

Recently, Twort¹ has stated (somewhat similar to the evidence offered a year earlier by Gratia^{2, 3}) that dead staphylococcus may undergo lysis if, in addition to a suitable bacteriophage, there is also present live staphylococcus. We have confirmed these observations, and in addition have endeavored to ascertain the explanation of the mechanism of this phenomenon. We found that in order to elicit the phenomenon it is necessary to control the numbers of live and dead bacteria in the mixture. An excess of dead bacteria interferes with lysis by adsorbing the active lytic substance before it has the opportunity to initiate lysis of the live bacteria, and thus all solution is prevented. The phenomenon is specific, that is, the lysis of live bacteria will initiate lysis of dead bacteria of the same species only. In its extent and completeness, lysis of dead bacteria occurs best with staphylococcus, the organism which easily undergoes autolysis under appropriate conditions. In the case of colon bacillus, which undergoes autolysis very slowly, the lysis of the dead bacteria is less regular and less complete.

If the experiment is performed so that a suitable semi-permeable membrane is interposed between the dead and live bacteria, dead bacteria are never dissolved, in spite of the lysis of living bacteria on the other side of the membrane. The active substance determining the lysis of dead bacteria is not diffusible while the principle initiating the lysis of live bacteria diffuses freely and is demonstrably present on both sides of the membrane. Thus, transmissible lysis of bacteria can be shown to consist of two phases: The first, initiated in the live bacteria by the transmissible principle, which does not of itself cause lysis. In this phase this substance shows an increase in concentration. The second phase consists of lysis of bacteria with coincident setting free of another active principle. If dead bacteria are present in the immediate vicinity during this phase of the process, they too may be dissolved.

The following protocol is given in illustration of the above statements:

¹ Twort, F. W., *Lancet*, 1925, ccix, 642.

² Gratia, A., and Rhodes, B., *Compt. Rend. Soc. Biol.*, 1923, lxxxix, 1171.

³ Gratia, A., and Rhodes, B., *Compt. Rend. Soc. Biol.*, 1924, xc, 640.

Inside the membrane	Live staphylococci	Live staphylococci	Dead staphylococci	Dead and live staphylococci
Outside the membrane	Bacteriophage	Dead staphylococci Bacteriophage	Live staphylococci Bacteriophage	Bacteriophage
Results	Lysis inside	Lysis inside None outside	Lysis outside No lysis inside	Lysis inside of dead and live staphylococci

The ferment-like substance responsible for lysis of dead bacteria is easily adsorbed on the clay filter; it is heat labile, and is quickly inactivated on standing. In these respects it differs markedly from the substance to which transmissible lysis of live bacteria is due.

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Changes in viscosity during lysis of bacteria by bacteriophage.

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The fact has been observed that prior to lysis in the presence of the bacteriophage, bacteria usually undergo more or less marked swelling. The extent of swelling and the relative proportion of swollen bacteria, as well as the actual relation between swelling and lysis are difficult to establish by direct microscopic examination, because the swelling and lysis of bacteria go on simultaneously and continuously, and because the degree of swelling of individual bacteria varies to such an extent that results of such an analysis must, of necessity, be highly subjective. Moreover, in the case of cocci it is very difficult to decide whether or not swelling takes place at all.

It seemed, therefore, that since swelling of bacteria increases the relative volume occupied by the solids in the medium, the swelling of the total bacterial mass (with proper correction for growth) should bring about an alteration in viscosity of the solution.