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Electrophoretic Characteristics of Streptococci Exposed to High Frequency Fields, and Subsequently Injected into and Recovered from Rabbits.

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Evidence has been presented[1] that the cataphoretic mobility of a culture of streptococci could be changed by application of high frequency energy. These changes were transmitted to the subcultures of the organisms. By the use of this technic, therefore, it may be possible to determine whether the source from which a strain of streptococci has been isolated is the single factor which determines the results produced by injection of the strain into rabbits or whether, in order to produce these results, the cataphoretic mobility of the organisms must be of a specific value.

Each animal in these experiments received an intravenous injection of 7.5 cc. of a subculture selected from one of the tubes of a series exposed to the high frequency field. Cultures in "glucose-brain broth" and blood agar platings were made from the blood, brain, joints, and other tissues of the animals within 30 hours of the time of injection. In the experiments presented, pure cultures of streptococci, usually either green-producing or indifferent on plates, were obtained from one or more of the tissues of each animal. After 24 hours of incubation at 37°C., 2 cc. of such a culture in glucose-brain broth was centrifuged at 1400 r.p.m. for 10 minutes; it was then drained and the residue was suspended in distilled water. This suspension was used to obtain the cataphoretic velocity distribution of the organisms.

The results of the cataphoretic measurements have been presented as distributions of cataphoretic time, which is related to cataphoretic velocity by the equation:

$$u = \frac{d}{t_c \times (v/l)} = \frac{48.1}{t_c \times 7.0} = \frac{6.9}{t_c}$$

in which t_c is the cataphoretic time and u is the cataphoretic mobility.

The investigations of Rosenow[2, 3, 4] have indicated a relationship

[1] Sheard, Charles, and Pratt, C. B., PROC. SOC. EXP. BIOL. AND MED., 1935, **32**, 899.

[2] Rosenow, E. C., *Arch. Int. Med.*, 1933, **51**, 327.

[3] Rosenow, E. C., and Jensen, L. B., *Proc. Staff Meetings of Mayo Clinic*, 1930, **5**, 49.

[4] Rosenow, E. C., and Jensen, L. B., *J. Infect. Dis.*, 1933, **52**, 167

between the cataphoretic velocities of streptococci and certain types of disease among patients from whom the organisms have been isolated. Evidence has been presented by him that streptococci obtained from the nasopharyngeal regions of patients with arthritis exhibit a cataphoretic mobility of 2.25 $\frac{\mu/\text{sec.}}{\text{v/cm.}}$ (microns per second divided by volts per centimeter) and that streptococci from nasopharynges of patients with encephalitis and with poliomyelitis show a cataphoretic mobility of either 1.7 or 3.4 $\frac{\mu/\text{sec.}}{\text{v/1}}$. Strains of streptococci isolated in cases of arthritis and showing a characteristic cataphoretic mobility of 2.25 $\frac{\mu/\text{sec.}}{\text{v/1}}$ have been designated by Rosenow as "arthrotropic" because he states that, after intravenous injection of such strains into animals, it was possible, in a majority of instances, to isolate streptococci from the joints of animals and that the organisms so isolated showed the characteristic cataphoretic mobility of the injected strains. Similarly, strains of streptococci isolated in cases of disease of the nervous system, such as encephalitis and poliomyelitis, which show a characteristic cataphoretic mobility of either 1.7 or 3.4 $\frac{\mu/\text{sec.}}{\text{v/1}}$, have been designated by Rosenow as "neurotropic" because streptococci could be isolated from the brain or spinal fluid of animals into which such strains had been injected and the cataphoretic mobility of the recovered organisms was found to be either 1.7 or 3.4 $\frac{\mu/\text{sec.}}{\text{v/1}}$.

In Fig. 1 are shown the results of intravenous injection of control and treated samples of culture No. 5596 (obtained originally from the nasopharynx of a patient with acute epidemic poliomyelitis, the strain having been passed 4 times through animal hosts, producing paralysis in each passage). The control sample of streptococci, having a distribution of cataphoretic time which indicated a majority of organisms at 2 seconds (a mobility of 3.4 $\frac{\mu/\text{sec.}}{\text{v/cm.}}$) was injected into rabbit No. 5969. Streptococci were recovered only from the spinal fluid of this animal, and the cataphoretic distribution of these recovered organisms was identical with that of the injected culture. Subcultures of the 2 samples of this strain which were exposed to the short wave electric field for 12½ minutes, and which showed a cataphoretic distribution indicating an approximately equal division of organisms between the times of 2 seconds and 3 seconds (mobilities of 3.4 and 2.25 $\frac{\mu/\text{sec.}}{\text{v/1}}$), were injected into rabbits Nos. 5970 and 5971. No growth was obtained from the blood of rabbit

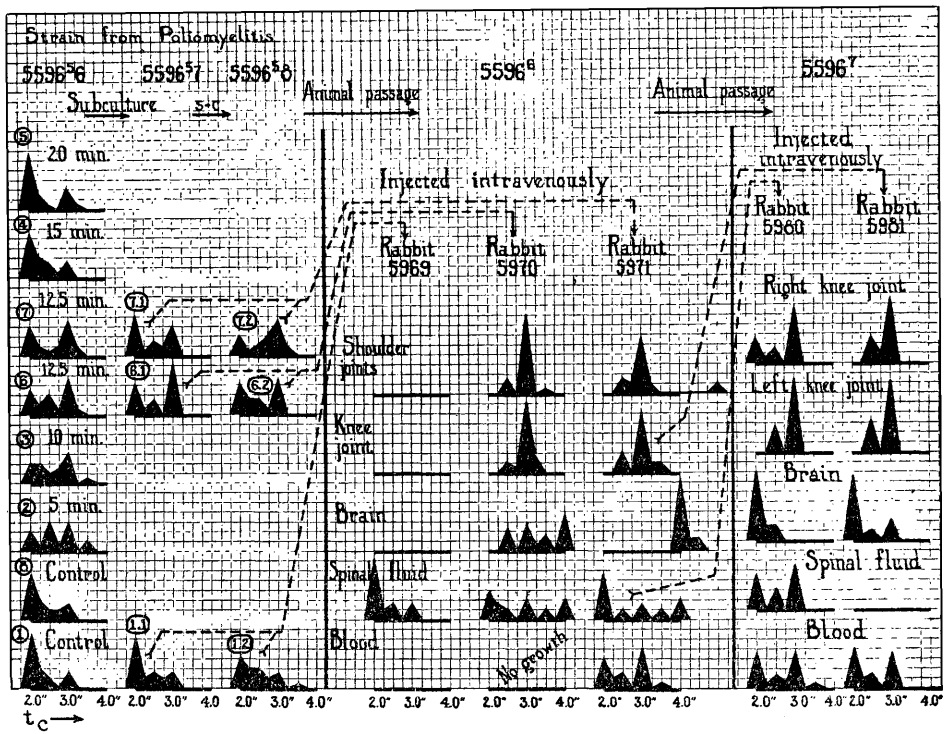

FIG. 1.

Distribution curves of cataphoretic time, showing, left, changes produced by a high frequency field in samples of culture number 5596 and their maintenance in subcultures; middle, distributions obtained from various tissues of rabbits into which the samples of treated culture have been injected intravenously, and right, distributions obtained from various tissues of rabbits into which cultures isolated from rabbit No. 5971 have been injected intravenously.

No. 5970, but the organisms obtained from the cardiac blood of rabbit No. 5971 gave a cataphoretic distribution identical with that of the injected sample of culture. The streptococci recovered from the spinal fluid of both animals showed a distribution spread between 2 and 4 seconds; the major portion of the bacteria, however, were situated near 2 seconds. The organisms obtained from the brain of rabbit No. 5970 showed a spread of distribution from 2.5 to 4 seconds, with slight predominance at the latter value, and those from the brain of rabbit No. 5971 were found to be (practically) entirely at a value of 4 seconds (mobility of 1.7 $\frac{\mu/\text{sec.}}{\text{v/cm.}}$). The cataphoretic distribution of the streptococci obtained from 2 regions in the joints of both animals possessed very marked maxima at 3 seconds (mobility of 2.25 $\frac{\mu/\text{sec.}}{\text{v/1}}$).

Further animal passages were accomplished with 2 of the strains

freshly isolated from rabbit No. 5971, one group of organisms from the spinal fluid having a cataphoretic maximum at 2 seconds and the other, from the knee joint, showing a predominance of organisms at 3 seconds. In the case of the animals Nos. 5980 and 5981, which received these apparently very dissimilar cultures of streptococci, the organisms recovered from respective samples of the blood showed a cataphoretic distribution indicating equal division of the bacteria between the times of 2 seconds and 3 seconds. Organisms were found in the spinal fluid of only one of the animals and the cataphoretic distribution of these was similar to that of the bacteria from the blood. From the brains of both animals streptococci were obtained which showed a marked cataphoretic predominance at 2 seconds. From the 2 knee joints of both animals streptococci were removed, and the cataphoretic distributions were uniformly concentrated at 3 seconds (mobility of 2.25 $\frac{\mu/\text{sec.}}{\text{v/l}}$).

Additional investigations concerning certain effects of the injection of streptococci into rabbits will be presented elsewhere.[5]

Conclusions. 1. Strains of streptococci, in which alterations in cataphoretic velocities have been produced by exposure to a high frequency field (wavelength of 11 meters), when subsequently injected into rabbits are found as frequently in certain tissues as are the control (unexposed) strains. 2. Irrespective of the type of cataphoretic distribution of the injected strain, the streptococci which are isolated from brain tissue exhibit a type of cataphoretic velocity distinctly different from the organisms which are isolated from tissues of the joints.

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Platelet and Blood-Cell Counts in Newborn During First Two Days of Life.

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The purpose of this study was to establish a set of blood-platelet-count standards in infants, based upon an accurate method of counting. Red cell counts, white cell counts, and hemoglobin determina-

[5] Pratt, C. B., Sheard, Charles, and Rosenow, E. C., *Protoplasma*, 1935.