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"Growth and Inheritance in Bacteriophage"

Our current work is based on the following facts previously reported. (1) Bacteria infected with T2 synthesize in the presence of chloramphenicol DNA that can combine with protein synthesized after the removal of chloramphenicol to form phage particles. (2) Part of the DNA of phage particles inactivated by ultraviolet light, when present in bacteria infected with unirradiated phage particles, is incorporated into a very few noninfective particles among the offspring.

The following facts have been demonstrated recently by J. Tomizawa, partly by independent work in his laboratory in Tokyo, partly by work done since he joined our group in February of this year. (3) Bacteria irradiated with ultraviolet light after infection produce dead phage particles in numbers dependent on the amount of phage precursor DNA present in the cells at the time of irradiation. (4) This is true equally whether such DNA is accumulated in the absence or in the presence of chloramphenicol. In the latter case, the irradiated DNA is incorporated into phage particles after removal of the antibiotic, and, if the amount of irradiated DNA is sufficient, nearly all the particles formed are dead. Such dead particles have properties similar to those produced by irradiating phage particles themselves.

Fact (2) we interpret to mean that irradiation produces lethal damages in phage "chromosomes" that contain only part of the phage DNA. If this is so, the other facts can only mean that the multiplicative phase of phage growth is synthesis of naked chromosomal DNA, which is incorporated into phage particles only as a final act of phage growth by a process that is little affected by radiation damage.

Experiments by J. Vandell and E. Burgi in our laboratory are designed to explore further the meaning of fact (2), but have not yet reached a decisive phase.

Further confirmation of the central genetic role of DNA is derived from the following work of the principal investigator. Examination of constituents of particles of phage T2 that can be labeled by C14-arginine and C14-lysine reveal only two previously undetected components, both minor. One is an unidentified amino acid present in the particles in the free state. The other is a peptide containing mainly lysine, aspartic acid, and glutamic acid. This component is not an integral part of the phage chromosome as shown by its failure to transfer from parental to offspring phage, and by its failure to be synthesized together with phage precursor DNA in the presence of chloramphenicol. The latter blocks synthesis of all types of protein equally.

Our work is closely related to but does not duplicate that of C. Levinthal, University of Michigan, A. H. Doermann, University of Rochester, and G. S. Stent, University of California at Berkeley.