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Observations on the Antigenicity of Viridans Streptococci Isolated from the Air.*

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In a previous report[1] it was noted that viridans streptococci were found widely distributed in the air of enclosed occupied places as well as in the open air. Many of these organisms seemed to be identical in morphology and biochemical characteristics with those recovered from the human nasopharynx and were therefore designated "typical." A group of "atypical" streptococci also were recovered from the air, which differed in some aspects of their morphology and biochemical characteristics from the viridans streptococci usually isolated from human throats. The principal differences noted were that the atypical organisms usually appeared as diplococci, tetrads, irregular groups, or very short chains; also these streptococci formed more opaque colonies, tended to grow with more uniform turbidity in broth culture, and when grown in 0.5% dextrose broth produced less acid.

We have described a serological classification of the viridans streptococci of human origin.[2] The present study is concerned with the serological grouping of viridans streptococci isolated from the air in order to compare the distribution of serologically identifiable groups of air streptococci with that already determined for organisms isolated directly from human sources.

Methods and Procedures. Exposure Locations: Samples from street air were obtained by exposing sheep's blood agar plates for one hour on the steps outside of a building on a busy street.

Samples from an occupied classroom of the amphitheatre type were obtained by exposing plates on several levels throughout the room. Although the plates were exposed for periods ranging from one to 3 hours before, during and after occupancy, the total bacterial counts were low. By exposing the plates in the pit of the amphitheatre and setting in motion 2 rotating electric fans 2 or 3 feet to one side and above the plates, a satisfactory seeding of the plates was obtained. The total bacterial counts per plate increased as did the number of viridans streptococci.

Treatment of Cultures. All the plates were incubated 48 hours at 37° C and total counts as well as counts of suspected viridans streptococci were made. Single colonies of these latter were picked off into nutrient broth containing one drop of sheep's blood. After incubation for 18-24 hours at 37° C, they were examined for purity and tested biologically for classification as "typical" or "atypical." The strains then were tested by means of the precipitin reaction with antiserums for 4 serological groups, I, II, III, and IV, previously prepared by immunizing rabbits with strains of viridans streptococci isolated from bacterial endocarditis. The technic for this as well as for the preparation of the antigen extract and the precipitin test have been reported previously.[2]

Results. Fifty strains of "typical" viridans streptococci were obtained, 47 of which were found on the plates exposed in the occupied classroom. Twenty-eight or 56% gave positive reactions with antiserums of either groups I, II, III, or IV; 10 reacting with group I, 7 with group II, 5 with group III, and 6 with group IV antiserums. In earlier studies,[2,3] it was reported that a little more than 50% of the strains from bacterial endocarditis, human throats and extracted teeth, and acute respiratory infections were classi-

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1 Buchbinder, L., Solowey, M., and Solotorovsky, M., *Am. J. Pub. Health*, 1938, **28**, 61.

2 Solowey, M., *J. Exp. Med.*, 1942, **76**, 109.

3 Solowey, M., *Am. J. Hyg.*, 1944, **39**, 295.

fiable into the same 4 groups.

Thirty-nine "atypical" strains of viridans streptococci were examined, 30 of which came from plates exposed to the street air, and 9 from plates exposed to the classroom. Six or 15% gave reactions with one of the 4 groups, 3 falling into group I, none into group II, I into group III, and 2 into group IV. One of the 6 reacting strains was recovered from the classroom air, the remaining 5 from the street air.

Discussion. More than half of the "typical" viridans streptococci isolated from the air were classifiable antigenically by the use of antiserums obtained by immunizing rabbits with strains of streptococci from bacterial endocarditis. Immunologically therefore they resemble the viridans streptococci obtained from human sources, 50% of which are classifiable antigenically with the same group antiserums. The "atypical" streptococci obtained from the air less frequently show antigenic relationship with the human strains.

It has been suggested that the presence of viridans streptococci in the air may be used as an index of human contamination in the same manner as the presence of *E. coli* is used as an index of fecal contamination. A method has been offered by which it is possible to identify many viridans streptococci serologically. The procedure may possibly be applied in epidemiological studies in the identification of viridans streptococci of human origin.

Summary. Twenty-six of 50 "typical" streptococci isolated from the air resemble immunologically the viridans streptococci obtained from human sources, whereas only 6 of 39 "atypical" streptococci from the air exhibit a similar relationship.

The epidemiological application of the data is discussed.

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Complement Fixation Antigen in *Entamoeba histolytica* Infection.

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Although infection with *Entamoeba histolytica* produces specific antibodies, the serological diagnosis is scarcely employed in this disease because of the ease with which ameba are demonstrated microscopically, thus rendering a serological diagnosis superfluous. However, the main obstacle to an extended use of a serological reaction has been the extreme difficulty of preparing a useful antigen.[1]

Izar[2] demonstrated specific antibodies in *E. histolytica* infection and obtained positive complement-fixation reactions during the disease as well as in those whom he considered to be healthy carriers. As antigen he employed an aqueous extract of ameba-containing feces and the contents of a liver abscess. Craig[3] however first put the serological diagnosis in amebic infections upon a rational basis. He made use of an alcoholic extract of ameba-cultures as antigen. But this extract was quite weak and had to be used undiluted. Craig found that the serological reaction was quite often positive in *E. histolytica* infection and exhibited a high degree of specificity. But the serological diagnosis often failed in cases where it would be most useful, namely in ulcerative colitis. The findings by Craig have since been confirmed by many, including Tsuchyia[4] and Weiss and

1 Manson-Bahr, P., *The Dysenteric Disorders*, Cassell & Co., London, 1939.

2 Izar, G., *Arch. Schiffs. u. Tropenhyg.*, 1914, **18**, Beiheft II.

3 Craig, C. F., *Amebiasis and Amebic Dysentery*, Chas. F. Thomas, Balto., 1934.