

# DNA

## Griffith & Transformation

- In 1928, British scientist Fredrick Griffith was trying to learn how certain types of bacteria cause pneumonia
- He isolated 2 different strains of pneumonia bacteria from mice & grew them in his lab
- **Griffith made two observations**
  - (1) The disease-causing strain of bacteria grew into smooth colonies on culture plates
  - (2) The harmless strain grew into colonies with rough edges
- **Griffith's Experiments**
  - Griffith set up 4 individual experiments
    - **Experiment 1:**
      - Mice were injected with the disease causing strain of bacteria, the mice developed pneumonia & died
    - **Experiment 2:**
      - Mice were injected with the harmless strain of bacteria. These mice didn't get sick
    - **Experiment 3:**
      - Griffith heated the disease causing bacteria, then injected the heat killed bacteria into the mice & the mice survived
    - **Experiment 4:**
      - Griffith mixed his heat killed disease causing bacteria with live harmless bacteria & injected the mixture into the mice, the mice developed pneumonia & died
- Griffith concluded that the heat killed bacteria passed their disease causing ability to the harmless strain

## Transformation

- Griffith called this process **transformation** because one strain of bacteria (the harmless strain) had changed permanently into another (the disease-causing strain)
- Griffith hypothesized that a factor must contain information that could change harmless bacteria into disease causing one

## Avery & DNA

- Oswald Avery repeated Griffith's work to determine which molecule was most important for transformation
- Avery & his colleagues made an extract from the heat-killed bacteria that they treated with enzymes
- The enzymes destroyed proteins, lipids, carbohydrates, & other molecules during the nucleic acid RNA
- Transformation still occurred
- Avery & other scientists repeated the experiment using enzymes that would break down DNA
- When DNA was destroyed transformation didn't occur. Therefore they concluded that DNA was the transforming factor
- **What did scientists discover about the relationship between genes & DNA?**
  - Avery & other scientists discovered that the nucleic acid DNA stores & transmits the genetic information from one generation of an organism to the next

# DNA

## The Hershey-Chase Experiment

- Alfred Hershey & Martha Chase studied viruses - non living particles smaller than a cell that can infect living organisms
- **Bacteriophages**
  - A virus that infects bacteria is known as a **bacteriophage**
  - Bacteriophages are composed of DNA or RNA core & a protein coat
  - When a bacteriophage enters a bacterium, the virus attaches to the surface of the cell & injects its genetic information into it
  - The viral genes produce many new bacteriophages which eventually destroys the bacterium
  - When the cell splits open, hundreds of new viruses burst out
  - They grew viruses in cultures containing radioactive isotopes of phosphorus-32 ( $^{32}\text{P}$ ) & Sulfur-35 ( $^{35}\text{S}$ )
  - **If  $^{35}\text{S}$  was found in the bacteria it would mean that the viruses protein had been injected into the bacteria**
  - **If  $^{32}\text{P}$  was found in the bacteria then it was the DNA that had been injected**
  - **Nearly all the radioactivity in the bacteria was from phosphorus ( $^{32}\text{P}$ )**
  - Hershey & Chase concluded that the genetic material of bacteriophage was DNA not protein

## The Components & Structure of DNA

- DNA is made up of **nucleotides**
  - A **nucleotide** is a monomer of nucleic acids made up of a 5 carbon sugar called deoxyribose, a phosphate group, & a nitrogenous base
- **There are 4 kinds of bases in DNA**
  - **Adenine**
  - **Guanine**
  - **Cytosine**
  - **Thymine**
- The back bone of a DNA chain is formed by sugar & phosphate groups of each nucleotide
- The nucleotides can be joined together in any order

## Chargaff's Rules

- **Erwin Chargaff discovered that**
  - The percentages of guanine (G) & cytosine (C) bases are almost equal in any sample of DNA
  - The percentages of adenine (A) & thymine (T) bases are almost equal in any sample of DNA
- **The Double Helix**
  - **Using clues from Franklins pattern, James Watson & Francis Crick built a model that explained how DNA carried information & could be copied**
  - Watson & Crick's model of DNA was a double helix in which 2 strands were wound around each other
  - Watson & Crick discovered that hydrogen bonds can form only between certain base pairs - adenine & thymine, & guanine & cytosine
  - This principle is called **base pairing**