Genetic Material

Discovery of Genetic Material

Mendel's work was rediscovered

- In the 1900s, people **already knew** that genetic info was **stored in the chromosomes**
- They **did not know** whether the info was **stored in the protein or the DNA** (nucleic acid), since chromosomes were made of both

Griffith

- Griffith's experiment was on **two strains of Streptococcus pneumoniae**
- The two strains were (**S**)mooth and (**R**)ough
- S had a sugar coat on it, and caused pnemonia
- Griffith's observations
Smooth Strain	**Rough Strain**	**Dead Smooth Strain**	**Dead Smooth Strain + Rough Strain**
Mouse died	Mouse Survived	Mouse Survived	Mouse Died
- He concluded that live **R strains can be transformed into S strains**

Avery

- Avery tested what part of the S strain turns the R strain into an S strain
- He tested:
  - DNA
  - Protein
  - Lipids
- He found that only the **DNA made the R strand turn into an S strand**
- He theorized that the **DNA from the S strand leaked** and the **R strand picked it up and replicated it**, creating live S strands

Hershey and Chase

Bacteriophage

- A type of virus
- Attacks bacteria
- In this study, the type selected was made of only **DNA and protein**

- Cannot reproduce on their own, need to inject themselves into a living cell

Method

- There are two groups of bacteriophage and liquid culture medium
- Radioactive labeling
    - In the **first** group
        - Bacteriophage grown in **radioactive Phosphorous**
        - DNA contains Phosphorous while Protein does not
        - **Labels the DNA** radioactively
    - In the **second** group
        - Bacteriophage grown in **radioactive Sulfur**
        - Protein contains Sulfur while DNA does not
        - **Labels the Protein** radioactively
- Labeled bacteriophage was then put in the liquid culture to hijack and reproduce
- After some time, the bacteriophage was removed, when the DNA was already injected into the culture (probably using a blender)
- The bacteriophage was then separated using a centrifuge and readings of the radioactivity taken
    - Culture sinks to the bottom while the bacteriophage floats to the top
- Radioactivity Results
    - In the **first** group
        - Radioactivity was detected in the **bottom** of the vial (where the **culture** was)
        - Since the first group labeled the DNA, this proves that the DNA moves on into the culture
        - **DNA is used in the reproduction** of the bacteriophage
    - In the **second** group
        - Radioactivity was detected in the **top** of the vial (where the removed **bacteriophage** was)
        - Since the second group labeled the Protein, this proves that the Proteins stay with the bacteriophage
        - **Protein is not used in reproduction**
- Conclusion is that DNA is used in reproduction of bacteriophage, not Protein

DNA Structure

- After Hershey-Chase, scientists believed that DNA was the genetic material
- We still do not know how RNA and DNA was formed

Nucleotides

- Nucleotides are what **make up Nucleic Acids** (including DNA and RNA)
- Parts of a nucleotide (discovered by **P. A. Levene**)

    - 5C Sugar
    - Phosphate Group
    - Nitogenous Base
- **Purine Bases have two rings** while **Pyrimidine Bases have one**
- **DNA**'s Nitrogenous Base will always be one of
    - Adenine (Purine Base)
    - Guanine (Purine Base)
    - Cytosine (Pyramidine Base)
    - Thymine (Pyramidine Base)
- **RNA**'s Nitrogenous Base will always be one of
    - Adenine (Purine Base)
    - Guanine (Purine Base)
    - Cytosine (Pyramidine Base)
    - Uracil (Pyramidine Base)

Chargaff

- Found that the amount of A and T, and G and C in a cell are roughly the same
- Chargaff's Rule: $C = G \ \& \ T = A$

Franklin

- Took photo 51, which depicted a double helix

Watson and Crick

- Used their own as well as Chargaff's and Franklin's data to make new conclusions
- Conclusions
    - The two outside strands consist of alternating deoxyribose and phosphate
    - **C and T** pair together with **three hydrogen bonds**
    - **T and A** pair together with **two hydrogen bonds**

DNA Structure

- **C and T** pair together with **three hydrogen bonds**
- **T and A** pair together with **two hydrogen bonds**
- Purine Bases can only bond with Pyramidine bases because of the space between the rails of the double helix
- The total number of pyramidine bases will **always equal** to the number of purine bases

Orientation

- Each side of the double helix points the opposite direction as they are **antiparallel**