



# Students will be able to.... AKA I can.....

- Use experimental evidence to explain how we know DNA is the hereditary material
  - Friedrich Miescher
  - Griffith
  - Avery
  - Hershey and Chase

# Discovery of DNA: Questions

- On a paper to turn in, and using your notes:
- Describe the experiment and the thinking that first indicated that DNA and not protein was the material carrying hereditary information.

# What Does DNA Do?

- Early researchers knew DNA made up chromosomes
- Doubted that it was hereditary material.
  - How could only four nucleotide bases code for all the different proteins?
- Researchers, including Linus Pauling, thought protein also found in chromosomes was probably the hereditary factor.

How do we know what DNA does? Who figured this out? How?

- Something from killed, lethal bacteria could transform living, non-lethal bacteria to lethal
- Phage DNA, which contained radioactive phosphorus, ended up in bacteria
- X-rays of DNA showed the backbone is actually on the outside
- In all living things, amounts of  $A=T$  and  $C=G$

# The Search for the Genetic Material:

## *Scientific Inquiry*

- **The key factor in determining the genetic material was choosing appropriate experimental organisms**
- The role of DNA in heredity was first discovered by studying bacteria and the viruses that infect them

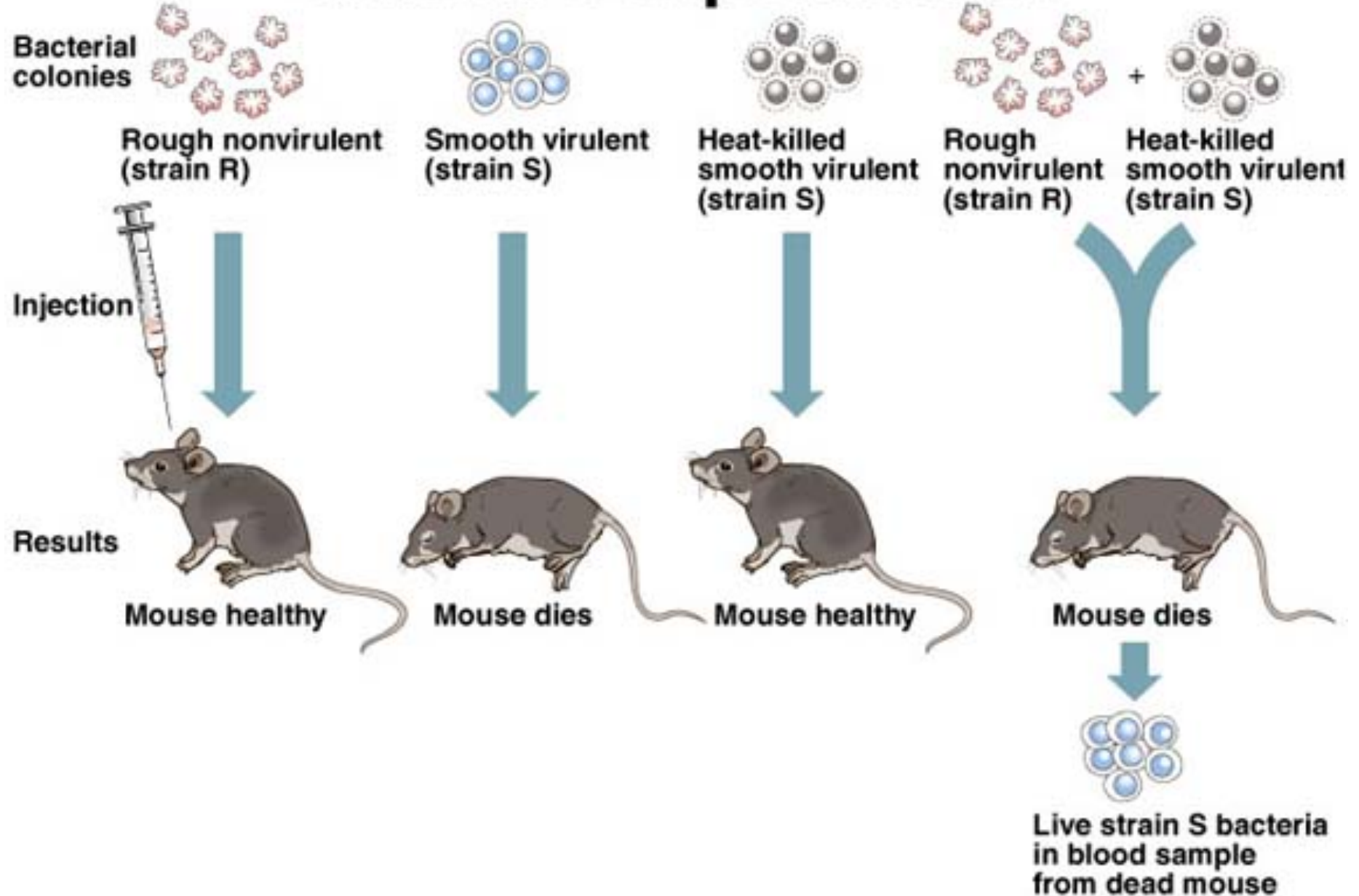
# Friedrich (Fritz) Miescher

- 1869
- extracted a substance from white blood cells
- Called it *nuclein*.
- *What do you think he was actually extracting?*

# Frederick Griffith

- 1928
- experimented on pneumonia bacteria in mice.
- Used 2 strains of a bacterium
  - one pathogenic
  - one harmless
- Discovery: something in heat-killed virulent bacteria could be transferred to live, harmless bacteria and make them virulent.

# Griffith's experiments

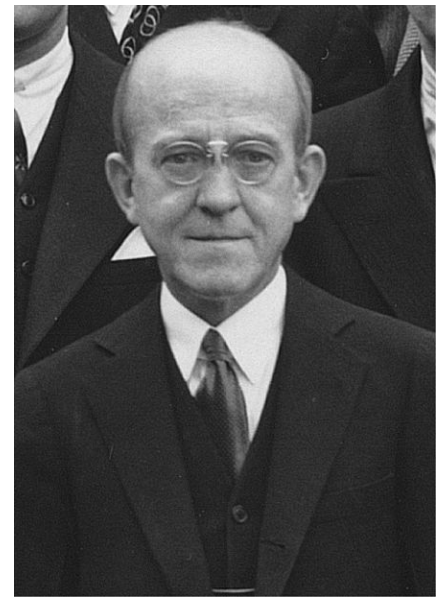


# Griffith's Experiments

- Mixed heat-killed remains of the pathogenic strain with living cells of the harmless strain, some living cells became *pathogenic* (deadly).
- Called this phenomenon **transformation**
- Noticed that genotype and phenotype changed due to assimilation of foreign DNA
- What was the “transforming agent?”

# Oswald Avery

- 1940s...
- Was the transforming agent RNA, DNA, or protein?
- Used enzymes to denature RNA, protein, and DNA, one at a time, in heat-killed S bacteria.
- If bacteria were missing protein and/or RNA, but had DNA, they could still transform R cells into S cells.
- If S bacteria were missing DNA, they could NOT transform R bacteria cells into S bacteria cells.



[https://en.wikipedia.org/wiki/Oswald\\_Avery](https://en.wikipedia.org/wiki/Oswald_Avery)

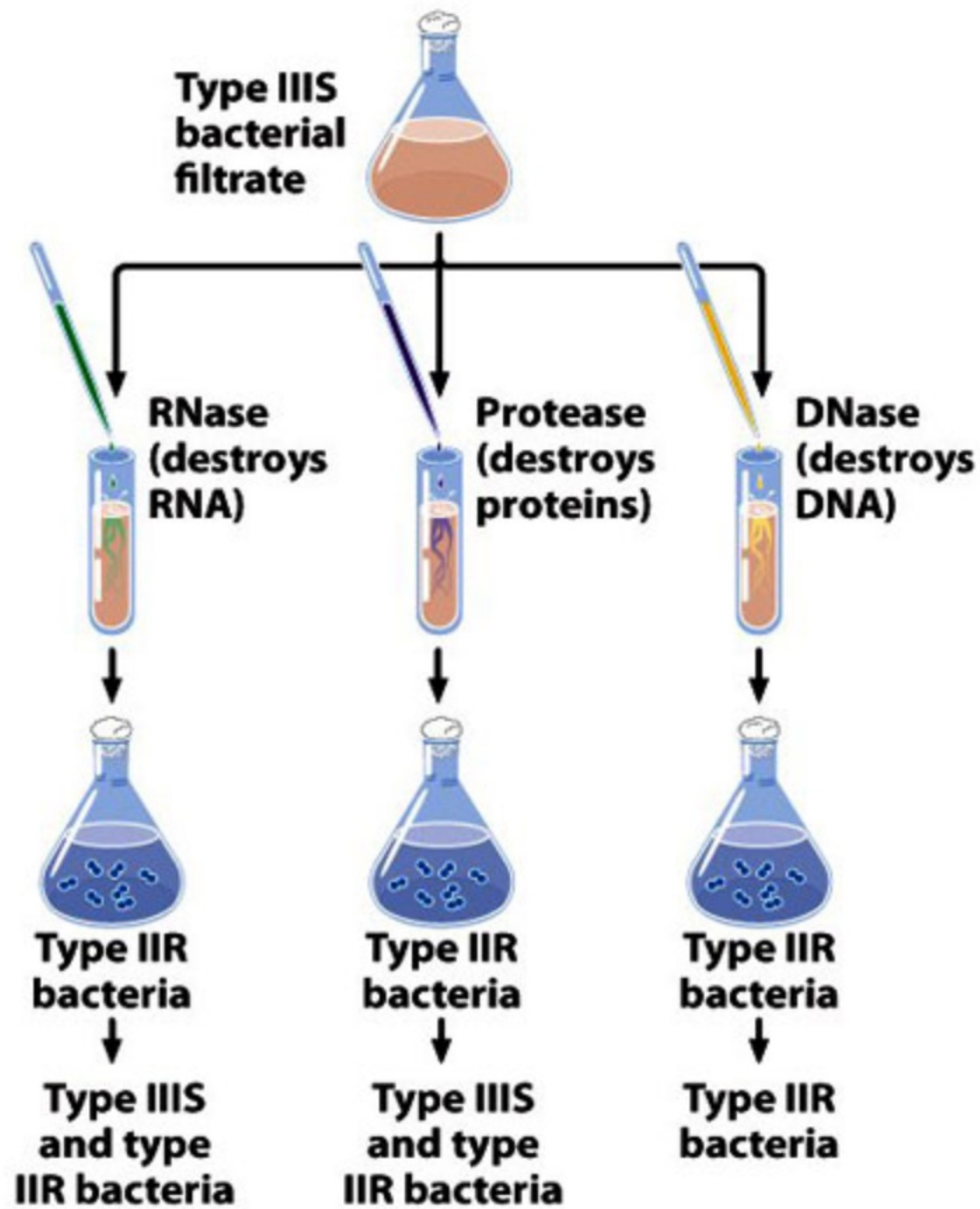
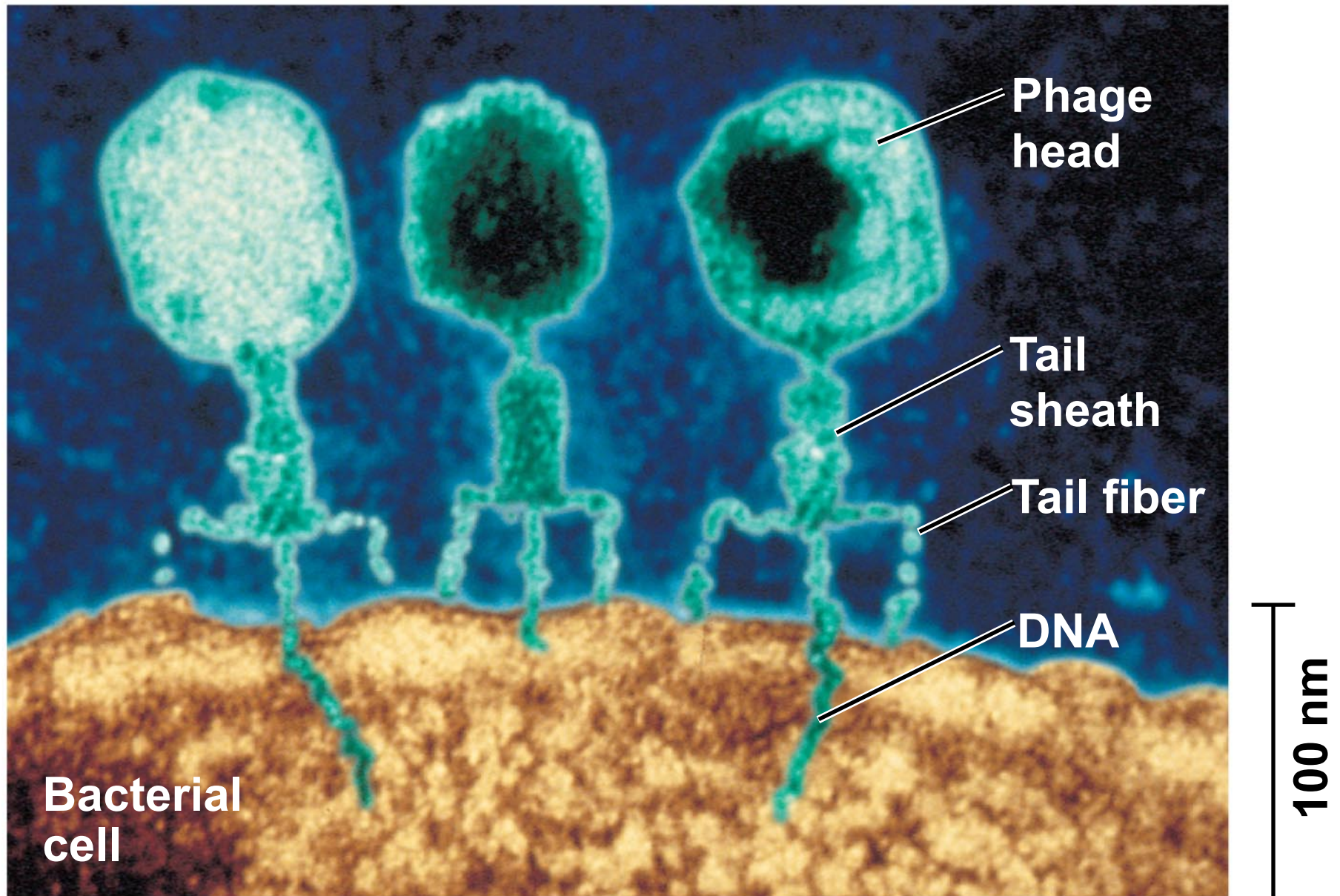


Fig. 16-3



# Hershey and Chase

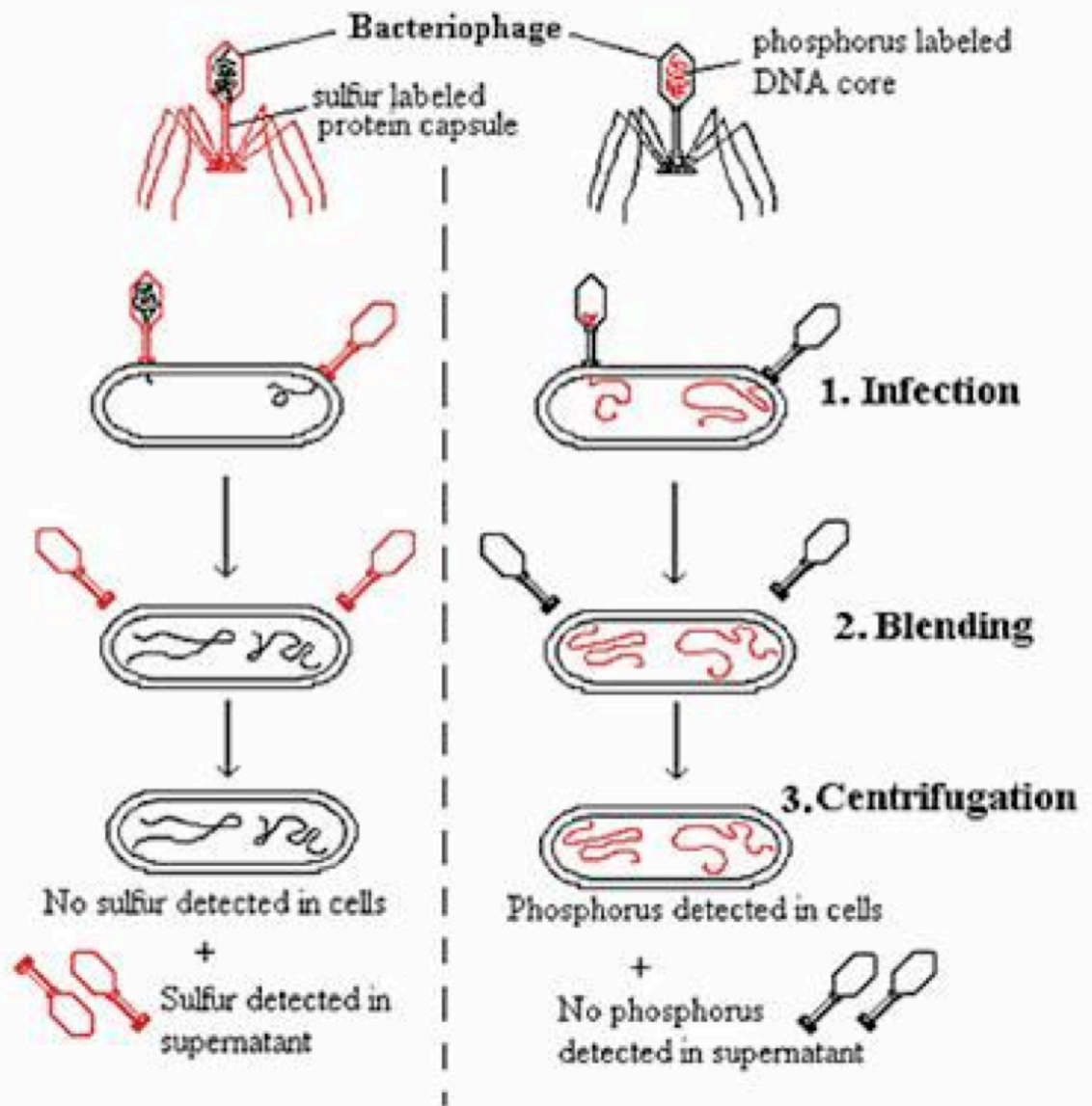
- 1952
- performed experiments showing that DNA is the genetic material of a phage known as T2
- T2 Phage has 2 components: protein and DNA
  - One of the components was the genetic material
- designed an experiment showing that either DNA or protein enters an *E. coli* cell during infection

# Hershey and Chase

Protein contains sulfur.

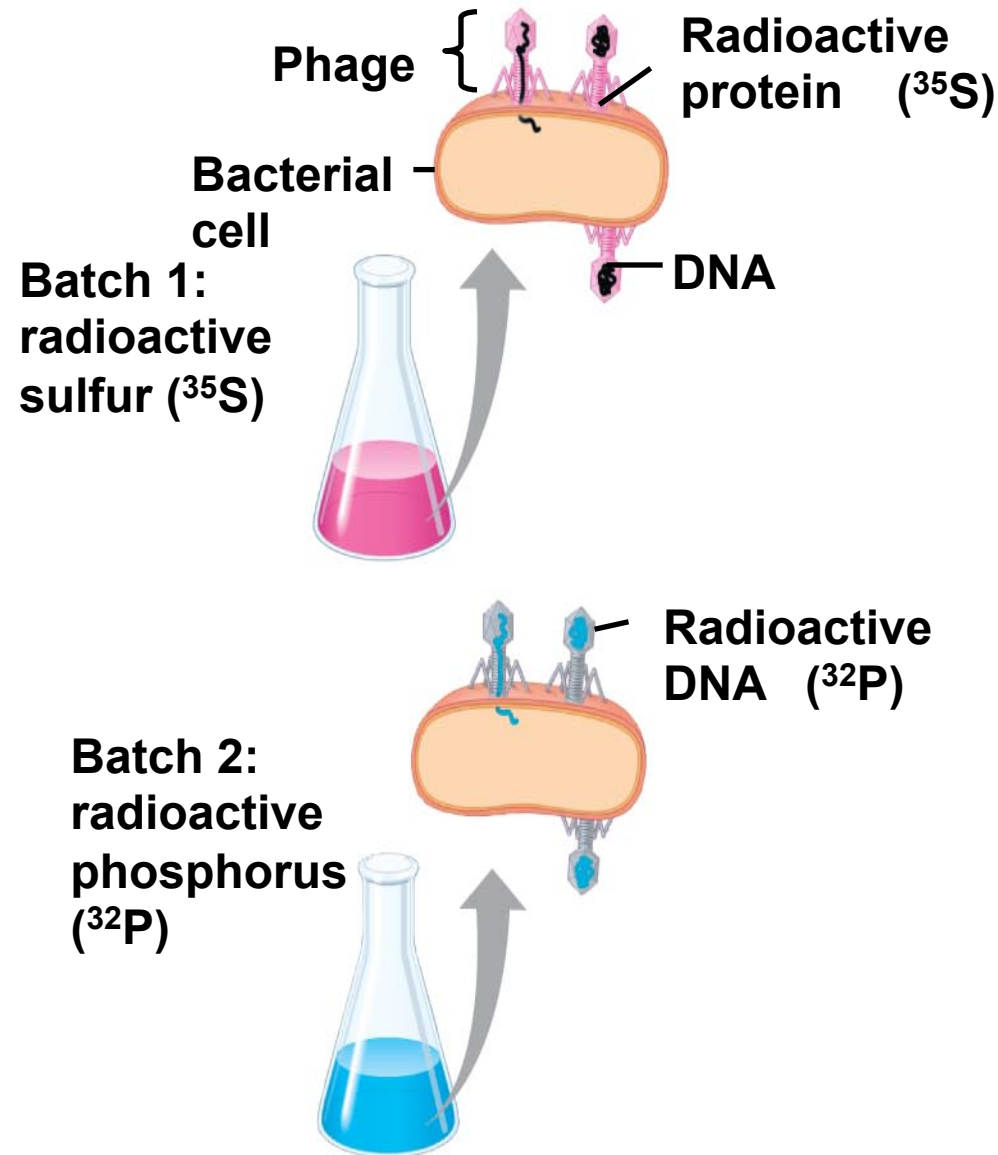
DNA contains phosphorous.

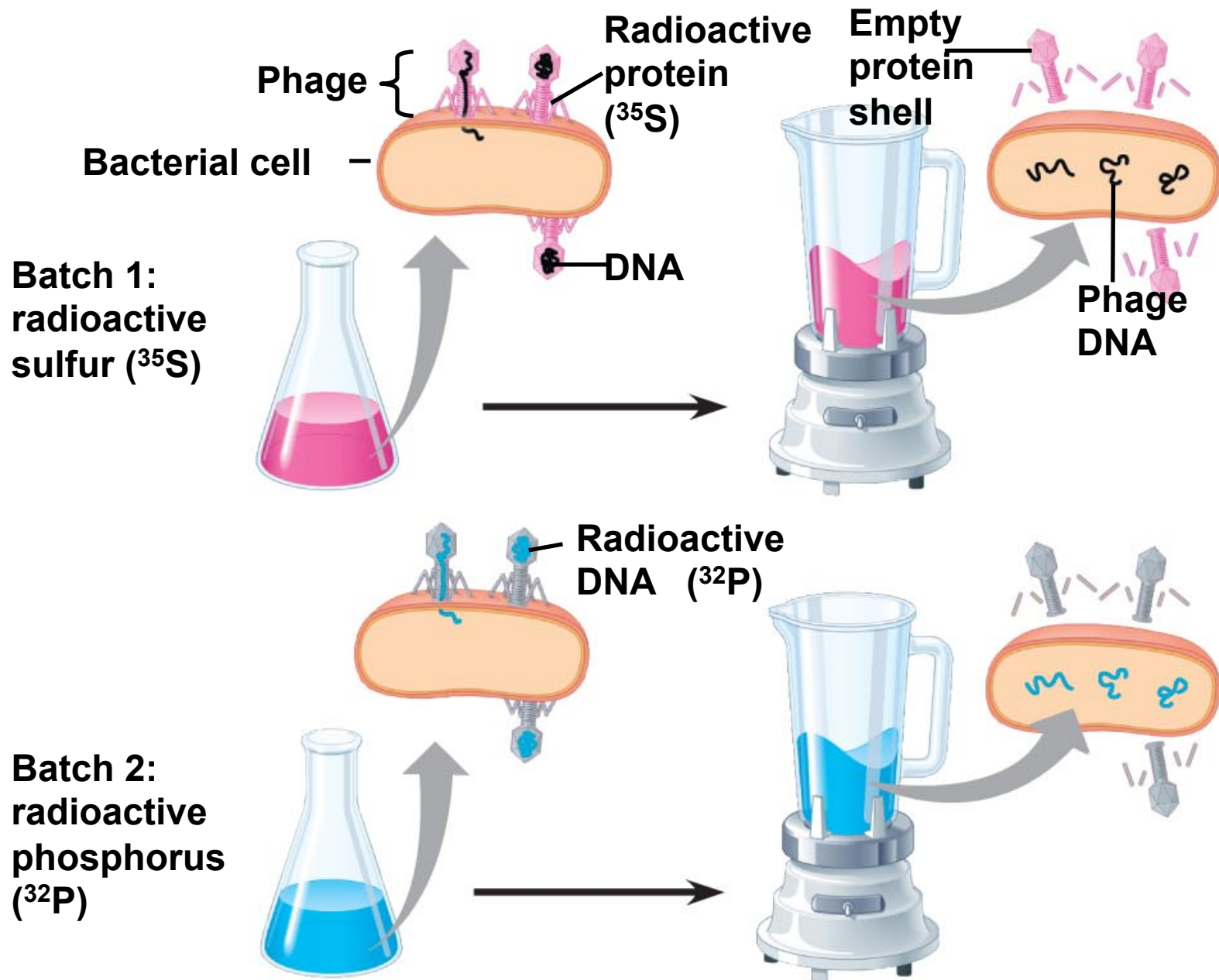
How can this knowledge help to identify protein or DNA as the carrier of genetic information?



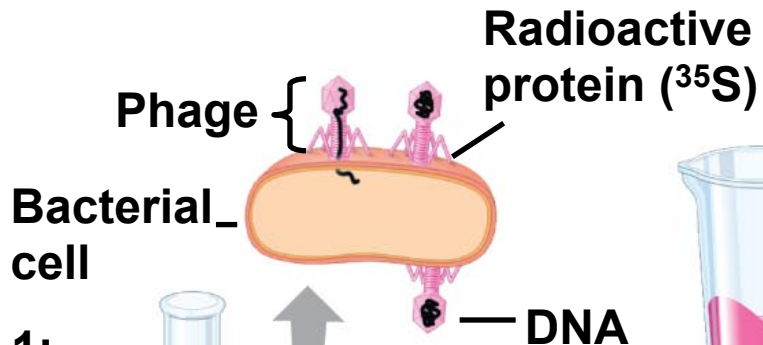
**The Hershey-Chase Experiment**

# Hershey – Chase Experiment





Batch 1:  
radioactive  
sulfur ( $^{35}\text{S}$ )



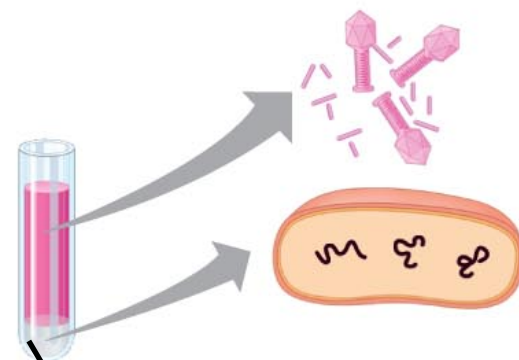
Empty  
protein  
shell



Phage DNA

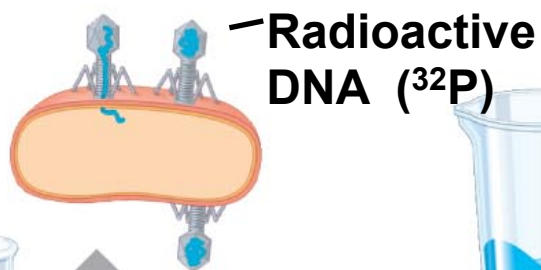
Centrifuge

Radioactivity  
(phage  
protein  $^{35}\text{S}$ )  
in liquid

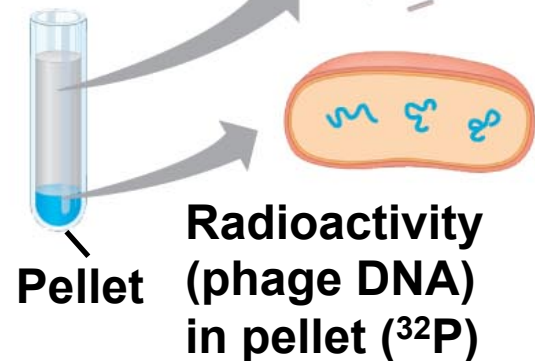


Pellet (bacterial  
cells and  
contents) ( $^{35}\text{S}$ )

Batch 2:  
radioactive  
phosphorus  
( $^{32}\text{P}$ )



Centrifuge



# Hershey and Chase

- Concluded that DNA entered the E. coli and caused the changes, so is the genetic material.

# What we knew so far:

- There are 4 nucleic acids
- Purines (1 CN ring)
  - Adenine
  - Guanine
- Pyrimadines (2 C-N rings)
  - Thymine
  - Cytosine



# Students will be able to.... AKA I can.....

- describe the chemical structure of DNA, and explain how we know the structure.
- explain how the coiling of DNA into chromosomes takes place and why this is important.
- explain 4 differences between DNA and RNA, and why each is significant.
- explain the transcription of RNA from DNA.
- describe three types of RNA and explain the role of each in protein synthesis.
- explain how mRNA is translated into protein.
- trace the synthesis of protein from the transcription of DNA into RNA through the production of a finished protein.