COMMENTS ON THE SPECIES STAPHYLOCOCCUS
EPIDERMIDIS (WINSLOW AND WINSLOW) EVANS AND
STAPHYLOCOCCUS SAPROPHYTICUS FAIRBROTHER¹

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ABSTRACT. The nomenclature and characterization of Staphylococcus epidermidis (Winslow and Winslow 1908) Evans, 1916 and Staphylococcus saprophyticus Fairbrother, 1940 are reviewed. It is apparent that these names have been applied to one and the same species and are therefore subjective synonyms. On the basis of priority, Staphylococcus epidermidis is the correct name of this species.

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According to Evans in Breed et al. (1957) as presented in Bergey's Manual of Determinative Bacteriology (7th ed.), the genus Staphylococcus, in contrast with Micrococcus, is comprised of those organisms that are capable of growing anaerobically in a complex medium containing glucose (Evans, Bradford and Niven, 1955). The genus is currently divided into two species: Staphylococcus aureus and Staphylococcus epidermidis. The distinctive characteristics of the species S. epidermidis are: catalase-positive, gram-positive, coagulase-negative cocci, fermenting glucose but not mannitol anaerobically. From the more extensive description of this species in Bergey's Manual, as well as by Jones, Deibel and Niven (1963), the name Staphylococcus epidermidis would appear to be synonymous with Staphylococcus saprophyticus as described by Fairbrother (1940) and Shaw, Stitt and Cowan

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(1951). (S. epidermidis ATCC 155 fell into the species S. saprophyticus as defined by Shaw et al.). The suspicion that these two specific epithets do, in fact, apply to the same species is strengthened by the work of Hill (1959). Hill, using some of the strains of Shaw et al., reported that S. saprophyticus was capable of fermenting glucose anaerobically. If, in fact, these species are identical (or nearly so), the question arises as to which epithet deserves acceptance.

Welch (1891) proposed the name Staphylococcus epidermidis albus for a white Staphylococcus which, in his experience, was frequently isolated from small stitch wounds. It was also sometimes present in more serious suppurative lesions, but then was almost always associated with some other pyogenic organism. Welch states: "This organism has been often seen by Bossowski and others in the same class of wounds, and has been hitherto identified as the Staphylococcus pyogenes albus (sic) of Rosenbach, - ". Welch hesitated to so designate his organism because, in his opinion, while Staphylococcus pyogenes albus differed from Staphylococcus pyogenes aureus only in having no yellow pigment, the organism he proposed to call S. epidermidis albus differed from S. pyogenes albus: "in much greater slowness of liquefaction of gelatin and of coagulation of milk, and in far less virulence when inoculated into the circulation of rabbits".

Chester (1901) used the epithet epidermidis in the species name Micrococcus epidermidis. The description given was meager: gonococcoid form, growth in the depth and on surface of gelatin slant, production of yellow pigment, and isolation from the skin in cases of eczema.

Gordon (1905) associated a coccus with Staphylococcus epidermidis albus of Welch which he found to be abundant on the hand, cheek, scalp and forearm. Gordon's description (from Winslow and Winslow (1908)) is as follows: "A parasitic coccus, living normally on the surfaces of the human or animal body. Occurs singly, or in pairs, or irregular groups. Generally stains by Gram. Good to abundant, white surface growth. Moderate acid production in lactose, maltose, and glycerin media. Nitrates and neutral red reduced. Gelatin liquefied, somewhat slowly. Mannite not fermented."

Winslow and Winslow (1908) found this organism three times; in each case isolated from the air. They state, "It is apparently the form named by Dyar (1895) M. dissimilis.

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It might well bear this name, as Dyar's description is the first which specifically includes the property of nitrate reduction. Gordon prefers, however, to identify his type with the Staphylococcus epidermidis albus of Welch. Since Gordon's is the earliest type founded on a comparative study, the name which he adopts from Welch may be accepted as the first to be adequately characterized. It must be modified, however, by the elimination of the *stet* form, in accordance with the rules of nomenclature. We propose, therefore, the name Albococcus epidermidis (Gordon) for this type, characterizing it according to Gordon's description".

In an attempt to classify the micrococci of freshly drawn milk, Evans (1916) employed for differential purposes pigment formation, hemolysis, gelatin liquefaction, nitrate reduction, decomposition of asparagine and urea, and acid production from dextrose, lactose, maltose, raffinose, mannitol and glycerin. She was of the opinion that the only tests which correlated and which were of any real value were hemolysis, pigment formation and mannitol fermentation. However, for reasons which are not at all clear in the paper, this author chose to disregard the earlier classifications by which the non-mannitol fermenting organisms would have been designated S. epidermidis (albus) and made the following statement: "If earlier classifications of the staphylococci are accepted, the negatively reacting variety from the udder would be termed Staph. epidermidis (albus). According to Andrewes and Gordon, Staph. epidermidis (albus) is differentiated from Staph. albus by its failure to ferment mannite. The Winslows accepted this classification but designated the type which fails to ferment mannite by the name Albococcus epidermidis. According to these same authorities, Staph. albus, or Albococcus pyogenes as the Winslows call it, is a white non-virulent variety which ferments mannitol.

"After a careful consideration of all the data in regard to the staphylococci from the udder, it seemed most reasonable not to follow the generally accepted classification in which failure to ferment mannite would place a culture in the Staph. epidermidis species, but to designate the negatively reacting variety as Staph. albus".

Hucker (1924) considered Micrococcus epidermidis Chester, 1901 to be synonymous with Micrococcus citreus Migula 1900. Chester's organism did produce a yellow pig-

ment, and the remainder of the description was so poor that this decision was probably justified. However, Hucker also chose to regard Staphylococcus epidermidis albus Welch 1891 as synonymous with Micrococcus albus Rosenbach, 1884, although in the original description of this species Welch (1891) specifically stated that, in his opinion, they were quite different species. Hucker also chose to ignore the species described by Gordon (1905) as Staphylococcus epidermidis albus Welch. Gordon had closely defined this species and the study was also a comparative one. Winslow and Winslow (1908) accepted Gordon's description and the adoption by him of the epithet epidermidis from Welch, although these authors chose the full species name, Albococcus epidermidis. This latter species is also ignored by Hucker.

In the same publication, Hucker proposed Micrococcus epidermidis (Kligler, 1913) as a comb. nov. The characteristics of this species, as given by Hucker, are: saprophytic, forms large irregular clumps, reduces nitrates, does not liquefy gelatin, produces luxuriant white growth on agar slant, generally ferments lactose, dextrose, glycerin and mannite; variable in utilization of ammonium salt as the only source of nitrogen; gram variable, and generally does not curdle milk. The epithet epidermidis as used by Hucker (1924), based on Kligler (1913), described a species which generally ferments mannitol, although previous workers, Gordon (1905), Andrewes and Gordon (1907) and Winslow and Winslow (1908), had used this epithet to describe non-mannitol fermenters.

Cowan (1938) also used the species name Staphylococcus epidermidis to include non-haemolysin producing, non-mannitol fermenting, gelatin liquefying and non-liquefying strains of staphylococci.

In a paper on the use of coagulase production as a criterion in the classification of the staphylococci, Fairbrother (1940) attempted to correlate coagulase production with pigment production, hemolysis on blood agar plates, mannitol fermentation and serological characteristics. In the discussion of his results he stated: "Coagulase-positive strains are pathogenic, usually ferment mannitol, may produce aureus or albus pigment, form soluble haemolysin, and should be designated Staphylococcus pyogenes. Coagulase negative strains are non-pathogenic, usually non-mannitol fermenters, tend to form albus and citreus pigments, do not

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produce soluble haemolysins, and should be designated Staphylococcus saprophyticus". This is the first time that the epithet saprophyticus was used. Fairbrother does not state his reasons for using this new epithet rather than adhering to the older epithet of epidermidis to describe non-mannitol fermenting, non-pathogenic staphylococci.

Shaw, Stitt, and Cowan (1951) suggested that Staphylococcus saprophyticus was a suitable name for their subgroup 2, which they describe as follows:

"species (ii), Staphylococcus saprophyticus, Fairbrother, emend.

"Essential characters of the genus. Coagulase test negative. Acid and acetoin produced from glucose.

"Usual characters. Colonies usually not pigmented. Usually reduce nitrates and methylene blue, hydrolyse urea, liquefy gelatin and acidify milk.

"Type strain. S41 (NCTC 7292)"

The reason these authors give for the choice of this species name is: "Fairbrother (1940) used the name Staphylococcus saprophyticus for coagulase-negative strains of human and animal origin and, although he said they were usually non-fermenters of mannitol, we suggest that this is a suitable name for our subgroup 2. It has the advantage that it avoids a name descriptive of a pigment." However, 75 of the S. saprophyticus strains of these authors produced acid from mannitol in tube culture.

Hill (1959), in an attempt to classify the Staphylococcus-Micrococcus group by the Adansonian classification method of Sneath (1957 a), used the criterion of anaerobic fermentation of glucose as well as the tests previously employed by Shaw et al. (1951). Hill retained the name Staphylococcus saprophyticus, but made the following statement: "The correct name for group (b), called here S. saprophyticus, is in doubt, for the group corresponds to S. epidermidis (Winslow and Winslow) Evans in Bergey's Manual (1957)".

On the basis of the evidence presented, we therefore propose that the species name Staphylococcus epidermidis (Winslow and Winslow) Evans be reserved for those staphylococci which exhibit the following characters:

- 1) ability to grow anaerobically in a standardized complex medium containing glucose.
- 2) inability to produce coagulase.
- 3) do not ferment mannitol.

- 4) usually have an anaerobic requirement for uracil.
- 5) reduce nitrate but not beyond nitrite.
- 6) require biotin for growth.

Additional supportive characteristics which define this species have been published by Jones, Deibel and Niven (1963).

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