting of the International Committee next following the date on which the Opinion was issued.

c. To designate official Type Culture Collections.

d. To receive and act upon all reports and recommendations received from the Judicial Commission or other committees relating to problems of nomenclature or taxonomy.

e. To hold at least one meeting triennially in connection with the meeting of the International Congress for Microbiology.

f. To report to the final Plenary Session of each Congress a record of its actions, and to recommend for approval such actions as require the approval of the Congress.

g. To cooperate with other Committees, particularly those of the International Botanical and Zoological Congresses, to consider common problems of nomenclature.

The functions of the Judicial Commission of the International Committee on Bacteriological Nomenclature were also defined as follows:

a. To issue formal *Opinions* when asked to interpret rules of nomenclature in cases in which the application of a rule is doubtful.

b. To prepare formal *Opinions* relative to the status of names which have been proposed, placing such names when deemed necessary in special lists, such as lists of *Nomina Conservanda*, *Nomina Rejicienda*, etc.

c. To develop recommendations for emendations of the International Rules for Bacteriological Nomenclature for presentation to the International Committee.

d. To prepare formal *Opinions* relative to types, particularly types of species and genera, and to develop a list of bacterial genera which have been proposed with the types species of each.

e. To prepare and publish lists of names of genera which have been proposed for bacteria, for protozoa, or for other groups in which microbiologists are interested in order to assist authors of new names in avoiding illegitimate homonyms.

f. To develop a list of publications in microbiology whose names of organisms shall have no standing in bacteriology in determination of priority.

g. To edit and publish the International Rules of Bacteriological Nomenclature, Opinions, Lists of *Nomina Conservanda*, *Nomina Rejicienda*, Type Species, etc.

h. To report to the International Committee at its triennial meetings all Recommendations, Transactions, and Opinions.

i. To report to the International Committee at its triennial meetings the names of all Commissioners whose terms of service expire, likewise a list of all vacancies caused by resignation or death.

Recommendation. Whenever, in the opinion of any microbiologist an interpretation of any rule or recommendation is desirable because the correct application of such a rule or recommendation is doubtful, or the stability of nomenclature could be increased by the conservation or by the rejection of some name which is a source of confusion or error, it is recommended that he prepare a brief outlining the problem, citing pertinent references and indicating reasons for and against specific interpretations. This brief should be submitted to the Chairman of the Judicial Commission; if desired, through one of the Permanent Secretaries. An Opinion will be formulated, which may not be issued until it has been approved by at least eight members of the Commission.

It was further voted:

That the Proposed International Rules of Bacteriological Nomenclature, in so far as they have been developed by the American-Canadian Committee on Compilation of Proposals on Bacteriological Nomenclature for the International Committee and modified by action of that Committee, shall be referred for final emendation and publication to the Judicial Commission in accordance with Provision (c) above as recorded.

The minutes of the International Committee contain the following statements relative to the Judicial Commission:

> With regard to the constitution of the Judicial Commission, members of the Commission present were requested to give its Secretaries lists of persons that they wished to nominate as members of the Judicial Commission, and the Secretaries were requested to transmit such nominations to the entire Committee for ballot, giving members the option of substituting other names if they so desired. It was agreed that after the final ballot the four persons receiving the greatest number of votes should be elected for the nine-year period and that the four persons receiving the smallest number of votes should be elected for the three-year period. The remaining four are to serve for a six-year period.

Nominations to membership on the Judicial Commission were made by the membership of the International Committee in attendance at the New York meeting. The Permanent Secretaries then conducted a mail ballot resulting in the election of twelve members (Commissioners) and designation of R. E. Buchanan as Chairman. R. S. Breed and R. St. John-Brooks as Permanent Secretaries of the International Committee also became *ex officio* members and Permanent Secretaries of the Commission.

The records of the Congress showed a membership of 62 on the International Committee on Bacteriological Nomenclature as of August 1939. There were representatives of Microbiological Societies of 24 nations as follows: Argentina, Australia, Belgium, Brazil, Bulgaria, Canada, Denmark, Deutsches Reich, Eire, France, Great Britain, Holland, Hungary, Italy, Norway, Palestine, Poland, Roumania, Spain, Sweden, Switzerland, United States of America, Union of Soviet Socialist Republics, and Uruguay.

It was expected that the mandate of the Congress to the Judicial Commission to develop and publish a tentative proposal for a Code of Bacteriological Nomenclature would be followed promptly. The final determination of the constitution of the Judicial Commission itself was long delayed because of the outbreak of World War II while the New York Congress was in session. It soon proved impracticable to circulate copies of the nomenclature proposals and to secure comments from all members of the Commission.

Dr. Ralph St. John-Brooks of the Lister Institute, London, one of the Permanent Secretaries of the International Committee, in March 1942 spent some days with the Chairman of the Commission in conference and in editing the manuscript which had been reviewed by the Committee at the New York City meeting.

BUCHANAN, R. E. 1939a (February) (Editor). Rules of Nomenclature: Annotated; with Suggestions for Rules of Bacteriological Nomenclature. Prepared for the American-Canadian Committee on Compilation of Proposals for Consideration by the Third International Congress for Microbiology. Mimeographed pp. 118, Ames, Iowa. U.S.A.

BUCHANAN, R. E. 1939b (July) (Editor). Proposed International Rules of Bacteriological Nomenclature. Prepared for Consideration by The American-Canadian Committee on Compilation of Proposals on Bacteriological Nomenclature for the International Committee. Mimeographed. pp. 63, Ames, Iowa. U.S.A.

DAWSON, M. H. 1940. (Editor). Third International Congress for Microbiology. Report of Proceedings. New York, September 2–9, 1939. International Association of Microbiologists, New York.

Editorial Board. 1951. Forward. *Internatl. Bull. Bact. Nomenclature and Taxonomy.* **1**:1–3. Iowa State College Press, Ames, Iowa. U.S.A.

Fourth International Congress for Microbiology

Copenhagen, Denmark 1947

The Proposed Bacteriological Code of Nomenclature as authorized by the Third International Congress for Microbiology was printed in June 1947 (Buchanan and St. John-Brooks, 1947) in a limited edition for distribution and for use by the Judicial Commission and the International Committee at the Fourth International Congress in September 1947.

At the Copenhagen Meeting (Bjørneboe, 1949) the proposed Code was considered, revised, and approved for publication by the Judicial Commission, the International Committee and the Plenary Session of the Congress. The English text was published in March 1948 in the Journal of Bacteriology (Buchanan *et al.*, 1948), and reprinted in September 1949 in the Journal of General Microbiology (Buchanan *et al.*, 1949). A Spanish translation (Verna, 1949) was published in Argentina in *De Archivos de Farmacia y Bioquimica del Tucumán* and a German translation by (Bloch 1950) in the *Schweizerische Zeitschrift für allgemeine Pathologie und Bakteriologie*. A French translation by Dr. Prévot and a Japanese translation were also issued.

BJØRNEBOE, M. 1949 (Editor). Fourth International Congress for Microbiology Report of Proceedings. Copenhagen, July 20–26, 1947. Rosenkilde and Bagger, Cophenhagen.

BUCHANAN, R. E., and RALPH ST. JOHN-BROOKS. 1947 (June) (Editors). Proposed Bacteriological Code of Nomenclature. Developed from proposals approved by International Committee on Bacteriological Nomenclature at the Meeting of the Third International Congress for Microbiology. Publication authorized in Plenary Session. pp. 61. Iowa State College Press, Ames, Iowa. U.S.A.

BUCHANAN, R. E., RALPH ST. JOHN-BROOKS, and ROBERT S. BREED. 1948 (March). (Editors). International Bacteriological Code of Nomenclature. *Journ. Bact.* **55**:287–306. Also reprinted in September 1949 *Journ. General Microbiology* **3**:444–462.

VERNA, LUIS C. (Translator). 1949. Codigo International de Nomenclatura Bacteriologica. *Archivos de Farmacia y Bioquimica del Tucumán.* **4**:283–316. Tucumán, Argentina.

BLOCH, HUBERT (Translator). 1950. Internationaler bakteriologischer Nomenklaturcodex. *Schweiz. Zeitschr. allgem. Path. u. Bakteriologie.* **13**:358–383. Basel, Schweiz.

Fifth International Congress for Microbiology

Rio de Janeiro, Brazil 1950

Meetings of the Judicial Commission and of the International Committee were held at Rio de Janeiro and Petropolis (Brazil) in August 1950 (Comissão, 1950). Among the important actions of these bodies, confirmed by the Plenary Session of the Congress, were the following:

1. An Editorial Board was established consisting of the Chairman of the Judicial Commission and the two Permanent Secretaries.
2. Publication of a quarterly "International Bulletin of Bacteriological Nomenclature and Taxonomy" was authorized; to be edited by the Editorial Board.
3. Agreement was reached that some revision of the International Bacteriological Code of Nomenclature was desirable and the Judicial Commission instructed to incorporate certain amendments approved, and to prepare recommendations for the 1953 International Microbiological Congress to be held in Rome.

The actions taken by the Commission, the Committee and the Fifth Congress are reported in Volume One of "The International Bulletin of Bacteriological Nomenclature and Taxonomy" (Editorial Board, 1951).

In preparation for the Rome Congress (September 1953), the provisional agenda for the meetings of the International Committee and of the Judicial Commission were prepared and published in the June (1953) issue of the International Bulletin.

Comissão Executiva do Congresso. 1950. Arquivos do V Congresso Internacional de Microbiologia, Rio de Janeiro, 17-24 de Agôsto de 1950.

Editorial Board. 1951. Forward. *Internatl. Bull. Bact. Nomenclature and Taxonomy.* **1**:1–3. Iowa State College Press, Ames, Iowa. U.S.A.

International Committee on Bacteriological Nomenclature. 1953. Meetings of September 7th and 11th, 1953 Agenda (Provisional). *Internatl. Bull. Bact. Nomenclature and Taxonomy.* **3**:26. Iowa State College Press, Ames, Iowa. U.S.A.

Judicial Commission of the International Committee on Bacteriological Nomenclature. 1953. Judicial Commission. Agenda (Provisional). *Internatl. Bull. Bact. Nomenclature and Taxonomy.* **3**:27. Iowa State College Press, Ames, Iowa. U.S.A.

Sixth International Congress for Microbiology

Rome, Italy 1953

The Editorial Board prepared a series of "Proposals Relative to Emendation and Publication" of a revised International Bacteriological Code of Nomenclature (Editorial Board, 1953) which recommended publication of the revised Code, suggested that the Rules and Recommendations be adequately annotated, and that there be noted significant resemblances to the Botanical and Zoological Codes of Nomenclature and likewise important differences between them. The hope was expressed that texts in other languages could be published simultaneously with the English text. In all, sixty draft proposals for amendment, deletions and modifications of the Code were submitted and acted upon.

The Judicial Commission, through the Editorial Board, was directed to edit, annotate, and publish the Code as finally approved by the International Committee and the Plenary Session.

The name of the Code was fixed as The International Code of Nomenclature of Bacteria and Viruses.

The manuscript for the Code in original draft form, including Annotations and Appendices, was submitted for editorial suggestions to all members of the Judicial Commission and to about twenty-five bacteriologists experienced in nomenclature and taxonomy. Unfortunately the preparation of the text and annotations has been so time-consuming that it has not been possible to include texts of the Code in the several important languages of science. It is to be hoped that this may be done in future printings.

Editorial Board. 1953. The International Bacteriological Code of Nomenclature: Proposals relative to emendation and publication. *Internatl. Bull. Bact. Nomenclature and Taxonomy.* **3**:31–62. Iowa State College Press, Ames, Iowa. U.S.A.

COWAN, S. T, and T. WIKÉN (Secretaries). 1953. Minutes of the Judicial Commission Meetings held in Rome in Connection with the VI International Congress for Microbiology. September, 1953. *Internatl. Bull. Bact. Nomenclature and Taxonomy.* **3**:141–154. Iowa State College Press, Ames, Iowa. U.S.A.

COWAN, S. T, and T. WIKÉN (Secretaries). 1953. Minutes of Meetings of the International Committee on Bacteriological Nomenclature held at Rome in Connection with the VI International Congress for Microbiology September, 1953. *Ibid*. **3**:155–161. Iowa State College Press, Ames, Iowa. U.S.A.

Editorial Board. 1951. Forward. *Internatl. Bull. Bact. Nomenclature and Taxonomy.* **1**:1–3. Iowa State College Press, Ames, Iowa. U.S.A.

Seventh International Congress for Microbiology

Stockholm, Sweden 1958

No changes to the Code were made at the Congress in Stockholm, and it was decided that matters pending should be presented to the Congress of 1962 (Cowan and Clark, 1958).

COWAN, S. T., and W. A. CLARK. 1958. Minutes of the Meetings of the International Committee on Bacteriological Nomenclature held at Stockholm in Connection with the VII International Congress for Microbiology, July–August, 1958. *Int. Bull. Bacteriol. Nomen. Taxon.* **8**:145–149.

International Code of Nomenclature of Bacteria and Viruses. 1958. Iowa State College Press, Ames, Iowa, 186 pp.

Eighth International Congress for Microbiology

Montreal, Quebec, Canada 1962

A large number of changes were made to the Code, mostly amplification to cover problems that were arising in bacteriological nomenclature (Clark and Seeliger, 1963a, b). They concerned in particular the nomenclature of categories between genus and subgenus (Section, Subsection, Series, Subseries), recommendations on infrasubspecific names, generic descriptions, and citation and orthography. Many were taken with some modification from the Botanical Code. The amendments were published (Clark and Seeliger, 1963a) but a complete amended version of the Code was not published. Many of these changes were clearly necessary, but their insertion into the existing Code made it difficult to maintain a clear and logical order to the various rules.

CLARK, W. A., and H. P. R. SEELIGER. 1963a. Detailed minutes concerning actions taken on the emendation of the International Code of Nomenclature and Viruses during the meetings of the Judicial Commission of the International Committee on Bacteriological Nomenclature at the VIII International Microbiological Congress in Montreal. August, 1962. *Int. Bull. Bacteriol. Nomen. Taxon.* **13**:1–22.

CLARK, W. A., and H. P. R. SEELIGER. 1963b. Minutes of the first meeting of the International Committee on Bacteriological Nomenclature, Pathology Building, McGill University, Montreal, August 18, 1962. *Int. Bull. Bacteriol. Nomen. Taxon.* **13**:39–46.

Ninth International Congress for Microbiology

Moscow, Union of Soviet Socialist Republics 1966

The Moscow Congress marked a change of direction in the philosophy of bacterial nomenclature. Change was in the air, and this is illustrated by the decision of the virologists (represented by the Subcommittee on Viruses of the International Committee on Nomenclature of Bacteria) to prepare their own rules of nomenclature. This led to the establishment at the Moscow Congress of a separate International Committee on Nomenclature of Viruses. This move was largely due to the feeling that viruses were of such a special nature that a new and different system of nomenclature should be introduced, and partly because Linnaean binary names were considered to be inappropriate (Cowan, 1963; Clark and Seeliger, 1967a, b). The first report of the Virus Committee was published in 1971 (Wildy, 1971).

At the same time the Executive Board of the International Association of Microbiological Societies requested all subordinate bodies to prepare and submit Statutes. In the first edition the statements covering the structure and functions of the International Committee on Nomenclature of Bacteria (ICNB) were contained in Provisions 4 and 5 of the Code. The Judicial Commission authorized the removal of these Provisions and the Executive Board of the ICNB proceeded with the formulation of Statutes.

At the Moscow Congress, the Judicial Commission was presented with a considerable list of proposed changes to the Bacteriological Code (Editorial Board, 1966; Clark and Seeliger, 1967a, b), of which the most lengthy were proposals to regulate the nomenclature of infrasubspecific forms, forms that had previously been subject only to recommendations on good practice. These proposals had, at Montreal, been deferred for further study, and it now became evident that they posed many difficulties that could not be avoided without consultation with epidemiologists, geneticists, biochemists, and others. These proposals were again referred back for further study.

The Commission discussed again the need for the regulation of names of sections, subsections, series and subseries. It became clear that these categories were used almost only within one genus, *Streptomyces*, whose taxonomy and nomenclature were increasingly at odds with modern practice in the rest of bacteriology. A feeling grew that it was a retrograde step to recognize complex rules for such categories if their need was diminishing, as awareness grew that many forms recognized as separate species of *Streptomyces* were more likely to be infrasubspecific variants. At its next meeting, the Commission agreed to remove from the Code the provisions that controlled the names of these categories, and this has been done in the present Code.

The revisions made at Moscow made it necessary to publish a new edition of the Code (International Code of Nomenclature of Bacteria, 1966).

CLARK, W. A., and H. P. R. SEELIGER. 1967a. Minutes of the Judicial Commission of the International Committee on the Nomenclature of Bacteria. *Int. J. Syst. Bacteriol.* **17**:59–72.

CLARK, W. A., and H. P. R. SEELIGER. 1967b. Minutes of the International Committee on Nomenclature of Bacteria Meetings at the IX International Congress on Microbiology, Moscow, 1966. *Int. J. Syst. Bacteriol.* **17**:73–78.

COWAN, S. T. 1963. Request of the Virus Subcommittee. *Int. Bull. Bacteriol. Nomen. Taxon.* **13**:171–173.

Editorial Board. 1966. Proposed emendation of the International Code of Nomenclature of Bacteria and Viruses—with comments. *Int. J. Syst. Bacteriol.* **16**:341–369.

International Code of Nomenclature of Bacteria. 1966. *Int. J. Syst. Bacteriol.* **16**:459–490.

WILDY, P. 1971. Classification and nomenclature of viruses. First Report of the International Committee on Nomenclature of Viruses. S. Karger, Basel. (Monographs in Virology, Vol. 5, 81 pp.)

Special Meeting of the Judicial Commission

Leicester, England, United Kingdom 1968

It was decided to hold a special meeting of the Judicial Commission to consider a complete revision of the Code and some way of eliminating the thousands of forgotten and useless names. This meeting was held in Leicester in 1968 (Lessel, 1970), and the Judicial Commission quickly agreed that the Code needed a complete new version. Dr. S. P. Lapage offered to undertake a complete revision, and a Drafting Committee was set up consisting of W. A. Clark, S. P. Lapage (Chairman), E. F. Lessel, H. P. R. Seeliger, and P. H. A. Sneath to prepare a Revised Code, to embody the following: publication of names in a limited range of publications; obligate designation of types; methods on designation and the preservation of type strains; minimal descriptions of taxa; and alteration to the provisions for amending the Code in view of impending changes in the organization of the International Committee on Nomenclature of Bacteria.

The question of old and useless names was considered at length. The device used by the Zoological Code—whereby names disused for 50 years could be considered to be forgotten names (*nomina oblita*) and thereafter ignored—was not thought useful. There was the risk of discovering later that such a name had been used in this period, thus necessitating reinstatement. Another suggestion was that there should be block conservation of well-established names in certain publications of international repute. This had the disadvantage that much detailed taxonomic work would be required before such names could be conserved, and that there would be numerous appeals where the publications were perpetuating obvious errors.

The idea of a new starting date was then discussed. Similar suggestions had been raised in the past, but the important innovation was the proposal that an Approved List be prepared containing all names of taxa with current usage, and that at some given date in the future all other names should lose their standing in nomenclature. The Approved List would then be the basis for the nomenclature of the future. It was realized that the object of the change would be defeated if the old names were not available for re-use, because search of literature would still have to be made to avoid earlier homonyms, but on closer examination it was felt that the re-use of old names should not lead to major confusion. In the event, this radical proposal was accepted and is thought to be workable (Clark and Seeliger, 1971).

CLARK, W. A., and H. P. R. SEELIGER. 1971. International Committee on Nomenclature of Bacteria, Tenth International Congress for Microbiology. Minutes of the Meetings 8 and 13 August 1970, Hotel Maria Isabel, Mexico City, Mexico. *Int. J. Syst. Bacteriol.* **21**:111–118.

LESSEL, E. F. 1970. Judicial Commission of the International Committee on Nomenclature of Bacteria. Minutes of Meeting. September 1968, Leicester, England. *Int. J. Syst. Bacteriol.* **20**:1–8.

Tenth International Congress for Microbiology

Mexico City, Mexico 1970

Only minor emendations (Lessel, 1971; Clark and Seeliger, 1971), mostly of an editorial nature, were made at Mexico to the Code that was currently in force (the Code as approved at Moscow). The International Committee also approved the Statutes and changed its name to the International Committee on Systematic Bacteriology.

The first drafts of the Revised Code were prepared by the Drafting Committee between 1968 and 1970, when two separate drafts were sent to the Judicial Commission, the second of which was discussed by the Judicial Commission at the tenth Congress. The draft was favorably received, so a resumé of the main changes that were proposed was presented to the International Committee on Nomenclature of Bacteria (Clark and Seeliger, 1971). The International Committee approved the main outline of the proposed Revised Code and later received copies of the fourth draft for comment. These comments were incorporated, and the fifth draft was published for comment in time for the next Congress at Jerusalem in 1973 (Lapage *et al.*, 1973).

CLARK, W. A., and H. P. R. SEELIGER. 1971. International Committee on Nomenclature of Bacteria, Tenth International Congress for Microbiology. Minutes of the Meetings 8 and 13 August 1970, Hotel Maria Isabel, Mexico City, Mexico. *Int. J. Syst. Bacteriol.* **21**:111–118.

LAPAGE, S. P., W. A. CLARK, E. F. LESSEL, H. P. R. SEELIGER, and P. H. A. SNEATH. 1973. Proposed Revision of the International Code of Nomenclature of Bacteria. *Int. J. Syst. Bacteriol.* **23**:83–108.

LESSEL, E. F. 1971. Minutes of the Judicial Commission of the International Committee on Nomenclature of Bacteria. *Int. J. Syst. Bacteriol.* **21**:100–103.

First International Congress of Bacteriology[2]

Jerusalem, Israel 1973

The Revised Code as proposed (Lapage *et al.*, 1973) was approved by the Judicial Commission of the International Committee on Systematic Bacteriology and the Plenary Session of the First International Congress of Bacteriology, with minor amendments mostly editorial in nature (Lessel, 1974; Clark and Schubert, 1974), and its publication was authorized in book form in the present volume.

CLARK, W. A., and R. H. W. SCHUBERT. 1974. International Committee on Systematic Bacteriology. 1st International Congress for Bacteriology. Minutes of the Meetings, 2 and 6 September 1973. Binyanei Ha'ooma, Jerusalem, Israel. *Int. J. Syst. Bacteriol.* **24**:375–379.

LAPAGE, S. P., W. A. CLARK, E. F. LESSEL, H. P. R. SEELIGER, and P. H. A. SNEATH. 1973. Proposed Revision of the International Code of Nomenclature of Bacteria. *Int. J. Syst. Bacteriol.* **23**:83–108.

LESSEL, E. F. 1974. Judicial Commission of the International Committee on Systematic Bacteriology. Minutes of the Meeting. 29 August 1973, Jerusalem, Israel. *Int. J. Syst. Bacteriol.* **24**:379–380.

First Intersectional Congress of the International Association of Microbiological Societies[3]

Tokyo, Japan, 1974

The Judicial Commission did not meet during this congress and no changes to the Code were made. The Executive Board approved restating Article 11b of the Statutes of ICSB to conform to the procedure adopted following the Jerusalem Meeting in September 1973.

Executive Board of the International Committee on Systematic Bacteriology. 1975. 1st Intersectional Congress of the International Association of Microbiological Societies: Minutes of the Meeting, 3 September 1974 Imperial Hotel, Tokyo, Japan. *Int. J. Syst. Bacteriol.* **25**:95.

[2] After the Tenth International Congress for Microbiology, the congress was divided into three sections: Bacteriology, Virology and Mycology. The Bacteriology Section was later referred to as the International Congress of Bacteriology and Applied Microbiology (BAM).

[3] In retrospect, this is considered to be the *Second International Congress of Bacteriology and Applied Microbiology*.

HASEGAWA, T. 1975. (Editor) Proceedings of the First Intersectional Congress of the International Association of Microbiological Societies, 1–7 September 1974, Tokyo, Japan. (6 vol.) Science Council of Japan. Tokyo.

Twelfth International Congress for Microbiology[4]

Munich, Federal Republic of Germany, 1978

Only a few changes were made to the Code, mostly of an editorial nature (Drafting Committee, 1978; Holt, 1979; Hill, 1979). The application of Rules 16 and 27, dealing with validation of names effectively published outside the IJSB, was clarified.

A proposal was published that the Cyanobacteria (Blue-Green Algae) should come under the provisions of the Bacteriological Code (Stanier *et al.*, 1978). This was discussed at length by the Judicial Commission and the ICSB. There are difficulties in reconciling the application of the Bacteriological and Botanical Codes to these organisms, the great majority of which have been studied and named according to botanical precedent. Few of them are yet in culture, and the Botanical Code has not permitted living types (i.e., type cultures). It was therefore decided to refer the matter to the officers of the Botanical Code, with whom discussion continues, and it is hoped that a satisfactory conclusion may be reached in due course. Meanwhile it was noted (Holt, 1979) that workers who consider cyanobacteria to be bacteria may name them in accordance with the Bacteriological Code. As none were to be included in the Approved Lists of Bacterial Names, their nomenclature under the Bacteriological Code would start from names validly published in the IJSB after 1979 under Rules 27 and 28.

A draft of the Approved Lists had been published in the IJSB in 1976 (Ad Hoc Committee, 1976), which initiated widespread consultations in the bacteriological community and resulted in the 1980 Approved Lists.

Ad Hoc Committee of the Judicial Commission of the ICSB. 1976. First Draft Approved Lists of Bacterial Names. *Int. J. Syst. Bacteriol.* **26**:563–599.

Drafting Committee, Judicial Commission. 1978. Proposals to Emend the International Code of Nomenclature of Bacteria. *Int. J. Syst. Bacteriol.* **28**:337.

HILL, L. R. 1979. International Committee on Systematic Bacteriology, XII International Congress for Microbiology, Minutes of the Meetings, 5 and 7 September 1978. *Int. J. Syst. Bacteriol.* **29**:168–169.

HOLT, J. G. 1979. International Committee on Systematic Bacteriology, Judicial Commission, Minutes of the Meeting, 3 September 1978, Munich, West Germany. *Int. J. Syst. Bacteriol.* **29**:267–269.

STANIER, R. Y, W. R. SISTROM, T. A. HANSEN, B. A. WHITTON, R. W. CASTENHOLZ, N. PFENNIG, V. N. GORLENKO, E. N. KONDRATIEVA, K. E. EIMHJELLEN, R. WHITTENBURY, R. L. GHERNA, and H. G. TRÜPER. 1978. Proposal to Place the

[4] In retrospect, the *Third International Congress of Bacteriology and Applied Microbiology*.

Nomenclature of the Cyanobacteria (Blue-Green Algae) Under the Rules of the International Code of Nomenclature of Bacteria. *Int. J. Syst. Bacteriol.* **28**:335–336.

Thirteenth International Congress for Microbiology[5]

Boston, Massachusetts, United States 1982

The Approved Lists of Bacterial Names had been published on 1 January 1980, so there had been two years of experience of the new system of nomenclature. This seemed to be working well, so a number of changes were made to the code to consolidate the system (Rules Revision Committee, 1982; Hill, 1983; Editorial Secretary, 1986). Provisional Rules A1, A2, B1, B2, and B3 were converted to addenda to Rules 33 and 34. Provisions for reviving names in a new combination were clarified (Rule 33d), and the provisions of Rule 18 on monotypes and lectotypes were removed as unnecessary. Minor clarifications of Rules 13 and 28 were made. There were also minor amendments to the ICSB Statutes (Hill, 1983) now that the IAMS had become the IUMS.

Plant-pathogenic bacteria present particular problems about which there had been much informal discussion since 1978. A large number of nomenspecies of these bacteria are now widely regarded as host-adapted pathogenic varieties (pathovars) of relatively few bacterial species. Consequently the Approved Lists did not list most of these nomenspecies, which thus lost standing in nomenclature. There was therefore concern that such species epithets might be revived for quite different bacteria and lead to much confusion in an area of great economic importance. The International Society of Plant Pathologists published a checklist of the earlier nomenspecies and pathovars (Dye *et al.*, 1980) and advised that such names should be revived only for the original bacteria. Sound recommendations were also given on the circumstances in which such revival would be justified. It was also noted that names that did cause confusion could be placed on the list of rejected names by the Judicial Commission, but clearly the smooth operation of the provisions for revived names requires the cooperation of bacteriologists in observing recommendations such as those made by the plant pathologists.

DYE, D. W., J. F. BRADBURY, M. GOTO, A. C. HAYWARD, R. A. LELLIOTT, and M. N. SCHROTH. 1980. Standards for naming pathovars of phytopathogenic bacteria and a list of pathovar names and pathotype strains. *Rev. Plant Pathol.* **59**:153–168.

Editorial Secretary. 1986. Judicial Commission of the International Committee on Systematic Bacteriology, Minutes of the Meeting, 6 August 1982, Boston, Massachusetts. *Int. J. Syst. Bacteriol.* **36**:577–578.

[5] In retrospect, the Fourth International Congress of Bacteriology and Applied Microbiology.

HILL, L. R. 1983. International Committee on Systematic Bacteriology, XIII International Congress of Microbiology, Minutes of the Meetings, 7 and 13 August 1982. *Int. J. Syst. Bacteriol.* **33**:435–437.

Rules Revision Committee, Judicial Commission, International Committee on Systematic Bacteriology. 1982. Proposals to Emend the International Code of Nomenclature of Bacteria. *Int. J. Syst. Bacteriol.* **32**:142–143.

Fourteenth International Congress for Microbiology[6]

Manchester, England, United Kingdom 1986

Several changes were made to the Code (Rules Revision Committee, 1985, 1986; Farmer, 1985; Lessel, 1986; Jones, 1987; Hill, 1987). General Consideration 6 was emended to make clear that Opinions of the Judicial Commission do not require approval of the ICSB although the ICSB can rescind them. Citation of subgenera was clarified (Rule 10c). Rule 12a was emended so that it was not necessary for species epithets to refer to a single concept. Rule 24b contains new provisions on priority of names published in the IJSB and its Validation Lists. A new provision was added to Rule 56 which permits the rejection of a name whose application is likely to lead to dangers to health or serious economic consequences (a *perilous name*). Opinion 58 of the Judicial Commission (see Appendix 5) confirmed that the nomenclatural types in the Approved Lists are to be accepted unless changed by the Commission. A list of all names validly published between 1 January 1980 and 1 January 1985 had been published in the IJSB (Moore *et al.*, 1985).

FARMER, J. J., III. 1985. Proposed Rewording of Rule 10c of the Bacteriological Code. *Int. J. Syst. Bacteriol.* **35**:222.

HILL, L. R. 1987. International Committee on Systematic Bacteriology, XIV International Congress of Microbiology, Minutes of the Meetings, 5, 6 and 9 September 1986, Manchester, United Kingdom. *Int. J. Syst. Bacteriol.* **37**:88–90.

JONES, D. 1987. Judicial Commission of the International Committee on Systematic Bacteriology, Minutes of the Meeting, 5 September 1986, Manchester, United Kingdom. *Int. J. Syst. Bacteriol.* **37**:85–87.

LESSEL, E. F. 1986. Proposed Modification of the International Code of Nomenclature of Bacteria as It Pertains to Specific Epithets. *Int. J. Syst. Bacteriol.* **36**:490.

MOORE, W. E. C., E. P. CATO, and L. V. H. MOORE (eds). 1985. Index of the Bacterial and Yeast Nomenclatural Changes Published in the International Journal of Systematic Bacteria since the 1980 Approved Lists of Bacterial Names (1 January 1980 to 1 January 1985). *Int. J. Syst. Bacteriol.* **35**:382–407.

Rules Revision Committee, Judicial Commission, International Committee on Systematic Bacteriology. 1985. Proposal to Emend the International Code of Nomenclature of Bacteria. *Int. J. Syst. Bacteriol.* **35**:123.

Rules Revision Committee, Judicial Commission, International Committee on Systematic Bacteriology. 1986. Proposals to Emend the International Code of Nomenclature of Bacteria. *Int. J. Syst. Bacteriol.* **36**:359.

[6] In retrospect, the Fifth International Congress of Bacteriology and Applied Microbiology.

Fifteenth International Congress for Microbiology[7]

Osaka, Japan 1990

Only one minor change was made to the Rules (Rule 33b), but a revision of Appendix 9 on Orthography was undertaken (Moore, 1990; MacAdoo, 1990; Wayne, 1991; Goodfellow, 1991). Grateful thanks are due to Professor T. O. MacAdoo for his expert advice on the new Appendix 9; a few changes were made in his draft where conventions of latinization and taxonomic precedent are not wholly concordant.

The Approved Lists were reprinted in 1989 (Skerman *et al.*, 1989), together with a list of names validly published in the IJSB (including names effectively published outside the IJSB but validated in the IJSB Validation Lists) between 1 January 1980 and 1 January 1989 (Moore and Moore, 1989). For the first time all valid bacterial names (except the most recent) are available in two slim volumes (see Appendix 3). The list of names published after 1 January 1980 was compiled by Professors W. E. C. Moore and L. V. H. Moore, to whom grateful thanks are due.

A new edition of the Code was authorized at the Osaka Congress. It is appropriate to record the contribution of the late Dr. S. P. Lapage, who died in 1990 and to whom the revised Code is a fitting memorial. Thanks are particularly due to Dr. L. G. Wayne and Professor W. E. C. Moore for their assistance in preparing the present volume.

GOODFELLOW, M. 1991. International Committee on Systematic Bacteriology, XV International Congress of Microbiology, Minutes of the Meetings, 14, 15, and 18 September 1990, Osaka, Japan. *Int. J. Syst. Bacteriol.* **41**:188–189.

MOORE, W. E. C., and L. V. H. MOORE (eds). 1989. Index of the Bacterial and Yeast Nomenclatural Changes Published in the International Journal of Systematic Bacteriology since the 1980 Approved Lists of Bacterial Names (1 January 1980 to 1 January 1989). American Society for Microbiology, Washington, D.C., 72 pp.

MOORE, W. E. C. 1990. Proposal for Modification of Rule 33b. *Int. J. Syst. Bacteriol.* **40**:216.

MACADOO, T. O. 1990. Proposed Revision of Appendix 9, Orthography, of the International Code of Nomenclature of Bacteria. *Int. J. Syst. Bacteriol.* **40**:103–104.

SKERMAN, V. B. D., V. MCGOWAN, and P. H. A. SNEATH (eds). 1989. Approved Lists of Bacterial Names (Amended Edition). American Society for Microbiology, Washington, D.C., 188 pp.

WAYNE, L. G. 1991. Judicial Commission of the International Committee on Systematic Bacteriology, Minutes of the Meeting, 14 September 1990, Osaka, Japan. *Int. J. Syst. Bacteriol.* **41**:185–187.

[7] In retrospect, the Sixth International Congress of Bacteriology and Applied Microbiology.

Seventh International Congress of Bacteriology and Applied Microbiology

Prague, Czech Republic 1994

Few changes were made to the Code at the meeting in Prague (Frederiksen, 1995, Goodfellow, 1995). It was generally accepted that the Code should apply to all prokaryotes (i.e. members of the Bacteria and Archaea). The issue of putative taxa (Candidatus) was also raised. Work on examining the possibility of harmonizing the existing Codes of Nomenclature had also been initiated. The topic was also raised concerning the recommendation that type strains be deposited in culture collections to the status of a Rule. Concern was expressed with regards the fact that strains that were involved in a patent pending were not readily available. The editorial secretary had also submitted a proposal to consider principles for the description of new taxa, with a view to assisting the subcommittees in drawing up minimal standards. The Judicial Commission noted that notification lists of names validated by original publication in the *International Journal of Systematic Bacteriology* had been established. The Index of the Bacterial and Yeast Nomenclatural Changes published in the IJSB had been updated to cover the period 1980–1992 (Moore and Moore, 1992), but the future of this initiative was uncertain. Other topics discussed included the restructuring of the subcommittees and the establishment of reference service laboratories with excellence in particular methods.

FREDERIKSEN, W. 1995. Judicial Commission of the International Committee on Systematic Bacteriology, Minutes of the Meetings, 2 and 6 July 1994, Prague, Czech Republic. *Int. J. Syst. Bacteriol.* **45**:195–196. doi:10.1099/00207713-45-1-195

LAWRENCE, G. W. 1994. Actions of the Judicial Commission of the International Committee on Systematic Bacteriology on Requests for Opinions Published Between January 1985 and July 1993. *Int. J. Syst. Bacteriol.* **44**:177–178.

MURRAY, R. G. E. and K. H. SCHLEIFER 1994. Taxonomic Notes: A Proposal for Recording the Properties of Putative Taxa of Procaryotes. *Int. J. Syst. Bacteriol.* **44**:174–176.

TRÜPER, H. G. 1994. Names for Higher Taxa and Their Impact on the Code of Nomenclature of Bacteria. *Int. J. Syst. Bacteriol.* **44**:368–369.

WOESE, C. R., KANDLER, O., and M. L. WHEELIS. 1990. Towards a natural system of organisms: proposal for the domains Archaea, Bacteria, and Eucarya. *Proc. Natl. Acad. Sci. USA.* **87**:4578–4579.

GOODFELLOW, M. (1995) International Committee on Systematic Bacteriology XVIth International Congress of Microbiology: Minutes of the Meetings, 2, 3, and 5 July 1994, Prague, Czech Republic. *Int J Syst Bacteriol*. **45**:613-615; doi:10.1099/00207713-45-3-613

MOORE, W. E. C., AND L. V. H. MOORE. (1992). Index of the bacterial and yeast nomenclatural changes published in the *International Journal of Systematic Bacteriology* since the 1980 Approved Lists of Bacterial Names (1 January 1980 to 1 January 1992). American Society for Microbiology, Washington, D. C.

Eighth International Congress of Bacteriology and Applied Microbiology

Jerusalem, Israel 1996

Given the relatively short period of time between the present and previous congress few additional issues had been raised (Labeda, 1997a; 1997b). The compulsory deposition of type strains was introduced into the wording of the Code. Further progress had been made on the wording of a BioCode, for which a first draft had become available (Greuter et al., 1996). In addition the fact that the American Society for Microbiology indicated that it may not be able to maintain publication of the International Journal of Systematic Bacteriology was discussed at length, with alternative publishers being considered.

Judicial Commission. 1996. Opinion 68: Designation of Strain B213c (=DSM 20284) in Place of Strain NCDO 1859 as the Type Strain of *Pediococcus acidilactici* Lindner 1887. *Int. J. Syst. Bacteriol.* **46**:835.

LABEDA, D. P., C. P. KURTZMAN, AND J. L. SWEZEY 1995. Taxonomic Note: use of patent strains as type strains in valid description of new microbial taxa. *Int. J. Syst. Bacteriol.* **45**:868–869.

MURRAY, R. G. E. and E. STACKEBRANDT 1995. Taxonomic Note: Implementation of the Provisional Status *Candidatus* for Incompletely Described Procaryotes. *Int. J. Syst. Bacteriol.* **45**:186–187.

MURRAY, R. G. E. 1995. Taxonomic Note: a Rule about the Deposition of Type Strains. *Int. J. Syst. Bacteriol.* **46**:831.

OLSEN, I., J. L. JOHNSON, L. V. H. MOORE, AND W. E. C. MOORE. 1995. Rejection of *Clostridium putrificum* and Conservation of *Clostridium botulinum* and *Clostridium sporogenes*: Request for an Opinion. *Int. J. Syst. Bacteriol.* **45**:414.

LABEDA, D. P. (1997a) Judicial Commission of the International Committee on Systematic Bacteriology VIIIth International Congress of Microbiology and Applied Bacteriology: Minutes of the Meetings, 17 and 22 August 1996, Jerusalem, Israel. *Int J Syst Bacteriol*. **47**:240; doi:10.1099/00207713-47-1-240

LABEDA, D. P. (1997b) International Committee on Systematic Bacteriology VIIth International Congress of Microbiology and Applied Bacteriology: Minutes of the Meetings, 17, 18, and 22 August 1996, Jerusalem, Israel. *Int J Syst Bacteriol.* **47**:597-600; doi:10.1099/00207713-47-2-597

GREUTER, W., D. L. HAWKSWORTH, D. L., MCNEILL, J., MAYO, M. A., MINELLI, A., SNEATH, P. H. A., TINDALL, B. J., TREHANE, P., AND P. TUBBS. (1996). Draft BioCode: the prospective international rules for the scientific names of organisms. http://www.bgbm.org/iapt/biocode/

Ninth International Congress of Bacteriology and Applied Microbiology

Sydney, Australia 1999

The meeting in Sydney (Labeda, 2000, De Vos and Trüper, 2000) saw a significant re-wording of the Code, largely based on the results of the participation in discussions on the BioCode (Tindall, 1999) Some of the issues raised had been the result of the need to clarify the workings of the present Bacteriological Code to colleagues representing the botanical, zoological, cultivated plant and virological Code, demonstrating a useful synergy. It was also noted that some changes made to the Bacteriological Code at the previous congress were retroactive and had undesirable effects on the standing of a number of names. Changes were also introduced to limit the possibility of correcting names as laid down in Rule 61. A consequence of this action was that more rigor would be needed when new names were submitted for valid publication. The most significant changes were fourfold. The *International Journal of Systematic Bacteriology* was now published by the Society for General Microbiology, Reading, UK, with there being a smooth transition from the previous publisher, the ASM. It was also decided that the journal should change its name to the *International Journal of Systematic and Evolutionary Microbiology* (IJSEM) (which was formally notified, Stackebrandt and Tindall, 1999), which would also affect the wording of the Code. In addition, a proposal to change the name of the Code to the International Code of Nomenclature of Prokaryotes was accepted (editorial note – while not clear from the wording of the minutes the name of the Code can only change with the publication of a new edition). A consequence of this was that the ICSB was renamed to the International Committee on Systematics of Prokaryotes (ICSP).

DE VOS, P., AND H. G. TRUPER. 2000. Judicial Commission of the International Committee on Systematic Bacteriology; IXth International (IUMS) Congress of Bacteriology and Applied Microbiology; Minutes of the Meetings, 14 and 17 August 1999, Sydney, Australia. *Int. J. Syst. Evol. Microbiol.* **50**:2239-2244; doi:10.1099/00207713-50-6-2239

LABEDA, D. P. 2000. International Committee on Systematic Bacteriology; IXth International (IUMS) Congress of Bacteriology and Applied Microbiology; Minutes of the Meetings, 14 and 17 August 1999, Sydney, Australia. *Int. J. Syst. Evol. Microbiol.* **50**:2245-2247; doi:10.1099/00207713-50-6-2245

STACKEBRANDT, E., AND B. J. TINDALL. (1999) *International Journal of Systematic Bacteriology* will become *International Journal of Systematic and Evolutionary Microbiology* from January 2000. *Int J Syst Evol Microbiol.* **49**:1323; doi:10.1099/00207713-49-4-1323

Tenth International Congress of Bacteriology and Applied Microbiology

Paris, France 2002

A number of refinements were made to the Code (De Vos *et al.*, 2002; Saddler, 2002). These included ensuring that the new version of Rule 27 was not retroactive. Despite the importance of the Notification Lists, reference to them had not been made in the Code, which was corrected. A further consequence of changes made at the last congress regulating the deposit of type strains in two different collections in two different countries it was felt that there was a need for the editorial board to be supplied with a "confirmation of deposit" confirming the availability of (type) strains from the culture collections. Corrections were also made with respect to the formation of names based on the names of certain inorganic ions. A key issue that had accompanied the Judicial Commission for many years was the problem of the nomenclature members of the genus *Salmonella*. The original Request for an Opinion could not be dealt with on the formal grounds that it asked the Commission to deal with a matter of taxonomic interpretation, not an issue solely relating to nomenclature. New Requests for Opinions had been received and allowed the Commission to re-evaluate this issue. After long deliberations a solution was found, dealing with the nomenclature of members of this genus. However, although the Commission could formally rule on the nomenclature of members of this genus it was felt that readers not familiar with the consequences of these actions would need help interpreting the taxonomic consequences. It was decided that a separate publication should deal with this issue, which has appeared subsequently (Tindall *et al.*, 2005).

BERNARDET, J-F., Y. NAKAGAWA, B. HOLMES, AND SUBCOMMITTEE ON THE TAXONOMY OF FLAVOBACTERIUM AND CYTOPHAGA-LIKE BACTERIA OF THE INTERNATIONAL COMMITTEE ON SYSTEMATICS OF PROKARYOTES. 2002. Proposed minimal standards for describing new taxa of the family Flavobacteriaceae and emended description of the family. *Int J Syst Evol Microbiol*. **52**:1049-1070; doi:10.1099/ijs.0.02136-0

DEWHIRST, F. E., J. G. FOX, AND S. L. ON. 2000. Recommended minimal standards for describing new species of the genus Helicobacter. *Int J Syst Evol Microbiol*. **50**:2231-2237; doi:10.1099/00207713-50-6-2231

DE VOS, P., H. G. TRÜPER, AND B. J. TINDALL. 2005. Judicial Commission of the International Committee on Systematics of Prokaryotes; Xth International (IUMS) Congress of Bacteriology and Applied Microbiology; Minutes of the meetings, 28, 29 and 31 July and 1 August 2002, Paris, France. *Int J Syst Evol Microbiol*. **55**:525-532; doi:10.1099/ijs.0.63585-0

SADDLER, G. S. 2005. International Committee on Systematics of Prokaryotes; Xth International (IUMS) Congress of Bacteriology and Applied Microbiology; Minutes of the meetings, 28 and 30 July 2002, Paris, France. *Int J Syst Evol Microbiol*. **55**:533-537; doi:10.1099/ijs.0.63589-0

TINDALL, B. J., GRIMONT, P. A. D., GARRITY, G. M., AND J. P. EUZÉBY. (2005) Nomenclature and taxonomy of the genus *Salmonella*. *Int J Syst Evol Microbiol.* **55**:521-524; doi:10.1099/ijs.0.63580-0

Eleventh International Congress of Bacteriology and Applied Microbiology

San Francisco, California, United States 2005

Further additions were needed to the Code (Tindall *et al.* 2005, Labeda and Oren, 2005), including the clarification of the fact that the publication of a particular name in no way endorsed any opinions/claims made outside of taxonomy. Apart from a number of changes to the wording in the Code a key addition was made to Rule 30 3b) that required that "evidence must be presented that the cultures (of type strains) are present, viable and available at the time of publication," further strengthening the basis for the issuing of a conformation of deposit. Furthermore the issue of strains deposited under collection numbers solely for patent purposes was brought to a conclusion, with different national/international regulations being identified as part of the problem. It was decided that strains deposited in a fashion that restricts access (for patent purposes, safe deposits, etc.) may not serve as type strains. This action is also retroactive. Problems were also perceived in the difficulty in always fulfilling the requirement to deposit type strains in two different collections in two different countries, especially where special facilities were required by the collections. As a consequence, allowances will be permitted for a limited number of cases, but this will be dealt with by a small committee that may grant exceptions.

Discussions on the issue of the fate of Requests for an Opinion indicated that there was a need to clarify the way the publications of Opinions were handled. It was generally agreed that the Judicial Commission should publish the results of their deliberations as an Opinion, irrespective of whether or not they were in agreement with the content of the Request. Copyright of the Code was transferred from IUMS to the ICSP.

LABEDA, D. P., AND A. OREN. 2008. International Committee on Systematics of Prokaryotes; XIth International (IUMS) Congress of Bacteriology and Applied Microbiology: Minutes of the meetings, 23, 24, 26 and 28 July 2005, San Francisco, CA, USA. *Int J Syst Evol Microbiol.* **58**:1746-1752; doi:10.1099/ijs.0.2008/005082-0

TINDALL, B. J., P. DE VOS, AND H. G. TRÜPER. 2008. Judicial Commission of the International Committee on Systematics of Prokaryotes; XIth International (IUMS) Congress of Bacteriology and Applied Microbiology: Minutes of the meetings, 23, 24 and 27 July 2005, San Francisco, CA, USA. I*nt J Syst Evol Microbiol.* **58**:1737-1745; doi:10.1099/ijs.0.2008/005074-0

Twelfth International Congress of Bacteriology and Applied Microbiology

Istanbul, Turkey 2008

A revision of Appendix 9 and inclusion of the Candidatus concept as a new appendix were reaffirmed but not yet available. An additional General Consideration was added to the Code. Cross-references have been added to General Considerations, Principles, Rules, and Appendices where possible. New examples from nomenclature have been introduced to replace many theoretical examples or those based on names that have been validly published.

Rules 8 and 15 were modified. The Judicial Commission recommended deletion of Note 1 of Rule 24b with a modification of the wording of Rule 24b (yet to be drafted and approved). Modifications to Rules 24a and 37a were proposed but the wording is yet to be decided upon. The status of names validly published in IJSB between 1 January 1978 and 1 January 1980 were discussed in light of possible changes to Rule 24a. Citations of authors via Rule 40d were clarified.

Opinions 81-87 have published since the previous meeting. Opinions 88-96 have been awarded but not yet published. Opinions 75, 79, and 83 were revisited.

Since the previous meeting, minimal descriptive standards have been published for the *Pasteurellaceae* (Christensen *et al.* 2007) and *Halomonadaceae* (Arahal *et al.* 2007), and an update of the minimal standards for the class *Mollicutes* (*Tenericutes*) has published (Brown *et al.* 2007; Whitcomb 2007).

ARAHAL, D. R., R. H. VREELAND, C. D. LITCHFIELD, M. R. MORMILE, B. J. TINDALL, A. OREN, V. BEJAR, E. QUESADA, AND A. VENTOSA. 2007. Recommended minimal standards for describing new taxa of the family *Halomonadaceae*. *Int J Syst Evol Microbiol.* **57**:2436-2446; doi:10.1099/ijs.0.65430-0

BROWN, D. R., R. F. WHITCOMB, AND J. M. BRADBURY. 2007. Revised minimal standards for description of new species of the class *Mollicutes* (division *Tenericutes*). *Int J Syst Evol Microbiol.* **57**:2703-2719; doi:10.1099/ijs.0.64722-0

CHRISTENSEN, H., P. KUHNERT, H.-J. BUSSE, W. C. FREDERIKSEN, AND M. BISGAARD. 2007. Proposed minimal standards for the description of genera, species and subspecies of the *Pasteurellaceae*. *Int J Syst Evol Microbiol*. **57**:166-178; doi:10.1099/ijs.0.64838-0

GARRITY, G. M., D. P. LABEDA, AND A. OREN. 2011. Judicial Commission of the International Committee on Systematics of Prokaryotes; XIIth International (IUMS) Congress of Bacteriology and Applied Microbiology. Minutes of the

meetings, 3, 4 and 6 August 2008, Istanbul, Turkey. *Int J Syst Evol Microbiol*. **61**:2775-2780; doi:10.1099/ijs.0.037366-0

LABEDA, D. P., AND A. OREN. 2011. International Committee on Systematics of Prokaryotes, XIIth International (IUMS) Congress of Microbiology and Applied Bacteriology: Minutes of the meetings, 3, 4, 5 and 7 August 2008, Istanbul, Turkey. *Int J Syst Evol Microbiol.* **61**:2781-2789; doi:10.1099/ijs.0.037374-0

WHITCOMB, R. F. 2007. Evolution and devolution of minimal standards for descriptions of species of the class Mollicutes: analysis of two Spiroplasma descriptions. *Int J Syst Evol Microbiol.* **57**:201-206; doi:10.1099/ijs.0.64545-0

Thirteenth International Congress of Bacteriology and Applied Microbiology

Sapporo, Japan 2011

The Judicial Commission was inquorate and thus the scheduled meetings of the Executive Board and Judicial Commission of the International Committee on Systematics of Prokaryotes (ICSP) to be held in association with the Congress of the International Union of Microbiological Societies in Sapporo, Japan, in September 2011, did not take place. Nevertheless the ICSP Executive Board did meet online during the last triennium to plan for the Fourteenth International Congress of Microbiology in Montreal. Revisions of the ICSP statutes were undertaken as a necessary step before revisions to the Prokaryotic Code could be undertaken.

No new Opinions were awarded and no new emendations were made to the Code. However, a draft of the new Appendix 11 had been circulated and is provisionally included with this revision of the Code (Tindall, unpublished). Additionally, the revised Appendix 9 has published (Trüper and Euzéby 2009).

Since the 2008 meeting, updated minimal descriptive standards have been published for *Halomonadaceae* (Arahal *et al.* 2008), *Micrococcineae* (Schumann *et al.* 2009), and for aerobic, endospore-forming bacteria (Logan *et al.* 2009).

ARAHAL, D. R., R. H. VREELAND, C. D. LITCHFIELD, M. R. MORMILE, B. J. TINDALL, A. OREN, V. BEJAR, E. QUESADA, AND A. VENTOSA. 2008. Recommended minimal standards for describing new taxa of the family *Halomonadaceae*. *Int J Syst Evol Microbiol.* **58**:2673.

LOGAN, N. A., O. BERGE, A. H. BISHOP, H.-J. BUSSE, P. DE VOS, D. FRITZE, M. HEYNDRICKX, P. KÄMPFER, L. RABINOVITCH, M. S. SALKINOJA-SALONEN, L. SELDIN, AND A. VENTOSA. 2009. Proposed minimal standards for describing new taxa of aerobic, endospore-forming bacteria. *Int J Syst Evol Microbiol.* **59**:2114-2121; doi:10.1099/ijs.0.013649-0

SCHUMANN, P., P. KÄMPFER, H.-J. BUSSE, L. I. EVTUSHENKO, AND FOR THE SUBCOMMITTEE ON THE TAXONOMY OF THE SUBORDER MICROCOCCINEAE OF THE INTERNATIONAL COMMITTEE ON SYSTEMATICS OF PROKARYOTES. 2009. Proposed minimal standards for describing new genera and species of the suborder Micrococcineae. *Int J Syst Evol Microbiol.* **59**:1823-1849; doi:10.1099/ijs.0.012971-0

TRÜPER, H. G., AND J. P. EUZÉBY. 2009. International Code of Nomenclature of Prokaryotes. Appendix 9: Orthography. *Int J Syst Evol Microbiol.* **59**:2107-2113; doi:10.1099/ijs.0.016741-0

Fourteenth International Congress of Bacteriology and Applied Microbiology

Montréal, Québec, Canada 2014

A new edition of the Code has been completed and is planned to be published in electronic format. Updated Chapters 1-4 will be published in the *International Journal of Systematic and Evolutionary Microbiology*.

Since the 2011 Congress, updated minimal descriptive standards have been published for *Bifidobacterium*, *Lactobacillus* and related genera (Mattarelli *et al.* 2014).

The last published Statutes of the International Committee on Systematic Bacteriology (ICSB), now the International Committee on Systematics of Prokaryotes (ICSP), were included in the 1990 Revision of the Code, and have remained largely unmodified since then. Many changes have occurred in microbiology and related fields in the intervening time and modifications of the Statutes are necessary. Some of these changes arise from decisions made by the ICSB/ICSP at its periodic meetings that have coincided with the Congresses of the International Union of Microbiological Societies (IUMS). Other changes are prompted by changes in the manner in which the ICSP and its committees and subcommittees currently operate that were not foreseen when the Statutes were drafted and approved. The Publications Committee presented a new draft version of the Statutes (Publications Committee 2013). Major changes in the proposed new version of the Statutes included:

(1) Change of the name International Committee on Systematic Bacteriology to International Committee on Systematics of Prokaryotes and of *International Journal of Systematic Bacteriology* to *International Journal of Systematic and Evolutionary Microbiology* (IJSEM);

(2) The option of electronic publication of the Statutes and electronic ballots, as approved by the ICSP at its meeting in Istanbul in 2008;

(3) Abolishment of the function of Editorial Secretary largely due to changes in the way the editorial process is now conducted;

(4) Changes in the description and operation of Subcommittees on Taxonomy, also based on current practice, including a means of automatically disbanding such subcommittees when their intended purpose may no longer be relevant;

(5) Changes in the ways the Editor and Associate Editors of IJSEM are appointed to coincide with modern publishing practices.

During the Plenary Session, the draft statutes were again revised and subsequently published (Labeda and Whitman, 2015).

THE PUBLICATIONS COMMITTEE OF THE ICSP. 2013. Statutes of the International Committee on Systematics of Prokaryotes. *Int J Syst Evol Microbiol.* **63**:4361-4369; doi:10.1099/ijs.0.058438-0

MATTARELLI, P., W. HOLZAPFEL, C. M. A. P. FRANZ, A. ENDO, G. E. FELIS, W. HAMMES, B. POT, L. DICKS, AND F. DELLAGLIO. 2014. Recommended minimal standards for description of new taxa of the genera *Bifidobacterium*, *Lactobacillus* and related genera. *Int J Syst Evol Microbiol.* **64**:1434-1451; doi:10.1099/ijs.0.060046-0

LABEDA, D., AND W. B. WHITMAN. 2015. Statutes of the International Committee on Systematics of Prokaryotes. *Int J Syst Evol Microbiol.* **65**:1093–1100; doi:10.1099/ijs.0.000019