

NOMENCLATURE OF THE COCCACEAE*

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The naming of bacterial species, genera, and higher groups, indeed the whole subject of bacterial nomenclature, is in a condition which can best be described as chaotic. Little, if any, advance has been made in the last two decades. The chief reasons for this state of affairs, pointed out at different times by various authors, may be summarized in the statement that many bacteriologists have ignored the rules or laws which are generally recognized by biologists to govern nomenclature. Even in those cases where there is an expressed purpose to be guided by fixed rules, the rules have not been well defined, and in some instances have not been compatible with best usage.

It is clearly recognized today that there exist among the so-called bacteria, forms which intergrade with the protozoa. While by many writers some of these are classed with animals, most of the organisms usually included with the bacteria are regarded rather definitely by biologists as plants, or at least as being plant-like in most of their characteristics. It would seem, therefore, that in so far as it is practicable, the botanical rules of nomenclature should be followed in naming the bacteria. Some authorities, it is true, have proposed that unicellular forms in general be placed in a separate "kingdom," the Prostista. From the standpoint of nomenclature this increases the difficulty by necessitating two points of contact among the kingdoms instead of one. It may not be easy to differentiate the lower plants from the lower animals, but there is just as great difficulty in separating higher plants from lower forms.

Both botanists and zoölogists have adopted codes of nomenclature at representative international congresses. No separate code for bacteriologists has ever been adopted or proposed. It is apparent, therefore, that so far as it is adapted, the bacteriologist should follow the botanical code in his classification of the bacteria. The protozoölogists have apparently been more successful than the bacteriologists (using this term in the narrow sense) in their naming of micro-organisms, for in most cases they have conformed with a measurable

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degree of success to the rules of zoölogical nomenclature. Bacteriologists, on the other hand, have usually followed their own bent. The present uncertainty in names is the result. Without adherence to definite standards there would seem to be no hope for improvement. However, a careful study of the international code of botanical nomenclature will show that it can be applied practically without any essential modification to the naming of groups among the bacteria quite as well as among the higher plants.

Probably the most successful and useful study of a considerable group of bacteria made in recent years is that of the Winslows (1906 and 1908) on the family Coccaceae. They have formulated apparently as satisfactory a classification of the group as a whole, as the present state of our knowledge would seem to admit. They have definitely expressed themselves in favor of following recognized rules, as is evidenced in their chapter on "Bacterial Classification," where they state:

If the Linnaean system is to be used among the bacteria, however, it should be used correctly. Much of the confusion in bacteriological literature results from neglect of the simple rules of nomenclature. The principle that a species should bear two Latin names, generic and specific, and two names only, has been ignored by many medical workers; and few bacteriologists, except Migula and Chester, have respected the principle of priority which requires that a species shall bear the name given to it in the first published description sufficiently full for identification.

With a view to checking the names applied by the Winslows to genera and higher groups, the writer has studied them from the standpoint of priority, validity, and suitability. Many of the names used by these authors are valid, but others apparently contravene the rules to which they have subscribed.

The Winslows (1908) divide the Coccaceae into subfamilies and genera as follows:

Subfamily A. Paracoccaceae Winslow and Rogers.

Genus I. Diplococcus (Weichselbaum) Winslow and Rogers.

Genus II. Ascococcus (Cohn) Winslow and Rogers.

Genus III. Streptococcus (Billroth) Winslow and Rogers.

Genus IV. Aurococcus Winslow and Rogers.

Genus V. Albococcus Winslow and Rogers.

Subfamily B. Metacoccaceae Winslow and Rogers.

Genus VI. Micrococcus (Hallier, Cohn) Winslow and Rogers.

Genus VII. Sarcina (Goodsir) Winslow and Rogers.

Genus VIII. Rhodococcus Winslow and Rogers.

These subfamilies and genera will be discussed below solely with respect to the apparent validity of the names used for the various groups, and wholly irrespective of the characteristics used by these authors in the diagnosis of the groups.

Paracoccaceae Winslow and Rogers.—This is a subfamily created by Winslow and Rogers to include those genera of the family Coccaceae which conform to the following diagnosis: "Parasites. Growth not abundant (or, one species, zoogloea-forming saprophytes. Growth abundant in saccharose media). Generally Gram-positive. Acid formers."

Article 23 of the International Rules for Botanical Nomenclature states: "Names of subfamilies are taken from the name of one of the genera in the group, with the ending—*oideae*." The subfamily name Paracoccaceae does not conform to either of these requirements. No genus Paracoccus has ever been described. Probably the most characteristic genus belonging to this group, at least the one which is most commonly recognized, is Streptococcus. A suitable subfamily designation would therefore be Streptococcoideae. It may be recalled, however, that a subfamily is a group interpolated between the groups family and tribe when such additional grouping appears to be desirable. It may be appropriate therefore to reduce the subfamily to a tribe. The name of a tribe, according to Article 23 of the code, should be taken from the name of one of the constituent genera with the ending—*ae*. Such a tribe, Streptococceae, was created by Trevisan (1889). An emendation of the tribal description given by this author could be made to cause it to conform to the subfamily diagnosis of Paracoccaceae.

It would therefore seem that strict adherence to the rules of nomenclature would necessitate that the tribal designation Streptococceae Trevisan be substituted for the invalid subfamily designation Paracoccaceae Winslow and Rogers.

Diplococcus (Weichselbaum) Winslow and Rogers.—In the designation of this genus, as well as in many of the succeeding, the method of indicating the author or the authority for the name as used by the Winslows does not appear to be in conformity with Article 41 of the code. This reads as follows:

"An alteration of the constituent characters or of the circumscription of a group does not warrant the quotation of another author than the one who first published the name or combination of names. When the changes have

been considerable, the words: *mutatis charact.*, or *pro parte.*, or *excl. sp.*, *excl. var.*, or some other abridged indication, are added after the citation of the original author, according to the changes which have been made, and of the group in question. Example: *Phyllanthus* L. *em. (emendavit)* Müll. Arg."

It is evident, therefore, that this name should have been written "Diplococcus Weichselbaum," or, if the emendation is so important or drastic as to require special emphasis, "Diplococcus Weichselbaum em. Winslow and Rogers."

This name was first used (with the spelling *Diplococcus*) by Billroth (1874) to designate a growth form of his *Coccobacteria septica* in which the spherical cells occurred in pairs. It was not used as a genus. As a generic name, *Diplococcus* came into use without any definite characterization. Bumm (1885) used the term *diplococcus* (tho not in a generic sense) for the gonococcus and related forms. In no case was it used in a binomial combination. Fluegge (1886) followed Bumm in the use of the name *Diplococcus albicans tardissimus*; but this is a trinomial and, therefore, invalid. In the same year Weichselbaum (1886) gave to the pneumococcus the name *Diplococcus pneumoniae*, a valid binomial. This seems to be the first correct and adequate designation of a species in the genus, and the pneumococcus should therefore be regarded as the type. Several other species were assigned to this genus in the next two years, but the writer has been able to find 4 only which appear to have binominal form and to be therefore valid. These are *Diplococcus roseus* Bumm, *D. subflavus* Bumm, *D. luteus* Adametz (1887), and *D. coryzae* Hajek (1888).

As the formal designation of a genus, *Diplococcus* has rarely found its way into classifications, altho *diplococcus* is in common use as a casual designation. For example, Sternberg (1892) under the heading of "Diplococcus" makes the following statement:

Association in pairs is common to all of the micrococci, inasmuch as they multiply by binary division. When such association has rather permanent character, it is customary to speak of the microorganism as a diplococcus, but we doubt the propriety of recognizing this mode of association as a generic character.

Winslow and Rogers (1905) have included *Diplococcus* as one of the valid genera in their classification of the Coccaceae. In their latest contribution on this subject (1908), the genus is defined as follows:

Strict parasites, not growing or growing very poorly, on artificial media. Cells normally in pairs, surrounded by a capsule. Fermentative powers high, most strains forming acid in dextrose, lactose, saccharose, and inulin. Hemolytic power generally lacking. Characteristic group serum reactions.

They assign to this genus the pneumococcus, the gonococcus, the meningococcus, and the coccus of catarrh. If the gram-positive cocci of which the pneumococcus is the type are to be grouped together into a genus, it would appear that the generic name *Diplococcus* is valid; if, however, the gram-negative cocci of which the gonococcus is the type are to be included in the same genus, *Diplococcus* becomes a synonym of an earlier genus *Neisseria* Trevisan. This latter genus was founded upon the gonococcus as the type by Trevisan in 1885. Article 46 of the botanical code states: "When two or more groups of the same nature are united, the name of the oldest is retained." Inasmuch as the genus *Diplococcus* as used by the Winslows contains also the type of the genus *Neisseria* Trevisan, and since the latter name has priority, it should replace *Diplococcus*. It may again be emphasized that *Diplococcus* apparently constitutes a valid generic designation for a genus of which the pneumococcus and not the gonococcus is the type.

Ascococcus (Cohn). *Winslow and Rogers*.—The designation of authorship as given by the Winslows is open to the objection previously noted. It should be written "*Ascococcus* Cohn," or "*Ascococcus* Cohn em. Winslow and Rogers."

The name *Ascococcus* was first used by Billroth (1874) for a growth form of his *Coccobacteria septica* in which the spherical cells are imbedded in gelatin or slime. It was not employed as a generic designation. Cohn (1875) published the name as a genus, with the species *A. Billrothii* Cohn. The generic description given by Cohn is:

"Cellulae achromaticae globosae densissime consociatae in familias tuberculosas globosas vel vales irregulariter lobatas, lobis in lobules minores sectis, capsula globosa vel ovali gelatinoso-cartilaginea crassissima circumdatas, in membranam mollem facili secendentem floccosam aggregatas."

The species described developed spontaneously in a culture medium of ammonium tartrate. The specific diagnosis is

"Familiae tuberculosae 20-160 μ . capsula ad 15 μ . crassae. In solutione ammonii tartarici acidi aëre lavata vel butyrico praeditam formantem observari. March 1874. Haud scio citrum eandem an affinem speciem ill. Billroth in aqua carnis foetida detexerit."

Cienkowski (1878) described an organism responsible for a gummy or viscous fermentation of syrups in sugar factories. He regarded it as conforming to Cohn's conception of *Ascococcus*, and named it *A. mesenteroides*. A study of the same organism was made by Van Tieghem (1878). He concluded that this form is distinct from *Asco-*

coccus Cohn, and made it the type of a new genus *Leuconostoc*. He called attention to the points differentiating the two genera. In *Ascococcus* the cells are spherical, very small, and grouped in great numbers to form globular or oval families, which are more or less irregularly lobed. The cells are closely united, separated by a small amount of gelatinous material; each family is surrounded by a cartilaginous envelope. In *Leuconostoc* the cells are arranged in curved chains separated from each other by a considerable amount of gelatinous material, the gelatin on the exterior not being thicker than that between the chains. The *Ascococcus* of Cohn grew in ammonium tartrate solution; *Leuconostoc* in sugar, making the medium decidedly acid. Van Tieghem placed the genus *Leuconostoc* among the *Nematogenae* in Cohn's classification, while *Ascococcus* was grouped with the *Glaeogenae*. The use of the names *Ascococcus* and *Leuconostoc* in subsequent literature shows great variation.

Winslow and Rogers (1905) have revived *Ascococcus mesenteroides* Cienkowski as the type of their emended genus *Ascococcus* (Cohn) Winslow and Rogers. They conclude, because of the cheesy odor developed by the organism described by Cohn and the frequent confusion by Cohn of cocci and bacilli, that in all probability this author was really dealing with a rod-shaped organism. It would seem that they are in error in this matter, for the illustrations accompanying Cohn's description are quite distinctive. They also note Cienkowski's use of the term *Ascococcus* and state: "Van Tieghem (1878) a little later worked on the same form and substituted for *Ascococcus* the generic name *Leuconostoc* in order to emphasize the resemblance between the zoogloea-forming coccus and the blue-green *Nostoc*." This would seem to be scarcely a full statement of the case. Van Tieghem concluded that the organism of Cienkowski differed so markedly from Cohn's description of *Ascococcus* that a new generic designation was required. The Winslows "emend" the diagnosis of *Ascococcus* to fit their conceptions of the genus. It would seem that they were misled, perhaps, by the apparent appropriateness of the name *Ascococcus*. There is little question but that Cohn's *Ascococcus* was entirely distinct from *Leuconostoc*. The former name should probably be reserved for Cohn's species. However, if Van Tieghem was in error in believing that Cienkowski's organism deserved generic separation from *Ascococcus*, then the latter's name may be revived.

It is probable that Migula's (1900) conclusion that Cohn's *Ascococcus* is a growth form of *Micrococcus* is correct. The species *A. Billrothii* has apparently never been recognized with certainty since described. Unless it can be found, and shown to be worthy of generic recognition, *Ascococcus* should lapse into synonymy. For the Winslows' type, the generic name *Leuconostoc* Van Tieghem should be substituted.

Streptococcus (Billroth) Winslow and Rogers.—This name (in the form *Streptococcus*) was introduced by Billroth (1874) as a designation of a growth form of his pleomorphic species *Coccobacteria septica*. His use of the term was not generic, and he should not be quoted as the author, as has often happened (Migula, Winslow, Vuillemin, etc.). Cohn (1875) did not early recognize *Streptococcus* as a genus. He states: "Was Billroth *Streptococcus* nennt, hatte ich selbst als *Torula* form von *Micrococcus* bezeichnet." Later, however, he included the genus in the tribe *Nematogenae*, tho there seems to have been no species assigned to it. This is generally regarded as essential to the validity of a genus, hence Cohn is not to be quoted as the author. Ogston (1883) again used *streptococcus* as the designation of a form-group, not as a genus. Fehleisen (1883) described organisms now regarded as members of the genus *Streptococcus*, but without using this term.

Apparently the first valid use of the name in a generic sense was that of Rosenbach (1884). He named two species, *Streptococcus pyogenes* and *S. erysipelatos*. The genus should therefore be ascribed to Rosenbach.

Probably the genus *Streptococcus* has been more generally accepted by bacteriologists than any other genus of bacteria, with the possible exception of *Micrococcus*. In 1905 Winslow and Rogers emended the characterization of the genus. In its later form (1908) it reads:

Parasites. Cells normally in short or long chains (under unfavorable cultural conditions, sometimes in pairs and small groups, never in large packets). Generally stain by Gram. On agar streak, effused translucent growth, often with isolated colonies. In stab culture, little surface growth. Sugars fermented with formation of large amount of acid. Generally fail to liquefy gelatin or reduce nitrates.

The generic name *Streptococcus* would appear to be valid, but should be credited to Rosenbach and not to (Billroth) Winslow and Rogers.

Aurococcus Winslow and Rogers.—This generic name was first proposed by Winslow and Rogers (1906) to include the orange cocci. In its later form (1908) the diagnosis of the genus reads:

“Parasites. Cells in groups and short chains, very rarely in packets. Generally stain by Gram. On agar streak good growth, of orange color. Sugars fermented with formation of moderate amount of acid. Gelatin often liquefied very actively. May or may not reduce nitrates.”

These authors include three species, *Aurococcus aureus* (Rosenbach) Winslow, *Aur. aurantiacus* (Schröter, Cohn) Winslow and Rogers, and *Aur. mollis* (Dyar) Winslow. This genus, together with *Albococcus*, was created by splitting up the older genus *Staphylococcus* into two genera. For the generic name *Aurococcus* to be established as valid, it must be shown that the name which it displaces is invalid. It is true that in the form “staphylococcus” the name is used as a casual designation of a coccus grouping, but this does not invalidate *Staphylococcus* as a genus name any more than the common use of “aster” and “lily” invalidates the genera *Aster* and *Lilium* of the botanists.

Staphylococcus was first proposed by Ogston (1881 and 1883), but first used in a strict generic sense by Rosenbach (1884), who described a *Staphylococcus pyogenes aureus* and a *Staphylococcus pyogenes albus*. On a later page in the same paper, Rosenbach designates these organisms as *Staphylococcus aureus* and *Staphylococcus albus*, respectively. This genus is split by the Winslows into the two genera, *Aurococcus* and *Albococcus*, the two species of Rosenbach constituting the types. These authors thereupon discard the original name, *Staphylococcus*. Article 45 of the botanical code reads:

When a genus is divided into two or more genera, the name must be kept and given to one of the principal divisions. If the genus contains a section or some other division which, judging by its name or its species, is the type or the origin of the group, the name is reserved for that part of it.

It would seem that the Winslows have no adequate nomenclatural reasons for abandoning the generic name *Staphylococcus*. It should therefore be retained for one of their genera. Inasmuch as the *Staphylococcus aureus* was described first, and is in a sense the type species, the name *Aurococcus* should be abandoned as invalid and should be reduced to a synonym of *Staphylococcus* Rosenbach.

Albococcus Winslow and Rogers.—If the white staphylococci are to be regarded as deserving of generic recognition, the name *Albococ-*

cus would appear to be valid. It is probable that strict conformity to the rules of nomenclature would require the use of the name *Albococcus albus* (Rosenbach) rather than *Albococcus pyogenes* (Rosenbach) Winslow for the type species.

Metacoccaceae Winslow and Rogers.—A subfamily proposed by Winslow and Rogers (1905) to include genera of cocci conforming to the following description:

Facultative parasites or saprophytes. Thrive best under aerobic conditions. Grow well on artificial media, producing abundant surface growths. Planes of fission often at right angles; cell aggregates in groups, packets, or zoöglæa masses. Generally decolorize by Gram. Pigment yellow or red.

The objections to the use of a subfamily name of this form made with reference to *Paracoccaceae* hold for this subfamily. The most important of the genera included is *Micrococcus*. The subfamily might well be designated *Micrococcoideae*, or a tribe created for these genera, with the name *Micrococceae*. The latter has already been used by Trevisan (1889) as a tribal name to include several genera, of which *Micrococcus* is one. It would seem, therefore, that by an emendation this term could be used appropriately, replacing *Metacoccaceae* Winslow and Rogers by *Micrococceae* Trevisan.

Micrococcus (Hallier, Cohn) Winslow and Rogers.—The name *Micrococcus* was first used by Hallier (1866) to designate a growth form of a mold, in accordance with his theory of pleomorphism. He did not use the name in a generic sense, and the genus should therefore not be ascribed to him, as has frequently occurred with various writers. Cohn (1872) adopted the name and defined it as a genus containing very small spherical or oval organisms, with colorless or faintly colored cells, without motility, variously united into cell groups. The organism to which the name was first given was *Micrococcus prodigiosus* (Chr.) Cohn. This organism we know now to be a rod; it has therefore been removed from this genus. The next organism described was *M. luteus* (Schroeter) Cohn. This form may well be considered the type of the genus, as it has been adequately described.

The genus *Micrococcus* has been very generally recognized by bacteriologists. Winslow and Rogers (1905) emended the diagnosis of the genus. In its later form it reads:

Facultative parasites or saprophytes. Cells in plates or irregular masses (never in long chains or packets). Generally decolorize by Gram. Growth on agar abundant, with formation of yellow pigment. Dextrose broth slightly

acid, lactose broth generally neutral. Gelatin frequently liquefied. Nitrates may or may not be reduced.

They include as valid species *M. flavus*, *M. citreus*, *M. luteus*, and *M. candicans*. It will be noted that *M. luteus* was previously mentioned as a suitable type species.

It would appear that the Winslows have supplied us with a generic diagnosis of *Micrococcus* which is usable and accurate. The genus is evidently valid, but should be written "*Micrococcus* Cohn"; not "*Micrococcus* (Hallier, Cohn) Winslow and Rogers."

Sarcina (*Goodsir*) *Winslow and Rogers*.—This genus was created in 1842 by Goodsir to include his species *Sarcina ventriculi*, discovered in the course of a microscopic examination of vomit. His work created a good deal of interest, and many papers were published during the next quarter century upon this sarcinosis. The organism was apparently found repeatedly. It is of peculiar interest because it is the first organism now included with the bacteria to be described definitely as a plant. The genus has been included in most schemes of bacterial classification down to the present time.

The species *Sarcina ventriculi* Goodsir was first cultivated by Falkenheim (1886). This investigator made use of the newly developed gelatin plate method to secure pure cultures. He found that this species would grow readily upon artificial media, forming light yellow, round colonies in from 36 to 48 hours. Packets characteristic of *Sarcina* were missing in all media tried, except hay infusion, where they developed abundantly. It would seem that this first described species of *Sarcina* might well be taken as the type of the genus.

Winslow and Rogers (1905) have proposed a somewhat radical emendation of the genus. In its later form it reads:

Facultative parasites or saprophytes. Division occurs under favorable conditions in three planes, producing regular packets. Generally decolorize by Gram. Growth on agar abundant, with formation of yellow pigment. Dextrose broth slightly acid, lactose broth generally neutral. Gelatin frequently liquefied. Nitrates may or may not be reduced.

They recognize three species, *Sarcina lutea*, *S. citrea*, and *S. flava*. To these Kligler (1913) has added *S. aurantiaca*, emending therefore the generic diagnosis by including orange as well as yellow forms.

The Winslows in a discussion of *Sarcina ventriculi* state (p. 236):

Another interesting *Sarcina*, possibly related to *S. lutea*, is the form originally isolated by Goodsir in 1842 and named by him *S. ventriculi*. It was described as a non-liquefying sarcina, isolated from the stomach in cases of hyperacidity

of the gastric juice. More recent investigations suggest that there is nothing specific in the relation of this organism to the pathological condition in question (Flügge 1896). *S. ventriculi* was distinguished from the type of *S. lutea* by the production of an orange, instead of a yellow pigment. It corresponds therefore to the non-liquefying *S. aurantiaca*. . . . Whether Goodsir's form was a packet-forming *Aurococcus* or an orange *Sarcina* can only be decided from a study of similar forms which the future may bring to notice.

The writer has been unable to find the authority upon which these authors base their statement that *Sarcina ventriculi* produces an orange pigment. Falkensheim (1885), Flügge (1886), and Eisenberg (1891) all state that this organism produces a yellow pigment on culture media. It would appear therefore that the name *Sarcina ventriculi* should have been given to one of their species, and that it should constitute the generic type. It is probable that the genus *Sarcina* Goodsir em. Winslow and Rogers is valid.

Rhodococcus Winslow and Rogers.—This generic name has been introduced 3 times into bacteriologic nomenclature. It was first used by Zopf (1891) to apply to 2 species of red bacteria the physiologic characters of which had previously been studied at length by Overbeck (1891). These organisms had been known as *Micrococcus erythromyxa* and *M. rhodochrous*. Zopf characterized the genus (or subgenus as he terms it) as follows:

Colonien auf gewöhnlicher Nährgelatine gebirgsrückenartig; roth gefärbte zellen, weder ausgesprochen fädige noch flächenförmige oder körperliche Verbände bildend, sondern unregelmässig zusammengelagert, ohne Gallerthülle, einen rothen Fettfarbstoff enthaltend, der nach der Ausscheidung in rothen, auffälligen Aggregaten krystallisirt, und durch ein einziges breites Absorptionsband bei F. ausgezeichnet ist.

These species are disposed of in various ways by subsequent authors. Migula (1900) uses the designation *Bacterium erythromyxa* (Zopf) Mig. Matzschita (1902) changed the name to *Bacillus erythromyxa*, because of its shape. He (p. 41) however uses the name *Micrococcus rhodochrous*, describing the latter as "Grosse Zellen, leine, mattglänzende, kreisrunde gewölbte, dunkelkarmin rosa gefärbte Kolonien. Auf Agar erst karmin rosa, dann tief zinnoberrote Auflagerung. In Bouillon bildet sich eine dicke rosa Haut, glatt, feucht. und ein roter flockig—bröckeliger Bodensatz." This description indicates that at least one of the species is a true coccus. It would seem evident, therefore, that if the red-pigmented cocci are worthy of generic designation, *Rhodococcus* Zopf is valid.

Winslow and Rogers (1906), evidently without knowledge of the previous use of the name by Zopf, proposed *Rhodococcus* as a generic

designation for the red cocci. In their later publication (1908) they give the following diagnosis:

Saprophytes. Cells in groups or regular packets. Generally decolorize by Gram. Growth on agar abundant, with formation of a red pigment. Dextrose broth slightly acid, lactose broth neutral. Gelatin rarely liquefied. Nitrates generally reduced to nitrites, but not to ammonia.

They recognize two species only, *Rhodococcus roseus* (Flügge) Winslow and *Rh. fulvus* (Cohn) Winslow. It is apparent that this description may well be regarded simply as an emendation of that of Zopf.

Rhodococcus was independently introduced as a bacterial genus by Molisch in 1907. The only species described is named *Rhodococcus capsulatus* Molisch. This organism is described as belonging with the Athiorhodaceae, that group of the sulphur bacteria which contain bacterio-purpurin, but no free sulphur granules. This generic name is a homonym of *Rhodococcus* Zopf. The genus is recognized by Jensen (1909).

It would appear that *Rhodococcus* Zopf is a valid name to apply to the red cocci as a generic designation if they are to be grouped separately.

CONCLUSIONS

1. Bacteriologic nomenclature should conform as far as practicable to the International Rules for Botanical Nomenclature.

2. A study of the validity of the subfamily and generic names used by the Winslows leads to the following conclusions:

(a) Subfamily Paracoccaceae Winslow and Rogers. The name does not conform to Art. 23 of the code. As a substitute *Streptococceae* Trevisan em. is proposed.

(b) Genus *Diplococcus* (Weichselbaum) Winslow and Rogers. The name is invalid because of prior use of the generic name *Neisseria* Trevisan for the gonococcus. The latter designation should be substituted.

(c) Genus *Ascococcus* (Cohn) Winslow and Rogers. This probably should be replaced by the generic name *Leuconostoc* Van Tieghem.

(d) Genus *Streptococcus* (Billroth) Winslow and Rogers. The genus is valid, but the authority incorrectly given. It should be designated *Streptococcus* Rosenbach.

(e) Genus *Aurococcus* Winslow and Rogers. This name is invalid because of prior use of the name *Staphylococcus* Rosenbach, which should be substituted for it.

(f) Genus *Albococcus* Winslow and Rogers. This name is probably valid if the white staphylococci are to be accorded separate generic recognition.

(g) Subfamily *Metacoccaceae* Winslow and Rogers. The name does not conform to Art. 23 of code. As a substitute, the name *Micrococceae* Trevisan is proposed.

(h) Genus *Micrococcus* (Hallier, Cohn) Winslow and Rogers. The genus is valid, but should be designated *Micrococcus* Cohn.

(i) Genus *Sarcina* (Goodsir) Winslow and Rogers. The genus is valid, but should be designated *Sarcina* Goodsir.

(j) Genus *Rhodococcus* Winslow and Rogers. The genus is valid if the red cocci are to be accorded generic rank, but should be designated *Rhodococcus* Zopf.

SUMMARY

The Winslows' classification of the Coccaceae with the preceding corrections becomes:

- A. Tribe *Streptococceae* Trevisan.
 - Genus 1. *Neisseria* Trevisan.
 - Genus 2. *Leuconostoc* Van Tieghem.
 - Genus 3. *Streptococcus* Rosenbach.
 - Genus 4. *Staphylococcus* Rosenbach.
 - Genus 5. *Albococcus* Winslow and Rogers.
- B. Tribe *Micrococceae* Trevisan.
 - Genus 6. *Micrococcus* Cohn.
 - Genus 7. *Sarcina* Goodsir.
 - Genus 8. *Rhodococcus* Zopf.

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