Symposium on Molecular Aspects of Viral Replication

CHAIRMAN: ROBLEY C. WILLIAMS

VIRUS LABORATORY

UNIVERSITY OF CALIFORNIA

BERKELEY, CALIFORNIA

INTRODUCTION

The symposium entitled "Molecular Aspects of Viral Replication" presented a sample of biophysics at the level of the molecular properties and interactions of biological systems. The speakers and their subjects were:

GUNTHER S. STENT	A Short Epistemology of Bacteriophage Multiplication.
M. MESELSON	The Mechanism of Recombination in Bacteriophage.*
A. GIERER	Structure and Replication of Tobacco Mosaic Virus.

The choice of this particular subject stems from the fact that viruses are particularly apt objects for the study of the relation of chemical structure to the phenomena of replication. The chemical composition of most of them is incomparably simpler than that of a cell, they may be obtained in purified form for treatment with various physical and chemical agents and subsequently introduced into cells, viruses of different strains may be crossed for genetic experiments, and they undergo replication and mutation. Viruses can be regarded as biological probes, to be removed from and introduced into the life stream at will, and capable of elucidating the interactions that go on within the cell when genetic material is replicated.

The bacterial viruses are particularly suitable for intensive study of viral genetics because of the happy circumstance that only one physical particle will initiate infection, thus allowing pure strains to be readily isolated. In addition, the same cell can be simultaneously infected with more than one virus, allowing genetic crosses to be studied. The host range of the bacteriophages is known to be immediately determined by their protein portion, while their genetic and replicative propensities reside in their nucleic acid. But their host range is a genetically determined characteristic, thus there is the possibility of studying the mechanism by which the structure of the infecting nucleic acid determines the structure of the associated protein of the progeny viruses. Infected cells may be broken open at various stages of the replication cycle of the infecting virus, thereby providing for a study of the rate of production of viral components. Since bacteriophage can be separated into their chemical components it is possible to make correlations between the chemical and physical structure of these components and the genetic and phenotypic characteristics of the infective virus. It is no exaggeration to say that by far our most detailed understanding of the viral replicative process has come from experiments with bacteriophage.

Another kind of virus which has been studied in great detail is tobacco mosaic virus. It may be produced in great quantities and readily purified to a high degree;

* Not available for publication.

consequently its physical and chemical structure is the best known of all the viruses. Unfortunately, it cannot be examined genetically with anything like the precision afforded by work with bacteriophage owing to the immense number of particles necessary to effect successful inoculation. However, it is the first virus for which it has been found that mechanical inoculation with only its nucleic acid component will initiate infection and normal replication. In addition, the complete amino acid sequence of the protein component of the wild-type virus has been established. Recently it has been found that mutations of tobacco mosaic virus can be evoked in large numbers by chemical treatment of either the intact virus or its nucleic acid. Thus the way has been opened for the arduous study of the detailed correlation between changes in the nucleotide structure of the genetic material and concomitant changes in the amino acid composition of the associated protein. Something of the beginnings of these investigations is to be found below.

ROBLEY C. WILLIAMS