International Committee on Nomenclature of Bacteria

Subcommittee on Taxonomy of Staphylococci and Micrococci

Minutes of Meeting, 2 and 3 April 1968

London, England

The Third Meeting of the Subcommittee was held on April 2 and 3, 1968 at the Imperial College of Science, London, England. Members attending were: A. C. Baird-Parker (Secretary), T. Gibson, L. Grün, L. R. Hill, M. Kocur, Per Oeding, and A. Torres Pereira. At the last minute, J. B. Evans (Chairman) was unable to attend, so Baird-Parker acted as Chairman and Hill as Secretary.

Invited persons taking part in the meeting included S. Cowan, L. Jeffries, and E. Todd.

The first day of the meeting was devoted to a discussion of the species and genera of gram-positive and catalase-positive cocci to be included in the 8th edition of *Bergey's Manual*. The second day was spent discussing papers presented by Subcommittee members and their invited guests. Papers presented have been published. The following are the main points arising from the discussions of proposals for the 8th edition of *Bergey's Manual*.

Genera. The majority of the Subcommittee favored the acceptance of four genera of gram-positive, catalase-positive and cluster-forming cocci. These were *Staphylococcus* Rosenbach, *Micrococcus* Cohn, *Planococcus* Migula, and *Aerococcus* Williams, Hirsch, and Cowan. The proposal of Evans that organisms currently placed in the genera *Aerococcus* and *Gaffkya* should be placed in a single genus (*Aerococcus*) was accepted on the basis of his studies (4). Gibson was not in favor of separating the genus *Staphylococcus* from the genus *Micrococcus* on the basis of the currently available information. Kocur proposed further division of the genus *Micrococcus*.

A lengthy discussion was held on the best method(s) of distinguishing staphylococci from micrococci. Anomalies between the presently accepted separation of staphylococci from micrococci on the results of the previously reported standard O/F test (11) and the use of other methods of determining the anaerobic production of acid from glucose (7) were presented by Kocur. The majority of the Subcommittee

considered, however, that the proposed method was still the most reliable and reproducible method of distinguishing these two genera. A further anomaly that was discussed was that, although certain gram-positive and catalase-positive cocci would be classified as micrococci on the basis of the O/F test, these organisms contain DNA with a guanine and cytosine content which is indistinguishable from that of staphylococci, i.e., 30 to 37% GC (guanine + cytosine) and quite different from the 65 to 75% GC content of DNA of most glucose-oxidizing micrococci; these organisms are mainly the acetoin-producing micrococci belonging to Baird-Parker's *Micrococcus* subgroups 1-4 (2). The proposal by A. C. Baird-Parker that these organisms should be placed in a subgenus of the genus *Staphylococcus* was not accepted. In the absence of a suitable routine test for determining the %GC in DNA it was decided to accept at present the results of the standard O/F test and to include organisms with widely different GC contents in the genus *Micrococcus*. Kocur drew our attention to his work dealing with the correlation of GC content with nucleoside phosphotransferase (8) and reported some preliminary work on the correlation between GC content and the breakdown of arginine (10) and the decarboxylation of glutamic acid. The Subcommittee considered that as these tests had only been done with a limited number of organisms further work was required to evaluate them. Jeffries (6) described his work on the lysozyme and novobiocin sensitivity of micrococci and staphylococci from a variety of sources and obtained results which correlate fairly well with the O/F test.

It was concluded that the genus *Micrococcus* as currently defined on the basis of the standard O/F test is probably genetically heterogeneous and this position should be emphasized in the preparation of data for inclusion in the 8th edition of *Bergey's Manual*.

The suggestion by Kocur (3) that motile micrococci of marine origin that produce a

characteristic yellowish-orange pigment and contain 39.6 to 57.2% GC in their DNA should be placed in the genus *Planococcus* Migula was accepted by the Subcommittee.

Species. Two species of staphylococci were accepted. These were *Staphylococcus aureus* Rosenbach (neotype strain NCTC 8532 (ATCC 12600)) and *Staphylococcus epidermidis* (Winslow and Winslow 1908) Evans 1916. The neotype strain of *S. epidermidis* (ATCC 14990) recently proposed by Hugh and Ellis (5) was accepted by the Subcommittee. Subdivision of these two species was discussed. Grün and Oeding were in favor of separating human and bovine strains of *S. aureus* on the basis of differences in hemolysin patterns and their differing abilities to coagulate plasma from different animal species (9), but Torres Pereira thought that antigenic differences may not be stable and could be subject to variations in technique. It was generally agreed, however, that while subspecies or forms of *S. aureus* should not be currently recognized, mention should be made of the above differences and also of the general correlation between phage susceptibility and serological grouping. It was agreed to recognize biotypes of *S. epidermidis* and four of the five biotypes (subgroups) previously proposed by Baird-Parker were accepted; these were biotypes 1, 2, 3, and 5 (2).

The recognition of species in the genus *Micrococcus* caused considerable difficulty, and the final conclusion of the Subcommittee was to accept five species. These were: *M. lactis* Shaw, Stitt and Cowan 1951 with type strain NCTC 7564 (ATCC 15306); *M. luteus* (Schroeter 1872) Cohn 1872 with neotype strain ATCC 398; *M. morrhuae* Klebahn 1919 (CCM 537); *M. roseus* Flugge 1866 with neotype strain ATCC 418 (NCTC 7520); and *M. saprophyticus* Fairbrother emend. Shaw, Stitt, and Cowan 1951 with type strain ATCC 15305 (NCTC 7292).

M. lactis was decided to be the most appropriate name for the glucose-oxidizing, acetone-negative micrococci corresponding to Baird-Parker's *Micrococcus* subgroups 5 and 6 (2), as the type strain of Shaw, Stitt, and Cowan's species *S. lactis* corresponds in all respects to the characters of this group of organisms.

M. luteus is a broad-based species which is recognized almost solely on a negative character, namely, the absence of detectable acid from glucose when grown in the medium used for the standard O/F test. Considerable discussion was held on this species, as the presently accepted neotype strain differs in GC

content from most of the yellow-pigmented *M. luteus* strains (12). On the basis of studies by Jeffries (6) and Rosypal and his coworkers (12), it is possible to recognize a number of forms within those members of this species that produce yellow pigments. Some nonpigmented variants of *M. luteus* can be fitted into forms within this species, but other nonpigmented micrococci that are unable to form the detectable acid from glucose in the standard O/F test possess different characters (6), and the recognition of forms within this rather ill-defined species is confusing.

M. morrhuae contains red-pigmented marine micrococci which are halophiles and which contain 57 to 62% GC in their DNA. The taxonomic position of this species is uncertain. Kocur supports the recommendation of Venkataraman and Sreenivasan (14) that it should be placed in the genus *Halococcus* Schoop, but this was not accepted by the majority of the Subcommittee.

M. roseus was accepted as a suitable name for the non-halophilic, red-pigmented micrococci. This species is separated from *M. luteus*, which it resembles in a number of respects, by its pigment, reduction of nitrate, and inability to liquefy gelatin.

M. saprophyticus contains the controversial acetoin positive and glucose-oxidizing micrococci that belong to Baird-Parker's *Micrococcus* subgroups 1-4 (2). The type strain of *S. saprophyticus* Fairbrother emend. Shaw, Stitt, and Cowan is a typical member of this group of organisms.

A. C. Baird-Parker
Secretary

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