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A Note on the *Beta* Hemolytic Streptococci of Air.*

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In a routine study of the air of such places as schools, theaters, the subway and streets in New York City *alpha* hemolytic streptococci were regularly found. Many strains were isolated which presumably originated in the human nasopharynx.[1] In contrast the occurrence of *beta* hemolytic streptococci was relatively infrequent. However 52 strains were isolated, all but 5 from indoor locations.† The properties of these strains were compared with those of known human pathogenic strains. The following tests were applied (1) Antigenic grouping (Lancefield[2]). (2) Lysis of human fibrin (Tillet and Garner[3]). (3) Hemolysis in poured sheep and rabbit blood-agar plates. (4) Final pH in 1% dextrose broth after incubation for 7 days. (5) Fermentation of trehalose, sorbitol, lactose, salicin, and mannite. (6) Hydrolysis of sodium hippurate. (7) Reduction of methylene-blue milk.

Forty-six of the 52 strains belonged to Lancefield's group A; 4 of these which were isolated from street air were indistinguishable from those obtained from indoor air. One strain belonged to group B, 3 to group C, 1 each to groups D and G. None of the strains reacted with group F or H serums.

The group A strains isolated from air were compared, for lysis of human fibrin, hemolysis of sheep and rabbit blood and final pH produced after 7 days' growth in dextrose broth, with 44 strains of group A streptococci isolated from human sources.‡ Both groups of strains were isolated during the same time period. It was found that 37 of 45 air strains lysed human fibrin within one hour, 28 of these within 20 minutes; while 3 produced complete lysis overnight,

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

† The cultures were collected by the Air Pollution Survey sponsored by the Department of Health of New York City.

2 Lancefield, R. C., *J. Exp. Med.*, 1933, **57**, 571.

3 Tillet, W. S., and Garner, R. L., *J. Exp. Med.*, 1933, **58**, 485.

‡ We are indebted to Dr. John Lytle, Dr. David Seegal, and Miss Elizabeth Jost for these cultures.

1 lysed fibrin only partially and 4 failed to lyse in 2 tests. Of 44 strains from human sources 35 lysed fibrin completely in 20 minutes, 8 in 80 minutes and one overnight. Thus it seems that on the whole the fibrinolytic function was slightly if at all affected by aërial environment. The hemolysis of sheep and rabbits' blood in agar plates by the air and human strains was practically indistinguishable. The range of final pH in dextrose broth was also the same in both groups, that is 4.6 to 5.2.

All the group A air strains fermented trehalose, but failed to ferment sorbitol, or to reduce methylene-blue milk or to hydrolyze sodium hippurate. These are the accepted reactions of group A strains from human sources. All but 9 strains fermented lactose, all but 5 fermented salicin, while only 5 strains fermented mannite.

The 3 group C strains apparently were of the so-called "human" type since they all fermented trehalose but not sorbitol, and lysed human fibrin.[4] The one group B strain hydrolyzed sodium hippurate, fermented trehalose but not sorbitol, and failed to lyse human fibrin. The group D strain was apparently one of the fecal streptococci. It fermented trehalose, salicin, lactose, and mannite, reduced methylene-blue milk, produced a final pH of 4.3 in glucose broth, and failed to hydrolyze sodium hippurate, to lyse human fibrin or to ferment sorbitol. The group G strain fermented lactose and failed to attack any of the other substances tested.

Discussion and Summary. Although it has been shown recently that the air of hospital wards contains *beta* hemolytic streptococci of the same serological types as those infecting patients in the same wards[5,6] it should be emphasized that the strains reported on here came from air breathed by the city population at large. Though our findings indicate that group A streptococci are relatively rare in normal air sampled at random, it is of great interest that, by the tests applied, they are indistinguishable from similar organisms isolated directly from disease processes. Furthermore, it should be noted that 88% of the strains in this small series were of the human pathogenic group A.

It has been estimated by several investigators[7, 8, 9] that group A hemolytic streptococci are present in from 3 to 7% of normal throats. None have reported as high a percentage of group A cultures among

[4] Sherman, J. M., *Bacteriol. Rev.*, 1937, **1**, 1.

[5] White, E., *Lancet*, 1936, **1**, 941.

[6] Brown, W. A., and Allison, V. D., *J. Hyg.*, 1935, **37**, 1.

[7] Hare, R., *J. Path. and Bact.*, 1935, **41**, 499.

[8] Davis, L. J., and Guzdar, J. S., *J. Path. and Bact.*, 1936, **43**, 197.

[9] Frisch, A. W., *J. Inf. Dis.*, 1938, **62**, 40.

the hemolytic streptococci of the throat as was found in this series of air streptococci. It is possible that the percentage of group A cultures of air was augmented by the coughing of individuals with group A infections of the throat.

The presence of group A streptococci does not necessarily indicate that they were suspended in droplets in air, for, as shown by studies of hospital air[5, 6] and as has been demonstrated experimentally by Wells and in this laboratory, bacteria sprayed in air may float for many hours after all droplets have evaporated. In conclusion we agree with Brown and Allison who, after studying the streptococci in the air of scarlet-fever wards, stated, " . . . . and while contact, direct or indirect, is probably of considerable importance in the transmission of infection the possibility of infection via the air other than that due to droplets cannot be dismissed."

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Germicidal Efficiency of Some Silver Compounds Tested by the Improved Tissue-Culture Method.

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Silver compounds are employed for their antiseptic and germicidal action on bacteria. The effectiveness of such preparations is due largely to the free silver ions. The higher the concentration of free ions the greater will be the germicidal effect. *New and Non-official Remedies* (1937) states, "The antiseptic action of silver nitrate is complicated by irritation, pain, astringency, and corrosion. These may be desirable for the destruction of tissue or the stimulation of indolent wounds; but when they are not necessary for such purposes, they are distinctly undesirable. They may be avoided by the use of colloidal silver preparations."

The colloidal preparations differ from the silver compounds in that the silver does not exist to any great extent in the form of free ions. The silver does not, therefore, precipitate chlorides or proteins and is noncorrosive and relatively nonastringent and nonirritating. The germicidal action is not proportional to the silver con-