BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

THE LEGITIMACY OF CERTAIN GENERIC HOMONYMS IN BACTERIOLOGY AND PROTOZOOLOGY

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A report (1) in the form of a mimeographed list of generic and subgeneric names proposed for protozoa up to the year 1939 (approximately) was submitted and distributed at the meeting of the Third Microbiological Congress in New York in 1939. About 6800 names were included, together with the names of homonyms found in other animal groups. Some additional copies of this list were later distributed to workers upon request. There was also presented at this Congress a brief list of names which had been proposed for genera both in bacteriology and protozoology, with some comments upon usage, priority and legitimacy. For some reason this paper was not included in the printed Proceedings of the Third Congress. It has been believed desirable to revise this older manuscript and to add to it discussions of some additional names. The present paper is an attempt to determine the legitimacy of names of genera and subgenera that are based upon different types and that have been proposed both in bacteriology and in protozoology.

Rule 24 of the International Bacteriological Code of Nomen-

clature states in part:- "A name of a taxonomic group is illegitimate in the following cases:-

(4). If it is a later homonym of a genus of bacteria, of a genus of plants, or of a genus of protozoa; that is, if it duplicates a name previously and validly published for a group of the same rank based on a different type. Even if the earlier homonym is illegitimate or if generally treated as a synonym on taxonomic grounds, the later homonym must be rejected."

It may be noted that there is no corresponding provision in the zoological code which would suppress generic names of protozoa that are later homonyms of generic names in bacteriology. Apparently both homonyms are legitimate if that proposed in bacteriology antedates that given in protozoology. The author suggests that this anomalous situation be called to the attention of the Zoological Commission in the hope that provision be made for a reciprocal arrangement which would clarify the situation in microbiology.

Fourteen generic and subgeneric

INTERNATIONAL BULLETIN

names, based on different type species, have been introduced independently in the literature of both bacteriology and protozoology. The legitimacy of the following should be considered: *Astasia*, *Babesia*, *Castellanella*, *Charon*, *Coccomonas*, *Klebsiella*, *Listerella*, *Pal-mula*, *Pelosphaera*, *Pfeifferella*, *Phytomonas*, *Proteus*, *Rhizomonas*, *Rhodosphaera*.

1. *Astasia*

Astasia Ehrenberg 1830 (2, p. 38).

Type species. *Astasia euchlora* Ehrenberg 1830.

This protozoan generic name has been commonly recognized by protozoologists. It is placed in the *Mastigophora*, *Phytomastigina*. According to Schulze and Kuekenenthal (3), *Astasia* was also proposed by Scudder (1869) as the name for a genus of *Lepidoptera*, and is probably to be regarded as a later illegitimate homonym.

Astasia Meyer 1897 (4, p. 185).

Type species. *Astasia asterspora* Meyer 1897.

This genus of endospore-bearing rods was segregated from the bacterial genus *Bacillus*. It was made a subgenus of *Bacillus* by Buchanan 1918 (5, p. 38).

Astasia Pribram 1929 (6, p. 374).

Type species. No species listed.

The genus *Astasia* Pribram is evidently segregated from the

bacterial genus *Bacillus*, but there is no evidence that it is based on the same type as *Astasia* Meyer.

Conclusion. *Astasia* Meyer 1897 and *Astasia* Pribram 1929 proposed as genera of bacteria are later homonyms of the protozoan genus *Astasia* Ehrenberg and illegitimate in bacteriology.

2. *Babesia*

Babesia Trevisan 1889 (7, p. 29).

Type species. *Babesia xanthopyrethica* Trevisan 1889.

This name was applied by Trevisan to the organism which Babes in 1883 believed to be the causal organism of yellow fever in man. Inasmuch as this species is apparently not identifiable, possibly the second species named by Trevisan should be regarded as the type species. This is the *Babesia erysipeloidis* Trevisan 1889, the "Coccus della erisipeloide o erisipela cronica Rosenbach 1887." This is apparently the organism called *Erysipelothrix erysipeloidis* (Lehmann and Neumann) Rosenbach in the Bergey Manual (Ed. 6, 1948), which should probably be corrected to *Erysipelothrix erysipeloidis* (Trevisan) Rosenbach. Whether *Babesia* Trevisan 1889 makes *Erysipelothrix* Rosenbach 1909 a later synonym is a problem that may well be considered by the Judicial Commission of the International Committee on Bacteriological Nomenclature. Ac-

BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

cording to Nannizzi (Bergey's Manual Ed. 6, 1948) the name *Babesia erysipeloides* was used by Chalmers and Christopherson (8), but an examination of the original fails to confirm this statement. *Babesia* has not been commonly used as a generic name in bacteriology.

Babesia Starcovici 1893 (9, p. 1)
Type species. *Babesia bovis* (Babes) Stareovici 1893. *Babesia* is the commonly accepted name of a genus of protozoan blood parasites. It is a later homonym of *Babesia* Trevisan, but this would not make it illegitimate under the rules of the zoological code.

Conclusion. Consideration should be given to the legitimacy of the generic name *Babesia* Trevisan 1889 in bacteriology. If found to be legitimate, consideration should also be given to its possible suppression inasmuch as confusion is inevitable in microbiology if two generic names (*Babesia*) are used, one for protozoan blood parasites of animals, and one for bacterial parasites of man and animals.

3. *Castellanella*

Castellanella Chalmers 1918 (10, p. 223).

Type species. *Castellanella gambiense* (Dutton) Chalmers 1918 = *Trypanosoma gambiense* Dutton 1902.

Chalmers segregated *Castella-*

nella from *Trypanosoma* as a genus of blood protozoa. Although this generic name is not commonly used, it seems to have been validly published and is legitimate.

Castellanella Pacheco and Rodrigues 1930 (11, p. 166).

Type species. *Castellanella alkalescens* (Andrewes) Pacheco and Rodrigues 1930 = *Bacillus alkalescens* Andrewes 1918.

The type species of this genus is included in the family *Enterobacteriaceae* as *Shigella alkalescens* (Andrewes) Weldin 1927. The genus *Castellanella* Pacheco and Rodrigues seems to have been validly published.

Conclusion. The genus *Castellanella* Pacheco and Rodrigues is probably to be regarded as illegitimate, being a later homonym of *Castellanella* Chalmers.

4. *Charon*

Charon Karsch 1879 (12, p. 197).

Type species. *Charon grayi* (Gervais) Karsch 1879. This was apparently validly published as a genus in the *Arachnida*. Its significance in microbiology stems from the fact that it is an earlier homonym of *Charon* Jameson 1925 next to be noted.

Charon Jameson 1925 (13, p. 403).

Type species. *Charon ventriculi* Jameson 1925.

The protozoan genus *Charon* Jameson seems to have been validly

INTERNATIONAL BULLETIN

published, but is probably to be regarded as an illegitimate later homonym of *Charon* Karsch.

Charon Holmes 1948. (14, p. 1265).

Type species. *Charon evagatus* Holmes 1948.

This generic name was validly published by Holmes for a genus of the family *Charonaceae* included in the filterable animal viruses. It is a later homonym both of *Charon* Karsch and *Charon* Jameson.

Conclusion. *Charon* Holmes 1948 may be regarded as an illegitimate later homonym of the name of the protozoan genus *Charon* Jameson 1925.

5. *Coccomonas*

Coccomonas Stein 1878 (15, Plate XXIV).

Type species. *Coccomonas orbicularis* Stein 1878.

Illustrated as a genus and species of protozoa.

Coccomonas Orla-Jensen 1921 (16, p. 268).

Type species. None listed. In a general discussion of his "Natural Bacterial System" the author makes a tentative proposal. "For the Gram-negative, non-acid-forming or, at most, very slightly acid-forming cocci (among which must probably be reckoned the gonococci and the meningococci too, as well as the Gram-negative streptococci, if such exist) we might simply use the generic

name *Coccus*, or, if they should turn out to have terminal flagella, *Coccomonas*."

Conclusion. *Coccomonas* Orla-Jensen is a later homonym of *Coccomonas* Stein. It probably should be regarded as not validly published, and having no standing in bacteriological nomenclature.

6. *Klebsiella*

Klebsiella Trevisan 1885 (17, p. 105).

Type species. *Klebsiella pneumoniae* (Schroeter) Trevisan 1887. Trevisan described this bacterial genus in 1885 with a single species *Klebsiella crouposa*, the *Bacterium pneumoniae-crouposae* Zopf 1885. Later (1887) he designated this organism as *Klebsiella pneumoniae* and still later (1889) as *Klebsiella friedlanderii*. *Klebsiella* is a commonly accepted genus in bacteriology.

Klebsiella Meunier 1908 (18, p. 245).

Type species. *Klebsiella extincta* Meunier 1908.

This was described as a genus of fossil insects, apparently of the family of *Protoblattidae*.

Klebsiella Pascher 1931 (19, p. 322).

Type species. *Klebsiella aligata* Pascher 1931.

A new protozoan genus and species assigned to *Mastigophora*, *Phytomastigina*.

BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

Conclusion. *Klebsiella* Trevisan may be regarded as a validly published and legitimate generic name in the bacteria. *Klebsiella* Pascher 1931 is a later homonym of *Klebsiella* Meunier 1908.

7. *Listerella*

Listerella Jahn 1906 (10, p. 540).

Type species. *Listerella paradoxa* Jahn 1906.

This new genus and species were included in the *Myxomycetes* or slime molds (*Mycetozoa*).

Listerella Pirie 1927 (21, p. 164).

Type species. *Listerella monocytogenes* (Murray, Webb and Swann) Pirie = *Listerella hepatolytica* Pirie 1927 = *Bacterium monocytogenes* Murray, Webb and Swann 1926.

Described as a new genus of bacteria.

Listerella Cushman 1933 (22, p. 36).

Type species. *Listerella primaeva* Cushman 1933.

A genus and species of protozoa assigned to the *Foraminifera*.

Conclusion. The generic name *Listerella* Pirie in bacteriology is an illegitimate later homonym of *Listerella* Jahn 1906. Inasmuch as the slime molds are usually included by the zoologists among the protozoa, it would seem that *Listerella* Cushman should also be regarded as a later and illegiti-

mate homonym of *Listerella* Jahn. Pirie (23) in 1940 recognized the priority of *Listerella* Jahn and proposed *Listeria* to replace it. The latter name seems not to have been used in protozoology, but *Listeria* has twice been proposed as a generic name in the flowering plants. The bacteriological status of *Listeria* therefore requires study from the standpoint of botanical priority.

8. *Palmula*

Palmula Lea 1833 (24, p. 219). Type species, *Palmula sagittaria* Lea 1833..

The standing of this generic name in the *Foraminifera* (*Protozoa*) has been somewhat problematical. Galloway (25, p. 240) and Cushman (26, p. 182) both regarded *Palmula* Lea 1833 as a synonym of *Flabellina* d'Orbigny 1839. However, Cushman (27) recognizes *Palmula* Lea and reduces *Flabellina* d'Orbigny to synonymy.

Palmula Prévot 1938 (28, p. 88).

Type species. *Palmula spermoides* (Ninni) Prévot.

Prévot placed this genus with the anaerobic sporebearing bacteria.

Conclusion. *Palmula* Prévot 1938 is probably to be regarded as a later homonym of *Palmula* Lea 1833. Prévot (29) later proposed the generic name *Acuformis* Prévot (29, p. 164) to replace *Palmula* Prévot 1938.

INTERNATIONAL BULLETIN

9. *Pelosphaera*

Pelosphaera Lauterborn 1906 (30, p. 197).

Type species. *Pelosphaera rotans* Lauterborn 1906.

Described as belonging to the bacteria. In current use.

Pelosphaera Heron-Allen and Earland 1932 (31, p. 255).

Type species. *Pelosphaera cornuta* Heron-Allen and Earland 1932.

Described as a protozoan genus in the *Foraminifera*. The generic name is in current use.

Conclusion. The generic name *Pelosphaera* Lauterborn 1906 was validly published, and is probably legitimate. The protozoan name *Pelosphaera* Heron-Allen and Earland 1932 is probably also valid and legitimate under the rules.

10. *Pfeifferella*

Pfeifferella Labbé 1899 (32, p. 60).

Type species. *Pfeifferella tritonis* Labbé = *Pfeifferia tritonis* Labbé 1894, not *Pfeifferia* Gray 1853.

A genus placed by the author in the *Sporozoa*.

Pfeifferella Buchanan 1918 (5, p. 54).

Type species. *Pfeifferella mallei* (Loeffler) Buchanan.

The type species is the glan-der's bacillus, one of the bacteria.

Conclusion. *Pfeifferella* Buchanan 1918 is an illegitimate later homonym of *Pfeifferella* Labbé 1899.

11. *Phytomonas*

Phytomonas Donovan 1909 (33, p. 1496).

Type species. *Phytomonas davidi* (Lafont) Donovan 1909 = *Lep-
tomonas davidi* Lafont.

The standing of *Phytomonas* as a protozoan genus is somewhat compromised by the fact that Donovan gave no description of the genus, and did not name a species. However, his reference to the work of Lafont (34) has apparently led to the acceptance of the name in protozoology.

Phytomonas Bergey, Harrison, Breed, Hammer and Huntoon 1923 (35, p. 174).

Type species. *Phytomonas campestris* (Pammel) Bergey et al. 1923 = *Bacillus campestris* Pammel 1895. Elliott (36) pointed out in 1937 that *Phytomonas* Bergey et al. is a later homonym of *Phytomonas* Donovan 1909. Dowson (37) proposed the generic name *Xanthomonas* to replace *Phytomonas* Bergey et al. but failed to retain the type species of the latter. He incorrectly designated the type species as *Xanthomonas hyacinthi* (Wakker) Dowson. Probably it should be *Xanthomonas campestris* (Pammel) Dowson.

BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

Conclusion. *Phytomonas* Bergey *et al.* is an illegitimate later homonym of *Phytomonas* Donovan 1909.

12. *Proteus*

Proteus Laurenti 1768 (38, p. 35).

Type species. *Proteus anguinus* Laurenti 1768.

The species described is placed in the *Amphibia*. The name is apparently currently accepted and used, as by Noble 1931 (39, p. 483).

Proteus Mueller 1786 (40, p. 91).

Type species. *Proteus diffluens* Mueller 1786.

This protozoan generic name was apparently a later homonym of *Proteus* Laurenti 1768.

Proteus Hauser 1885 (41, p. 1).

Type species. *Proteus vulgaris* Hauser 1885.

The generic name *Proteus* Hauser 1885 for a genus of bacteria is apparently a later homonym of the generic name *Proteus* Mueller 1786. It is therefore illegitimate.

Conclusion. Apparently the generic name *Proteus* Mueller 1786 is itself illegitimate as a later homonym of *Proteus* Laurenti 1768 under the Zoological Code. The generic name *Proteus* Hauser is widely used in bacteriology. It may be desirable to request that *Proteus* Hauser be made a *genus conservandum* in bacteriology, inasmuch as *Pro-*

teus is not currently used as a generic name in protozoology.

13. *Rhizomonas*

Rhizomonas Kent 1880 (42, p. 224).

Type species. *Rhizomonas verrucosa* Kent 1880.

A protozoon observed in hay infusions.

Rhizomonas Orla-Jensen 1909 (43, p. 334).

Type species. None named. Possibly *Rhizomonas radiculicola*. Proposed to replace the bacterial generic name *Rhizobium*, of which it is a later synonym.

Conclusion. *Rhizomonas* Orla-Jensen is a later homonym of *Rhizomonas* Kent. The validity of its publication may be questioned.

14. *Rhodosphaera*

Rhodosphaera Haeckel 1881 (44, p. 452).

Type species. No species listed.

The name was applied to a protozoan genus (*Radiokaria*).

Rhodosphaera Buchanan 1918 (45, p. 472).

Type species. *Rhodosphaera capsulatus* (Molisch) Buchanan. This bacterial genus was proposed to replace the generic name *Rhodococcus* Molisch which name is a later homonym of the bacterial generic name *Rhodococcus* Zopf.

INTERNATIONAL BULLETIN

Conclusion. *Rhodosphaera* Buchanan 1918 is a later homonym of the protozoan generic name *Rhodosphaera* Haeckel.

homonyms of protozoan genera, and hence unavailable in bacteriology except by international agreement.

SUMMARY

1. The bacterial and viral generic names *Astasia* Meyer, *Castellanella* Pacheco and Rodrigues, *Charon* Holmes, *Coccomonas* Orla-Jensen, *Palmula* Prévot, *Pfeifferella* Buchanan, *Phytomonas* Bergey et al., *Proteus* Hauser, *Rhizomonas* Orla-Jensen and *Rhodosphaera* Buchanan may be regarded as later

2. The bacterial generic names *Babesia* Trevisan, *Klebsiella* Trevisan, *Pelosphaera* Lauterborn are legitimate in the sense that they are earlier homonyms of the duplicating protozoan generic names.

3. The bacterial generic name *Listerella* Pirie is an illegitimate later homonym of *Listerella* Jahn.

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INTERNATIONAL BULLETIN

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