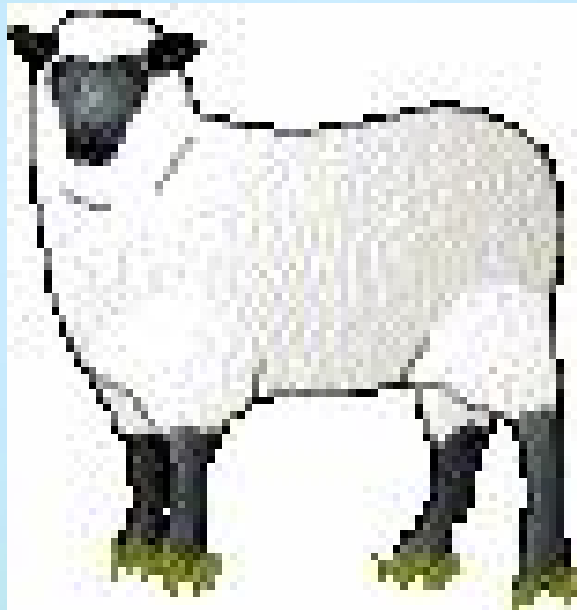


The Search for Heredity



The Players

- Frederick Griffith (1928)
- Avery, McCarty, & MacLeod (1944)
- Alfred Hershey & Martha Chase (1952)
- Edwin Chargaff (late 1940's)
- Maurice Wilkins & Rosalind Franklin
(late 40's & early 50's)
- Linus Pauling (late 40's & early 50's)
- Francis Crick & James Watson (1953)

Griffith & Pneumonia 1928

Streptococcus pneumoniae bacteria

Smooth colonies = **virulent**

Rough colonies = **benign**

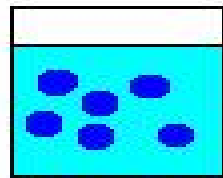
Heat-killed smooth = **benign**

Heat-killed smooth & heat-killed rough = **benign**

Live smooth & heat-killed rough = **virulent**

Heat-killed smooth & live rough = **virulent**

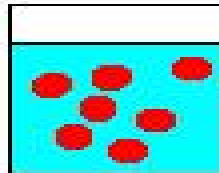
Griffith & Pneumonia



living virulent strain



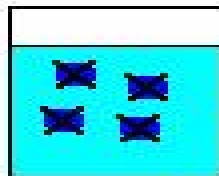
mouse dies



living avirulent strain



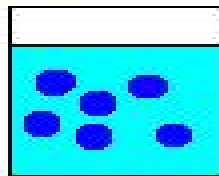
mouse lives



heat-killed virulent strain

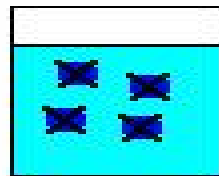


mouse lives



living avirulent strain

+



heat-killed virulent strain



mouse dies

Avery, McCarty, & MacLeod 1944

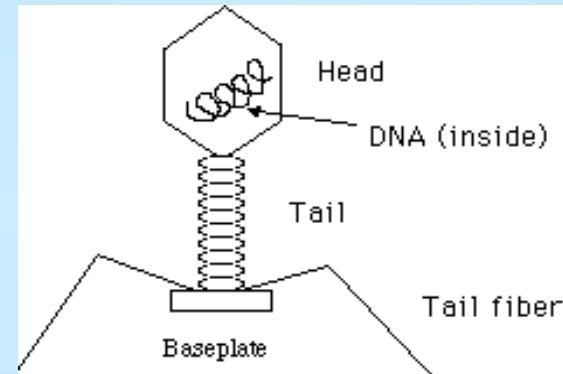
- Extended Griffith's work 16 years later
- Search for the transforming factor
- Live rough cells +
 - Protein from heat-killed smooth cells
 - Carbohydrates from heat-killed smooth cells
 - Lipids from heat-killed smooth cells
 - DNA from heat-killed smooth cells ← This one
 - Which was virulent?

Alfred Hershey & Margaret Chase

Used bacteriophage

Remember...

a virus that infects bacteria



Protein capsid.....proteins contain **sulfur**

DNA core.....**DNA** contains **phosphorus**

Radiolabelled the **sulfur** in the **protein** capsid

Radiolabelled the **phosphorus** in the **DNA** core

The radio-labeled phages are allowed to infect bacteria.

Agitation in a blender dislodges phage particles from bacterial cells.

Centrifugation concentrates cells, separating them from the phage particles left in the supernatant.

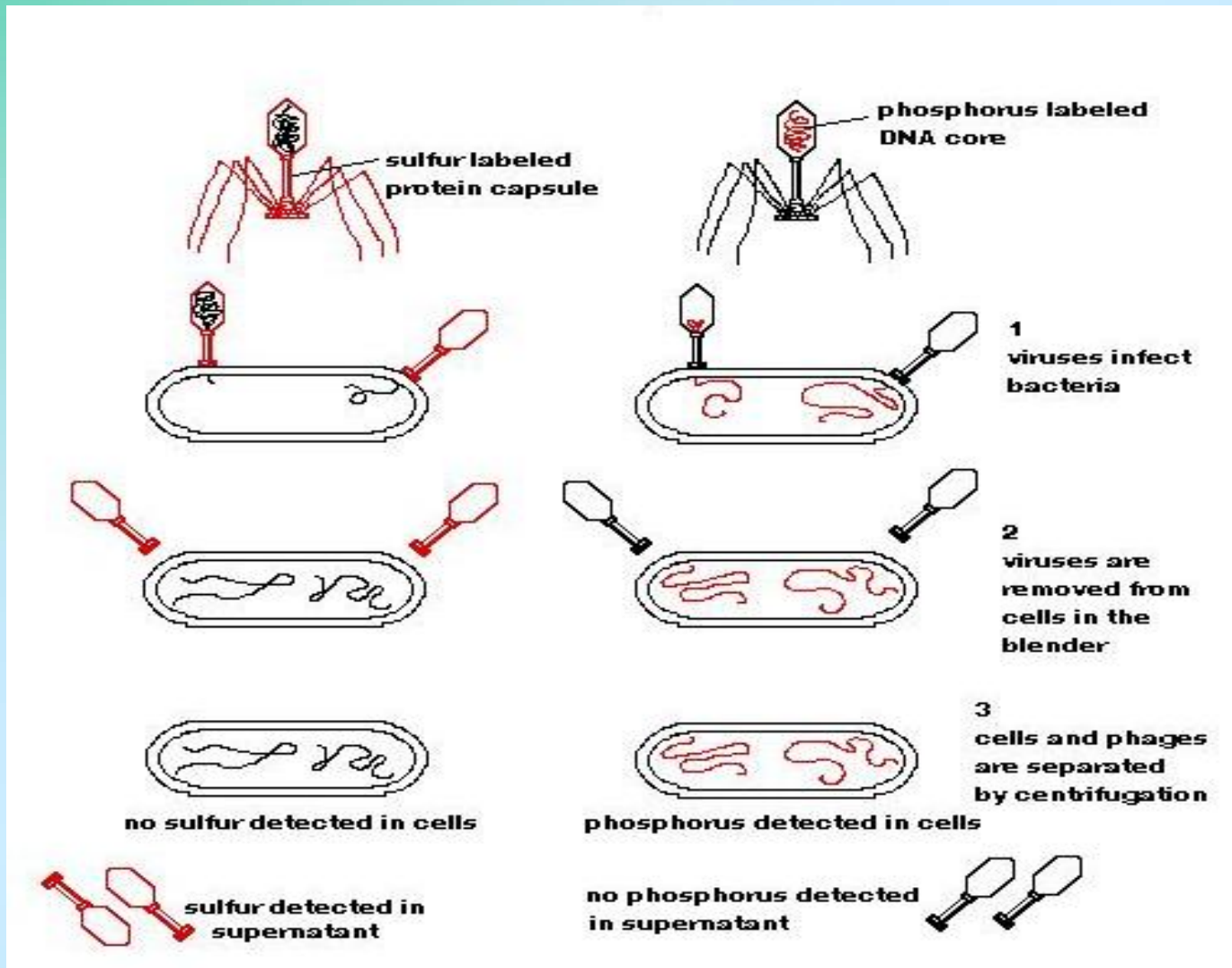
What is in the cell?

Protein

or

DNA ?

Alfred Hershey & Martha Chase 1952



Hershey~Chase Results & Conclusion

Results

Radioactive **sulfur** is found predominantly in the supernatant.

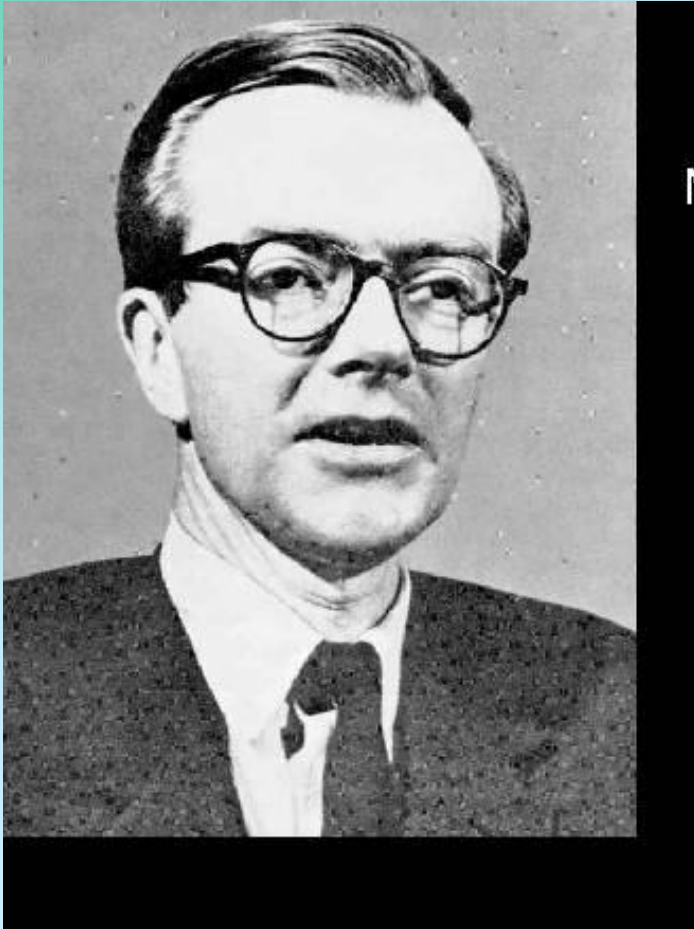
Radioactive **phosphorus** is found predominantly in the cell fraction, from which a new generation of infective phage can be isolated.

Conclusion

The **active component** of the bacteriophage that transmits the infective characteristic is the **DNA**.

There is a clear correlation between **DNA** and **genetic information**.

Maurice Wilkins



Head of the X-Ray Lab
at King's College

X-Ray Crystallography

"Pictures" of
crystallized DNA

Rosalind Franklin



Worked in Wilkin's X-Ray laboratory at King's College

Gathered evidence for the structure of several forms of crystallized DNA

Francis Crick



Graduate student in
Cavendish Lab

Developed a
mathematical theory
for the
crystallography of
helices

Studied **protein**
structure...**proteins**
from helices!

Erwin Chargaff

1950

Columbia University

discovered that no matter what tissue from an animal he looked at,

% Adenine = % Thymine

&

% Cytosine = % Guanine

the percentages did vary from species to species

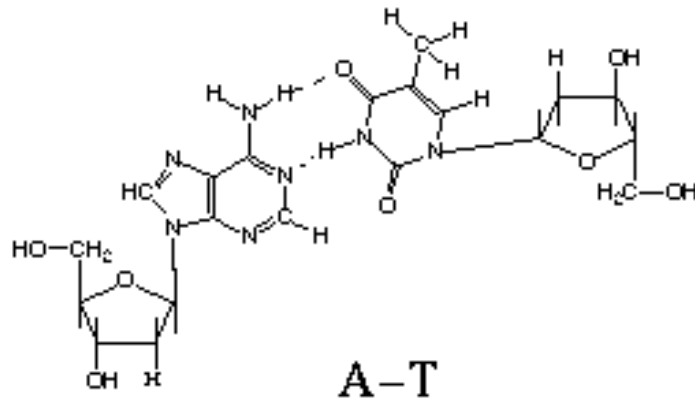
James Watson



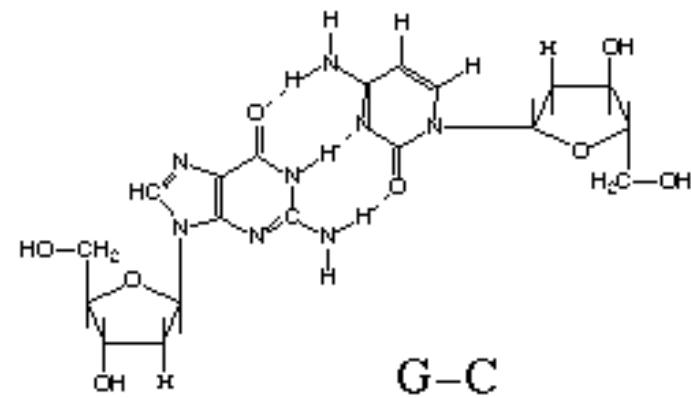
Post-graduate fellow
at the Cavendish
Developed base-pairing
rules from
Edwin Chargaff's
observations about
constant proportions of
adenine and thymine,
cytosine and guanine

Base-Pairing Rules

DNA Basepairs



Adenosine-Thymidine
(Adenine-Thymine)

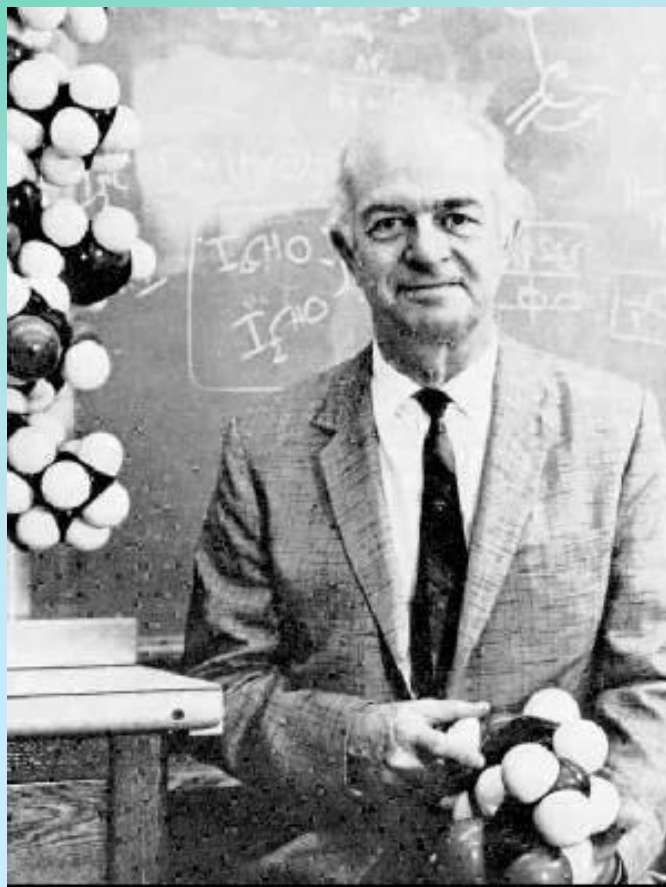


Guanosine-Cytidine
(Guanine-Cytosine)

Watson & Crick at *work*



Linus Pauling



Protein Chemist at Cal
Tech

Chemical Bonding
Theory

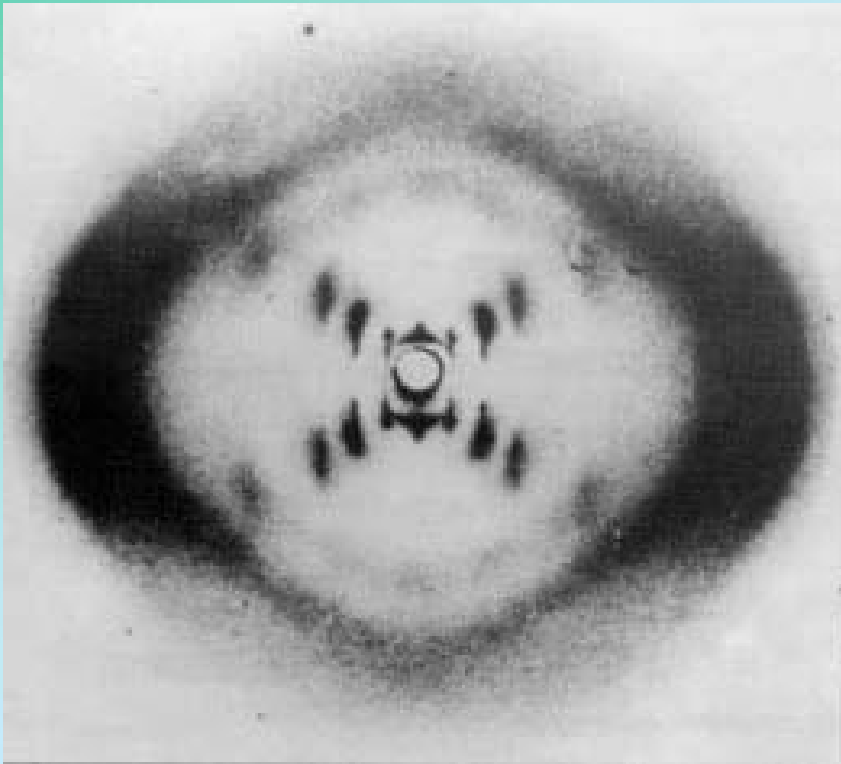
Protein chemistry &
structure

Vitamin C studies

Anti-nuclear bomb
activist

Triple Helix Model of
DNA

Rosalind's X-Ray Picture of DNA



Clearly a *HELIX*

<http://www.accessexcellence.org/AB/WYW/wkbooks/SFTS/sidebarmilestone.html#history>

Known Information

DNA is made up of subunits called nucleotides. Each nucleotide is made up of a sugar, a phosphate and a base.

There are 4 different bases in a DNA molecule:

- adenine (a purine)
- cytosine (a pyrimidine)
- guanine (a purine)
- thymine (a pyrimidine)

Requirements of Genetic Material

It must be able to

replicate,

to be in each cell of a growing organism.

control expression of traits
by encoding the sequence of proteins.

change in a controlled way,
to ensure survival of a species in a changing environment.

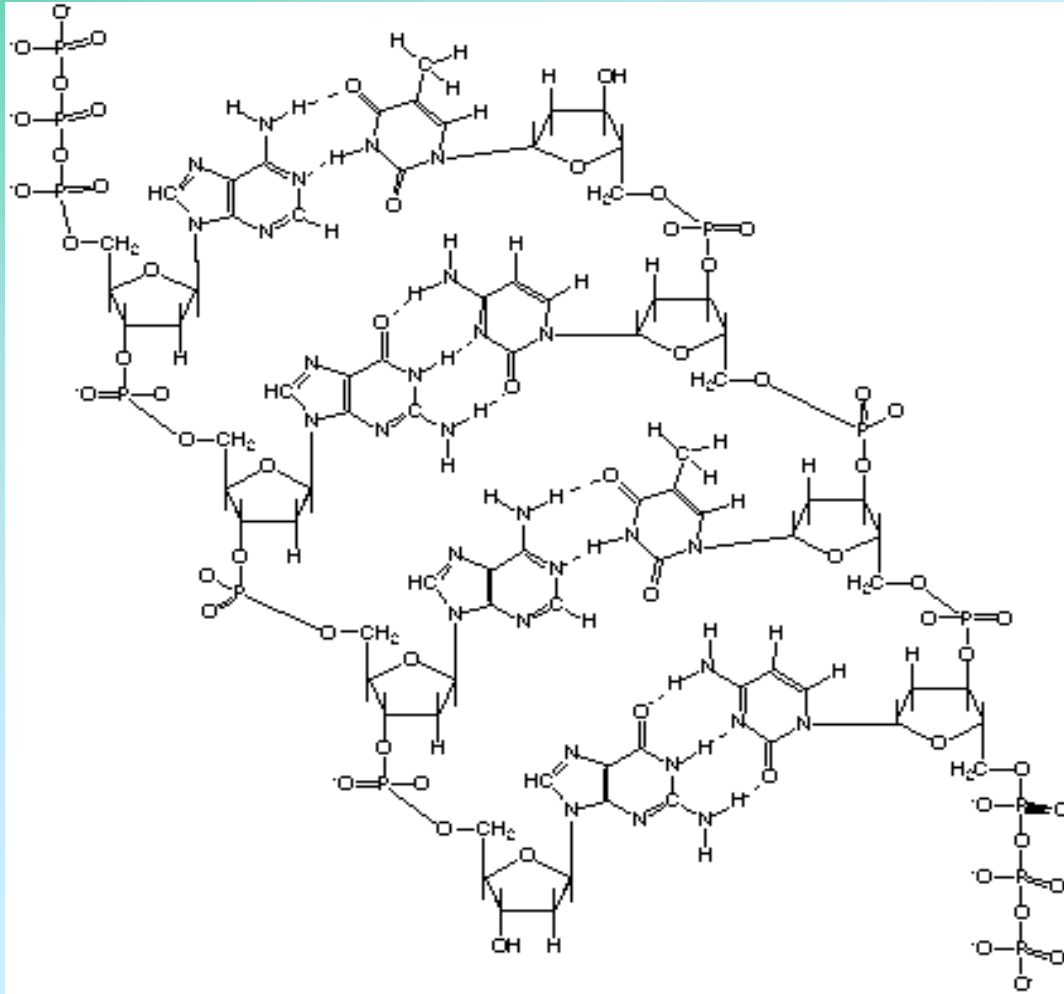
A Structural Model

- Used nucleotide models made of wire
- Watson and Crick put the pieces together to account for the variety of facts that they knew described the molecule would permit replication, control of traits, and controlled change

published their hypothesis

"Molecular Structure of Nucleic Acids: A Structure for Deoxyribose Nucleic Acid"
in the British journal
Nature (April 25, 1953). 171:737-738.)

A 2-Dimensional Version



Journey
into DNA

DNA Function....Protein Synthesis

- Replication...make more DNA
- Transcription...make RNA from DNA
 - mRNA
 - rRNA
 - tRNA
- Translation...make proteins from RNA



Sources

<http://www.biology.arizona.edu/>

<http://www.accessexcellence.org/AB/GG/hershey.html>

<http://www.botany.uwc.ac.za/mirrors/MIT-bio/bio/dogma/history1.html>

<http://www.accessexcellence.org/AB/WYW/wkbooks/SFTS/sidebarmilestone.html#history>

http://www.brookscole.com/biology/member/student/tutor/interactive_concepts/genetic.html