Proposed Revision of the International Code of Nomenclature of Bacteria

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INTRODUCTION

A revision of the *International Code of Nomenclature of Bacteria* (Int. J. Syst. Bacteriol. 16: 459-490 [1966]) has been undertaken in an attempt to simplify the rules of nomenclature, thus encouraging wider use of the code,

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and to provide a sound basis for bacterial systematics. When ratified, it will supersede all previous editions of the International Code of Nomenclature of Bacteria.

In order to achieve these aims, certain principles were recently approved by the International Committee on Systematic Bacteriology (ICSB) (Int. J. Syst. Bacteriol. 21: 100-103 [1971]), and these have been incorporated into the proposed revision. In essence the significant modifications are as follows:

(1) A new starting date (1 January 1980 rather than 1 May 1753) for the nomenclature of bacteria will be instituted so as to put into practice more meaningful requirements for the valid publication of names. Among these are:

(a) New names and combinations must be published in the IJSB or, if published previously elsewhere, an announcement of such publication must be made in the IJSB;

(b) A description or a reference to a previously and effectively published description of the named taxon must also be given in the IJSB.

(c) The type of named taxon must be designated.

Furthermore, it will be recommended that the description of the named taxon contain at least those characters cited for the taxon in the list of minimal standards which will be compiled by the members of the various ICSB taxonomic subcommittees and by other experts. In addition, it will be recommended 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.

(2) For names published prior to 1 January 1980, *Approved Lists of Names of Bacteria* 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 which 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 type or neotype strains.

The proposed revision of the code has now gone through five drafts, the fourth draft having been circulated to the members of the ICSB for comment. The fifth draft is presented here for consideration and comment by the scientific community prior to submission to the Judicial Commission, the ICSB, and ultimately the Plenary Session of the relevant International Congress for final approval and acceptance.

In order to be considered by the drafting committee, all comments on the proposed revision will have to be received by Professor Skerman (Department of Microbiology, University of Queensland, St. Lucia, Queensland 4067, Australia) no later than 1 June 1973.

Chapter 1. GENERAL CONSIDERATIONS

1. *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.

2. *General Consideration 2.* To achieve order in nomenclature, it is essential that scientific names be regulated by internationally accepted Rules.

3. *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).

4. *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.

5. *General Consideration 5.* This *Code of Nomenclature of Bacteria* applies to all bacteria. The nomenclature of certain other microbial groups is provided for by other Codes: fungi and algae by the Botanical Code, protozoa by the Zoological Code, and viruses by the Virological Code when it is approved (see Appendix 1).

6. *General Consideration 6.* This Code is divided into Principles, Rules, and Recommendations.

6.1. (1) The *Principles* (Chapter 2) form the basis of the Code, and the Rules and Recommendations are derived from them.

6.2. (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.

6.3. (3) The *Recommendations* 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.

6.4. (4) *Provisions* (Chapter 5) 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 Systematic Bacteriology (ICSB) and its Judicial Commission, which acts on behalf of the ICSB. (See Statutes of the International Committee on Systematic Bacteriology [IJSB 23:000-000].) The decisions of the Judicial Commission are not final until ratified by the ICSB, which procedure is to be understood throughout this Code but which is not always made explicit. The official journal of the ICSB is the *International Journal of Systematic Bacteriology* (IJSB). (Some other journal could be specified by the ICSB if requested. Such possible future specification is implicit in the use of 'International Journal of Systematic Bacteriology' or "IJSB" throughout this Code, but is not always made explicit.)

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

6.6. (6) *References to definitions* of certain words used in the Code are provided (see page 107). Such words are indicated in bold type in the clause concerned, and they may be printed in bold type on other occurrences in this Code.

7. *General Consideration* 7. Nomenclature deals with the following.

7.1. (1) Terms used to denote the taxonomic categories, e.g., "species," "genus," and "family." These categories are referred to in this Code by the words "taxonomic categories." A taxonomic group is referred to throughout this Code as a **taxon**, **plura 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 belong to a category.

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

7.3. (3) Names applied to individual taxa. 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*.

Chapter 2. PRINCIPLES

8. *Principle 1.* The essential points in nomenclature are as follows.

8.1. (1) Aim at fixity of names.

8.2. (2) Avoid or reject the use of names which may cause error or confusion.

8.3. (3) Avoid the useless creation of names.

Note "Name" in this Code is used to refer to scientific names applied to bacteria (see Section 3).

9. *Principle 2.* The nomenclature of bacteria is independent of botanical nomenclature, except for algae and fungi, and of zoological nomenclature, except protozoa. For these exceptions and for relationships with virological nomenclature, see General Consideration 5 and Rule 52b(4).

"Independent" means that the same name may be validly used for a taxon of bacteria as well as a taxon of plants or animals with the exceptions noted above.

10. *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).

11. *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.

12. *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).

13. *Principle 6.* The correct name of a taxon is based upon **valid publication**, **legitimacy**, and **priority of publication** (see Chapter 3, Section 5).

14. *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 5B).

15. *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. Provisions exist for exceptions to this Principle (see Rules 23a and 23b and Chapter 5).

15.1. *Note 1.* The name of a species is a binary combination of genus name and specific epithet.

15.2. *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 hierarchical sequence of taxonomic categories.

16. 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

Section 1. General

17. Rule 1. This revision supersedes all previous editions of the *International Code of Nomenclature of Bacteria* (see Appendix 1). It shall be cited as *Bacteriological Code* (197? Revision).

18. Rule 2. The Rules of this Code are retroactive, except where exceptions are specified.

19. Rule 3. Names contrary to a Rule cannot be maintained, except that the International Committee on Systematic Bacteriology, on the recommendation of the Judicial Commission, may make exceptions to the Rules (see Rule 23a and Chapter 5).

20. 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

21. 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.

22. 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 be recognized where pertinent; those in the right-hand column are optional. The Latin equivalent is given in parentheses.

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

23. Rule 5c. A species may be divided into subspecies, which are dealt with by the Rules of this Code. **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 variety will have no standing in nomenclature.

24. Rule 5d. Taxa below the rank of subspecies (**infrasubspecific subdivisions**) are not covered by the Rules of this Code, but see Appendix 10A.

Section 3. Naming of Taxa

General

25. Rule 6. The scientific names of all taxa must be treated as Latin; names of taxa above the rank of species are single words.

26. Recommendation 6. To form new bacterial names and epithets, authors are advised as follows.

26.1. (1) Avoid names or epithets that are very long or difficult to pronounce.

26.2. (2) Make names or epithets that have an agreeable form that is easy to pronounce when latinized.

26.3. (3) Avoid combining words from different languages, **hybrid names** (*nomina hybrida*).

26.4. (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.

26.5. (5) Give the etymology of new generic names and of new epithets.

26.6. (6) Determine that the name or epithet which they propose is in accordance with the Rules.

Names of Taxa Above the Rank of Genus

27. Rule 7. The name of a taxon above the rank of genus 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*.

27.1. Historically, all these names were feminine plural adjectives qualifying the word "*plantae*," plants; in modern bacterial nomenclature they qualify the word "*procaryotae*." Example: *Plantae pseudomonadaceae*; *Procaryotae pseudomonadaceae*.

27.2. In practice, such names are used alone and as substantives. Example: A member of the *Pseudomonadaceae*.

Names of Taxa Above the Rank of Order

28. Rule 8. The name of each taxon above the rank of order is a Latin or latinized word preferably in conformity with Recommendation 6. It is based by choice on a combination of characters of the taxon or from a single character of outstanding importance. Exam-

ples: Kingdom—*Procaryotae*; Class—*Schizomycetes*.

Names of Taxa Between Subclass and Genus
(order, suborder, family, subfamily, tribe, subtribe)

29. *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 as follows:

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

Names of Genera and Subgenera

30. *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, *Ricolesia*.

31. *Recommendation 10a*. The following Recommendations apply when forming new generic or subgeneric names.

31.1. (1) Refrain from naming genera and subgenera after persons quite unconnected with bacteriology or at least with natural science.

31.2. (2) Give a feminine form to all personal generic and subgeneric names whether they commemorate a man or a woman.

31.3. (3) Avoid introducing into bacteriology as generic names such names as are in use in botany or zoology, in particular well known names.

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

33. *Rule 10c*. The name of the subgenus, when included in the name of a species, is placed in parentheses between the generic name and specific epithet. Example: *Bacillus (Bacillus) subtilis*; *Bacillus (Aerobacillus) polymyxa*.

Names of Taxa Between Subgenus and Species

34. *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.

34.1. *Note*. Priority (see Section 5A) means that the name first published in accordance with the Rules is the correct name for a taxon. Homonyms are identical validly published names for taxa which are of the same rank but which are based on different types. Homonymy refers to the situation where the same name is given to two or more different taxa of the same rank. The first published homonym is known as the senior homonym and any later published homonyms as junior homonyms.

Names of Species

35. *Rule 12a*. The name of a species is a binary combination consisting of the name of the genus followed by a single specific epithet.

35.1. 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 original publication, then the epithet is not to be rejected but the form 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 retains its validity and standing in nomenclature. Example: *Calcoaceticus* corrected to *Caleoaceticus*.

36. *Rule 12b*. No specific or subspecific epithets within the same genus may be the same if based on different types (see *Rule 13c* 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 *helvolus* cannot be used for *Corynebacterium helvolum* Jensen 1934, another bacterium whose name is based on a different type.

37. *Rule 12c*. A specific epithet may be taken from any source, and may even be composed arbitrarily. Example: *etousae* derived from European Theater of Operations of the U.S. Army.

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

37.1. (a) As an adjective that must agree in gender with the generic name. Example: *aureus* in *Staphylococcus aureus*.

37.2. (b) As a substantive in apposition in the nominative case. Example: *radicicola* in *Bacillus radicicola*.

37.3. (c) As a substantive in the genitive case. Example: *lathyri*.

38. *Recommendation 12c*. Authors should attend to the following Recommendations, and those of Recommendation 6, when forming specific epithets.

38.1. (1) Choose a specific epithet that, in

general, gives some indication of a property or of the origin of the species.

38.2. (2) Avoid those that express a character common to all, or nearly all, the species of a genus.

38.3. (3) If taken from the name of a person, it should recall the name of one who discovered or described it, or was in some way connected with it, and possess the appropriate gender (see Appendix 9B).

38.4. (4) Avoid in the same genus epithets which are very much alike, especially those that differ only in their last letters.

38.5. (5) Avoid the use of the genitive and the adjectival forms of the same specific epithet to describe two different species of the same genus (see Rule 63).

Names of Subspecies

39. *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 cereus subsp. mycoides* (Flügge 1886) Smith et al. 1946.

For "variety" see Rule 5c.

40. *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.

41. *Rule 13c.* No two subspecies may bear the same subspecific epithet within the same species or within the same genus (see also Rule 12b).

Names of Intrasubspecific Subdivisions

42. *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).

43. *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: *Leptospira javanica* Collier 1948, elevation of *Leptospira* sp. serovar *javanica* of Essevald and Mochtar 1938 by Collier in 1948.

Section 4. Nomenclatural Types and Their Designation

General

44. *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. 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 can be summarized as follows:

Item	Taxonomic category	Type
44.1	Subspecies Species	Designated strain; in special cases the place of the strain may be taken by a description, preserved specimen, or an illustration
44.2	Subgenus Genus	
44.3	Subtribe Tribe Subfamily Family Suborder Order	Designated species
44.4	Subclass Class	
		One of the contained orders

45. *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 proposed.

46. *Rule 17.* The type determines the application of the name of a taxon in the event the taxon is subsequently divided or united with another taxon. Example: If the genus *Bacillus* is divided into the genera *Bacillus* and *Aerobacillus*, the genus which contains the type species, *Bacillus subtilis*, must be named *Bacillus*.

Type of a Species or Subspecies

47. *Rule 18a.* Whenever possible the type of a species or subspecies is a designated strain.

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

47.2. For a species which has not so far been maintained in laboratory culture or for which a type strain does not exist, a description,

preserved specimen, or an illustration (see also Rule 18h) may serve as the type. Example: Non-cultivated, *Oscillospira guilliermondi* Chatton and Perard 1913.

Designation by original author

48. *Rule 18b.* If the author in the original 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.

Designation by monotypy

49. *Rule 18c.* If the original author described only a single strain and did not designate it as the holotype, then this strain shall be accepted as the type strain and may be referred to as the monotype.

Designation as lectotype

50. *Rule 18d.* If no holotype exists, one of the strains on which the original author based his description may be later designated as the type strain by the original or a subsequent author, and this strain shall be accepted as the type strain and may be referred to as the lectotype.

Designation as neotype

51. *Rule 18e.* If strain on which the original description was based cannot be found, a neotype strain may be proposed.

51.1. A neotype strain must be proposed (proposed neotype) in the IJSB, 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).

51.2. 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.

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

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

53. *Rule 18g.* If an original strain that should constitute the type of a species is discovered subsequent to the formal proposal or establish-

ment of a neotype for that species, the matter shall be referred immediately to the Judicial Commission.

54. *Rule 18h.* If a description or illustration constitutes, or a dead preserved specimen has been designated as, the type of a species (Rule 18a, para 3) and later a strain of this species is cultivated, then the strain may be designated as the neotype by the person who isolated the strain or by a subsequent author. This strain shall then replace the description, illustration, or preserved specimen as the nomenclatural type.

Change in characters of type and neotype strains

55. *Rule 18i.* If a type or neotype strain has become unsuitable due to changes in its characters, then the matter should be referred to the Judicial Commission, which may decide to take action leading to replacement of the strain.

Reference strains

56. *Rule 19.* A reference strain has no standing in nomenclature, but it may, by subsequent action, be made a neotype.

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, serological or chemical assay.

Type of a Genus

57. *Rule 20a.* The nomenclatural type 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.

Designation by original author

58. *Rule 20b.* If the author of the original publication of a generic or subgeneric name designated a type species, this species shall be accepted as the type species.

Genus with only one species

59. *Rule 20c.* If the genus when originally published included only one species, then this species is the type species.

Designation by a subsequent author

60. *Rule 20d.* The type species shall be selected from one of the species included when the genus was originally published.

60.1. *Recommendation 20d.* Authors are recommended to exclude the following species from consideration in selecting the type.

60.2. (1) Doubtfully identified or inadequately characterized species. Example: *Lactobacillus caucasicus* Beijerinck 1901 (Opinion 38).

60.3. (2) Species doubtfully referred to the genus. Example: No example yet found.

60.4. (3) Species which definitely disagree with the generic description. Example: *Halococcus litoralis* (Poulsen) Schoop.

60.5. (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.

Designation by International Agreement

61. Rule 20e. (1) If none of the species named by an author in his original 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. Example: Rejection of the generic name *Gaffkya* Trevisan 1885 (Opinion 39)

61.1. (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 cholerae* Pacini 1854 (Opinion 31).

Retention of type species on publication of a new generic name

62. Rule 20f. The 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 campestris* and which became *Xanthomonas campestris*.

Type of a Subgenus

63. Rule 20g. A genus and its type subgenus share the same type species. Example: *Bacillus subtilis* is the type species of the genus *Bacillus* and of its type subgenus, *Bacillus*.

Type of a Taxon from Genus to Order (subtribe, subfamily, family, suborder, and order)

64. Rule 21a. The nomenclatural type of a taxon above genus up to and including order is the genus on whose name the relevant taxon is based. If there are two or more genera, the type shall be designated by the author at the time of the proposal of the name. 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, *Rhodospirillales*; suborder, *Rhodospirillineae*; family, *Rhodospirillaceae*; type genus, *Rhodospirillum*.

65. 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).

Type of a Taxon Higher than Order

66. Rule 22. The type 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 *Mycoplasmatales* of the class *Mollicutes*.

66.1. If not designated, it may be later designated by an Opinion of the Judicial Commission. Example: None of the Opinions so far issued (1-46) have dealt with this subject.

Section 5. Priority and Publication of Names

A. Priority of Names

67. 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.

67.1. The name of a species is a binary combination of genus 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 pertussis* bears this name in the genus *Haemophilus*. If placed in the genus *Bordetella*, it bears the name *Bordetella pertussis*.

67.2. 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).

The name of a subspecies is a ternary combination of a genus 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.

67.3. Note 2. 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).

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

67.5. 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 also amend the approved lists (see Rule 24a).

67.6. (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.

67.7. (ii) **Opinions** on the conservation or rejection of names, issued by the Judicial Commission, are published with other **Opinions** in the IJSB. **Opinions** are now numbered serially.

67.8. Note 5. Names and epithets may be:

67.9. Legitimate—in accordance with the Rules.

67.10. Illegitimate—contrary to the Rules.

67.11. Effectively published—in printed matter made generally available to the scientific community (see Rule 25).

67.12. 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).

67.13. Correct—the name which must be adopted for a taxon under the Rules.

68. 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 56).

B. Publication of Names

69. 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.

69.1. After 1 January 1980, priority shall date from 1 January 1980. On that date all names published prior to 1 January 1980 and included in the Approved Lists of Bacterial Names of the ICSB shall be 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).

69.2. Note 1. Names of bacteria in the various taxonomic categories validly published up to 31 December 1977 will be assessed by the Judicial Commission with the assistance of taxonomic experts. Lists of names will be prepared together with the names of the authors who originally proposed the names. When approved by the ICSB these Lists of Approved Bacterial Names will be published in the IJSB before 1 January 1980. Names validly published under this Code between 1 January 1978 and 1 January 1980 will be added to the Approved Lists of Bacterial Names.

69.3. After 1 January 1980, no further names will be added to the lists. Those names validly published prior to 1 January 1980 but not included in the approved lists will have no further standing in nomenclature. They will not be added to the lists of *nomina rejicienda* and will thus be available for reuse for the naming of new taxa.

69.4. The Approved Lists of Bacterial Names will 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 will be listed by its designation, and the culture collection(s) from which it may be obtained will be indicated. If such a strain is not available, a reference strain or reference material will be listed if possible. Neotypes may be proposed in conformity with Rule 18c on such lists. (For citation of names on the approved lists see provisional Rules A1 and A2 (page 95).

69.5. Note 2. These approved lists may contain more than one name attached to the same type (**objective synonyms**) since the names on the lists will 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. Example: To be added from an approved list.

69.6. Note 3. Synonyms may be **objective synonyms**, i.e., more than one name has been associated with the same type, or **subjective synonyms**, i.e., different names have been associated with different types that in the opinion of the bacteriologist concerned belong

to the same taxon. The synonym first published is known as the **senior synonym**, and later synonyms are known as **junior synonyms**.

69.7. Publication of objective synonyms in the lists does not affect bacterial nomenclature any more than does the valid publication of objective synonyms in different works in the bacteriological literature at present.

Examples: Objective synonyms—*Nocardia rhodochrous* and *Mycobacterium rhodochrous*. Subjective synonyms—Luedemann (IJSB [1971] 21:240-247) regards *Micromonospora fusca* Jensen 1932 as a subjective synonym of *Micromonospora purpureochromogenes* (Waksman and Curtis 1916) Luedemann 1971. These two species have different types.

70. Rule 24b. 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 original publication of the name before 1 January 1980.

71. Rule 24c. The Judicial Commission may place on the list of rejected names (*nomina rejicienda*) a name previously published in an approved list.

Effective publication

72. Rule 25a. Effective publication is effected under this Code by making generally available, by sale or distribution, to the scientific community, printed material for the purpose of providing a permanent record.

72.1. Recommendation 25a. When names of new taxa are published in works written in a language unfamiliar to the majority of workers in bacteriology, it is recommended that the authors include in the publication descriptions in a more familiar language.

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

73.1. (1) Communication of new names at a meeting, in minutes of a meeting, or, after 1950, in abstracts of papers presented at meetings.

73.2. (2) Placing of names on specimens in collections or in listings or catalogues of collections.

73.3. (3) Distribution of microfilm, microcards, or matter reproduced by similar methods.

73.4. (4) Reports in ephemeral publications, newsletters, newspapers after 1900 or non-scientific periodicals.

73.5. (5) Inclusion of a name of a new taxon of bacteria in a published patent application or issued patent.

Date of publication

74. Rule 26a. The date of publication of a scientific book or paper is the date of publication of the printed 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.

75. 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

76. Rule 27. From the date of publication of this revision of the Code, a name of a new taxon, or a **new combination** for an existing taxon, is not validly published unless the following criteria are met.

76.1. (1) The name is published in the IJSB.

76.2. (2) The publication of the name in the IJSB is accompanied by a description of the taxon or by a reference to a previous effectively published description of the taxon (see Rules 25a and 25b, and for genus and species, Rules 29-32).

76.3. (3) The type is designated (new taxon) or cited (new combination) in the IJSB.

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

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 publication. It is recommended that the type of a species or subspecies be deposited in a recognized culture collection (Recommendation 30a) and that the description of the taxon conform to minimal standards (Recommendation 30b).

77. Rule 28a. An author validly publishing a new name may revive a name validly published prior to 1 January 1980 (see Rule 24a) but not listed in one of the Approved Lists of Bacterial Names. 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.

77.1. 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, he may do so by appending the abbreviations *nom. rev.* (revived name) to the name (see Provisional Rule B3, p. 95).

77.2. Note 1. After 1 January 1980, publication of a new name is not invalidated by previous publication of the name (before 1 January 1980) unless the name is included in the Approved Lists of Bacterial Names.

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

77.4. Note 3. After 1 January 1980, search for publication of names and effectively published descriptions prior to 1 January 1980 will no longer be required. The Approved Lists of Bacterial Names will form the foundation of bacterial nomenclature and taxonomy.

78. Rule 28b. A name or epithet is not validly published under the following conditions.

78.1. (1) It is not accepted at the time of publication by the author who published it. Example: *Muellerina* de Petschenko 1910 (Opinion 10).

From the date of publication of this Code, names or epithets published with a question mark or other indication of taxonomic doubt yet accepted by the author are not validly published.

78.2. (2) It is 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); (b) *Corynebacterium hemophilum* Svendsen et al. (J. Bacteriol. [1947] 53:758). "Its haemolytic 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."

78.3. (3) It is 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) *Pseudobactrinium* Trevisan 1888. (b) Raj (IJSB [1970] 20:79) stated: "Also, recently another organism tentatively

named as *Microcycclus marinus* was isolated from the ocean."

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

79. Rule 29. For a generic or subgeneric name to be validly published it must comply with the following conditions.

79.1. (1) It must be published in conformity with Rules 27 and 28b.

79.2. (2) The genus or subgenus named must include one or more described or previously described species.

79.3. Instead of a 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.

79.4. In the case of a genus containing a single species, a combined generic and specific description may be given. Example: *Thiobacillus thioparus* Beijerinck 1904.

80. 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

81. Rule 30. For the name of a species to be validly published:

81.1. (1) It must be published in conformity with Rules 27 and 28b.

81.2. (2) It must be published as a binary combination consisting of a generic name followed by a single specific epithet (see Rule 12a).

82. Recommendation 30a. Before publication of the name of a new species, a culture of the type strain (or, if the species is noncultivable, type material, a photograph or illustration) 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 collection should be quoted in the published description.

83. Recommendation 30b. Before publication of the name and description of a new species, the examination and description should conform at least to the minimal standards required for the relevant taxon of bacteria.

83.1. Note. Lists of minimal standards will be prepared for each group of bacteria by experts at the request of the Judicial Commission for

consideration by the Judicial Commission for publication in the IJSB. Such standards would include tests for the establishment of generic identity and for **diagnosis** of the species, i.e., an indication of characters which would distinguish the species from others.

84. Rule 31a. The name of a species or subspecies is not validly published if the description is based upon studies of a mixed culture of more than one species or subspecies: this does not apply to descriptions based chiefly on morphology, e.g., *Selenomonas palpitans* Simons 1922.

85. Rule 31b. The naming of a **consortium** is not regulated by this Code, and such names have no standing in nomenclature. Example: *Cylindrogloea bacterifera* Perfiliev 1914.

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

Valid Publication of the Name of a Subspecies

86. Rule 32a. For the name of a subspecies to be validly published:

86.1. (1) It must be published in conformity with Rules 27 and 28b.

86.2. (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*

86.3. (3) The author must clearly indicate that a subspecies is being named.

87. 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

88. 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 to Rule 20f).

Section 6. Citation of Authors and Names

Proposal and Subsequent Citation of the Name of a New Taxon

89. 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.

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

89.1. Note. To be completed (use of *sp. nov.*, *gen. nov.* etc.).

90. 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. Example: *Actinomyces bovis* Harz 1877.

90.1. 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, not *Mycobacterium terrae* Tsukamura 1966.

90.2. 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 the original publication (Untersuchungen über Bakterien. Beitr. Biol. Pfl. Heft 2. 1: 127-224) on which the proposal of the new combination occurs.

Proposal and Subsequent Citation of a New Combination

91. 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 a new combination by the addition to the citation of the abbreviation *comb. nov.* (*combinatio novum*).

Example: *Actinomyces exfoliatus* Waksman and Curtis 1916; *Streptomyces exfoliatus* (Waksman and Curtis) *comb. nov.* (as cited by Waksman and Henrici, in *Bergey's Manual of Determinative Bacteriology*, 6th ed. The Williams & Wilkins Co., Baltimore, 1948).

92. 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: *Bacillus polymyxa* (Prazmowski) Macé 1889 or *Bacillus polymyxa* (Prazmowski 1880) Macé 1889.

93. Rule 34c. When a taxon from genus to subspecies 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 affected the alteration and the year of publication.

Example: *Actinomyces exfoliatus* Waksman and Curtis 1916 to *Actinomyces chromogenes* subsp. *exfoliatus* (Waksman and Curtis) Krasil'nikov 1941.

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

94. 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: Not yet found.

Citation of a Name Conserved so as to Exclude the Type

95. 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 type species of the genus *Aeromonas*, has been excluded from *Aeromonas* (Opinion 00). The generic name *Aeromonas* is now attributed to Stanier 1943, not to Kluver and van Niel 1936.

Citation of Names Included in the Approved Lists of Bacterial Names, 1 January 1980

(As no Approved Lists of Bacterial Names exist, the following rules can only be provisional.)

Note. The nomenclatural status of a name included in an approved list is the same as that of new names published after 1 January 1980. If special reference to the inclusion of a name in an approved list be desired, Provisional Rules A1-2 and B1-4 should be followed.

96. Provisional Rule A1. (1) 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 List No. . . . 1980" in parentheses.

Examples: *Bacillus cereus* Frankland & Frankland 1888 (Approved List No. 1, 1980); *Bacillus subtilis* (Ehrenberg 1835) Cohn 1872 (Approved List No. 1, 1980).

96.1. (2) Alternatively, a name which is included in an approved list may be cited simply by the addition of the words "Approved List No. . . . 1980" in parentheses.

Examples: *Bacillus cereus* (Approved List No. 1, 1980); *Bacillus subtilis* (Approved List No. 1, 1980).

96.2. (3) 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.

97. Provisional Rule A2. If an author transfers a species which has been included in one of the approved lists to another genus, the proposal of the new combination should be made by the addition of the abbreviation *comb. nov.* (*combinatio novum*) followed in parentheses by the name under which it appeared in the approved list and the correct citation for that list.

Example: If *Bordetella parapertussis* appears in Approved List No. 5, 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 List No. 5, 1980).

97.1. Another author citing this proposal would then use the citation: *Moraxella parapertussis* (Eldering and Kendrick 1938) Smith 1983 (*Bordetella parapertussis*—Approved List No. 5, 1980).

97.2. Note. The correct form of citation of an approved list can be found in the approved list itself.

Citation of Reused Names

(Since the reuse of names has not come into operation, the following rules can only be provisional.)

98. Provisional Rule B1. 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, b and 34a, b.

99. Provisional Rule B2. 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 revivendum*) after the correct abbreviation (Rule 33a) for the category concerned. Example: *Bacillus palustris* sp. nov. *nom. rev.*

100. Provisional Rule B3. 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: *Bacillus palustris* (ex Sickles and Shaw 1934) *nom. rev.*

100.1. A subsequent author citing this revived name would use the citation *Bacillus palustris* Brown 1982, or *Bacillus palustris* (ex Sickles and Shaw 1934) Brown 1982.

100.2. Provisional Rule B4. 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 publication of the author who first used the name.

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

101. Rule 36. (1) The name of a taxon must be changed if the nomenclatural type of the taxon is excluded.

101.1. (2) However, 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 23b). At the time of conservation, the new type is established by the Judicial Commission.

102. Rule 37. 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:

102.1. (1) An Opinion of the Judicial Commission (see Rule 36).

102.2. (2) Transfer of the taxon (see Rule 41).

102.3. (3) Union with another taxon (Rules 43, 47a, and 47b).

102.4. (4) Change of its rank (Rules 48, 49, 50a, 50b).

103. 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. If, however, this choice would lead to confusion in bacteriology, the author should refer the 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

104. 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*.

105. 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.

106. Rule 39c. Rules 39a and 39b apply when a subgenus is divided into two or more subgenera with change of the word "genus" to the word "subgenus" in Rules 39a and 39b.

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

107. 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 reinstated. (See Rule 50a when a subspecies is elevated to a species.)

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

108. 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.

109. Rule 40c. Rules 40a and 40b apply when a subspecies is divided into two or more subspecies with change of the word "species" to the word "subspecies."

109.1. 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.

Transfer of a Species to Another Genus

110. Rule 41a. When a species is transferred to another genus without any change of rank, the specific epithet must be retained, and if it has not been retained (in a previous publication), it must be reestablished, unless:

110.1. (1) The resulting binary combination would be a later junior homonym. Example: Pridham (1970) proposed *Streptomyces auriscloeroticus* for *Chainia aurea* on transfer to *Streptomyces* in which genus the name *Streptomyces aureus* already existed.

110.2. (2) There is available an earlier validly published and legitimate specific or subspecific epithet. Example: Not yet found.

111. 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

112. 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.

112.1. If the names of 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.

113. *Recommendation 42.* Authors who have to choose between two generic names of the same date should note the following.

113.1. (1) Prefer the one which is better known.

113.2. (2) Prefer the one which was first accompanied by the description of a species. Example: Not yet found.

113.3. (3) If both are accompanied by descriptions of species, prefer the one which includes the larger number of species. Example: Not yet found.

113.4. (4) In cases of equality from these points of view, prefer the more appropriate name. Example: Not yet found.

Union of Genera as Subgenera

114. *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: *Lactobacillus* Beijerinck 1901 (see *Bergey's Manual*, 1957, p. 543).

Union of Species in a Single Genus

115. *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 the earliest legitimate generic name whose type is one of the included types. Example: *Pseudobacterium* Krasil'nikov 1949 is illegitimate for this reason (see *Index Berg-eyana*, p. 845).

115.1. 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.

Union of Species as Subspecies

116. *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 IBBNT 15:214 and 224 [1965]).

117. *Rule 46.* 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. *viscosus* Chester 1904 automatically created a new subspecies, *Bacillus subtilis* subsp. *subtilis*.

117.1. The author of the species name is to be cited as the author of such an automatically created subspecific name. Example: *Bacillus subtilis* subsp. *subtilis* (Ehrenberg) Cohn 1872.

Union of Taxa Above Species Under a Higher Taxon

118. *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.

118.1. If, however, this choice would lead to confusion in bacteriology, the author should refer the matter to the Judicial Commission.

118.2. *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.

119. *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 (see IJSB 21:235 [1971]).

Change in Rank

120. *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*.

121. *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*.

122. *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: *Propionibacterium jensenii* subsp. *raffinosa* van Niel 1928 becomes *Propionibacterium raffinosa* (van Niel) Werkman and Kendall 1931.

123. *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: *Bacillus atterimus* Lehmann and Neumann 1896 becomes *Bacillus subtilis* subsp. *atterimus* (Lehmann and Neumann) Smith et al. 1946.

Section 8. Rejection and Replacement of Names

Rejection of Names

124. *Rule 51*. A legitimate name or epithet may not be disregarded merely because of the following.

124.1. (1) It is inappropriate. Example: *Bacteroides melaninogenicum* (see J. Gen Microbiol. 1:109-120 [1947]).

124.2. (2) It is disagreeable. Example: *Miyagawanella lymphogranulomatis*.

124.3. (3) Another name is preferable. Example: Not yet found.

124.4. (4) Another name is better known. Example: *Corynebacterium pseudodiphtheriticum* cannot be rejected because *Corynebacterium hofmanni* is better known.

124.5. (5) It no longer describes the organism. Example: *Haemophilus influenzae*.

124.6. (6) It has been cited incorrectly: an incorrect citation can be rectified by a later author. Example: *Proteus morgani* Yale 1939; see Lessel, E. F., IJSB 21:55-57 (1971).

Illegitimate Names

125. *Rule 52a*. A name contrary to a Rule is illegitimate and must be rejected. 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.

126. *Rule 52b*. Among the reasons for which a name may be illegitimate are the following.

126.1. (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: Not yet found.

126.2. (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.

126.3. (3) If its specific epithet must be rejected under Rule 54 or 55.

126.4. (4) If it is a junior homonym of a name of a taxon of bacteria, fungi, algae, protozoa, or viruses. Example: *Phytomonas* Donovan 1909 (a genus of flagellates); *Phytomonas* Bergey et al. 1923 (Opinion 14).

126.5. *Note*. After 1 January 1980, names of bacteria validly published under this revision of the Code are not to be rejected as homonyms of names of bacteria published under previous editions of the Bacteriological Code.

127. *Rule 53*. Only the Judicial Commission can place names on the list of rejected names (*nomina rejicienda*) (Appendix 4). A name may be placed on this list for various reasons, including the following.

127.1. (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).

127.2. (2) A doubtful name (*nomen dubium*), i.e., a name whose application is uncertain. Example: *Leuconostoc citrovorum* (Opinion 45).

127.3. (3) A name causing confusion (*nomen confusum*), i.e., a name based upon a mixed culture. Example: *Malleomyces* Hallier 1870.

127.4. (4) A perplexing name (*nomen perplexum*), a name whose application is known but which causes uncertainty in bacteriology (see Rule 57c). Example: *Mycobacterium marinum* or *Mycobacterium marianum*.

Illegitimate Epithets

128. *Rule 54*. The following are not to be regarded as specific or subspecific epithets.

128.1. (1) A word or phrase which is not

intended as a specific epithet. Example: *Bacillus nova species* Matzuschita.

128.2. (2) A word which is merely an ordinal adjective used for enumeration. Example: *primus, secundus*.

128.3. (3) A number or letter. Example: α in *Bacillus* α von Freudenreich.

129. Rule 55. An epithet is illegitimate if it duplicates a specific or subspecific epithet previously validly published for a different species or subspecies of the same genus.

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

Replacement of Names

130. Rule 56. The name or epithet rejected according to Rules 52b, 53, or 55 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.

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

Section 9. Orthography

131. 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.

132. 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*.

133. 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 53 [4]). Example: *Mycobacterium marianum* and *Mycobacterium marinum*.

133.1. Note. **Orthographic variants** may be corrected by any author; **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. Example: *Salmonella gamaba* and *Salmonella gambaga*.

134. 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, this spelling should be used by succeeding authors.

Example: The epithet "*megaterium*" (over "*megatherium*") in the species name *Bacillus megaterium* du Bary (Opinion 1).

134. 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).

135. Rule 60. Intentional latinizations involving changes in orthography of personal names, particularly those of earlier authors, must be preserved. Example: Pasteur may be latinized as Pastor, and *Streptococcus pastorianus* is derived from Pastor.

Typographic and Orthographic Errors

136. 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 or small letter or to diacritic signs. Example: The original spelling was *Bacillus megaterium*, not *megatherium* (Opinion 1).

136.1. An unintentional typographic or orthographic error later corrected by the author is to be accepted in its corrected form without affecting its validity and original date of 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 affect the validity and original date of publication.

Example: *Mycobacterium stercusis* (sic) Bergey et al. 1923. Typographic error later corrected by the author to *Mycobacterium stercoris*; this may be cited as *Mycobacterium stercoris* corrig.

136.2. 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.

Orthographic Variants by Transliteration

137. 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*.

138. 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

139. 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).

Diacritic Signs

140. Rule 64. *Diacritic signs* are not used in names or epithets in bacteriology.

140.1. 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*, *ê* and *ë* become *e*; (3) *ø*, *æ* and *å* become *oe*, *ae* and *aa*, respectively.

Gender of Names

141. Rule 65. The gender of generic names is governed by the following.

141.1. (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, a package).

141.2. 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: Not yet found.

141.3. In doubtful cases, general usage should be followed. Example: Not yet found.

141.4. (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.

141.5. If the ending is altered, the gender is that of the new ending in the language of origin. Example: Not yet found.

141.6. (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: *Ricolesia* Rake 1957, who assigned the feminine gender.

Chapter 4. ADVISORY NOTES

A. Suggestions for Authors and Publishers

142. 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.

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

144. 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(s) is published even if the name(s) itself is not quoted in the title.

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

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

147. 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.

148. The name of a genus should be spelled without abbreviation the first time it is used with a specific epithet in a publication. Example: *Bacillus subtilis*.

149. 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*.

150. 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*.

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

B. Quotations of Authors and Names

152. (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*).

153. (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: 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.

154. (3) Use of *pro* synonym, *ex*, *non*, and *sic*.

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

154.2. (b) When an author has published a name from a manuscript of another author, 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: *Bacillus caryocyanus* Dupaix 1930 *ex* Beijerinck (see Dupaix, 1930, Trav. Lab. Fac. Pharm., fasc. 3, p. 13).

154.3. (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: *Pfeifferella* Buchanan 1918 *non* Labbé 1899.

154.4. (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 pantothenicus (sic)*.

155. (4) *Nomen nudum*.

155.1. In the citation of a bare name (*nomen nudum*), the status of the name should be indicated by adding "*nom. nud.*"

155.2. 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.

156. (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

157. 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.

158. 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 Recommendation 30a).

159. 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.

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

Chapter 5. PROVISIONS

161. A permanent International Committee on Systematic Bacteriology (ICSB) has been established by the International Association of

Microbiological Societies. This Committee is so constituted that, wherever practicable, each country is represented by at least one member and by no more than five. The organization of the Committee is summarized below (see Statutes of the International Committee on Systematic Bacteriology [IJSB 23:000]).

162. The Committee has an Executive Board, a Board of Publications, and a Judicial Commission. The functions of the ICSB include the following: (i) to hold meetings as part of the sessions of the International Congresses and to sponsor a section on taxonomy at the Congresses; (ii) to approve the International Code of Nomenclature of Bacteria and those changes recommended by the Judicial Commission; (iii) to receive and approve the Opinions issued by the Judicial Commission; (iv) to set up special Subcommittees on Taxonomy to study and make recommendations on classification and nomenclature of bacterial taxa; (v) to publish the Code of Nomenclature, certain official lists of bacterial names, statutes of the ICSB, and the IJSB.

163. The Judicial Commission of the ICSB is elected from the members of that Committee. The Chairman and Secretaries of that Committee are *ex officio* members of the Commission. The functions of the Judicial Commission include the following: (i) to consider all proposals for emendation of the International Code of Nomenclature of Bacteria and to recommend emendations to the ICSB; (ii) to consider all requests for Opinions; (iii) to establish lists of names that have been conserved or rejected and other lists of use in bacterial taxonomy; (iv) to receive proposals for the establishment of minimal standards for the descriptions of taxa and to make recommendations to the ICSB for approval.

164. The Judicial Commission considers Requests for Opinions on the interpretation of the Code and on specific exceptions to the Code (including the conservation or rejection of names of bacterial taxa) in the interest of stability. Requests for Opinions should be submitted to the Chairman of the Judicial Commission. Requests should be accompanied by a fully documented statement of the relevant facts; requests will be returned for revision if the evidence presented is not adequate to allow the Commission to decide upon the case. The Judicial Commission also considers proposals for the designations of infrasubspecific subdivisions made by the International Taxonomic Subcommittees of the ICSB.

APPENDICES

Appendix 1. Codes of Nomenclature

165. International Code of Nomenclature for Bacteria and Viruses (1958) Ames, Iowa.: Iowa State College Press. 186 pp.

166. Editorial Board. 1966. International Code of Nomenclature of Bacteria. *Int. J. Syst. Bacteriol.* 16:459-490.

167. International Code of Botanical Nomenclature, adopted by the Tenth International Botanical Congress, Edinburgh, August 1964. (International Bureau of Plant Taxonomy and Nomenclature, Utrecht, 1966, 402 pp.)

168. International Code of Nomenclature for Cultivated Plants. (International Bureau for Plant Taxonomy and Nomenclature, Utrecht, 1969, 32 pp.)

169. International Code of Zoological Nomenclature, adopted by the XV International Congress of Zoology (International Commission on Zoological Nomenclature, London, 1964, 176 pp.)

170. The Code of Nomenclature of Viruses has not yet been issued, but see Classification and Nomenclature of Viruses, First Report of the International Committee on Nomenclature of Viruses, edited by P. Wildy (S. Karger, Basel, 1971, 81 pp.)

Appendix 2. Approved Lists of Bacterial Names

171. References to the Approved Lists of Bacterial Names in the IJSB will be added to this appendix as they are published in the IJSB.

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

172. To include references to any lists of the above which are available, e.g., *Index Bergeyana*. Published sources for names of bacterial, algal, protozoal, fungal, and viral taxa.

Bacteria

173. Buchanan, R. E., J. G. Holt, and E. F. Lessel. 1966. *Index Bergeyana* (The Williams & Wilkins Co., Baltimore, 1472 p.).

174. Hatt, H. D., and E. Zvirbulis. 1967. Status of names of bacterial taxa not evaluated in *Index Bergeyana* (1966). I. Names published circa 1950-1967 exclusive of the genus *Salmonella*. *Int. J. Syst. Bacteriol.* 17:171-225.

175. Zvirbulis, E., and H. D. Hatt. 1969. Status of names of bacterial taxa not evaluated in *Index-Bergeyana* (1966). Addendum II. *Acetobacter* to *Butyrivibrio*. *Int. J. Syst. Bacteriol.* 19: 57-115.

176. Zvirbulis, E., and H. D. Hatt. 1969. Status of names not evaluated in *Index Berge-*

yana (1966). Addendum III. *Achromobacter* to *Lactobacterium*. Int. J. Syst. Bacteriol. 19:309-369.

Algae

177. De Toni, 1889. Sylloge Algarum.

178. Index Kewensis 1895-present (Royal Botanical Gardens, Kew).

Protozoa

179. Index Zoologicus 1902-present. (Zoological Society, London.)

Fungi

180. Saccardo, P. A. 1882-1921. Sylloge Fungorum. (Pavia, 25 vol.)

181. Clements, F. E., and C. L. Shear. 1931. The Genera of Fungi (H. W. Wilson & Co., New York).

182. Index to Fungi, 1940-present. (Commonwealth Mycological Institute, Kew).

Viruses

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

Appendix 4. Conserved and Rejected Names of Bacterial Taxa

184. (The lists of conserved and rejected names which appear in the Code in book form will be updated and published in this appendix. Some matters will require decision by the Judicial Commission and the ICSB at the International Congress for Bacteriology in 1973; therefore no text is given.)

Appendix 5. Opinions Relating to the Nomenclature of Bacteria

185. (A list of opinions updated. Some matters will require decision by the Judicial Commission and the ICSB at the International Congress for Bacteriology in 1973; therefore no text is given.)

Appendix 6. Published Sources for Recommended Minimal Descriptions

186. (References to the publications where the recommendations for minimal standards can be found will be included in this appendix.)

Appendix 7. Publication of a New Name

187. After the date of publication of this revision of the Code, valid publication of the name of a taxon (including a new combination) requires publication in the International Journal of Systematic Bacteriology 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 Bacteriology or in another publication. Fuller details are given below.

188. (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 lower-case 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*.

189. Although not a requirement for the valid publication of a new name, the derivation of the name should be given.

190. Where possible, the title of the paper should include any new names or combinations that are proposed in the text.

191. (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 he is proposing as new; alternatively, the author may make a statement to the effect that he is introducing a new name or combination.

192. (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 International Journal of Systematic Bacteriology from 1975 onwards, and Appendix 2, for names for bacterial taxa; and see Appendix 3 for published sources for names of algal, protozoal, fungal, and viral taxa.)

193. (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).

194. (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 strain number under

which it is held by at least one culture collection from which the strain is available.

195. A nomenclatural type is that constituent element of a taxon on which the name of the 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). For species and subspecies whose cells cannot be maintained in culture or for which cultures are not extant, the type strain can be represented by the original description and by illustrations and specimens.

196. A type strain is one of the strains on which the author who first described a named organism based his description of the organism and which he or a subsequent author definitely designated as a type; if the description was based on a single strain, this strain is the type by monotypy.

197. A neotype strain is a strain accepted by international agreement to replace a type strain which is no longer in existence. 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 International Journal of Systematic Bacteriology 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 International Journal of Systematic Bacteriology. Any objections should be referred to the Judicial Commission within one year. 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 a type strain.

198. (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, in the case of species whose description is based on more than one strain;

(d) the frequency of each characteristic expressed as the number of strains with the characteristic compared to the total number of strains studied (if the numbers are considered significant, they may be expressed as a percentage); and (e) a separate description of the type (or neotype) strain (this is necessary for checking the authenticity of cultures of the type or neotype strain). Because few characteristics are completely invariant in taxa of bacteria, those characteristics that are most constant should be employed in a to c, inclusive, above. Where appropriate, suitable photomicrographs and, if necessary, electron micrographs 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

199. 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 ICSB. Requests for Opinions must be accompanied by a fully documented statement of the relevant facts. 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. 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 a proposed Opinion or of an issued Opinion should be submitted to the Editorial Secretary in such a form that they can be published without delay in the IJSB.

Appendix 9. Orthography

A. Orthographic Variants

200. The following are some of the possible orthographic variants found in names and epithets.

200.1. (1) Different transliterations into Latin of words from other languages. Examples: *Corynebacterium* and *Corynobacterium*.

200.2. (2) Changes in the gender and endings of specific or subspecific epithets to agree with the gender of the generic substantive. Example: *Micrococcus luteus*, *Sarcina lutea*.

200.3. (3) The use of a wrong or alternative connecting vowel or its omission.

modified by these endings retain their original spellings, even with the consonants *k* or *w*, or

200.4	Compound	Preferred connecting vowel	Orthographic variant	Examples
200.5	Latin-Latin	- i -	- o -	.. ? ..
200.6	Greek-Greek	- o -	.. ? ..	Actinomyces,?
		None if first stem ends in -y-	.. ? ..	Glycyphylus,?
		Another vowel if precedent is found in Greek	.. ? ..	Corynebacterium,?
200.7	Two or more languages	No special vowel	Different connecting vowels	.. ? ..

.. ? .. = Examples to be completed.

200.8. (4) Words of Greek origin differing merely by having Greek and Latin gender endings, respectively. Example: *Coccus* and *Coccus*.

200.9. (5) Words having the same meaning and differing only slightly in form. Example: *cinnamoneus* and *cinnamomeus*.

200.10. (6) Words differing only in the presence or suppression with transliteration of diacritic marks (see Rule 65). Example: *Muel-lerina* and *Müllerina*.

200.11. (7) Words derived from a language other than Latin or Greek, one of which has the ending latinized and the other does not. Example: *londonensis*, *london*.

B. Names and Epithets Formed from Personal Names

Genus or Subgenus

201.1. (1) When the name for a genus or subgenus is taken from the name of a person, the ending should be formed in the following manner.

Ending of personal name	Addition	Example
-a	-ea	.. ? ..
Other vowel or -y	-a	<i>Gaffkya</i>
-er	-a	<i>Zinssera</i>
Other consonant	-ia	<i>Nocardia</i>
Latinized name	Drop -us	
Ending in -us	Add suffix	.. ? ..

.. ? .. = Examples to be completed.

In addition the name may be formed by adding a diminutive ending to the name of the person. Example: *Salmonella*, *Klebsiella*.

201.2. (2) The syllables which are not

groupings of vowels and consonants not used in classical Latin. Examples: *Wolbachia*, *Kurthia*.

Epithets

202. A new specific or subspecific epithet taken from the name of a man or woman may assume (a) an adjectival or (b) a substantive form.

202.1. (1) When the epithet is an adjective, it is formed by the addition of an appropriate adjectival suffix the terminal ending of which agrees in gender with the gender of the genus.

Example: The name "Gordon" takes the adjectival form *gordonianus*, *gordoniana*, or *gordonianum*, depending on the gender of the generic name and not on whether the name Gordon refers to a male or a female; e.g., *Bacillus gordonianus*, *Sarcina gordoniana*, *Propionibacterium gordonianum*. (These are hypothetical examples.)

202.2. (2) When the epithet is a substantive, the terminal ending of the specific epithet varies with the gender of the person to whom the name refers and not with the gender of the generic name. It takes the form of the modernized Latin genitive and is formed in the following manner.

202.3. Ending of personal name. a; Addition: -i or -e (masculine), -e (feminine); examples: ? (example to be completed), *stellae*.

202.4. All other vowels or consonants. Addition: -i (masculine), -ae (feminine); examples: *sonnei*, *barkeri*, *welchi*, *gordonae*, *sordelli* (from Professor Sordelli).

202.5. Greek, Latin, or latinized name. Addition: appropriate latin genitive; example: *pastori*.

202.6. (3) The syllables which are not modified by the endings retain their original spellings even with the consonants *k* and *w* or

with groupings of vowels or consonants not used in classical Latin. Example: *welchi*.

Appendix 10. Intrasubspecific Subdivisions

203. 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

204. The term *intrasubspecific subdivision* (or *division*) has been used in two ways to denote both terms and taxa. It is preferable to distinguish them as given below. *Intrasubspecific "subdivision"* has been used rather than "division" to avoid any confusion with the taxonomic category "division" (*divisio*).

205. Note. *Intrasubspecific subdivisions* are not arranged in any order of rank, and may overlap one another.

206. (1) Intrasubspecific terms. An *intrasubspecific term* is used to refer to the kinds of taxa below subspecies. Examples: *serovar*, *chemovar*, *forma specialis*.

207. If a species has not been divided into subspecies, the *intrasubspecific terms* may be applied to other subdivisions within that species. The subdivisions so named would still be *intrasubspecific subdivisions* for nomenclatural purposes until such time as they may be raised to subspecific or specific rank. Example: *Serovars of Erysipelothrix rhusiopathiae*.

208. (2) Intrasubspecific taxa. An *intrasubspecific taxon* is a set of strains showing the same or similar properties and is treated as a taxonomic group. Example: *Staphylococcus aureus* phagovar 81.

209. 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.

210. *Intrasubspecific 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.

211. (3) Use of other terms. *Intrasubspecific form* has been used to refer to a bacterial strain, but this use should be avoided.

212. 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.

213. A *clone* is a population of bacterial cells derived from a single parent cell.

214. 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.

215. 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. Terminology of Intrasubspecific Terms

216. Many names have been used for these terms. The following list contains some of those 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 page 107.)

227. 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.

228. 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.

229. 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*.

C. Nomenclature of Intrasubspecific Taxa

230. An *intrasubspecific taxon* is designated or cited by the name of the species followed by the *intrasubspecific term* used to designate this *intrasubspecific category* followed by the *intrasubspecific designation*. Example: *Staphylococcus aureus* phagovar 81.

231. Reference strains of *intrasubspecific taxa* may be designated.

232. There are many ways that *intrasubspecific 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 *Staphylococcus aureus* phagovar 42D.

Item no.	Preferred name	Synonyms	Notes
217	Biovar	Biotype, physiological type	Biochemical or physiological properties
218	Chemoform	Chemotype	Chemical constitution
219	Chemovar		Production or amount of production of a particular chemical
220	Cultivar		A cultivated strain with special properties
221	<i>forma specialis</i>	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.
222	Morphovar	Morphotype	Morphological characteristics
223	Pathovar	Pathotype	Pathogenic reactions in one or more host
224	Phagovar	Phagotype, lysotype	Reactions to bacteriophage
224	Phase		Restrict to well-defined stages of naturally occurring alternating variations
225	Serovar	Serotype	Antigenic characteristics
226	State		Colonial variants, e.g., rough, smooth, mucoid (may be defined antigenically)

D. Nomenclature of Strains

233. A strain may be designated in any manner, e.g., by the name of an individual, by a locality, or by a number.

REFERENCES TO DEFINITIONS

234. The following terms are defined in the clauses of the Code to which reference is given. Additional information may be found in S. T. Cowan. 1968. *A Dictionary of Microbial Taxonomic Usage*. Oliver and Boyd, Edinburgh. 118 pp.

Ambiguous name	Rule 53 (1)	<i>emend. (emendavit)</i>	Rec. 33b
Approved name	Rule 24a	Epithet	See "specific epithet," Rule 12a and subspecific epithet," Rule 13a
Approved lists	Rule 24a	<i>et al.</i>	Chapter 4B (1)
Bare name	Chapter 4B (4)	Established neotype	See "neotype," Rule 18e
Binary combination	Rule 12a	Group	Appendix 10B
Circumscription	Prin. 8	Holotype	Rule 18b
Clone	Appendix 10A 3	Homonym	Rule 11
Combination	See "new combination," Rule 34b	Hybrid name	Rec. 6 (3)
<i>comb. nov.</i>	See "new combination," Rule 34b	Illegitimate name (or epithet)	Rule 23a, Note 5
Conserved name	Rule 23b	<i>In</i>	Chapter 4B (2)
Consortium	Rule 31b	Incidental mention	Rule 28b (3)
Correct name (or epithet)	Rule 23a, Note 5	Independent	Principle 2
Corrigendum	Rule 61	Individual	Appendix 10A
Culture	Appendix 10A (3)	Infrasubspecific division	Appendix 10A (3)
Diagnosis	Rec. 30b	Infrasubspecific form	Appendix 10A (3)
Doubtful name	Rule 53 (2)	Infrasubspecific subdivision	Appendix 10A
Effectively published (name or epithet)	Rule 23a, Note 5	Infrasubspecific taxon	Appendix 10A (2)
		Infrasubspecific term	Appendix 10A (1)
		Junior homonym	Rule 11
		Junior synonym	Rule 24a, Note
		Lectotype	Rule 18d
		Legitimacy	See "legitimate name" or "epithet"
		Legitimate name or epithet	Rule 23a, Note 5
		Minimal standards	Rec. 30b
		Monotype	Rule 18c

Name	Prin. 1 (see also "nomen")	Priority of publication	Rule 11
Name causing confusion	Rule 53 (3)	<i>pro synonym</i>	Chapter 4B (3) a
New combination	Rule 34b	Publication	Rule 23a, Note 5
Neotype	Rule 18e	Rank	Prin. 8
<i>nom. cons.</i>	Chapter 4B (5)	Reference strain	Rule 19
<i>nom. nud.</i>	Chapter 4B (4)	Rejected name	Rule 23a, Note 4
<i>nom. rev.</i>	Provisional rule B2	Revived name	Rule 28a
<i>nomen ambiguum</i>	See "ambiguous name," Rule 53 (1)	Senior homonym	Rule 11
<i>nomen approbatum</i>	See "approved name," Rule 24a	Senior synonym	Rule 24a, Note 3
<i>nomen confusum</i>	See "name causing confusion," Rule 53 (3)	<i>sic</i>	Chapter 4B (3) d
<i>nomen conservandum</i>	See "conserved name," Rule 23b	Specific epithet	Rule 12a
<i>nomen dubium</i>	See "doubtful name," Rule 53 (2)	Strain	Appendix 10A (3)
<i>nomen hybridum</i>	See "hybrid name," Rule 6 (3)	Subjective synonym	Rule 24a, Note 3
<i>nomen nudum</i>	See "bare name," Chapter 4B (4)	Subspecific epithet	Rule 13a
<i>nomen perplexum</i>	See "perplexing name," Rule 53 (4)	Suggested neotype	See "neotype," Rule 18e
<i>nomen rejiciendum</i>	See "rejected name," Rule 23b	Synonym	Rule 24a Note
<i>nomen revivendum</i>	See "revived name," Rule 28a	Taxon	Gen. Cons. 7
Nomenclatural type	Rule 15	Taxonomic category	Gen. Cons. 7
<i>non</i>	Chapter 4B (3) c	Taxonomic group	Gen. Cons. 7
Objective synonym	Rule 24a, Note 2	Ternary combination	Rule 13a
Opinion	Rule 23a, Note 4, ii	Type	See "established neotype," Rule 18e
Orthographic variant	Rule 57a		See "holotype," Rule 18b
Perplexing name	Rule 53 (4)		See "lectotype," Rule 18d
Position	Principle 8		See "monotype," Rule 18c
Proposed neotype	See "neotype," Rule 18e	Typical	See "neotype," Rule 18e
		Validly published name (or epithet)	See "nomenclatural type," Rule 15
		Variety	See "proposed neotype," Rule 18
			See "suggested neotype," Rule 18e
			Rule 15
			Rule 23a, Note 5
			Rule 5c