Emended Descriptions of the Genus *Alcaligenes* and of *Alcaligenes faecalis* and Proposal That the Generic Name *Achromobacter* be Rejected: Status of the Named Species of *Alcaligenes* and *Achromobacter*

Request for an Opinion

MARGARET S. HENDRIE, A. J. HOLDING, and J. M. SHEWAN

Torry Research Station, Aberdeen, Scotland, United Kingdom, and Department of Microbiology, University of Edinburgh, Scotland, United Kingdom

The descriptions of the genus *Alcaligenes* Castellani and Chalmers and *Alcaligenes faecalis* Castellani and Chalmers have been emended. It is requested that the Judicial Commission issue an Opinion rejecting the name *Achromobacter* Bergey et al. as a nomen dubium. It is proposed, on the basis of a comparison of type and reference strains, that *Alcaligenes denitrificans* Leifson and Hugh, *Achromobacter arsenoxydans-tres* Turner, and *Alcaligenes odorans* (Málek and Kazdová-Kožišková) Málek et al. be considered as subjective synonyms of *A. faecalis*. The proposed taxonomic status of all known previously described species of the genera *Alcaligenes* and *Achromobacter* is indicated in appendixes.

Emendation of description of the genus *Alcaligenes* Castellani and Chalmers. Extensive studies on the morphology and physiology of the gram-negative asporogenous rods have been undertaken in recent years by Baumann et al. (10, 11), De Ley et al. (56-58), Cabassi et al. (38), Samuels et al. (131), and De Ley and Shewan (unpublished data). These studies have revealed that strictly aerobic, peritrichous bacteria (with the exception of those also possessing anaerobic respiratory mechanisms) should be considered for inclusion in the genus *Alcaligenes*. No valid criteria that justify the separation of *Achromobacter* from *Alcaligenes* have been established. Organisms such as those belonging to *Acetobacter*, *Agrobacterium*, or *Rhizobium* possess these characteristics, but they also possess special physiological or ecological properties that exclude them from *Alcaligenes* and *Achromobacter*. These two prime characteristics, therefore, exclude from *Alcaligenes* and *Achromobacter* bacteria that are facultatively anaerobic, nonmotile, or polarly flagellated. These bacteria are allocated to the family *Enterobacteriaceae*, the *Acinetobacter-Moraxella* group, and the family *Pseudomonadaceae*, respectively.

As a result of these previous studies and of unpublished investigations on 300 extant strains of 270 named species previously classified as belonging to either *Alcaligenes* or *Achromobacter*, the following emended description of the genus *Alcaligenes* is proposed.

Rods or coccoid cells, 0.5 to 0.6 by 1.2 to 2.6 μm , usually occurring singly. Motile by means of one to four (occasionally up to eight) flagella; the flagella may be degenerate. Cells are peritrichous. No resting stages are known. Gram negative.

Chemoorganotrophic; some species are chemolithotrophic with H_2 ; metabolism is respiratory, never fermentative. Molecular oxygen is the final electron acceptor.

Strictly aerobic except for some strains that are capable of anaerobic respiration in the presence of nitrate or nitrite, which act as alternate electron acceptors.

Most strains (except those of *A. aquamarinus*) have simple nitrogenous nutritional requirements and produce very turbid growth in liquid media with ammonium or nitrate salts as the sole nitrogen source; some strains require organic nitrogen compounds (amino acids and/or vitamins). Gaseous nitrogen is not fixed.

Not actively proteolytic in casein or gelatin media. Cellulose, chitin, and agar are not hydrolyzed. Oxidase is produced (Kovacs test).

Optimal temperatures are between 20 and 37 $^{\circ}\text{C}$. All species grow quickly at pH 7.0.

The guanine plus cytosine (G + C) content of the deoxyribonucleic acid ranges from 58 to 70 mol%.

Attempts by many workers to isolate a strain that possesses the described characteristics of the type species of *Achromobacter*, *A. liquefaciens* (Eisenberg) Bergey et al., have failed. This lack of

a neotype strain has prevented more detailed investigations of the genus from being carried out.

Proposed rejection of the generic name *Achromobacter* Bergey et al. The genus named *Achromobacter* was first instituted in 1923 by the Committee of the Society of American Bacteriologists (16) to accommodate nonpathogenic, small to medium-sized, motile or nonmotile rods that were aerobic, nonpigmented, and asporogenous and which occurred principally in soil and water. Such rods had been described previously by Eisenberg (61), Lehmann and Neumann (100), Mez (110), Migula (111), Chester (44), and Ford (67) under a variety of names, including *Bacillus liquefaciens* and *Bacillus liquidus*. It was recognized early (51), however, that "there seems to be no recognisable distinction between *Alcaligenes* and similar organisms which were (then) placed in *Achromobacter*" and that *Achromobacter* is an ill-defined genus with a possibly unrecognizable type species.

In most of the early work, little or no mention is made of the type of flagellation of organisms placed in *Achromobacter*, and only in *Bergey's Manual* (16), when the genus *Achromobacter* was first named, were other additional characteristics, including flagella position, added. *A. liquefaciens* was listed in *Bergey's Manual* (16) as the type species and was described as possessing peritrichous cells; *A. liquidum* was described as possessing polar flagella. Documentation of the specific reasons for ascribing peritrichous cells to *A. liquefaciens* is lacking.

As described in *Bergey's Manual* (16), organisms of the genus *Alcaligenes* differed from those of *Achromobacter* in that the former were of intestinal origin and did not ferment carbohydrates. The description of *Achromobacter* did not mention the action on carbohydrates but stated that the organisms were from soil and water. Both genera included nonmotile and motile forms, although no polarly flagellated cells were described in *Alcaligenes*. Clearly, even in this early publication, grounds for separation of the genera were questionable. Succeeding editions of *Bergey's Manual* emphasized the action on carbohydrates and, for *Alcaligenes*, in the 7th edition it was specifically stated that carbohydrates were not attacked. The action of *Achromobacter liquefaciens* on carbohydrates has not been reported. As a result of the description presented in *Bergey's Manual* (16), the genus *Achromobacter* was used to place a very heterogeneous collection of organisms reputed to be aerobic, gram-negative, motile or nonmotile bacteria occurring in soils, water, foods, etc.

The most recent descriptions of the genera *Alcaligenes* (25) and *Achromobacter* (26) are as follows.

Alcaligenes Castellani and Chalmers 1919 (41): "Rods which are either motile by means of peritrichous flagella or non-motile. Gram-negative. May or may not liquefy gelatin and solidified blood serum. Litmus milk turned alkaline, with or without peptonization. Carbohydrates not utilized. Acetylmethylcarbinol not produced. Chromogenesis, when it occurs, is grayish-yellow, brownish-yellow or yellow. Generally found in the intestinal tracts of vertebrates or in dairy products. The type species is *Alcaligenes faecalis* Castellani and Chalmers."

Achromobacter Bergey et al. 1923 (16): "non-pigment-forming (at least no pigment formed on agar or gelatin) rods. Motile by means of peritrichous flagella or non-motile. Gram-negative. Litmus milk faintly acid to unchanged or alkaline. Occur in salt- to fresh-water and in soil. The type species is *Achromobacter liquefaciens* (Eisenberg) Bergey et al."

Although there exists a reference strain of *Alcaligenes faecalis* that accords with the original description of Castellani and Chalmers, there is no extant culture of *Achromobacter liquefaciens*, and the most recent attempt (149) to establish a neotype failed because all extant cultures did not comply with the type description and, in fact, were found to be gram-positive rods. Moreover, both the original and subsequent descriptions of *Achromobacter liquefaciens* were so indeterminate and apparently were not based on the examination of extant cultures that they attracted a heterogeneous collection of what are now obviously widely divergent strains. On these grounds, the Judicial Commission is asked to issue an Opinion rejecting the generic name *Achromobacter* as a nomen dubium.

Emended description of *Alcaligenes faecalis* Castellani and Chalmers (1919) (41). The following revised description of *Alcaligenes faecalis* is based upon an investigation of available strains, including the reference strain ATCC 8750 (= NCIB 8156).

Coccoid rods, 0.5 to 0.6 by 2.0 μm , usually occurring singly. Motile by means of one to eight flagella. Cells are peritrichous. Gram negative. No special pigments are produced. A characteristic strawberry-like odor is produced by some strains.

Acetate, propionate, butyrate, and other organic acids are utilized as sole carbon and energy sources, as are aspartic acid, asparagine, histidine, glutathione, and some other organic nitrogenous compounds. The utilization of carbohydrates and chemolithotrophic growth using H_2 gas have not been demonstrated. Oxidation of arsenite, which is very active in some strains, does not support chemolithotrophic growth.

Sole nitrogen sources include ammonium and

nitrate salts, some amino acids, and other organic nitrogenous compounds. Some strains are able to denitrify by respiring anaerobically in the presence of nitrate or nitrite to produce nitrogen gas. This ability may be lost on prolonged aerobic cultivation. Litmus milk is turned alkaline. The optimal temperature is between 25 and 37 C. The guanine plus cytosine content of the deoxyribonucleic acid is 58.9 mol%.

A comparison of the properties, confirmed by us, of the type strains of three previously described species of *Alcaligenes*, viz. *Alcaligenes denitrificans* Leifson and Hugh 1954 (101) (strain NCTC 8582 [= ATCC 15173 = CIP 6081]), *Achromobacter arsenoxydans-tres* Turner 1954 (151) (strain

NCIB 8687), and *Alcaligenes odorans* Málek and Kazdová-Kožisková 1946, 189 (106), Málek, Radochova and Lysenko 1963 (107) (strain CCEB 554 [= ATCC15554]) (Table 1), shows that they are so similar to the reference strain of *Alcaligenes faecalis* (NCIB 8156 = ATCC 8750) that their names can be regarded as subjective synonyms of *Alcaligenes faecalis*.

The only characteristic differentiating strains of *Alcaligenes denitrificans* from those of *Alcaligenes faecalis* is anaerobic respiration in the presence of nitrate, a property which may be lost on subculturing, and one which, in our opinion, should not be used by itself to differentiate species.

Achromobacter arsenoxydans-tres (not validly

TABLE 1. *Properties possessed in common by Alcaligenes faecalis* (NCIB 8156 = ATCC 8750), *Alcaligenes denitrificans* (NCTC 8582 = ATCC 15173), *Alcaligenes odorans* (CCEB 554 = ATCC 15554), and *Alcaligenes arsenoxydans* (NCIB 8687) as published (Castellani and Chalmers [41], Leifson and Hugh [101], Malek and Kazdova-Koziskova [106], and Turner [151]) and confirmed by us

Determination	Result
Morphology	Gram-negative non-sporeforming, coccoid rods measuring 0.5–1.0 × 0.4–2.0 µm; occurring singly, in pairs, and irregularly or in short chains; peritrichous
Growth	
On agar plate	Semitransparent to opaque, entire, smooth, flat, non-pigmented colonies
In broth	Uniformly turbid; thin to moderate pellicle; strong aerobic growth
Temperature	Mesophilic, range is from 5 to 37 C
Gelatin liquefaction	Negative
Starch hydrolysis	Negative
Utilization of the usual pentoses or hexoses	Negative
Litmus milk	Alkaline; no other change
H ₂ S production	Usually negative
NO ₃	May or may not be reduced
Indole production	Negative
Oxidase production	Positive
Arsenite oxidation	Slightly to strongly positive (in strains of <i>A. arsenoxydans</i>).
Lipolysis	Variable
Guanine + cytosine	56.6 to 59.4 mol% <i>Alcaligenes faecalis</i> , 58.9 mol% <i>Alcaligenes odorans</i> , 56.6 mol% <i>Alcaligenes arsenoxydans</i> , 59.4 mol%
Nutrition	No vitamin requirements (i.e., can grow in Hutner mineral salt solution plus (per liter): glucose (5 g), sodium nitrate (1 g), sodium acetate (1 g), sodium succinate (1 g), calcium gluconate (1 g), and KNO ₃ (1 g), (see ref. 85)

published because it is not a binary combination [Rule 14a(1))] was a name proposed for strains possessing the ability to oxidize arsenite actively. However, in our hands some strains of *Alcaligenes faecalis*, *Alcaligenes odorans* CCEB 554, and *Alcaligenes denitrificans* CIP 6081 oxidize arsenite, but much less actively than *A. arsenoxydans-tres*.

Alcaligenes odorans is a name proposed for an organism producing a characteristic odor variably described as being similar to valerian tincture or as strawberry-like. However, odor production by the strains investigated is a variable, apparently unreliable characteristic, and in our opinion organisms possessing it do not merit specific ranking on this basis alone.

Therefore, it is proposed that *Alcaligenes denitrificans*, *Achromobacter arsenoxydans-tres*, and *Alcaligenes odorans* be considered as subjective synonyms of *Alcaligenes faecalis*.

Status of previously described species of Al-

caligenes and Achromobacter. During the reappraisal of the characteristics of the genus *Alcaligenes*, a comprehensive list of the names of all described species of *Alcaligenes* and *Achromobacter* was prepared. Certain species are acceptable under the proposed redescription of the genus *Alcaligenes* (Appendix Ia), but an opportunity to investigate certain named species of *Achromobacter*, *Agrobacterium*, and *Pseudomonas* that might be acceptable (Appendix Ib) has not been possible. Other species that either are of unknown status because there are no known extant type strains (Appendix II) or do not conform to the revised description (Appendix III) have been excluded from the genus *Alcaligenes*. Appendix IV lists species that were originally placed in *Achromobacter* and that have some properties in common with *Alcaligenes* but that were transferred to other genera in the 7th edition of *Bergey's Manual*. Appendix V lists species names which have not been validly published.

APPENDIX Ia

The following extant species previously placed in either the *Alcaligenes* or *Achromobacter* appear to be acceptable as species of *Alcaligenes*.

Species	Type or reference strain	Reference
<i>Alcaligenes faecalis</i>	ATCC 8750 = NCIB 8156	Castellani and Chalmers 1919 (41)
<i>Achromobacter aquamarinus</i>	ATCC 14400 = NCMB 557	ZoBell and Upham 1944 (163)
<i>Alcaligenes eutrophus</i>	ATCC 17697	Davis et al. 1969 (54)
<i>Alcaligenes paradoxus</i>	ATCC 17713 (Biotype I) ATCC 17549 (Biotype II)	Davis et al. 1969 (54)

APPENDIX Ib

The following extant species previously described as belonging to the genus *Achromobacter*, *Agrobacterium* or *Pseudomonas* appear to be acceptable as species of *Alcaligenes*. However, a comparison with other species has not been carried out, and their status is therefore uncertain.

Species	Type or reference strain ^a	Reference
Achromobacter		
<i>A. agile</i>	NCIB 9986	From the Institute of Microbiology, Academy of Sciences, Moscow
<i>A. cholinophagum</i>	ATCC 15918 = NCMB 1501	Shieh 1964 (134)
<i>A. pestifer</i>	ATCC 15445	Bergey et al. (16)
<i>A. starkeyi</i>	NCIB 10688	Ruiz-Herrera 1970 (130)
Agrobacterium		
<i>A. agile</i>		Ahrens 1968 (3)
<i>A. aggregatum</i>		Ahrens 1968 (3)
<i>A. ferrugineum</i>		Ahrens and Rheinheimer 1967 (4)
<i>A. gelatinovorum</i>		Ahrens 1968 (3)
<i>A. kielense</i>		Ahrens 1968 (3)
<i>A. luteum</i>		Ahrens and Rheinheimer 1967 (4)
<i>A. sanguineum</i>		Ahrens and Rheinheimer 1967 (4)
<i>A. polysphaeroidum</i>		Nikitin and Vasilyeva 1967 (114)
Pseudomonas		
<i>P. oxalaticus</i>		Khambata and Bhat 1953 (92)

^a The strains investigated at NCIB possess peritrichous cells and appear to belong to the genus *Alcaligenes*.

APPENDIX II

There are no known extant type strains of the following species which were placed either in the genus *Alcaligenes* or *Achromobacter*. Their status is, therefore, unknown.

Alcaligenes

- A. albus* (Buchanan and Hammer 1915) Haupt 1935 (78)
- A. alkalifoetidus* Castellani and Florence 1930 (42)
- A. denieri* Corbet 1930 (53)
- A. denitrificans* (Jensen 1898) Monias 1928 (112)
- A. faecalis* var. *mariense* Hauduroy et al. 1937 (77)
- A. faecalis* subsp. *radicans* Evans 1931 (65)
- A. hemolysans* Henriksen 1936 (82)
- A. lenis* de Assis 1930 (55)
- A. recti* (Ford 1903) Bergey et al. 1923 (16)
- A. stevensae* Brown 1927 (36)
- A. vivax* (Archibald 1918) Castellani and Chalmers 1919 (41)

Achromobacter

- A. aceris* (Edson and Carpenter 1912) Bergey et al. 1934 (15)
- A. album* (Pagliani, Maggiora, and Fratini 1887) Bergey et al. 1923 (16)
- A. alcaliaromaticum* (Berlin 1927) Bergey et al. 1930 (18)
- A. amylovorum* (Rubentschik 1926) Bergey et al. 1930 (18)
- A. centropunctatum* (Jensen 1898) Bergey et al. 1923 (16)
- A. cycloclastes* (Gray and Thornton 1928) Bergey et al. 1930 (18)
- A. dendriticum* (Lustig 1893) Bergey et al. 1925 (17)
- A. formosum* (Ravenel 1896) Bergey et al. 1923 (16)
- A. galophilus* Bergey et al. 1930 (18)
- A. gasoformans* (Eisenberg 1891) Bergey et al. 1923 (16)
- A. hyalinum* (Jordan 1890) Bergey et al. 1923 (16)
- A. inunctum* (Pohl 1892) Bergey et al. 1923 (16)
- A. iophagus* (Gray and Thornton 1928) Bergey et al. 1930 (18) (NCMB 1051 [= CCM 281] does not possess the described characters. The existence of any other strain from the original source is not known.)
- A. liquefaciens* (Eisenberg 1891) Bergey et al. 1923 (16) (ATCC 15716, isolated by Tulecke et al. [149] and proposed as a neotype strain, does not possess the characteristics ascribed to the species by Bergey et al. or to the strain described by Tulecke et al.)
- A. litoralis* (Russell 1892) Bergey et al. 1923 (16)
- A. mucidus* Alford and McCleskey 1943 (5)
- A. nitrificans* (Chester 1897) Bergey et al. 1923 (16)
- A. raveneli* (Chester 1901) Bergey et al. 1923 (16)
- A. reticulare* (Jordan 1890) Bergey et al. 1923 (16)
- A. reticularum* (Jordan 1890) Bergey et al. 1923 (16)
- A. rugosum* (Chester 1897) Bergey et al. 1923 (16)
- A. sewerinii* Bergey et al. 1923 (16)
- A. solitarium* (Ravenel 1896) Bergey et al. 1923 (16)
- A. stolonatum* (Adametz-Wichmann according to Adametz 1888) Krasil'nikov 1949 (98)
- A. stoloniferum* (Pohl 1892) Bergey et al. 1923 (16)
- A. superficialis* (Jordan 1890) Bergey et al. 1923 (16)
- A. terrestris* Spalla et al. 1961 (139)
- A. thalassius* ZoBell and Upham 1944 (163)
- A. venosum* (Vaughan 1892) Bergey et al. 1923 (16)
- A. visco-symbioticum* (Buchanan and Hammer 1915) Bergey et al. 1930 (18)

APPENDIX III

The following species, previously assigned either to *Alcaligenes* or *Achromobacter*, are excluded from *Alcaligenes* because they do not conform to the genus *Alcaligenes* as it is now defined. Culture collection accession numbers are quoted where extant strains are available.

Species	Present generic status and/or reason for rejection (from original description if no reference is given)
Alcaligenes	
<i>A. ammoniagenes</i> (Cooke and Keith 1927) Bergey et al. 1930 (18) (ATCC 6871; ATCC 6872)	Gram positive; <i>Brevibacterium</i> (Breed 1953) (24)
<i>A. bookeri</i> (Ford 1903) Bergey et al. 1923 (16)	NCIB 8155 (=ATCC 9128 = NCTC 6535) possessed polar flagella (NCIB, unpublished data). Letter from R. Hugh (1959) to NCIB stated that this strain was no longer distributed as an <i>Alcaligenes</i> sp. by ATCC and NCTC. It is no longer listed in the ATCC or NCIB catalogues. The existence of other strains is not known.
<i>A. giganteus</i> Sonnabend 1963 (138)	Nonmotile, facultatively anaerobic, oxidase negative
<i>A. lipolyticus</i> (Evans 1916) Pacheco 1933 (116)	Gram positive (Evans 1918) (64)
<i>A. marshallii</i> (Buchanan and Hammer 1915) Brisou and Prévot 1954 (34)	Nonmotile
<i>A. metalcaligenes</i> (Castellani and Chalmers 1919) Brisou and Prévot 1954 (34)	Nonmotile
<i>A. radiobacter</i> (Beijerinck and van Delden 1902) Conn 1939 (48) (E.X.3.24.2 = NCIB 9042 = ATCC 19358; ATCC 6466 = NCIB 8149)	<i>Agrobacterium</i> (Conn 1942) (49)
<i>A. tolerans</i> Abd-el-Malek and Gibson 1952 (1) (Gibson A3 = NCIB 8551 = ATCC 19359)	Nonmotile
<i>A. viscolactis</i> (Mez 1898) Breed 1957 (25) (Syn. <i>A. viscosum</i> Weldin 1927) (ATCC 9036 = NCIB 8154)	Nonmotile; <i>Acinetobacter</i> (Baumann, Doudoroff and Stainer 1968) (10, 11)
Achromobacter	
<i>A. acidum</i> (Chester 1901) Bergey et al. 1923 (16)	Nonmotile
<i>A. aerophilum</i> (Rubentschik 1926) Bergey et al. 1930 (18)	Gram positive
<i>A. ambiguum</i> (Wright 1895) Bergey et al. 1923 (16)	Terminal flagellum; <i>Pseudomonas</i> (Haynes 1957) (79)
<i>A. ammoniagenes</i> Wiidik 1950 (158)	Polar flagella
<i>A. amylolyticus</i> Rubentschik and Goicherman 1935 (127)	Indole produced
<i>A. anaerobium</i> Shimwell 1937 (135)	<i>Zymomonas</i> (Kluyver 1957) (96)
<i>A. anitratum</i> (Schaub and Hauber 1948) Brisou 1953 (29)	Nonmotile; <i>Acinetobacter</i> (Brisou and Prévot 1954) (34)
<i>A. arabinosaceum</i> Patrick and Werkman 1933 (118)	Nonmotile, ferments lactose, methyl red positive
<i>A. arcticum</i> Rusakova and Butkevich 1941 (128)	Polar flagella
<i>A. argenteophosphorescens</i> (Katz 1888) Bergey et al. 1930 (18)	Luminescent
<i>A. aromafaciens</i> (Chester 1901) Bergey et al. 1923 (16)	Illegitimate specific epithet (Rule 24b); synonym of <i>Bacterium connii</i> Migula 1900 but not <i>A. connii</i> (Chester 1901) (44) Bergey et al. 1923 (16)
<i>A. arvillum</i> (Gray and Thornton 1928) Bergey et al. 1934 (15)	Polar flagella
<i>A. azotogena</i> (ZoBell and Upham 1944) Brisou 1955 (31)	Polar flagella, amphitrichous
<i>A. buckleyi</i>	Not validly published. Personal communication from J. R. Waller (on behalf of Duerre) to Shewan (1970) states that the <i>Achromobacter</i> sp. (as quoted in papers by Duerre and colleagues but received labeled <i>A. buckleyi</i> by J. De Ley and by J. M. Shewan from Duerre's laboratory) is almost certainly an atypical <i>Proteus retigeri</i> .
<i>A. butyri</i> Bergey et al. 1923 (16)	Nonmotile; illegitimate specific epithet (Rule 24b)

APPENDIX III—Continued

Species	Present generic status and/or reason for rejection (from original description if no reference is given)
<i>A. candicans</i> (Frankland and Frankland 1889) Bergey et al. 1923 (16)	Nonmotile
<i>A. caseinicum</i> Gahl 1928 (70)	Polar flagellum
<i>A. chitinophilum</i> (Hock 1941) Brisou 1955 (31)	Chitinoclastic
<i>A. chitinovorur</i> (Benecke 1905) Brisou 1955 (31)	<i>Benecke</i> (Campbell 1957) (39)
<i>A. citroalcaligenes</i> Mannheim and Stenzel 1962 (108) (NCTC 10307 = ATCC 17908; type strain)	Nonmotile; <i>Acinetobacter</i> (Baumann, Doudoroff, and Stanier 1968) (10, 11)
<i>A. citrophilum</i> (Rubentschik 1926) Bergey et al. 1930 (18)	Gram positive
<i>A. coadunatum</i> (Wright 1895) Bergey et al. 1923 (16)	Polar flagellum
<i>A. coccoideum</i> (Chester 1901) Bergey et al. 1923 (16)	Nonmotile
<i>A. conjunctivae</i> Mannheim and Stenzel 1962 (108) (NCTC 10304 = ATCC 17905; type strain)	Nonmotile; <i>Acinetobacter</i> (Baumann, Doudoroff and Stanier 1968) (10, 11)
<i>A. connii</i> (Chester 1901) Bergey et al. 1923 (16)	Nonmotile
<i>A. cruciviae</i> (Gray and Thornton 1928) Bergey et al. 1930 (18) (NCIB 9432 = NRRL B-1021 = NCTC 2580)	Polar flagella; <i>Pseudomonas</i>
<i>A. cyaneophosphorescens</i> (Katz 1888) Bergey et al. 1930 (18)	Luminescent
<i>A. cystinovorum</i> Barber and Burrows 1936 (9)	NCIB 4854, the type strain, possesses polar flagella (unpublished results, Holding and NCIB).
<i>A. dacunhae</i> (Gray and Thornton 1928) Bergey et al. 1930 (18)	Polar flagella; <i>Pseudomonas</i>
<i>A. delicatulum</i> (Jordan 1890) Bergey et al. 1923 (16)	Synonym of <i>A. delicatulus</i>
<i>A. delicatulus</i> (Jordan 1890) Bergey et al. 1923 (16)	Steinhaust (140) assigned an organism to this species but later indicated that it could be assigned to the paracolon group (Breed 1957) (26). Description of the species is insufficient to distinguish it from other groups.
<i>A. delmarvae</i> Smart 1932 (136)	Nonmotile
<i>A. desmolyticum</i> (Gray and Thornton 1928) Bergey et al. 1930 (18) (NCIB 9427 = NRRL B-979 = NCTC 2578)	Polar flagella; <i>Pseudomonas</i>
<i>A. dianthi</i> Patrick and Werkman 1933 (118)	Gram positive
<i>A. echinodermis</i> Brisou 1954 (30)	Methyl red positive
<i>A. epsteinii</i> Peshkov 1937 (119) (NCMB 1972 from INMI, Moscow)	The original description of this species—rods; motile with polar flagella; gram negative; actively proteolytic; produces acid and gas from carbohydrates; indole, NH ₃ , and Voges Proskauer positive; nitrates reduced to nitrites—suggests that it would now be classified as an <i>Aeromonas</i> sp. This has been confirmed by the NCMB (unpublished data).
<i>A. eurydice</i> (White 1912) Bergey et al. 1925 (17)	<i>Lactobacillus</i> (Kreig 1961) (99)
<i>A. fairmountensis</i> (Wright 1895) Bergey et al. 1923 (16)	Polar flagella
<i>A. fermentationis</i> (Chester 1901) Bergey et al. 1923 (16)	Nonmotile
<i>A. filifaciens</i> (Jensen 1898) Bergey et al. 1923 (16)	Nonmotile
<i>A. fischeri</i> (Beijerinck 1889) Bergey et al. 1923 (16) (ATCC 7744 = NCMB 1281)	<i>Vibrio fischeri</i> (Hendrie, Hodgkiss, and Shewan 1970) (80)
<i>A. formicum</i> (Omelianski 1903) Bergey et al. 1923 (16)	<i>Escherichia</i> (Bergey et al. 1925) (17)
<i>A. geminum</i> (Chester 1901) Brisou and Prévot 1954 (34)	Indole produced
<i>A. geniculatum</i> (Wright 1895) Bergey et al. 1923 (16) (NCIB 9428 = CCEB 338 = ATCC 19374)	Polar flagella
<i>A. georgiopolitatum</i> Colwell et al. 1968 (45) (ATCC 23203)	Nonmotile, deoxyribonucleic acid base ratio 41 mol% guanine plus cytosine
<i>A. globiformis</i> (Conn 1928) Bergey et al. 1930 (18) (ATCC 8010 = NCIB 8907)	Illegitimate specific epithet (Rule 24b); <i>Arthrobacter</i> (Conn and Dimmick 1947) (50)
<i>A. granii</i> (Lundestad 1928) Bergey et al. 1930 (18)	<i>Vibrio</i> (Stanier 1941) (142)

APPENDIX III—Continued

Species	Present generic status and/or reason for rejection (from original description if no reference is given)
<i>A. grypaeae</i> Brisou 1954 (30)	Polar flagella (Brisou 1955) (31)
<i>A. grypaeae</i> var. <i>cannensis</i> Brisou 1954 (30)	Polar flagella (Brisou 1955) (31)
<i>A. guttatus</i> (Zimmerman 1890) Bergey et al. 1923 (16)	NCIB 9405 has polar flagella (NCIB and Holding, unpublished results). Existence of other strains not known.
<i>A. haemolyticus</i> Mannheim and Stenzel 1962 (108) (NCTC 10305 = ATCC 17906; type strain)	Nonmotile; <i>Acinetobacter</i> (Baumann, Doudoroff, and Stanier 1968) (10, 11)
<i>A. haemolyticus</i> var. <i>alcaligenes</i> Mannheim and Stenzel 1962 (108) (NCTC 10306 = ATCC 17907; type strain)	Nonmotile; <i>Acinetobacter</i> (Baumann, Doudoroff, and Stanier 1968) (10, 11)
<i>A. haemolyticus</i> var. <i>glucidolytica</i> Mannheim and Stenzel 1962 (108)	Nonmotile; synonym of <i>A. haemolyticus</i> var. <i>haemolyticus</i> (144), which is the same as <i>A. haemolyticus</i> ; <i>Acinetobacter</i> (Baumann, Doudoroff and Stanier 1968) (10, 11)
<i>A. halestorgus</i> (Elazari-Volcani 1940) Prévot 1961 (122)	<i>Pseudomonas</i>
<i>A. halophilus</i> Bergey et al. 1930 (18)	Nonmotile
<i>A. hartlebii</i> (Jensen 1898) Bergey et al. 1923 (16)	ATCC 365 (= NCIB 8129), the only known strain has shoulder flagella (unpublished data, Holding and NCIB), resembling <i>Agrobacterium</i> . Taxonomic studies have also shown that this organism resembles <i>Agrobacterium</i> (148) (Bain, Houston, and Shewan, unpublished data, 1966–67) (28)
<i>A. harveyi</i> Johnson and Shunk 1936 (88) (ATCC 14126 = NCMB 1280)	<i>Photobacterium</i> (Breed and Lessel 1954) (28) <i>Lucibacterium</i> (Hendrie, Hodgkiss, and Shewan 1970) (80)
<i>A. healii</i> (Buchanan and Hammer 1915) Bergey et al. 1925 (17)	Nonmotile; <i>Brevibacterium</i> (Breed 1953) (24)
<i>A. histamineum</i> Kimata and Kawai 1953 (93) (NCMB 865)	<i>Proteus morganii</i> (Kimata, Kawai, and Akamatsu 1958) (94)
<i>A. hyperopticum</i> Campbell and Williams 1951 (40)	<i>Beneckea</i> (Campbell 1957) (39)
<i>A. ichthyoderms</i> Wells and ZoBell 1934 (156) (NCMB 407)	<i>Vibrio anguillarum</i> (Hendrie, Hodgkiss, and Shewan 1971) (81)
<i>A. immobilis</i> Müller 1961 (113) (ATCC 15934)	Nonmotile
<i>A. indoloxidans</i> (Gray 1928) Prévot 1961 (122) (NCIB 2760 = ATCC 13751; NCIB 9153 = CCM 283)	Polar flagella; <i>Pseudomonas acidovorans</i> (Stanier, Palleroni, and Doudoroff 1966) (143)
<i>A. labrum</i> Campbell and Williams 1951 (40)	<i>Beneckea</i> (Campbell 1957) (39)
<i>A. lacticum</i> Bergey et al. 1923 (16) (NCIB 8209 = NRRL B-552; ATCC 23220 = NCIB 8208 = NRRL B-551)	Nonmotile
<i>A. larvae</i> (Stutzer and Wsorrow 1927) Bergey et al. 1930 (18)	Nonmotile
<i>A. lipidis</i> (Anderson 1937) Allison et al. 1938 (6)	Nonmotile
<i>A. lipolyticum</i> (Huss 1908) Bergey et al. 1925 (17)	<i>Brevibacterium</i> (Breed 1953) (24)
<i>A. lipophagum</i> Campbell and Williams 1951 (40)	<i>Beneckea</i> (Campbell 1957) (39)
<i>A. liquidum</i> (Frankland and Frankland 1889) Bergey et al. 1923 (16)	Polar flagella
<i>A. luminosum</i> Bergey et al. 1930 (18)	Luminescent
<i>A. lwoffii</i> var. <i>glucidolytica</i> (Piéchaud, Piéchaud, and Second 1951) Brisou and Morichau-Beauchant 1952 (33)	Nonmotile; <i>Moraxella</i> (Piéchaud et al. 1951) (120)
<i>A. marinoglutinosus</i> ZoBell and Allen 1935 (162)	Polar flagella; <i>Pseudomonas</i> (ZoBell 1943) (161)
<i>A. membranoformis</i> ZoBell and Allen 1935 (162)	Polar flagella; <i>Pseudomonas</i> (ZoBell 1943) (161)
<i>A. metalcaligenes</i> (Castellani and Chalmers 1919) Mannheim and Stenzel 1962 (108) (NCTC 10308 = ATCC 17909; proposed neotype strain)	Nonmotile; <i>Acinetobacter</i> (Baumann, Doudoroff, and Stanier 1968) (10, 11)
<i>A. merluccius</i> Garmendia 1947 (71)	Luminescent
<i>A. middletonii</i> (Chester 1901) Bergey et al. 1923 (16)	Nonmotile

APPENDIX III—Continued

Species	Present generic status and/or reason for rejection (from original description if no reference is given)
<i>A. mirus</i> (McBeth 1916) Prévot 1961 (122)	Polar flagella
<i>A. mobile</i> Kluyver and Hoppenbrouwers 1931 (95) (NCIB 8938 = ATCC 10988 = NRRL B-806)	<i>Zymomonas</i> (Kluyver and van Niel, 1936) (97); (<i>A. mobile</i> is not validly published, Rule 12c)
<i>A. mucosus</i> (von Lingelsheim 1906) Mannheim and Stenzel 1962 (108) (NCTC 10303 = ATCC 17904; proposed neotype strain)	Nonmotile; <i>Acinetobacter</i> (Baumann, Doudoroff and Stanier 1968) (10, 11)
<i>A. multistriatum</i> (Wright 1895) Bergey et al. 1923 (16)	Polar flagella
<i>A. nebulosum</i> (Wright 1895) Bergey et al. 1923 (16)	Polar flagella
<i>A. nematophilus</i> Poinar and Thomas 1965 (123) (ATCC 19061)	Fermentative, oxidase negative
<i>A. nenckii</i> (Biernacki 1911) Bergey et al. 1930 (18)	Nonmotile
<i>A. nijibetsui</i> Takeda 1936 (147)	Polar flagella
<i>A. nitrovorum</i> (Jensen 1898) Bergey et al. 1923 (16)	Nonmotile
<i>A. parvulus</i> (Conn 1922) Breed 1957 (26)	ATCC 4335 has polar flagella (R. Hugh personal communication to ATCC); existence of other strains not known
<i>A. pastinator</i> Goresline 1933 (72)	<i>Agarbacterium</i> (Breed 1957) (27)
<i>A. pellucidum</i> Harrison 1929 (76)	Polar flagella (Krasil'nikov 1949) (98)
<i>A. perfectum</i> (ZoBell and Upham 1944) Brisou and Prévot 1954 (34)	Polar flagella
<i>A. perolens</i> Turner 1927 (150) (ATCC 10757 = NCIB 9327)	Polar flagella; forms green, water-soluble pigment; <i>Pseudomonas</i> (Szybalski, 1950) (146)
<i>A. phosphoreum</i> (Migula 1900) Bergey et al. 1930 (18)	Luminescent
<i>A. phosphoricum</i> (Migula 1900) Bergey et al. 1930 (18)	Luminescent
<i>A. picrum</i> Fuller and Norman 1943 (69)	Nonmotile
<i>A. pictorum</i> (Gray and Thornton 1928) Bergey et al. 1930 (18) (NCIB 9152 = CCM 284)	Polar flagella; <i>Pseudomonas</i>
<i>A. pikowskyi</i> Bergey et al. 1930 (18)	Indole produced
<i>A. pinnatum</i> (Ravenel 1896) Bergey et al. 1923 (16)	Indole produced
<i>A. pinnatum</i> var. <i>gemminum</i> Brisou and Prévot 1954 (34)	Variety of above-named species
<i>A. punctatum</i> (Zimmerman 1890) Bergey et al. 1923 (16)	<i>Aeromonas</i> (Sneiszko 1957) (137)
<i>A. putrefaciens</i> Derby and Hammer 1931 (59) (ATCC 8071, 8072, 8073 = NCIB 10471, 10472, 10473; co-types)	<i>Pseudomonas putrefaciens</i> (Long and Hammer 1941) (103); deoxyribonucleic acid base ratio 44 to 47 mol% guanine plus cytosine (Herbert et al. 1971) (83)
<i>A. radiobacter</i> (Beijerinck and van Delden 1902) Bergey et al. 1934 (15) (E.X. 3.24.2 = NCIB 9042 = ATCC 19358; ATCC 6466 = NCIB 8149)	<i>Agrobacterium</i> (Conn 1942) (49)
<i>A. rathonis</i> (Gray and Thornton 1928) Bergey et al. 1930 (18) (NCIB 9679 = NRRL B-988 = NCTC 2577)	Polar flagella; <i>Pseudomonas</i>
<i>A. refractans</i> (Wright 1895) Breed 1948 (23)	Nonmotile
<i>A. refractum</i> (Wright 1895) Bergey et al. 1923 (16)	Synonym of <i>A. refractans</i>
<i>A. riboflavinus</i> (Foster 1944) Prévot 1961 (122) (NCIB 8177 = ATCC 9526)	<i>Pseudomonas</i>
<i>A. rodonatum</i> (Ravenel 1896) Bergey et al. 1923 (16)	Nonmotile
<i>A. salopium</i> (Gray and Thornton 1928) Bergey et al. 1930 (18)	Polar flagella; <i>Pseudomonas</i>
<i>A. sinosum</i> (Wright 1895) Bergey et al. 1923 (16)	Polar flagella
<i>A. smaragdiphosphorescens</i> (Katz, 1888) Bergey et al. 1930 (18)	Luminescent
<i>A. spermophilum</i> Severi 1946 (133)	Nonmotile
<i>A. stationis</i> ZoBell and Upham 1944 (163) (NCMB 565 = ZoBell 622 = ATCC 14403)	Nonmotile; gram positive; <i>Brevibacterium</i> (Breed 1953) (24)
<i>A. stearophilum</i> (Weinzirl 1919) Bergey et al. 1923 (16)	Gram positive
<i>A. stenohalis</i> ZoBell and Upham 1944 (163)	Nonmotile
<i>A. stereotropis</i> (ZoBell and Upham 1944) Brisou, Tysset, and Vacher 1959 (35)	Polar flagella

APPENDIX III—Continued

Species	Present generic status and/or reason for rejection (from original description if no reference is given)
<i>A. stutzeri</i> (Lehmann and Neumann 1896) Bergey et al. 1930 (18)	Polar flagella
<i>A. stutzeri</i> (Lehmann and Neumann 1896) Prévot 1961 (122)	Synonym of above-named species; illegitimate specific epithet (Rule 24a)
<i>A. sulfureum</i> Bergey et al. 1930 (18)	Gram positive
<i>A. tiogense</i> (Wright 1895) Bergey et al. 1923 (16)	Nonmotile
<i>A. tralucidus</i> (Kellerman, McBeth, Scales, and Smith 1913) Prévot 1961 (122)	Polar flagella
<i>A. ubiquitum</i> (Jordan 1890) Bergey et al. 1923 (16)	Nonmotile
<i>A. ureasophorum</i> Campbell and Williams 1951 (40)	<i>Beneckea</i> (Campbell 1957) (39)
<i>A. viscosum</i> Bergey et al. 1925 (17)	Illegitimate name under Rule 24b of the Code. Synonym of <i>Alcaligenes viscolactis</i> . NCIB 9408, labeled <i>A. viscosum</i> , does not correspond to the description of the species.
<i>A. viscosus</i> Sreenivasan 1956 (141) (ATCC 12448)	Indole produced
<i>A. winogradskii</i> Bourlat 1953 (22) (NCIB 9017 = ATCC 17922)	Not validly published as <i>Achromobacter winogradskii</i> but listed under this name in the NCIB catalogue. Nonmotile; <i>Neisseria</i> (Lemoigne et al. 1952) (102); <i>Acinetobacter</i> (Brisou 1957) (32)
<i>A. xerosis</i> Groupé et al. 1954 (75)	ATCC 14780, the type strain of <i>A. xerosis</i> Groupé et al. is gram positive (NCIB, unpublished data).

APPENDIX IV

The following named species of *Achromobacter* (see Appendix III), which belong to other genera, are now considered to be of uncertain status and have some properties, such as being motile, peritrichate, oxidase positive, and gram negative, in common with organisms belonging to *Alcaligenes*.

Achromobacter chitinovor, *A. hyperopticum*, *A. labrum*, *A. lipophagum*, and *A. ureasophorum* in *Beneckea* (Campbell 1957) (39)

A. pastinator in *Agarbacterium* (Breed 1957) (27).

APPENDIX V

In *Index Bergeyana*, the following names of species of *Achromobacter* are considered to be not validly published.

A. alcaligenes var. *alcaliaromaticum*
A. alcaligenes var. *pellucidum*
A. alcaligenes var. *ravenelli*
A. alcaligenes var. *rugosum*
A. alcaligenes var. *solitarium*
A. arsenoxydans — *tres*
A. arvillum var. *salopium*
A. centropunctatum var. *reticulare*
A. fecaloides
A. formosum var. *bookeri*
A. formosum var. *geniculatum*
A. formosum var. *nebulosum*
A. formosum var. *nitrificans*
A. formosum var. *stalloniferum*
A. formosum var. *superficialis*
A. hyalinus var. *dentriticum*
A. hyalinus var. *liquidum*
A. litorale var. 2
A. lwoffii
A. membracula
A. miniscula
A. periphyta
A. pikowsky var. *ambigua*
A. pikowsky var. *sinosum*
A. rathonis var. *stutzerii*
A. recti
A. septicemiae
A. sewerini var. *stutzerii*

Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Turner 1954 (151)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Bois and Roy, 1944 (21)
 Brisou 1955 (31)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)
 Brisou and Prévot 1954 (34)

REPRINT REQUESTS

Address reprint requests to: Dr. J. M. Shewan, Torry Research Station, P. O. Box 131, Aberdeen AB9 8 DG, Scotland, U. K.

LITERATURE CITED

- Abd-el-Malek, Y., and T. Gibson. 1952. Studies in the bacteriology of milk. IV. The Gram-negative rods of milk. *J. Dairy Res.* **19**:294-301.
- Adametz, L. 1888. Die Bakterien der Trink und Nutzwasser. Mitt öst Versuchsst Brauer. Malz Wien **1**:19-63.
- Ahrens, R. 1968. Taxonomische Untersuchungen an sternbildenden *Agrobacterium*—Arten aus der westlichen Ostsee. *Kiel. Meersforsch.* **24**:147-173.
- Ahrens, R., and G. Rheinheimer. 1967. Über einige sternbildende Bakterien aus der Ostsee. *Kiel. Meersforsch.* **23**:127-136.
- Alford, J. A., and C. S. McCleskey. 1943. A new bacterial species producing a 'musty' odor. *Proc. Acad. Sci., La.* **7**:25-27.
- Allison, J. B., J. A. Anderson, and W. H. Cole. 1938. The method of electrical conductivity in studies on bacterial metabolism. *J. Bacteriol* **36**:571-586.
- Anderson, J. A. 1937. Spoilage of cream at low temperatures, p. 19-24. *Bull. Int. Ass. Milk Deal. Proc.* 30th Annu. Conv.
- Archibald, R. G. 1918. Enterica in the Sudan. *J. Trop. Med. Hyg.* **21**:229-236.
- Barber, H. H., and R. B. Burrows. 1936. The production of free sulphur from l-cystine by a soil bacterium. *Biochem. J.* **30**:599-603.
- Baumann, P., M. Doudoroff, and R. Y. Stanier. 1968. A study of the *Moraxella* group I. Genus *Moraxella* and the *Neisseria catarrhalis* group. *J. Bacteriol.* **95**:58-73.
- Baumann, P., M. Doudoroff, and R. Y. Stanier. 1968. A study of the *Moraxella* group II Oxidase-negative species (Genus *Acinetobacter*) *J. Bacteriol.* **95**:1520-1541.
- Beijerinck, M. W. 1889. Le Photobacterium luminosum, bactérie lumineuse de la Mer du Nord. *Arch. Néerl Sci. Exactes Natur.* **23**:401-427.
- Beijerinck, M. W., and A. van Delden. 1902. Ueber die Assimilation des freien Stickstoffs durch Bakterien. *Zentralbl. Bacteriol. Parasitenk. Infektionskr. Hyg. Abt. 2.* **9**:3-43.
- Benecke, W. 1905. Über *Bacillus chitinovororus*, einen Chitin zersetzenden Spaltpilze. *Bot. Ztg* **63**:227-242.
- Bergey, D. H., R. S. Breed, B. W. Hammer, F. M. Huntton, E. G. D. Murray, and F. C. Harrison. 1934. *Bergey's manual of determinative bacteriology*, 4th ed., p. 1-664. The Williams & Wilkins Co., Baltimore.
- Bergey, D. H., F. C. Harrison, R. S. Breed, B. W. Hammer, and F. M. Huntton. 1923. *Bergey's manual of determinative bacteriology*, 1st ed., p.

- 1-442. The Williams & Wilkins Co., Baltimore.
17. Bergey, D. H., F. C. Harrison, R. S. Breed, B. W. Hammer, and F. M. Huntoon. 1925. Bergey's manual of determinative bacteriology, 2nd ed., p. 1-462. The Williams & Wilkins Co., Baltimore.
18. Bergey, D. H., F. C. Harrison, R. S. Breed, B. W. Hammer, and F. M. Huntoon. 1930. Bergey's manual of determinative bacteriology, 3rd ed., p. 1-589. The Williams and Wilkins Co., Baltimore.
19. Berlin, A. L. 1927. *Bacterium alcaliaromaticum*. Rev. Microbiol. Epidemiol. 6:402-413 (p. 473-474, English summary).
20. Biernacki, W. 1911. *Bacterium Nenckii* Biern., ein neuer den Agar verflüssigender Mikroorganismus. Zentralbl. Bakteriell. Parasitenk. Infektionskr. Hyg. Abt. 2. 29:166-169.
21. Bois, E., and G. Roy. 1944. Quelques microorganismes isolés d'intestins de morue. Natur. Can. 71:259-264.
22. Bourlat, R. 1953. Contribution à l'étude bactériologique de *B. anitratum* et des germes voisins. Leur position dans la systématique, p. 1-46. Ph.D. thesis, Université de Bordeaux. E. Drouillard, Bordeaux.
23. Breed, R. S. 1948. Genus II *Achromobacter* Bergey et al., p. 417-427. In R. S. Breed, E. G. D. Murray, and A. P. Hitchens (ed.), Bergey's manual of determinative bacteriology, 6th ed. The Williams & Wilkins Co., Baltimore.
24. Breed, R. S. 1953. The families developed from *Bacteriaceae* Cohn with a description of the family *Brevibacteriaceae* Breed 1953. VI Congr. Int. Microbiol. Roma 1:10-15.
25. Breed, R. S. 1957. Genus I. *Alcaligenes* Castellani and Chalmers 1919, p. 297-300. In R. S. Breed, E. G. D. Murray and N. R. Smith (ed.), Bergey's manual of determinative bacteriology, 7th ed. The Williams & Wilkins Co., Baltimore.
26. Breed, R. S. 1957. Genus II. *Achromobacter* Bergey et al. 1923, p. 300-309. In R. S. Breed, E. G. D. Murray, and N. R. Smith (ed.), Bergey's manual of determinative bacteriology, 7th ed. The Williams & Wilkins Co., Baltimore.
27. Breed, R. S. 1957. Genus IV. *Agarobacterium* Angst, 1929, p. 322-328. In R. S. Breed, E. G. D. Murray, and N. R. Smith (ed.), Bergey's manual of determinative bacteriology, 7th ed. The Williams & Wilkins Co., Baltimore.
28. Breed, R. S., and E. F. Lessel. 1954. The classification of luminescent bacteria. Antonie van Leeuwenhoek J. Microbiol. Serol. 20:58-64.
29. Brisou, J. 1953. Essai sur la systématique du genre *Achromobacter*. Ann. Inst. Pasteur (Paris) 84:812-814.
30. Brisou, J. 1954. Étude d'espèces et variétés nouvelles, d'*Achromobacter* isolées du milieu marin. Ann. Inst. Pasteur (Paris) 86:118-120.
31. Brisou, J. 1955. Microbiologie du Milieu Marin, p. 1-271. Flammarion, Paris.
32. Brisou, J. 1957. Contribution de l'étude de la systématique des *Pseudomonadaceae*. Ann. Inst. Pasteur (Paris) 93:397-404.
33. Brisou, J., and R. Morichau-Beauchant. 1952. Identité biochimique entre certaines souches de *B. anitratum* et *Moraxella lwoffii*. Ann. Inst. Pasteur (Paris) 82:640-643.
34. Brisou, J., and A. R. Prévot. 1954. Études de Systématique Bactérienne. X. Révision des espèces réunies dans le genre *Achromobacter*. Ann. Inst. Pasteur (Paris) 86:722-728.
35. Brisou, J., C. Tysset, and B. Vacher. 1959. Étude d'une souche d'*Achromobacter*: *Achromobacter stereotropis* Ann. Inst. Pasteur (Paris) 96:524-529.
36. Brown, F. M. 1927. Descriptions of new bacteria found in insects. Amer. Mus. Novit. 251:1-11.
37. Buchanan, R. E., and B. W. Hammer. 1915. Slimy and ropy milk. Bull. Iowa State Coll. Agr. Mech. Arts 22:209-295.
38. Cabassi, E., P. Adami, and A. Caravita. 1969. Tassonomia numerica Adansoniana di ceppi di *Moraxella* isolati dalla carne e dai suoi prodotti di trasformazione. Arch. Vet. Ital. 20:45-63.
39. Campbell, L. L., Jr. 1957. Genus V. *Beneckea* Campbell, gen. nov., p. 328-332. In R. S. Breed, E. G. D. Murray and N. R. Smith (ed.), Bergey's manual of determinative bacteriology, 7th ed. The Williams & Wilkins Co., Baltimore.
40. Campbell, L. L., and O. B. Williams. 1951. A study of chitin-decomposing microorganisms of marine origin. J. Gen. Microbiol. 5:894-905.
41. Castellani, A., and A. J. Chalmers. 1919. Manual of tropical medicine, 3rd ed. William Wood and Co., New York.
42. Castellani, A., and M. D. Florence. 1930. *Foetor oris* of tonsillar origin and certain bacilli causing it. Lancet 218:623-624.
43. Chester, F. D. 1897. Report of mycologist: bacteriological work. Annu. Rep. Del. Agr. Exp. Sta. 9:38-145.
44. Chester, F. D. 1901. A manual of determinative bacteriology, p. 1-401. The Macmillan Co., New York.
45. Colwell, R. R., E. J. Smith, and G. B. Chapman. 1968. Properties of a D-quinovosamine-producing *Achromobacter*. Can. J. Microbiol. 14:165-171.
46. Conn, H. J. 1922. Description of an ammonia volatilizing organism found in manure. Bull. N.Y. Sta. Agr. Exp. Sta. 494:26-27.
47. Conn, H. J. 1928. A type of bacteria abundant in productive soils, but apparently lacking in certain soils of low productivity. Tech. Bull. N.Y. Sta. Agr. Exp. Sta. 138:3-26.
48. Conn, H. J. 1939. Genus III. *Alcaligenes* Castellani and Chalmers, p. 95-102. In D. H. Bergey, R. S. Breed, E. G. D. Murray and A. P. Hitchens (ed.), Bergey's manual of determinative bacteriology, 5th ed. The Williams & Wilkins Co., Baltimore.
49. Conn, H. J. 1942. Validity of the genus *Alcaligenes*. J. Bacteriol. 44:353-360.
50. Conn, H. J., and I. Dimmick. 1947. Soil bacteria similar in morphology to *Mycobacterium* and *Corynebacterium*. J. Bacteriol. 54:291-303.
51. Conn, H. J., G. E. Wolfe, and M. Ford. 1940. Taxonomic relationships of *Alcaligenes* spp. to certain soil saprophytes and plant parasites. J. Bacteriol. 39:207-226.
52. Cooke, J. V., and H. R. Keith. 1927. A type of urea-splitting bacterium found in the human intestinal tract. J. Bacteriol. 13:315-319.
53. Corbet, A. S. 1930. An organism found in the latex of *Hevea brasiliensis*. J. Bacteriol. 19:321-326.

54. Davis, D. H., M. Doudoroff, R. Y. Stanier, and M. Mandel. 1969. Proposal to reject the genus *Hydrogenomonas*: taxonomic implications. *Int. J. Syst. Bacteriol.* **19**:375-390.
55. de Assis, A. 1930. Sobre *Alcaligenes lenis* e sua verificacao no homem. *Bol. Inst. Vital. Braz.* **14**:1-13.
56. De Ley, J., N. Bain, and J. M. Shewan. 1967. Taxonomy of the *Achromobacter* and allied species. *Nature (London)* **214**:1037-1038.
57. De Ley, J. 1968. DNA base composition and taxonomy of some *Acinetobacter* strains. *Antonie van Leeuwenhoek J. Microbiol. Serol.* **34**:109-114.
58. De Ley, J., K. Kersters, J. Khan-Matsubara, and J. M. Shewan. 1970. Comparative d-gluconate metabolism and DNA base composition in *Achromobacter* and *Alcaligenes*. *Antonie van Leeuwenhoek J. Microbiol. Serol.* **36**:193-207.
59. Derby, H. A., and B. W. Hammer. 1931. Bacteriology of butter. IV. Bacteriological studies of surface taint butter. *Res. Bull. Iowa Agr. Exp. Sta.* **145**:387-416.
60. Edson, H. A., and C. W. Carpenter. 1912. Technical description of certain bacteria in maple sap. (A) Description of *Bacillus aceris* (new species) *Bull. Vt. Agr. Exp. Sta.* **167**:475-606.
61. Eisenberg, J. 1891. Bakteriologische Diagnostik, Hilfstabellen zum Gebrauche beim Praktischen Arbeiten 3 Aufl., p. 1-509. Leopold Voss, Hamburg.
62. Elazari-Volcani, B. 1940. Studies on the microflora of the Dead Sea, p. 1-119. Ph.D. thesis, Hebrew University, Jerusalem.
63. Evans, A. C. 1916. The bacteria of milk freshly drawn from normal udders. *J. Infect. Dis.* **18**:437-476.
64. Evans, A. C. 1918. Further studies on *Bacterium abortus* and related bacteria. III. *Bacterium abortus* and related bacteria in cow's milk. *J. Infect. Dis.* **23**:354-372.
65. Evans, A. C. 1931. A new sub-species, *radicans*, of *Alcaligenes faecalis*. *Publ. Health Rep. Wash.* **46**:1676-1680.
66. Frankland, G. C., and P. F. Frankland. 1889. Ueber einige typische Mikroorganismen in Wasser und im Boden. *Z. Hyg. Infektionskr.* **6**:373-400.
67. Ford, W. W. 1903. The classification and distribution of the intestinal bacteria in man. *Roy. Vic. Hosp. Montreal* **1**(no. 5):1-95.
68. Foster, J. W. 1944. Microbiological aspects of riboflavin. I. Introduction. II. Bacterial oxidation of riboflavin to lumichrome. *J. Bacteriol.* **47**:27-41.
69. Fuller, W. H., and A. G. Norman. 1943. Cellulose decomposition by aerobic mesophilic bacteria from soil. *J. Bacteriol.* **46**:273-280.
70. Gahl, R. 1928. Description of an organism found in solutions of sodium caseinate. *J. Bacteriol.* **16**:35-42.
71. Garmendia, H. E. 1947. Una nueva especie de bacteria luminosa. *Rev. Fac. Cienc. Quim Farm. Univ. Nac. La Plata* **22**:225-229.
72. Goresline, H. 1933. Studies on agar digesting bacteria. *J. Bacteriol.* **26**:435-457.
73. Gray, P. H. H. 1928. The formation of indigotin from indole by soil bacteria. *Proc. Roy. Soc. Ser. B* **102**:263-280.
74. Gray, P. H. H., and H. G. Thornton. 1928. Soil bacteria that decompose certain aromatic compounds. *Zentralbl. Bakteriell. Parasitenk. Infektionskr. Hyg. Abt. 2* **73**:74-96.
75. Groupé, V., L. H. Pugh, A. S. Levin, and E. C. Herrmann. 1954. Suppression of certain viral lesions in demonstrable antiviral properties produced by *Achromobacter xerosis* n. sp. *J. Bacteriol.* **68**:10-18.
76. Harrison, F. C. 1929. The discoloration of halibut. *Can. J. Res.* **1**:214-239.
77. Hauduroy, P., G. Ehringer, A. Urbain, G. Guillot, and J. Magrou. 1937. Dictionnaire des bactéries pathogènes p. 1-597. Masson et Cie, Paris.
78. Haupt, H. 1935. Zur Systematik der Bakterien. Die für Mensch und Tier pathogenen gram negativen alkalibildenden Stäbchen-bakterien (*Aerobactereae* Pribram 1929 em). *Ergebn. Hyg. Bakteriell.* **17**:175-230.
79. Haynes, W. C. 1957. Genus I. *Pseudomonas* Migula 1894, p. 89-152. In R. S. Breed, E. G. D. Murray and N. R. Smith (ed.), *Bergey's manual of determinative bacteriology*, 7th ed. The Williams & Wilkins Co., Baltimore.
80. Hendrie, M. S., W. Hodgkiss, and J. M. Shewan. 1970. The identification, taxonomy and classification of luminous bacteria. *J. Gen. Microbiol.* **64**:151-169.
81. Hendrie, M. S., W. Hodgkiss, and J. M. Shewan. 1971. Proposal that the species *Vibrio anguillarum* Bergman, 1909, *Vibrio piscium* David, 1927 and *Vibrio ichthyodermis* (Wells and ZoBell) Shewan, Hobbs and Hodgkiss, 1960 be combined as a single species, *Vibrio anguillarum*. *Int. J. Syst. Bacteriol.* **21**:64-68.
82. Henriksen, S. D. 1936. Studies on the bacterial flora of the respiratory tract in acute and chronic bronchitis, bronchial asthma and lung gangrene. *Avh. Nor. Vidensk. Akad. Oslo* **2**(no. 11):7-235.
83. Herbert, R. A., M. S. Hendrie, D. M. Gibson, and J. M. Shewan. 1971. Bacteria active in the spoilage of certain sea foods. *J. Appl. Bacteriol.* **34**:41-50.
84. Hock, C. W. 1941. Marine chitin-decomposing bacteria. *J. Mar. Res.* **4**:99-106.
85. Holding, A. J., and J. G. Collee. 1971. Routine biochemical tests, p. 1-32. In J. R. Norris and D. W. Ribbons (ed.), *Methods in microbiology*, vol. 6A. Academic Press Inc., London.
86. Huss, H. 1908. Eine feltspaltende Bakterie (*Bacteridium lipolyticum*) (n.sp.) *Zentralbl. Bakteriell. Parasitenk. Infektionskr. Hyg. Abt. 2* **20**:474-484.
87. Jensen, H. 1898. Beitrage zur Morphologie und Biologie der Denitrifikationsbakterien. *Zentralbl. Bakteriell. Parasitenk. Infektionskr. Hyg. Abt. 2* **4**:401-411.
88. Johnson, F. H., and I. V. Shunk. 1936. An interesting new species of luminous bacteria. *J. Bacteriol.* **31**:585-592.
89. Jordan, E. O. 1890. A report on certain species observed in sewage, p. 821-824. In W. T. Sedgwick (ed.), *A report on the biological work of the Lawrence Experiment Station, including an account of methods employed and results obtained in the microscopical and bacteriological investigation*

- of sewage and water. Report on water supply and sewerage (part II). State Board of Health of Massachusetts. Wright and Potter Printing Co., State Printers, Boston.
90. Katz, O. 1888. Preliminary remarks on phosphorescent bacteria from sea-water. *Proc. Linn. Soc. N.S.W.* 2:331-336.
 91. Kellerman, K. F., I. G. McBeth, F. M. Scales, and N. R. Smith. 1913. Identification and classification of cellulose dissolving bacteria. *Zentralbl. Bakteri. Parasitenk. Infektionskr. Hyg. Abt. 2.* 39:505-522.
 92. Khambata, S. R., and J. V. Bhat. 1953. Studies on a new oxalate-decomposing bacterium, *Pseudomonas oxalaticum*. *J. Bacteriol.* 66:505-507.
 93. Kimata, M., and A. Kawai. 1953. A new species of bacterium which produces large amounts of histamine on fish meats, found in spoiled fresh fish. *Mem. Res. Inst. Food Sci. Kyoto Univ.* 6:1-2.
 94. Kimata, M., A. Kawai, and M. Akamatsu. 1958. Classification and identification of the bacteria having an activity which can produce a large amount of histamine. *Mem. Res. Inst. Food Sci. Kyoto Univ.* 14:33-41.
 95. Kluyver, A. J., and W. J. Hoppenbrouwers. 1931. Ein merkwürdiges Gärungsbakterien: Lindner's *Termobacterium mobile*. *Arch. Mikrobiol.* 2:245-260.
 96. Kluyver, A. J. 1957. Genus VII. *Zymomonas* Kluyver and van Niel, 1936, p. 199-200. In R. S. Breed, E. G. D. Murray, and N. R. Smith (ed.), *Bergey's manual of determinative bacteriology*, 7th ed. The Williams & Wilkins Co., Baltimore.
 97. Kluyver, A. J., and C. B. van Niel. 1936. Prospects for a natural system of classification of bacteria. *Zentralbl. Bakteri. Parasitenk. Infektionskr. Hyg. Abt. 2.* 94:369-403.
 98. Krasil'nikov, N. A. 1949. Guide to the bacteria and actinomycetes, p. 1-830. *Akad. Nauk. SSSR, Moscow* (in Russian).
 99. Kreig, A. 1961. Grundlagen der Insektenpathologie, p. 1-304. Dr. Dietrich Stein-kopff. Verlag, Darmstadt.
 100. Lehmann K. B., and R. O. Neumann. 1896. Atlas und Grundriss der Bakteriologie und Lehrbuch der speciellen bakteriologischen Diagnostik. Teil II, p. 1-448. Verlag von J. F. Lehmann, Munich.
 101. Leifson, E., and R. Hugh. 1954. *Alcaligenes denitrificans* n.sp. *J. Gen. Microbiol.* 11:512-513.
 102. Lemoigne, H., H. Girard, and G. Jacobelli. 1952. Bactérie du sol utilisant facilement le 2-3 butanediol. *Ann. Inst. Pasteur (Paris)* 82:389-398.
 103. Long, H. F., and B. W. Hammer. 1941. Classification of the organisms important in dairy products. III *Pseudomonas putrefaciens*. *Res. Bull. Iowa Agr. Exp. Sta.* 285:176-195.
 104. Lundestad, J. 1928. Über einige ander norwegischen Küste isolierte Agarspaltende Arten von Meerbakterien. *Zentralbl. Bakteri. Parasitenk. Infektionskr. Hyg. Abt. 2.* 75:321-344.
 105. Lustig, A. 1893. Diagnostik der Bakterien des Wassers, Zweite sehr vermehrte Auflage, p. 1-128. Turm Übersetzung, Jena.
 106. Malek, I., and V. Kadzová-Kožíšková. 1946. *Pseudomonas odorans* n.sp. nový mikrob z diagnostického materialu. *Sb. Lék.* 47(52):189-194.
 107. Malek, I., M. Radochova, and O. Lysenko. 1963. Taxonomy of the species *Pseudomonas odorans*. *J. Gen. Microbiol.* 33:349-355.
 108. Mannheim, W., and W. Stenzel. 1962. Zur Systematik der obligat aeroben gramnegativen Diplobakterien des Menschen. *Zentralbl. Bakteri. Parasitenk. Infektionskr. Hyg. Abt. 1 Orig.* 186:55-83.
 109. McBeth, I. G. 1916. Studies on the decomposition of cellulose in soils. *Soil Sci.* 1:437-487.
 110. Mez, C. 1898. Mikroskopische Wasseranalyse, Anleitung zur Untersuchung des Wassers mit besonderer Berücksichtigung von Trink und Abwasser, p. 1-69.
 111. Migula, W. 1900. System der Bakterien, p. 1-1068. Gustav Fischer, Jena.
 112. Monias, B. L. 1928. Classification of *Bacterium alcaligenes*, *pyocyaneum* and *fluorescens*. *J. Infect. Dis.* 43:330-334.
 113. Müller, G. 1961. Mikrobiologische Untersuchungen über die "Futterverpilzung durch Selbsterhitzung." III. Mitteilung Ausführliche Beschreibung neuer Bakterien-Species. *Zentralbl. Bakteri. Parasitenk. Infektionskr. Hyg. Abt. 2.* 114:520-537.
 114. Nikitin, D. I., and L. V. Vasilyeva. 1967. A new soil organism *Agrobacterium polyspheroidum* n.sp. *Izv. Akad. Nauk. SSSR, Ser. Biol.* 3:443-444 (in Russian, English summary).
 115. Omelianski, W. 1903. Über die Zersetzung der Ameisensäure durch Mikroben. *Zentralbl. Bakteri. Parasitenk. Infektionskr. Hyg. Abt. 2.* 11:117-189.
 116. Pacheco, G. 1933. A posição sistematica das bacterias das febres ondulantes. *Rev. Soc. Paul. Med. Vet.* 3:1-14.
 117. Pagliani, Maggiora, and Fratini. 1887. Esame dei terreni colle culture; forme e caratteri dei microorganismi osservati. *G. Soc. Ital. Ig.* IX:584-593.
 118. Patrick, R., and C. H. Werkman. 1933. Bacteria fermenting xylan. *Iowa State Coll. J. Sci.* 7:407-418.
 119. Peshkov, M. A. 1937. The variability, life-cycle and nuclear forms of a saprophytic water microbe—*Achromobacter epsteinii* mihi. *Biol. Zh.* 6:971-1006.
 120. Piéchaud, D., M. Piéchaud, and L. Second. 1951. Étude de 26 souches de *Moraxella lwoffii*. *Ann. Inst. Pasteur (Paris)* 80:97-99.
 121. Pohl, F. 1892. Ueber Kultur und Eigenschaften einiger Sumpfwasser-Bacillen und über die Anwendung alkalischer Nahrgeleatine. *Zentralb. Bakteri. Parasitenk. Infektionskr. Hyg. Abt. 1.* 11:141-145.
 122. Prévot, A. R. 1961. *Traité de Systématique Bactérienne*, p. 1-711, vol. 2. Dunod, Paris.
 123. Poinar, G. O., and G. M. Thomas. 1965. A new bacterium, *Achromobacter nematophilus* sp. nov. (*Achromobacteriaceae: Eubacteriales*) associated with a nematode. *Int. Bull. Bacteriol. Nomencl.*

- Taxon. **15**:249-252.
124. Ravenel, M. P. 1896. Notes on the bacteriological examination of the soil of Philadelphia. Mem. Nat. Acad. Sci. **8**:3-41.
 125. Rubentschik, L. 1925. Über die Lebenstätigkeit der Urobakterien bei einer Temperatur unter 0°. Zentralbl. Bakterirol. Parasitenk. Infektionskr. Hyg. Abt. 2. **64**:166-174.
 126. Rubentschik, L. 1926. Über einige neue Urobakterienarten. Zentralbl. Bakterirol. Parasitenk. Infektionskr. Hyg. Abt. 2. **66**:161-180.
 127. Rubentschik, L. I., and D. G. Goicherman. 1935. On microbiology of mud lakes. I. Investigation of Kuyal'nitskiy liman. Mikrobiologiya **4**:403-420 (in Russian).
 128. Russakova, G. S. and V. S. Butkevich. 1941. Denitrification without making use of nitrates as a source of nitrogen. Mikrobiologiya **10**:137-162 (in Russian).
 129. Russell, H. L. 1892. Untersuchungen über im Golf von Neapel lebende Bakterien. Z. Hyg. Infektionskr. **11**:165-206.
 130. Ruiz-Herrera, J. 1970. *Achromobacter starkeyi* n.sp. a methionine decomposing bacterium isolated from the soil. Antonie van Leeuwenhoek J. Microbiol. Serol. **36**:329-333.
 131. Samuels, S. B., B. Pittman, H. W. Tatum, and W. B. Cherry. 1972. Report on a study set of *Moraxella* and allied bacteria. Int. J. Syst. Bacteriol. **22**:19-38.
 132. Schaub, I., and F. Hauber. 1948. A biochemical and serological study of a group of identical unidentifiable gram-negative bacilli from human sources. J. Bacteriol. **56**:379-390.
 133. Severi, R. 1946. La patogenicità degli Achromobatteri per l'uomo. Prima osservazione sull'azione patogena di questi germi. Epididimite cronica da "Achromobacter spermophilum" n.sp. Boll. Ist. Sieroter. Milan **25**:224-230.
 134. Shieh, H. S. 1964. Aerobic degradation of choline. I. Fermentation of choline by a marine bacterium, *Achromobacter cholinophagum* n.sp. Can. J. Microbiol. **10**:837-842.
 135. Shimwell, J. L. 1937. Study of a new type of beer disease bacterium (*Achromobacter anaerobium* sp. nov.) producing alcoholic fermentation of glucose. J. Inst. Brew. **43**:507-509.
 136. Smart, H. F. 1932. A new bacterial species isolated from strawberries. Proc. 33rd Annu. Meet. Soc. Amer. Bacteriol., Baltimore. J. Bacteriol. **23**:41-42.
 137. Snieszko, S. F. 1957. Genus IV. *Aeromonas* Kluyver and van Niel 1936, p. 189-193. In R. S. Breed, E. G. D. Murray and N. R. Smith (ed.), Bergey's manual of determinative bacteriology, 7th ed., The Williams & Wilkins Co., Baltimore.
 138. Sonnabend, W. 1963. Eine neue Alcaligenes-Art *Alcaligenes giganteus* n.sp. Arch. Hyg. **147**:609-615.
 139. Spalla, C., G. Biffi, and E. Rocca. 1961. Esigenza per vitamin B₁₂ citosina desossiriboside E citosina desossiribotide in *Achromobacter terrestris* n.sp. G. Microbiol. **9**:130-134.
 140. Steinhaus, E. A. 1941. A study of bacteria associated with thirty species of insects. J. Bacteriol. **42**:757-790.
 141. Sreenivasan, A. 1956. New species of marine bacteria tolerating high concentrations of copper. Curr. Sci. **25**:92-93.
 142. Stanier, R. Y. 1941. Studies on marine agar-digesting bacteria. J. Bacteriol. **42**:527-558.
 143. Stanier, R. Y., N. J. Palleroni, and M. Doudoroff. 1966. The aerobic pseudomonads: a taxonomic study. J. Gen. Microbiol. **43**:159-271.
 144. Stenzel, W., and W. Mannheim. 1963. On the classification and nomenclature of some non motile and coccoid diplobacteria exhibiting the properties of *Achromobacteriaceae*. Int. Bull. Bacteriol. Nomencl. Taxon. **13**:195-200.
 145. Stutzer, M. J., and W. J. Wsorrow. 1927. Über Infektionen der Raupen der Wintersautenle (*Euxoa segetum* Schiff). Zentralbl. Bakterirol. Parasitenk. Infektionskr. Hyg. Abt. 2. **71**:113-129.
 146. Szybalski, W. 1950. A comparative study of bacteria causing mustiness in eggs. Nature (London) **165**:733-734.
 147. Takeda, S. 1936. On the relation between the salmon hatching and the bacterial content of the feeding water. Zentralbl. Bakterirol. Parasitenk. Infektionskr. Hyg. Abt. 2. **94**:33-64.
 148. Thornley, M. J. 1967. A taxonomic study of *Acinetobacter* and related genera. J. Gen. Microbiol. **49**:211-257.
 149. Tulecke, W., S. W. Orenski, R. Taggart, and L. Colavito. 1965. Isolation of an organism resembling *Achromobacter liquefaciens*. J. Bacteriol. **89**:905-909.
 150. Turner, A. W. 1927. *Achromobacter perolens* (n.sp.) the cause of mustiness in eggs. Aust. J. Exp. Biol. Med. Sci. **4**:57-60.
 151. Turner, A. W. 1954. Bacterial oxidation of arsenite. I. Description of bacteria isolated from arsenical cattle-dipping fluids. Aust. J. Biol. Sci. **7**:452-478.
 152. Vaughan, V. C. 1892. A bacteriological study of drinking water. Amer. J. Med. Sci. **104**:167-198.
 153. von Lingelsheim, W. 1906. Die bakteriologischen Arbeiten der Kgl. Hygienischen Station zu Beuthen O. Schl. während der Genickstarrepidemie in Oberschlesien in Winter 1904/05. Klin. Jb. **15**:373-488.
 154. Weinzirl, J. 1919. The bacteriology of canned foods. J. Med. Res. **39**:349-413.
 155. Weldin, J. C. 1927. The colon-typhoid group of bacteria and related forms. Relationships and classification. Iowa State Coll. J. Sci. **1**:121-197.
 156. Wells, N. A., and C. E. ZoBell. 1934. *Achromobacter ichthyodermis*, n.sp. the etiological agent of an infectious dermatitis of certain marine fishes. Proc. Nat. Acad. Sci. U.S.A. **20**:123-126.
 157. White, G. F. 1921. The cause of European foul brood. U.S. Dep. Agr. Bur. Entomol. **157**:1-15.
 158. Wiidik, R. W. 1950. Weissfäule von Hühnereiern-bedingt durch eine Achromobakterart—*Achromobacter ammoniagenes* (n.sp.) Nord. Vet. Med. **2**:789-803.
 159. Wright, J. H. 1895. Report on the results of an examination of the water supply of Philadelphia.

- Mem. Nat. Acad. Sci. 7:422-484.
160. Zimmermann, O. E. R. 1890. Die Bakterien unserer Trink- und Nutzwässer, insbesondere des Wassers der Chemnitzer Wasserleitung. I. Reihe. In *Elfter Berichte naturwiss. Ges. Chemnitz* 54-154.
161. ZoBell, C. E. 1943. The effect of solid surfaces upon bacterial activity. *J. Bacteriol.* 46:39-56.
162. ZoBell, C. E., and E. C. Allen. 1935. The significance of marine bacteria in the fouling of submerged surfaces. *J. Bacteriol.* 29:239-251.
163. ZoBell, C. E., and H. C. Upham. 1944. A list of marine bacteria including descriptions of sixty new species. *Bull. Scripps. Inst. Oceanogr.* 5:239-292.