NOTES

Some Atypical Features of *Streptococcus sanguis* ATCC 10557

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Streptococcus sanguis American Type Culture Collection (ATCC) strain 10557 showed atypical reactions in dextran formation, streptocin activity, and response to mitomycin C when compared with other *S. sanguis* strains. Therefore, ATCC 10557 must be considered an aberrant member of *S. sanguis*; alternatively, this strain should not be assigned to this species.

In 1946, White and Niven (12) isolated a group of α -hemolytic streptococci from the blood of endocarditis patients. These isolates, originally called *Streptococcus s.b.e.*, were regarded as belonging to a new species, which White (12) named *Streptococcus sanguis*. The ability of a microorganism to cause endocarditis does not, however, mean that the microbe is a member of the species *S. sanguis*, since other organisms can cause this disease. Important physiological characteristics of this species included α hemolysis on blood agar, dextran production from 5% sucrose broth, ammonia production from arginine, fermentation of inulin, and failure to ferment mannitol, sorbitol, or raffinose. However, White and Niven (12) observed certain strains showing atypical reactions in several of these characteristics.

Interest in *S. sanguis* has continued, due to its implication in endocarditis and to its predominance in human dental plaque (3), and the number of isolates of this organism has increased substantially. With this increase, the diversity within *S. sanguis* became more apparent. For example, certain strains can grow on chemically defined media whereas others cannot (4). *S. sanguis* ATCC 10557 (9) is related serologically to *S. salivarius* HHT (11) and resembles it on mitis-salivarius agar (I. L. Shklair, personal communication). In recent work, we have observed that American Type Culture Collection (ATCC) strain 10557 differs from ATCC 10556, 10558, and other strains of *S. sanguis* in three additional properties.

The bacterial strains studied included *S.*

sanguis ATCC 10556, 10557, 10558, *S. sanguis* F90A, *S. sanguis* enole, *S. sanguis* challis, and other strains of *S. sanguis* as well as *S. mutans* K1R and *S. mutans* GS5. These strains were obtained from the Dental Sciences Department, Naval Medical Research Institute, Bethesda, Md., and from the Center for Disease Control, Atlanta, Ga.

The media used included brain heart infusion broth supplemented with 2% yeast extract (BHIYE), BHIYE plus 1.5% agar, sucrose broth (5), and P broth (8). Difco products were used.

Biochemical activity. Three characteristics of *S. sanguis* which distinguish it from *S. mutans* are: gelling of 5% sucrose broth and the inability to ferment mannitol or sorbitol (J. D. DeStoppelaar, Ph.D. thesis, Rijksuniversiteit, Utrecht, 1971). ATCC 10557 behaves like neither *S. sanguis* nor *S. mutans* (Table 1).

Antimicrobial inhibition. One interesting characteristic of *S. sanguis* is its ability to inhibit, at least in vitro, the growth of a wide spectrum of streptococci (6). While developing a strain-typing system for *S. sanguis* based on inhibition (E. Crooks, R. Kolstad, and J. Cole, J. Dent. Res., Abstr. 281, 1973), we observed that ATCC 10557 does not share this antimicrobial activity (Table 2).

Insensitivity to mitomycin C. The in vitro inhibition of gram-positive bacteria by *S. sanguis* has been linked to streptocins (2, 7). Because bacteriocin induction leads to the death of the activated cell (10), we examined the ability of mitomycin C, an effective inducing agent of some bacteriocins (1), to kill cultures of ATCC 10557. This strain, when

TABLE 1. *Differential characteristics of Streptococcus sanguis and S. mutans*^a

Strain	Gelling of 5% sucrose	Mannitol fermentation	Sorbitol fermentation
<i>Streptococcus sanguis</i> ATCC 10556	++++	—	—
<i>Streptococcus sanguis</i> ATCC 10557	—	—	—
<i>Streptococcus sanguis</i> ATCC 10558	+++	—	—
<i>Streptococcus sanguis</i> F90A	++++	—	—
<i>Streptococcus mutans</i> K1R	—	+	+
<i>Streptococcus mutans</i> GS5	—	+	+

^a Methodology according to J. D. DeStoppelaar, Ph.D. thesis, Rijksuniversiteit, Utrecht, 1971.

TABLE 2. *Streptocin production by various strains of Streptococcus sanguis*.^a

Sensitive indicators	Streptocin-producing strains ^b									
	ATCC 10556	ATCC 10557	ATCCS 10558	Challis	F90A	Enole	410	174P	167	Wicky
<i>Streptococcus salivarius</i> 1	+	—	+	+	+	+	+	+	+	+
<i>Streptococcus salivarius</i> 3	+	—	+	+	+	+	+	+	+	+
<i>Streptococcus bovis</i> ATCC 9809	+	—	+	+	+	+	+	+	+	+
<i>Streptococcus mutans</i> GS5	+	—	+	+	—	+	+	+	+	+
<i>Streptococcus mutans</i> SL1	+	—	+	+	+	+	+	+	+	+
<i>Streptococcus mutans</i> BHT ²	+	—	+	+	+	+	+	+	+	+
<i>Streptococcus mutans</i> C4	+	—	+	+	+	+	+	+	+	+

^a Methodology of reference 6.

^b Symbols: +, clear ring around producer spot; —, no ring around producer spot.

TABLE 3. *Effect of mitomycin C on strains of Streptococcus sanguis*^a

Strain	— Mitomycin C	+ Mitomycin C
ATCC 10556	65 ^b	35
ATCC 10557	123	101
ATCC 10558	56	20
174P	105	48
Challis	118	52
167	111	26

^a Methodology according to reference 8.

^b Klett values, green filter, 2 h after treatment; zero-time Klett readings were 23 to 25.

this strain should not be assigned to this species.

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exposed to 0.1 μ g of mitomycin C in P broth (10) for 2 h, is relatively insensitive to the drug, whereas five representative strains of *S. sanguis* are sensitive (Table 3).

In conclusion, ATCC 10557, originally assigned to the species *S. sanguis* by White and Niven (12) because it was isolated from the blood of an endocarditis patient, differs in several properties from representative members of the species. ATCC 10557 must be considered an aberrant member of *S. sanguis*; alternatively,

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