of type IIIS virulent cells. processed and heat killed. Following homogenization and several extractions of soluble filtrate were prepared which contain DNA, RNA and proteins. that retained the ability to induce transformation of type IIR avirulent cells. Then the soluble filtrates were treated with protease, ribonuclease, DNase enzyme separately and incubate with IIR culture separately. The transforming activity were checked independently. The transforming activity remained in filtrate treated with protease and RNase, but lost in filtrate treated with DNase. Thus, suggest that DNase destroyed the transforming activity of the DNA.

1.1.3 The Hershey–Chase Experiment

Another evidence that DNA was the molecule responsible for heredity was the independent work from the study of the bacterium *Escherichia coli* and bacteriophage T2. The simple body organisation of a phagevirus consists of a protein coat surrounding a core of DNA.

The work of Alfred Hershey and Martha Chase while studying the events leading to phage reproduction that found that some molecular component of the phage**DNA or protein** (or both)—entered the bacterial cell and directed viral reproduction.To distinguish the events Hershey and Chase used the radioisotopes 32P and 35S to follow the molecular components of phages during infection. The key features of the experiment is that 32P labelled DNA but not by 35S (due to absence of sulphur), and 35S effectively labelled protein but no DNA (due to absence of phosphorus).Steps of the experiments are,

Step 1:E. coli cells are first grown in the presence of 32P or 35S and then infected with T2 viruses.The resulting progeny phages will have either 32P labelledDNA core or 35S labelled protein coat, respectively. These labelled phages were isolated and used to infect unlabelled bacteria for further experiment.

Step 2: Reinject the unlabelled bacteria by labelled phages. Then the phase particles and bacterial cells were separated after the absorption complex formation. By tracing the radioisotopes, it was found that most of the 32P-labeled DNA had been recovered from the bacterial cell; while almost all of the 35S-labeled protein remained outside the bacterial cell and was recovered in the phage “ghosts” (empty phage coats). Following new phages from the bacterial cells this separation, the bacterial cells, which now contained viralDNA, were eventually lysed as which contained 32P, but not 35S.

The results indicatethat the protein coat remains outside the host cell and is not involved in directing the production of new phages. On the other hand, phage DNA enters the host cell and directs phage reproduction, thus concluding the fact that the genetic material in phage T2 is DNA, not protein.

1.2 RNA as genetic material in some viruses

Genetic material	Organisms
Double stranded DNA (ds DNA)	Higher animals and plants
	Bacteria
	Polyoma virus and small-pox virus
	The T-even bacteriophages (T2, T4, T6)
Single Stranded DNA (SS DNA)	The bacteriophage $\phi \times 174$ and several bacterial viruses.
Double stranded RNA (ds RNA)	Reo group of viruses.
	Wound tumour virus.
Single Stranded RNA (SS RNA)	Tobacco mosaic virus.
	A tobacco virus.
	Influenza virus.
	Bacterial viruses F_2 and R_{17}.
	Poliomyelitis virus.

It became very clear that most of the eukaryotes have DNA as the basic genetic materials. However, certain viruses have RNA as the genetic material rather than a DNA like **tobacco mosaic virus (TMV), Influenza viruses etc.** when purified RNA from **tobacco mosaic virus (TMV)** was spread on tobacco leaves, the characteristic lesions caused by viral infection subsequently appeared. Thus, it was concluded that RNA is the genetic material of this virus. While many viruses such the phage T2 virus are called **retroviruses, a**nother group of RNA-containing viruses but their RNA serves as a template for the synthesis of the complementary DNA molecule called **reverse transcription**. Reverse transcription is made possible by RNA-dependent DNA polymerase enzyme called **reverse transcriptase**. This DNA intermediate incorporated into the genome of the host cell, and when the host DNA is transcribed, copies of the original retroviral RNA chromosomes are produced and thus new viruses. **Some examples of** Retroviruses are human immunodeficiency virus (HIV), and several RNA tumor viruses etc.

SOLVED EXAMPLES

1. Which of the following was used by Hershey and Chase to prove that DNA is the genetic material? **(JNU PhD BIOTECH_2015)**

(a) E. coli (b) TMV (c) T2 bacteriophage (d) Pichia pastoris

Soln. The Hershey–Chase Experiment provides the evidence that DNA is the molecule responsible for heredity from the study of the bacterium *Escherichia coli* and bacteriophage T2. Hence option (c) is correct.

2. Ebola virus contains which of the following as its genetic material? **(JNU PhD LIFE SCIENCES_2015)**

(a) Single-stranded RNA (b) Double-stranded RNA
(c) Single-stranded DNA (d) Not yet characterized

Soln. Ebola is a filamentous virus, possess a single-stranded RNA genome as the genetic material of the virus.The virus has an unusual, variable-length, branched morphology. The helical capsid is enclosed inside a membrane. However, the mechanism of attachment and entry of the virus into the cell is unknown. Hence option (a) is correct.

3. Bovine group A rotavirus contains: **(DBT_BET_2008)**

(a) ss RNA (b) ds RNA (c) ss DNA (d) ds DNA

Soln. Correct option is (b).