1. Structure of DNA

The base sequence of DNA forms the **genetic code** for producing **specific proteins**.

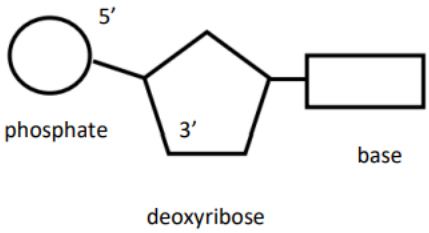
3D Structure

DNA is made of **2 strands** of nucleotides that coil up to form a **3D structure** called a **double helix**.

Nucleotide

Smallest individual unit of DNA made up of:

1. **Phosphate** on carbon 5 (C5)
2. **Deoxyribose sugar** on carbon 3 (C3)
3. **Base** (Adenine, Thymine, Guanine or Cytosine)

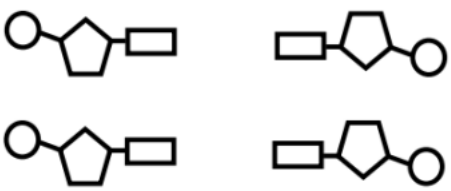


Complementary Base Pairing

Adenine pairs with **Thymine**.

Guanine pairs with **Cytosine**.

* ALWAYS USE FULL NAMES *

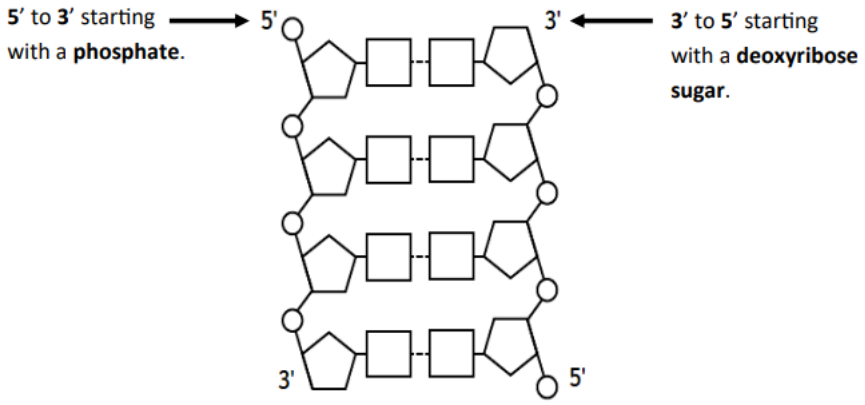


1. Structure of DNA

Antiparallel Structure

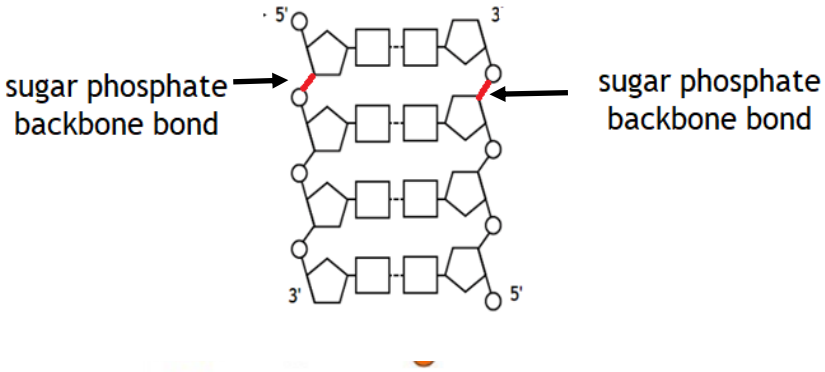
One strand runs from **5' to 3'** starting with a phosphate.

The other strand runs from **3' to 5'** starting with a deoxyribose sugar.



Hydrogen Bonds

Bonds between **complementary** bases hold the two strands together.



Sugar Phosphate Backbone

Sugar-phosphate bond between C3 on Deoxyribose sugar and C5 on phosphate creates the DNA backbone.

DNA Calculations

1. If there are 300 bases in total and 20% are guanine, calculate the number that are Adenine.

   Adenine - 30% Thymine - 30%
   Guanine - 20% Cytosine - 20%

   Adenine - 30% of 300
   300/100 = 3 (1%)
   3 x 30% = **90 bases**

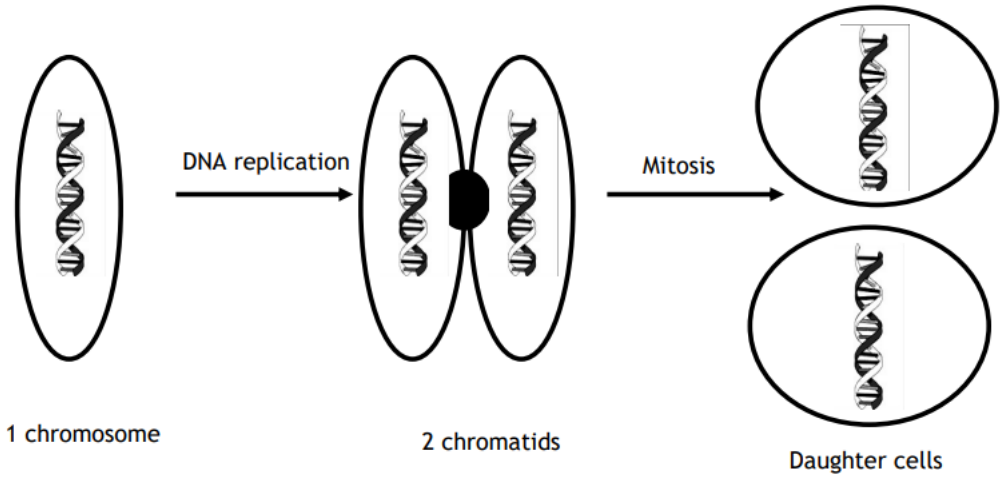
2. If there are 20 adenine and 40 cytosine how many DNA bases are there in total.

   20 adenine = 20 thymine
   40 cytosine = 40 guanine

   20 + 20 + 40 +40 = **120 bases**

2. Replication of DNA

DNA is replicated **before cell division** occurs to form two identical DNA double helixes.



Importance of DNA Replication

To ensure that each daughter cell has the **correct number of chromosomes** to ensure that no genetic information is lost.

DNA Replication - Requirements

1. Primers
2. Enzymes (DNA Polymerase and Ligase)
3. DNA Template
4. Free complementary DNA nucleotides
5. ATP

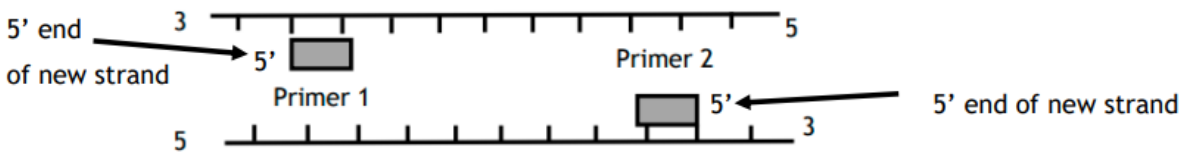
Primers

Short strand of nucleotides **complementary** to target DNA.

Function of Primers

Start DNA replication by binding to **3' end** of DNA **template strand**.

This allows DNA polymerase to start replication of the new DNA strand.



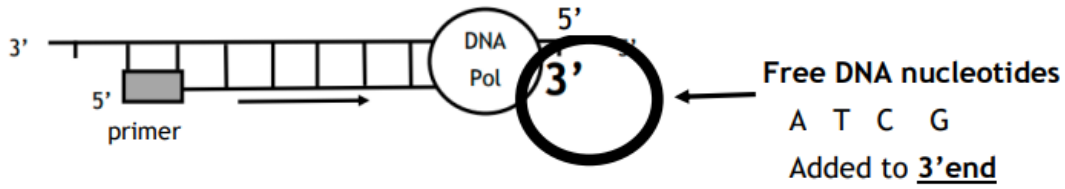
2. Replication of DNA

DNA Polymerase (enzyme)

Adds **free complementary DNA** nucleotides to the **3' end** of the new DNA strand

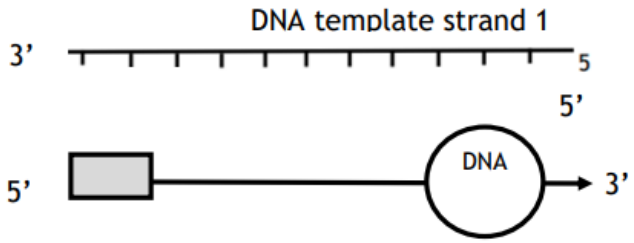
Free Complementary DNA Nucleotides

Added to the 3' end to create the **new** strand.



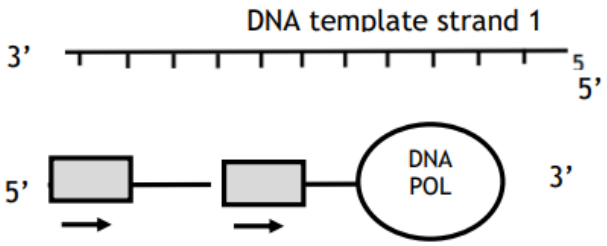
Leading & Lagging Strand

Leading strand **replicated continuously** Lagging strand replicated in **fragments**



Leading strand

Newly synthesised single leading strand from **5' to 3'**



Lagging strand

Newly synthesised DNA fragments in lagging strand from **5' to 3'**

Ligase (enzyme)

Joins fragments of DNA together.

2. Replication of DNA

DNA Replication

Stage 1

DNA **unwinds** and separates into **two template strands**, breaking **hydrogen bonds** between the bases.

Stage 2

Primers bind to the **5' end** of the new strand, **starting DNA replication** by allowing DNA polymerase to add DNA nucleotides.

Stage 3

DNA polymerase adds **free** complementary **DNA nucleotides** to the **3'** end of the new DNA strand.

Stage 4

DNA polymerase only adds nucleotides from **5' to 3'** on the new strand and as DNA is **antiparallel**

1. The **leading** strand being replicated **continuously**
2. The **lagging** strand replicated in **fragments.**

Stage 5

Fragments in the lag strand are joined by the enzyme **ligase.**