



The Hershey-Chase Experiment

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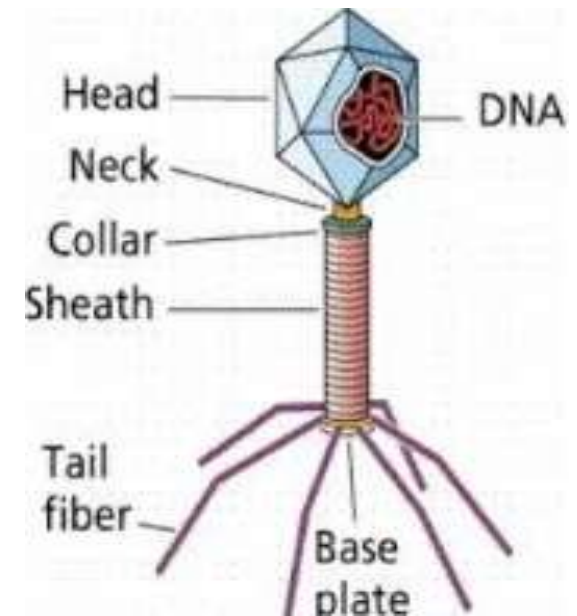
The Hershey-Chase Experiment

▶ AIMS

- ◆ In 1952, American biologists Alfred Hershey and Martha Chase set out to determine what composed the genetic material of a bacteriophage.
- ◆ Their aim was to prove that DNA is the genetic material being transferred from parents to offsprings

T2 Bacteriophage

- ▶ T2 Bacteriophage
- ◆ They are viruses which infect bacteria
- ◆ They consist of : A protein head (genetic material)
Tail
- ◆ T2 infects the bacteria E.coli



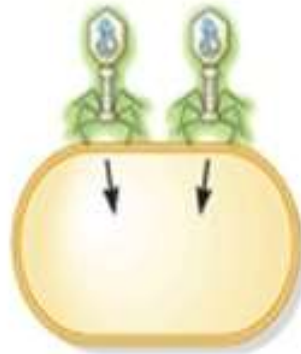
Principle

- ▶ Principle

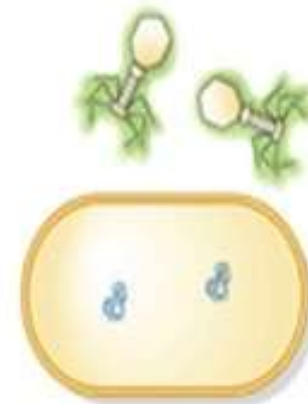
DNA contains phosphorous but no sulphur. Protein contains sulphur but hardly any phosphorous



1 Protein coats of phages are radioactively labeled.



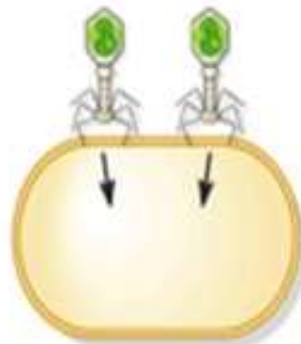
2 Phages infect bacteria with genetic material.



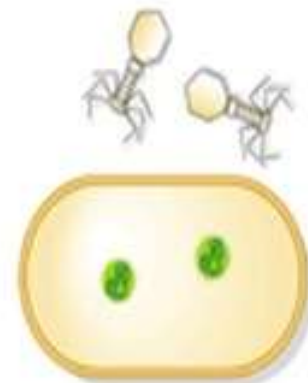
3 No radioactivity enters cell.



1 DNA of phages is radioactively labeled.



2 Phages infect bacteria with genetic material.



3 Radioactivity enters cell.

Process

- ▶ Process

- ◆ Bacteriophage attach a bacterium inject genetic material (DNA) into bacterium synthesis of DNA replicate & protein coat and tail form a new bacteriophage

DNA is the genetic

◆ Alfred Hershey and Martha Chase discovered that DNA is the genetic material of a phage known as T2

Experiment A. 1

- ▶ Viral protein and DNA were tagged with different radioactive isotopes. Protein Tagging: T2 and E. coli were grown in media with radioactive sulfur (^{35}S) which incorporated only into the phage protein.
- ▶ DNA Tagging: T2 and E. coli were grown in media containing radioactive phosphorus (^{32}P) which was incorporated only into the phage DNA

- ◆ 2: Protein-labeled and DNA- labeled T2 phages were allowed to infect separate samples of nonradioactive E. coli cells.
- ◆ 3: Cultures were agitated to shake loose phages that remained outside the bacterial cells

A. 4 Mixtures were centrifuged forcing the heavier bacterial cells into a pellet on the bottom of the tubes. The lighter viruses remained in the supernatant.

◆5 : Radioactivity in the pellet and supernatant was measured and compared

Results

- ◆ In tubes with *E. coli* infected with protein labeled T2, most of the radioactivity was in the supernatant with viruses.
- ◆ In tubes with *E. coli* infected with DNA-labeled T2, most of the radioactivity was in the pellet with the bacterial cells. When the bacteria containing DNA-labeled phages were returned to culture medium, the bacteria released phage progeny which contained ^{32}P in their DNA

- ▶ Hershey and Chase found that When bacteriophages containing ^{35}P (radioactive), were allowed to infect nonradioactive bacteria, all the infected cells became radioactive and, in fact, much of the radioactivity was passed on to the next generation of bacteriophages.

Conclusions

Conclusions A. Viral proteins remain outside the host cell. Viral DNA is injected into the host cell. Injected DNA molecules cause cells to produce additional viruses with more viral DNA and proteins. These data provided evidence that nucleic acids rather than proteins are the hereditary material.

- ▶ When the bacteria were infected with bacteriophages labeled with ^{35}S and then the virus coats removed (by whirling them in an electric blender), practically no radioactivity could be detected in the infected cells.

PHAGE TYPE	E.Coli bacteria fraction	Phage ghost fraction	Phage offspring
A (P 32)	RADIOACTIVE	NON - RADIOACTIVE	RADIOACTIVE
B (S 35)	NON - RADIOACTIVE	RADIOACTIVE	NON - RADIOACTIVE