D. Genetic functions of bacterial viruses (Dr. E. M. Lederberg and Mr. M. L. Morse)

A study of the genetic properties of a symbiotic bacteriophage, lambda, was initially undertaken in this laboratory in the expectation that it would behave as a cytoplasmic factor or plasmagene. Instead there has accumulated very substantial evidence that in its stable symbiotic condition the lambda functions as a part of the chromosomal make-up of the bacterium. In crosses of lysogenic (that is, lambda-carrying) bacteria with non-lysogenic strains the property of lysogenicity is found to segregate just like any other genetic trait and is in fact closely linked to genetic factors for galactose fermentation. This finding has been greatly strengthened by the isolation of diploids heterozygous both for lysogenicity and for galactose fermentation. These diploids segregate primarily the two parental combinations of these traits together with occasional crossovers. Other students ~~of lysogenicity~~ at the Pasteur Institute at Paris, and at Pasadena, have subsequently adduced considerable confirmatory evidence of other kinds in support of the chromosomal fixation of the bacteriophage in lysogenic systems, but lambda has been adopted as a model system for the study of lysogenicity in several laboratories.

The genetic functions of lambda ~~(these are the~~ vis-a-vis the galactose factors ~~)~~ are displayed in a converse way in a transduction phenomenon, that is, particles of lambda are capable of transducing the genetic quality of the bacteria on which they have grown, with respect to galactose fermentation, to their new bacterial hosts. This transduction is set off from the Salmonella transduction in at least two ways: (1) Whereas in Salmonella every genetic trait of the bacterium is equally liable to transduction by phage, in E. coli only the factors controlling galactose fermentation, which are closely linked to the site of fixation of the lambda, are capable of transduction; (2) In Salmonella the immediate products of transduction, so far as can be ascertained, already ~~di[illegible]~~ slow the permanent displacement of the previous genetic material by the newly transduced homologues. In E. coli there is a long-lasting intermediate stage in which both the original and the newly transduced genetic material ~~[illegible]~~ exist. This may

however be followed by a crossingover and permanent unique implantation of the transduced material. From many points of view the E. coli system seems to be more favorable for a study of the fundamental processes of transduction. ~~and is being actively pursued from that point of view~~. The bearing of these findings on the general problems of virus biology does not need to be explicitly overemphasized.