

New York Section.

New York Academy of Medicine, February 19, 1930.

4771

Bacteriophage in Relation to Healing of Osteomyelitis.

MARJORIE B. PATTERSON AND FRED H. ALBEE.

(Introduced by W. J. MacNeal.)

From the Department of the Laboratories and the Department of Orthopedic Surgery, New York Post-Graduate Medical School and Hospital.

In the treatment of osteomyelitis by the method of Orr, the open wound is protected by vaseline gauze under slight pressure and immobilized by plaster dressings. It is then left undisturbed for long periods. Success evidently depends in large measure upon the effective control of infection by the humors and cells of the patient. The possible influence of bacteriophage requires consideration.¹

A boy of 10 years, presenting open sinuses leading into the right tibia, the left tibia and the left humerus resulting from an original haematogenous osteomyelitis twice subjected to surgical operation elsewhere, and of one year's duration, was again subjected to surgical operation for removal of sequestra from both legs on September 9, 1929.

Pus from the right tibia was examined bacteriologically at this time, again at the first subsequent dressing on November 11, on December 9 and on December 23. Bacteriological examination of material from the left tibia was made on November 11 and December 9 and of material from the left humerus on November 7, December 9 and December 23. Native bacteriophage was not found in the arm wound. A stock anti-staphylococcus bacteriophage lytic for the wound strain, was introduced into the wound of the arm on December 9, which was followed by complete closure of the wound in 2 weeks. The data of these examinations are summarized in Table I.

¹ Albee, F. H., *Int. J. of Med. and Surg.*, 1929, xlii, 1.

TABLE I.—Chronic Multiple Osteomyelitis.

Right Tibia	Left Tibia (Organisms are listed in order of their predominance)	Left Humerus
First specimen, Sept. 9. Hemol. <i>Staph. aureus</i> <i>B. coli</i> and active native anti-coli phage		
Second specimen, Nov. 11. <i>B. coli</i> <i>B. pyocyaneus</i> Native anti-coli phage	First specimen, Nov. 11. Non-hemol. <i>Staph. aureus</i> Hemol. <i>Staph. aureus</i> <i>B. coli</i> , <i>B. pyocyaneus</i> Native anti-coli phage	First specimen, Nov. 7. Hemol. <i>Staph. aureus</i> Phage not detected
Third specimen, Dec. 9 Diphtheroids <i>B. coli</i> <i>B. pyocyaneus</i> Phage not detected	Second specimen, Dec. 9 <i>B. pyocyaneus</i> Diphtheroids Phage not detected	Second specimen, Dec. 9 Diphtheroids Hemol. <i>Staph. aureus</i> Stock anti-staphylococcus phage introduced
Fourth specimen, Dec. 23 <i>B. coli</i> <i>B. pyocyaneus</i> Hemol. <i>Staph. aureus</i> Phage not detected Wound $\frac{1}{4}$ area of Sept 9.	Dec. 23 Wound healed	Third specimen, Dec. 23 Diphtheroids Hemol. <i>Staph. aureus</i> Anti-staph. phage recovered from scrapings Wound healed

The bacteriophage in the first specimen of pus from the right tibia was at once active against 2 stock strains of *B. coli*. Of greater interest is the fact that it was also active against the native strain of *B. coli* in the pus, so that after 5 serial filtrations of cultures of this organism, complete lysis was obtained with a titer of 1×10^8 .

A woman aged 21 was admitted with a compound comminuted fracture of left radius and ulna due to automobile accident 2 months before. Bone fragments were now presenting through the sloughing wounds. Sequestrectomy and dressing by the Orr technic was carried out. The pus contained *B. coli* (acidi lactici) and lesser numbers of *Staphylococcus aureus*, both susceptible to lysis by stock bacteriophage strains in the laboratory collection. The pus also yielded a native bacteriophage, ineffective against the bacteria of the wound but active against a laboratory strain of staphylococcus, by means of which its lytic power was exalted so that it eventually produced complete lysis of the wound strain of staphylococcus. At the first dressing, 8 weeks after operation, the same bacteria were recovered from the wound, the staphylococcus now predominating. Bacteriophage could not be found at this time although the staphylococcus strain from the wound was still lysed by the regenerated and exalted native bacteriophage obtained at the first examination. The wound presented a satisfactory appearance. Seven weeks later,

examination of the exudate yielded only *Staphylococcus aureus*. The opening on the dorsal aspect had healed and the volar opening was in very satisfactory condition.

A man of 40 was admitted with osteomyelitis of left tibia of 36 years' duration. The sinus was widely excised and an Orr dressing applied. Pus taken at this time showed predominating hemolytic *Staphylococcus aureus* and a few diphtheroids. The pus also yielded a bacteriophage active against a stock strain of staphylococcus and, after exaltation, lytic for the wound strain. At subsequent dressings the diphtheroids predominated and only a few colonies of staphylococcus were obtained. The bacteriophage could no longer be detected. Satisfactory healing was obtained after approximately 4 months.

These preliminary observations have convinced us that neither the bacteriologist nor the surgeon should ignore the significance of bacteriophage in infected wounds, particularly those involving bone.

4772

The Electric Charge of Mosaic Virus Particles.

PETER K. OLITSKY AND DONALD C. HOFFMAN.

*From the Laboratories of the Rockefeller Institute for Medical Research,
New York City.*

Recently a number of ultramicroscopic viruses of man and animals, and bacteriophage have been found, in general, to migrate to the anode under ordinary conditions of hydrogen ion concentration.

In the controlled experiments to be reported, a study was made of a typical virus of plants, namely that of mosaic disease in the tomato with the object of noting (a) the possible migration of a plant virus in an electrical field, (b) the direction of migration, and (c) any difference of behavior of unfiltered and filtered suspensions for a considerable amount of protein particles are removed from the latter.

The method of cataphoresis employed has already been described.¹ Tests were made at 4 m. a., 118-119 volts P.D., over a period of 3 hours. Suspensions of ground mosaic-infected leaves were prepared in G.P.A.,² or in phosphate buffer solutions at pH=5.3 to 8.5, with

¹ Olitsky, P. K., and Long, P. H., *J. Exp. Med.*, 1929, i, 263.

² Northrop, J. H., and de Kruif, P. H., *J. Gen. Physiol.*, 1922, iv, 639.