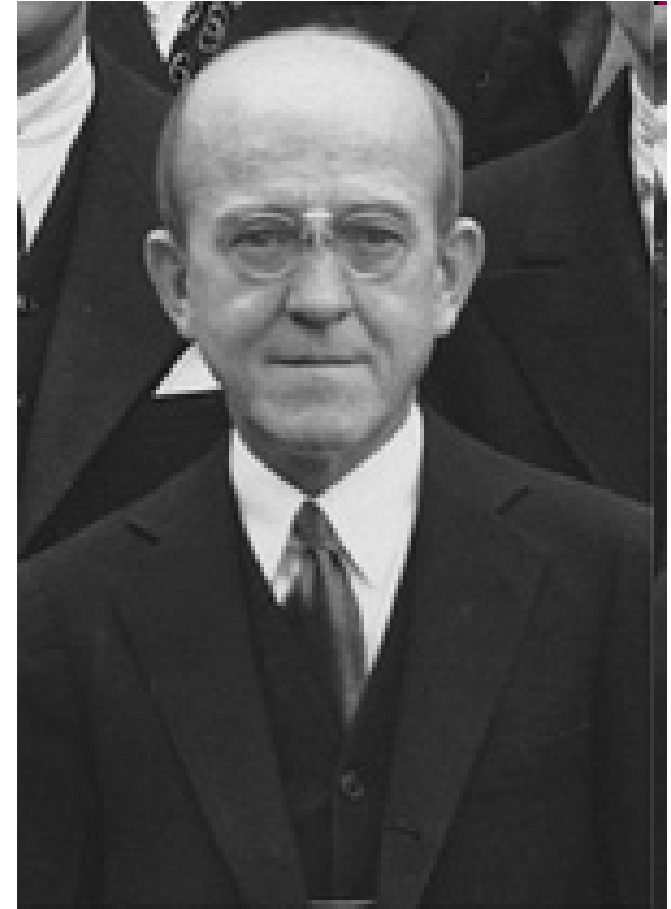


The Search for the Genetic Material: DNA or Protein?

Chapter 12-1

I. Frederick Griffith - 1928

Question: Why do some strains of a particular bacteria cause pneumonia and some don't?

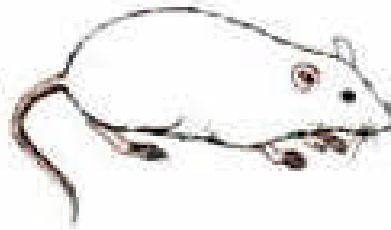


Experimental Design: Griffith worked with two similar strains of bacteria that cause pneumonia in mice.

Smooth Coat



S strain



Mouse dies

(a)

Rough Coat

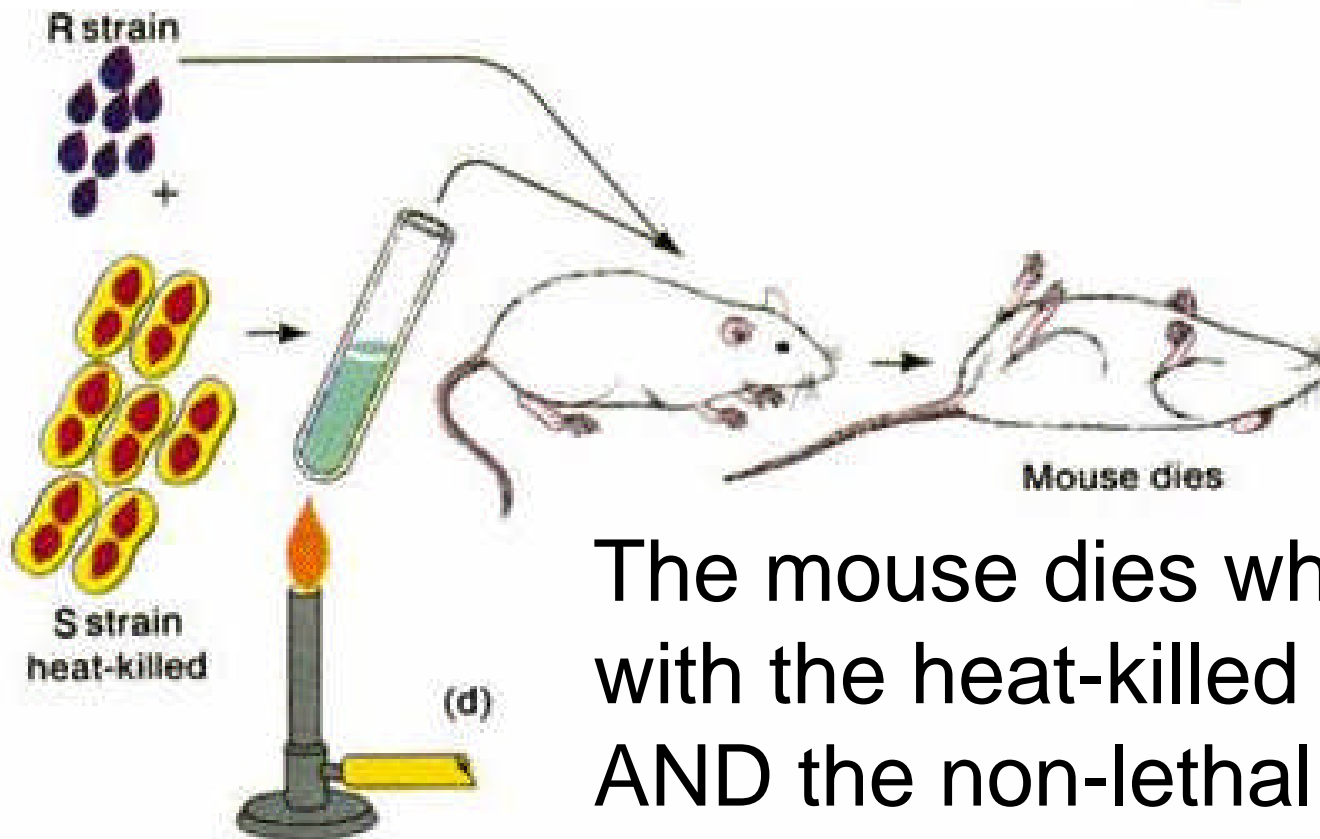
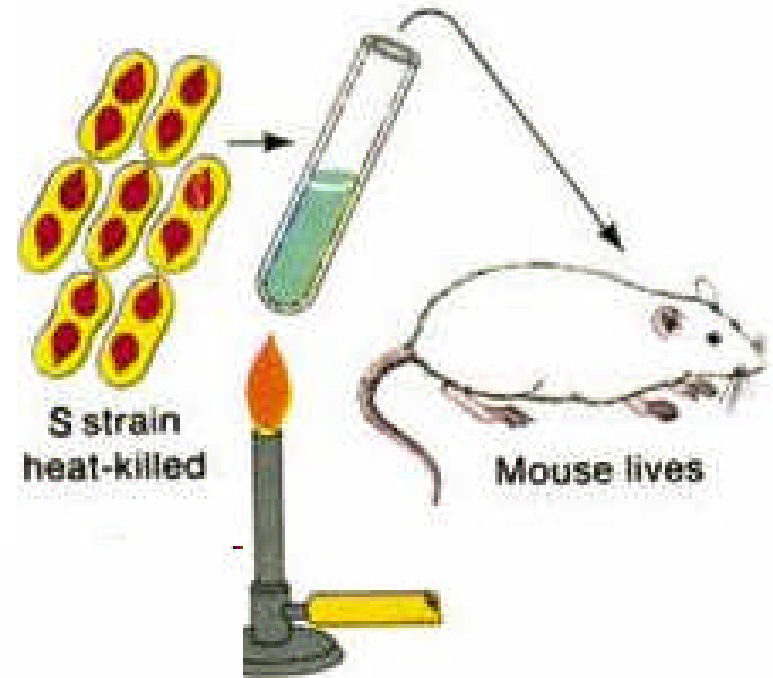
R strain



Mouse lives

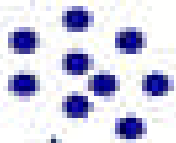
(b)

The mouse survives when injected with the heat-killed Smooth strain.....



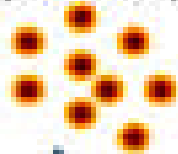
The mouse dies when injected with the heat-killed Smooth strain AND the non-lethal R strain.

Living R
Cells
(control)



Mouse Healthy

Living S
Cells
(control)



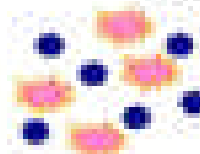
Mouse Dies

Heat-killed S
Cells
(control)



Mouse Healthy

Heat-killed S cells
and Living R
Cells



Mouse Dies

TPS: What conclusion would you draw from these results?

In blood sample, living S cells are found that can reproduce, yielding more S cells



Conclusion

- Some “factor” (gene) that caused the disease (toxin) in the S strain was incorporated into the R strain.
- This process is called.....

Genetic Transformation

II. Oswald Avery - 1944

Question: Which biomolecule is responsible for the transformation?



Experimental Design:

1. Made an extract from the heat-killed S strain of the bacteria.
2. Added enzymes to break down the lipids, carbohydrates, proteins, RNA, or DNA in the extract.

Lipase: Digests lipids

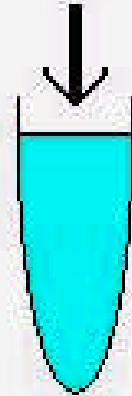
Protease: Digests proteins

RNase: Digests RNA

DNase: Digests DNA

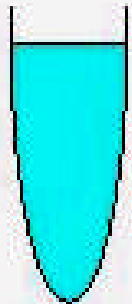
The Result:

Mix of dead smooth and rough live cells



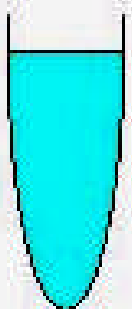
Protease added →

Mice Die



RNase added →

Mice Die



DNase added →

Mice Live

Conclusion

DNA IS THE GENETIC MATERIAL

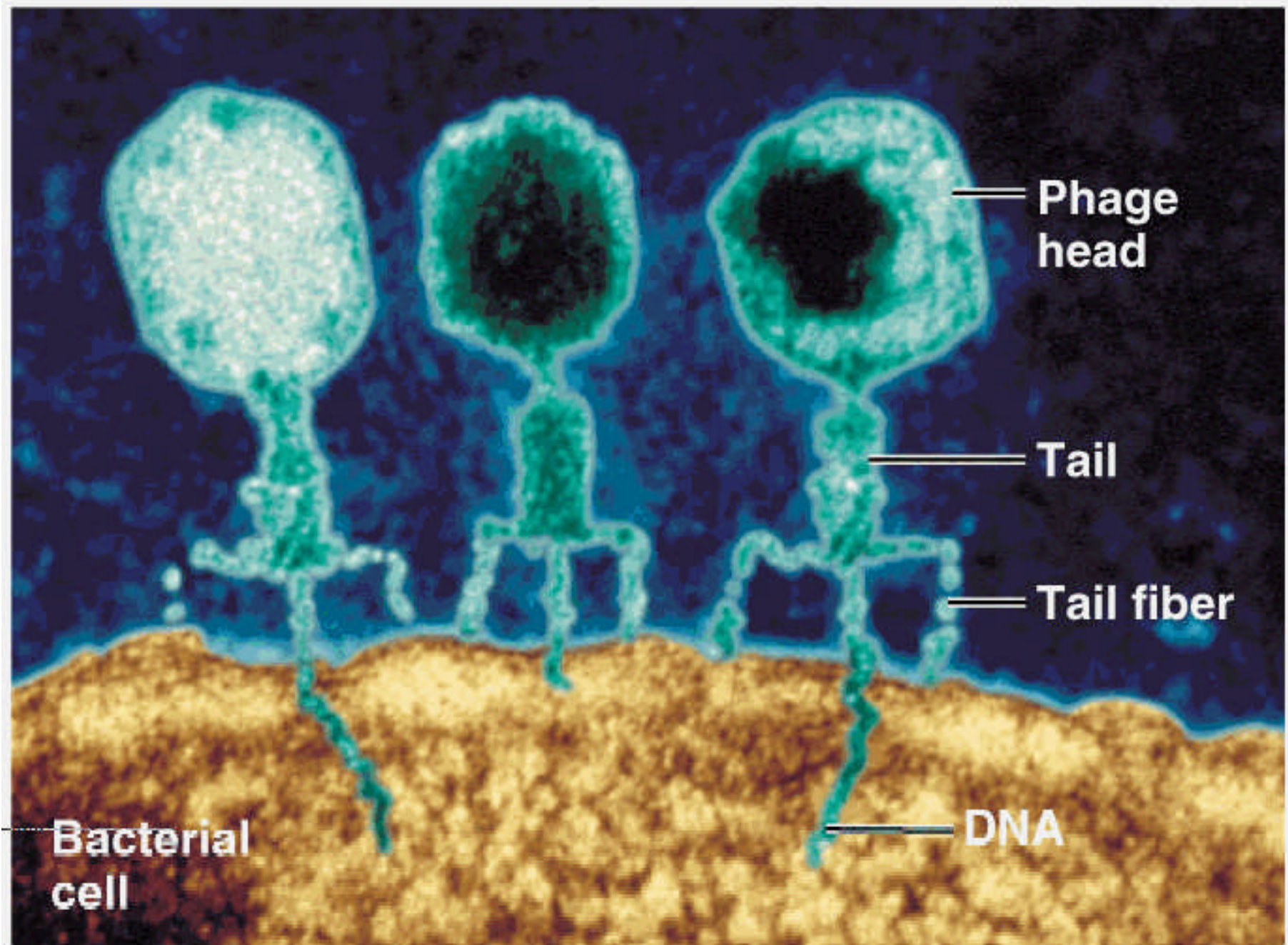
**....but, no one
believed it!**

III. Alfred Hershey and Martha Chase (1952)



Background:

- A bacteriophage is a virus that infects a bacteria.
- Viruses are composed of DNA or RNA and a protein coat.
- In order for virus to reproduce, they must inject their genetic information into the host cell.



(a) T2 and related phages use their tail pieces to attach

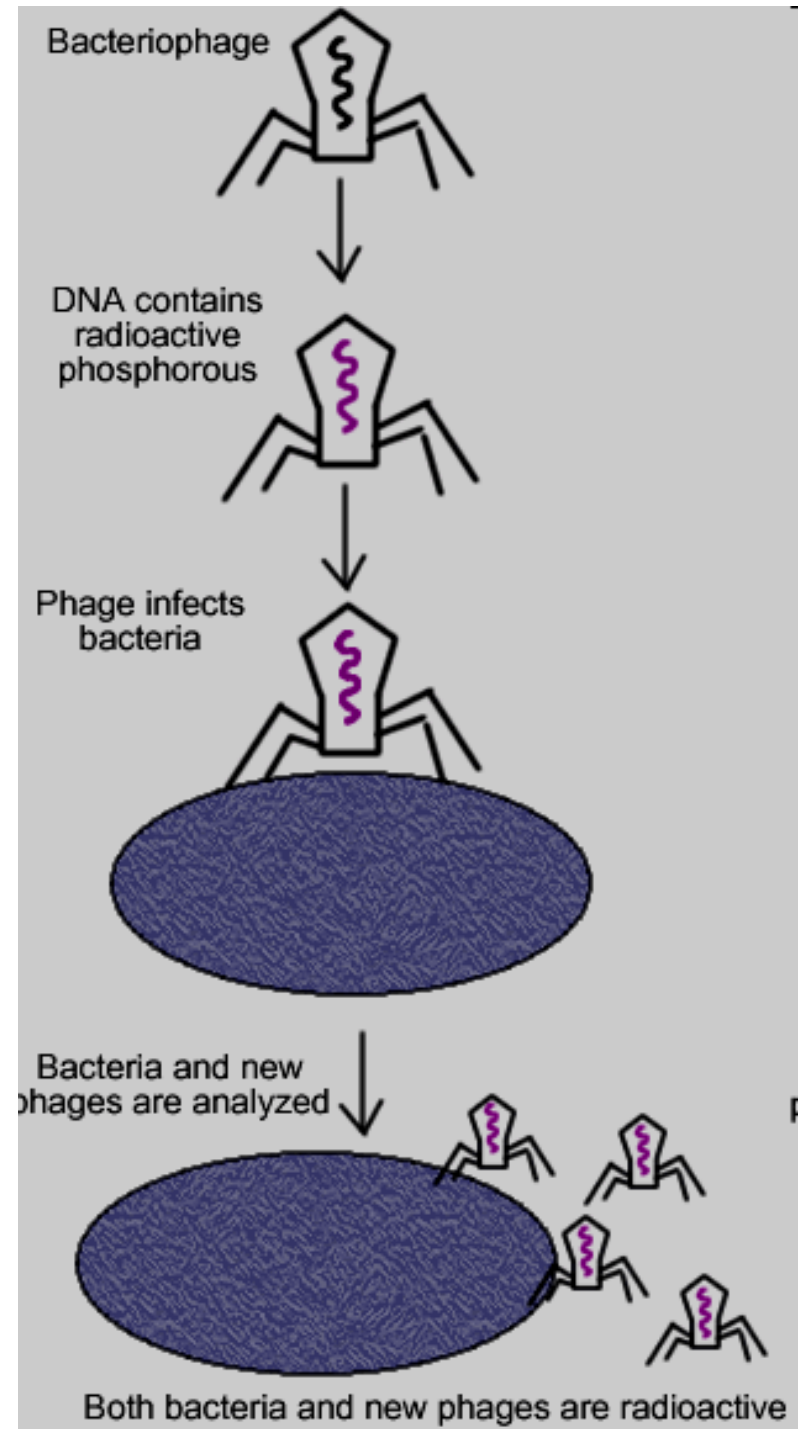
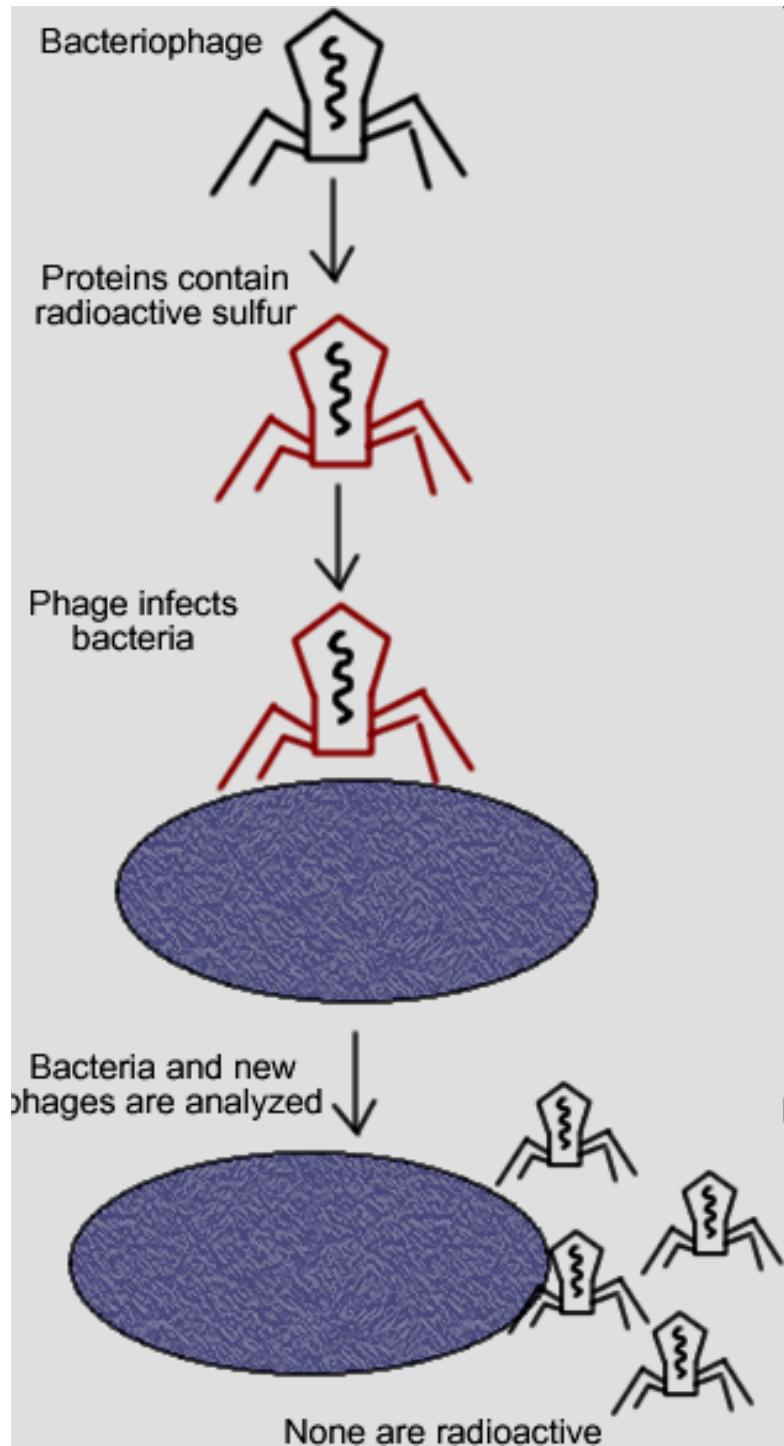
The “Blender” Experiment

Experimental Design:

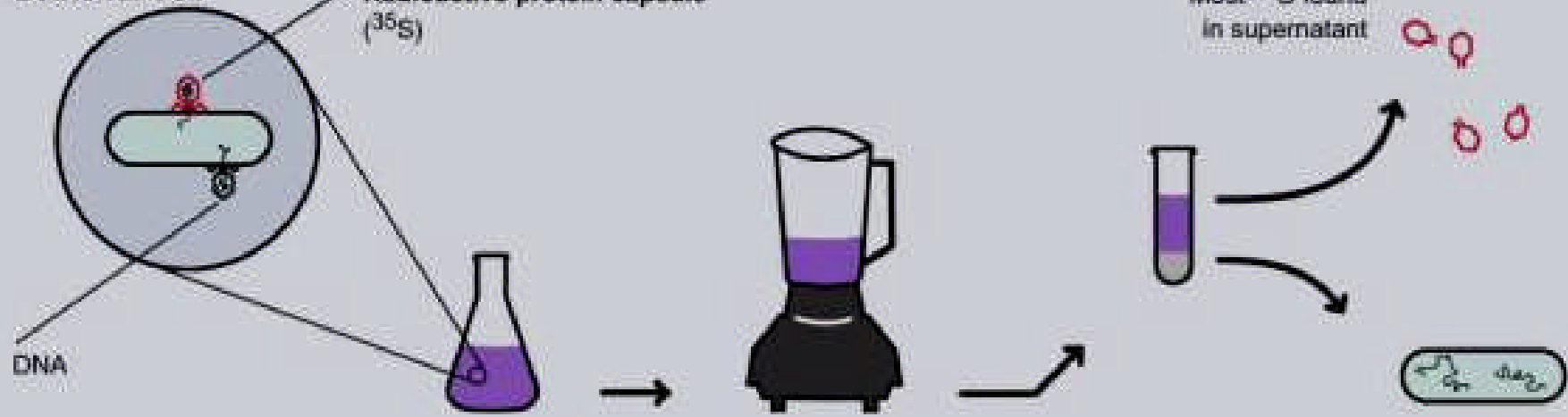
- Proteins contain sulphur, but not phosphorus.
- DNA contains phosphorus, but not sulphur.
- Hershey-Chase used radioactive sulphur and phosphorous to label the DNA and protein in the bacteriophage.

Experimental Design:

- Once the bacteria were infected, the mixture was placed in a blender to dislodge the part of the virus not injected into the cell.
- The samples were spun in a centrifuge where the heavy bacteria were forced to the bottom.
- The lighter liquid on top is called the **supernatant**.



Bacterial Cell
Radioactive protein capsule (^{35}S)

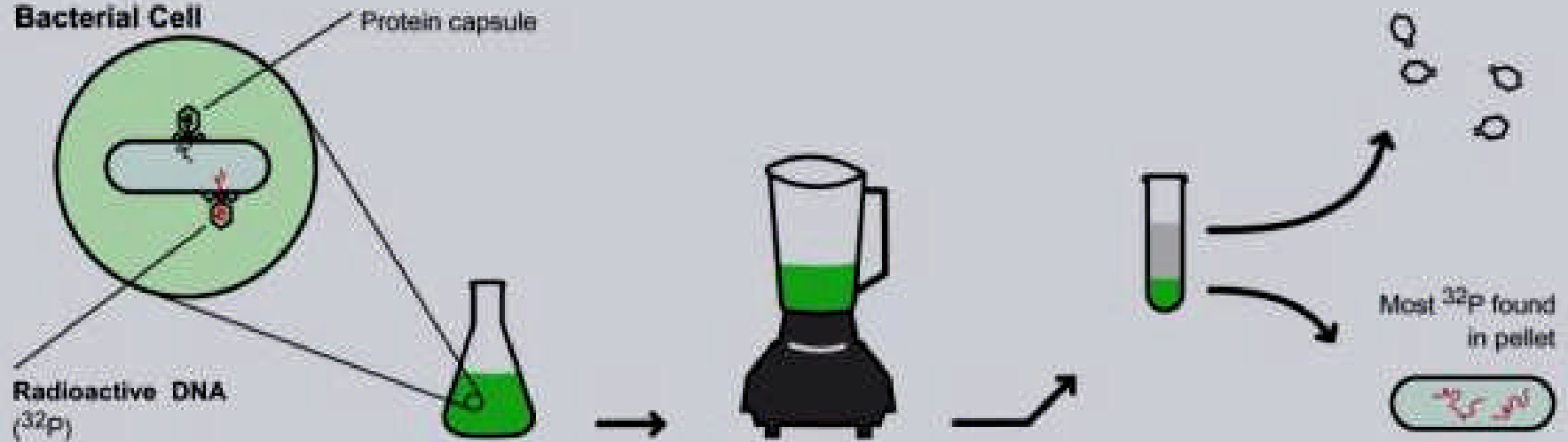


Labeled phages infect bacteria.

Blender separates phages outside the bacteria from the cells and their contents

Cells and Phages are separated by centrifugation.

Bacterial Cell
Protein capsule



Radioactive DNA (^{32}P)

Most ^{32}P found in pellet

Are you convinced now?

DNA is the genetic material.