changed the refraction and the staining properties of the capsule proper.

Altogether 12 different encapsulated and 9 other anthrax strains were examined in this way. We never failed to observe the closest parallelism in demonstrating the capsule production in India ink preparation and in our specific capsular reaction.

The correlation of the agglutinability of our strains and of the capsular reaction was also complete. The capsular reaction therefore has to be regarded as a visible sign of the union of anticapsular antibody with the capsular substance. The agglutination must be in consequence a secondary reaction following the specific alteration of the capsular material.

We believe that it would be of great importance to study in infected animals the protecting rôle of an antibody exhibiting such a marked specific action on the capsule of anthrax bacilli.

Summary. Anthrax immune serum containing P precipitin exerts a specific effect on the capsule of anthrax bacilli. Following the addition of a small quantity of this immune serum to the suspension of encapsulated anthrax bacilli, the capsular material is specifically affected and becomes visible in unstained preparates. This is the final proof of the existence of a separate antibody in specially prepared immune serum acting in a specific way on the capsule of anthrax bacilli.

7583 C

Stability of Toxin Producing Attribute of Scarlet Fever Strains of Streptococci.

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Several reports have appeared concerning the stability of the toxin producing power of scarlet fever strains of streptococci. Organisms dried on swabs or in cultures have been found to retain the toxin producing attribute (Jettmar,[1] Tunnicliff[2]). Tunnicliff[3] reported also that filtrates of certain different appearing colonies of

[1] Jettmar, M. H. v., *Z. f. Hyg. u. Infektionskr.*, 1927, **107**, 265.

[2] Tunnicliff, R., *J. Infect. Dis.*, 1927, **41**, 272.

[3] Tunnicliff, R., *J. Infect. Dis.*, 1931, **48**, 511.

strains which had been cultivated for long periods of time were toxic as were filtrates of recently isolated strains when measured by the paramecium test. However, the filtrates of the dissociated strains were not neutralized by scarlet fever antitoxin. Pilot and Stocker[4] reported a non-hemolytic variant of a scarlet fever strain which was toxigenic. Friedemann and Deicher[5] passed 2 scarlet fever strains 10 times through mice and found that the filtrate of one strain had lost its toxigenic power while in the other strain the toxin producing power had increased. In the work here reported, comparative skin tests were made with filtrates of the original strains and filtrates of these strains after subjecting them to various methods used to dissociate bacteria.

From 3 to 9 strains were used in each method. The original strains had toxin titers ranging from 1:500 to 1:5000. All tests were done on 2 adults who gave consistent results with the various dilutions. Neither of these individuals reacted to injections of toxic filtrates from erysipelas and septic sore throat strains. Dissociation of the strains was attempted by:

1. Subculturing daily in homologous immune rabbit serum diluted 1:10 in infusion broth. These sera were produced by the method used in preparing sera for the dissociation of pneumococcus. The sera contained agglutinins which clumped the homologous streptococcus strains at dilutions of 1:640 or greater. Nine strains were used and the number of transfers varied from 60 to 128.

2. Subculturing daily 4 strains in 1% glucose infusion broth for 60 to 121 transfers.

3. Subculturing daily 3 strains in infusion broth containing methylene blue at a concentration of 0.00001 mol. for 62 to 114 transfers.

4. Subculturing daily 4 strains in infusion broth and incubation at 45°C. for 60 to 119 transfers.

5. Passing 3 strains from 7 to 12 times through mice by intraperitoneal injections and recovery of the organisms from heart blood or peritoneal fluid.

6. From 1 strain 5 atypical colonies were selected which were apparently similar to some of the various dissociated colony forms described by others. Determinations of electrophoretic velocities as well as tests of toxigenicity were made with these strains.

In each instance the toxins, produced by all strains treated by

[4] Pilot, I., and Stocker, S., PROC. SOC. EXP. BIOL. AND MED., 1933, **31**, 181.

[5] Friedemann, U., and Deicher, H., *Z. f. Hyg. u. Infektionskr.*, 1928, **108**, 192.

these 5 methods, gave reactions to the same dilutions as those of the filtrates of the original cultures.

In the case of the 5 colonies selected from one culture, while all of these produced filtrates which gave reactions at the titer of the original cultures, 3 gave reactions smaller in extent than the other 2. Cataphoresis determinations made on 2 occasions showed that the rate of migration of the organisms producing the smaller reactions was about twice that of the other 2 and of that of original culture. It should be stated, however, that we have previously shown[6] that a faster rate of migration is not a specific characteristic of non-toxin producing strains of streptococcus.

Summary. The use of several recognized methods for dissociation of bacteria when applied to scarlet fever strains of streptococci failed to deprive these strains of their ability to produce toxin.

7584 C

On the Motion of Growth. IX. A Scheme for Analysis of Experiments on Growth, Nutrition and Metabolism.

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The quantitative relationships between normal growth and heat production which the author has recently found and applied in the case of bacterial cultures,[1] in *Bufo vulgaris* from fertilization throughout metamorphosis[2] and from birth to adult life in man[3] should likewise be helpful in dealing with the results of many experimental studies on growth, nutrition, or metabolism.

Such studies are carried out, almost without exception, upon the young of some species, and noteworthily, in the present connection, on subjects still immersed in the "flux of growth." It is just at this stage of life, moreover, that characteristic and often conspicuous changes in metabolism are known to occur. Sufficient evidence in the 3 normal cases we have mentioned has already been brought forward to show that these changes in metabolism, as portrayed in

[6] Thompson, R. L., and Megrail, E., *Am. J. Hyg.*, 1934, **19**, 457.

[1] Wetzel, N. C., PROC. SOC. EXP. BIOL. AND MED., 1932, **30**, 360.

[2] Wetzel, N. C., *Proc. Nat. Acad. Sc.*, 1934, **20**, 183.

[3] Wetzel, N. C., PROC. SOC. EXP. BIOL. AND MED., 1932, **30**, 227, 233; *J. Pediat.*, 1933, **3**, 252; 1934, **4**, 465.