

Chapter 6: Nucleic acids and protein synthesis

▼ 6.1. The structure of DNA and RNA

▼ What are the characteristics of genetic materials (2)

1. the ability to carry instructions
2. ability to be copied perfectly

▼ What does DNA and RNA stand for?

DNA - Deoxyribonucleic acid, RNA - ribonucleic acid. They are macromolecules/ polymers.

They are referred to as nucleic acids.

▼ Nucleotides

Nucleotides are made up 3 smaller components; a nitrogen-containing base, a pentose sugar, and a phosphate group.

▼ Name the five different nitrogen-containing bases.

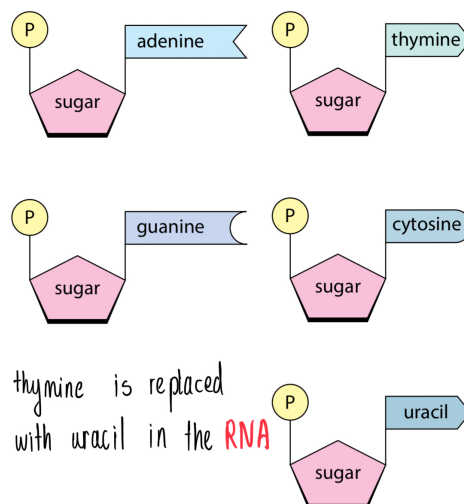


Figure 6.2 Nucleotides. A nucleotide is made of a nitrogen-containing base, a pentose sugar and a phosphate group ©.

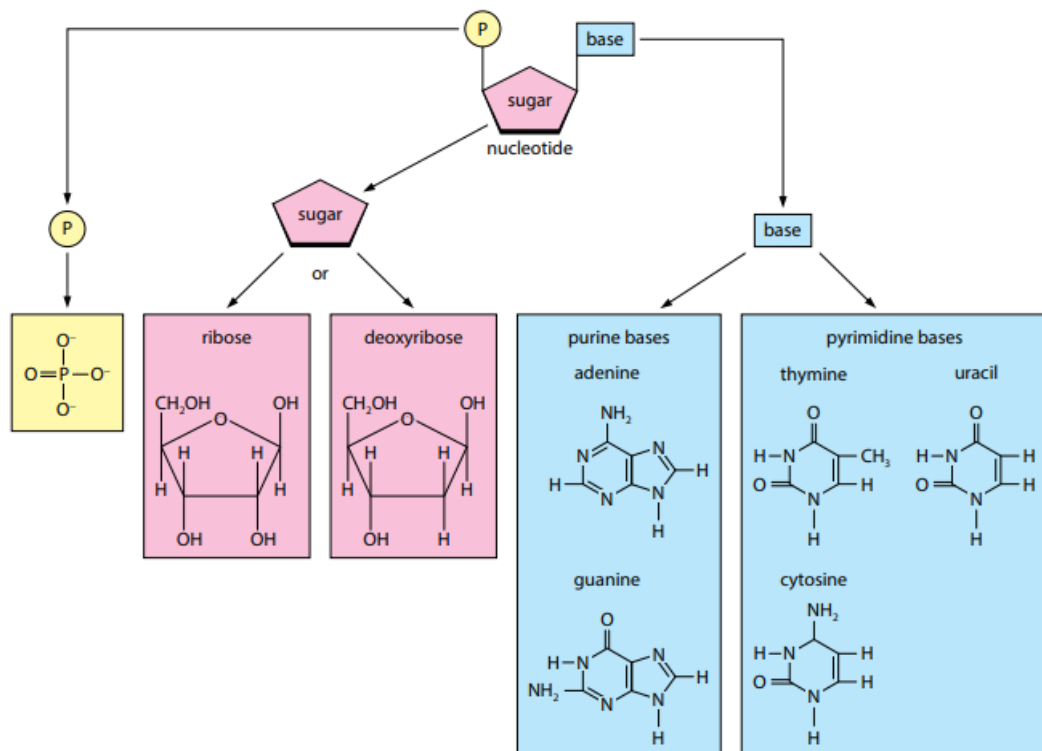
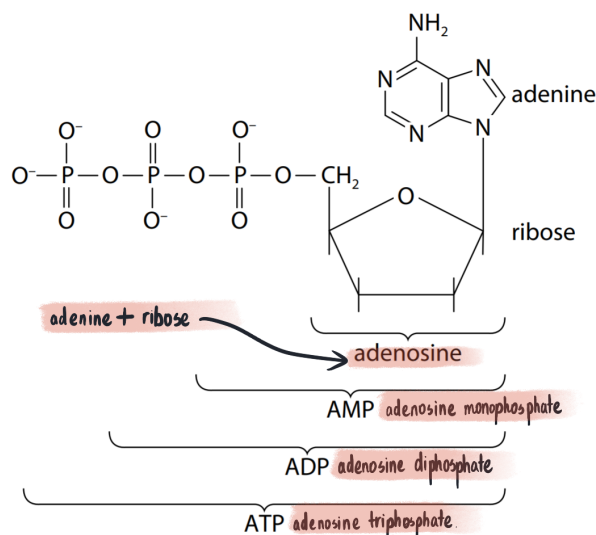


Figure 6.3 The components of nucleotides. Note that you do not need to learn these structural formulae.

▼ Draw the structure of ATP and name each part.



▼ What is the bond joining two nucleotides

Phosphodiester bond: a bond joining two nucleotides together; there are two ester bonds, one from the shared phosphate group to each of the sugars either side of it

● Polynucleotides

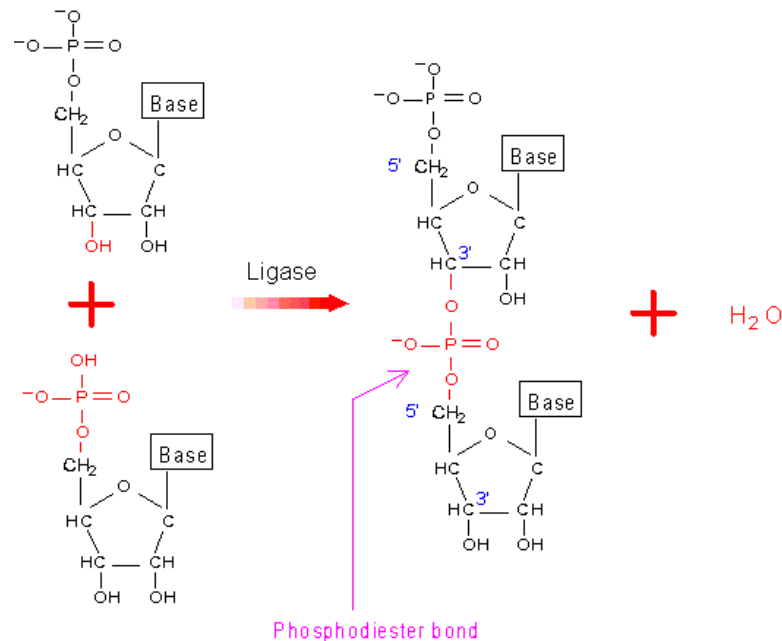
▼ What are the complementary bases

A with T, C with G.

Pyrimidines are one ring wide and purines are two ring wide.

▼ What is a phosphodiester bond?

A phosphodiester bond is a chemical bond that forms when exactly two hydroxyl groups in phosphoric acid react with a hydroxyl group on other molecules forming ester bonds. It is found in the DNA and RNA backbone.



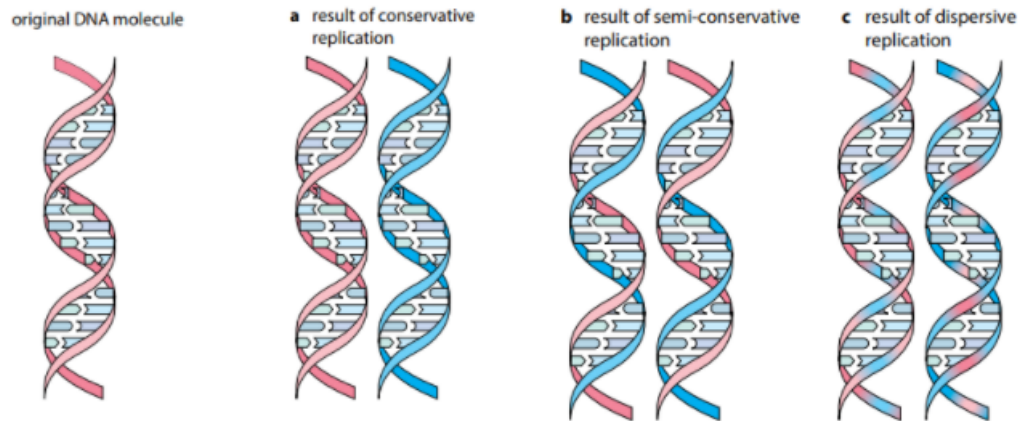
▼ What is ligase?

ligase. / ('laɪ,geɪz) / noun. any of a class of enzymes that catalyze the formation of covalent bonds and are important in the synthesis and repair of biological molecules, such as DNA.

▼ 6.2. DNA replication

▼ What is the method of copying called?

Semi-conservative replication, and it is the method by which a DNA molecule is copied to form two identical molecules, each containing one strand from the original molecule and one newly synthesized strand.



▼ DNA replication process and Okazaki fragments

1. The DNA double helix unwinds and 'unzips' as the hydrogen bonds between the bases break.
2. The DNA polymerases are then used, on both strands, and it adds one new nucleotide at a time, which is held by hydrogen bonding to the strand being copied.
3. DNA polymerase can only copy in the 5' to 3' direction along each strand.
4. **The leading strand:** during the DNA replication, the parent strand that runs in the 3' to 5' direction is copied to produce the leading strand.
The leading strand is formed from DNA polymerase simply following the unwinding process, copying the DNA as it is unwound.
5. **The lagging strand:** during DNA replication, the parent that runs in the 5' to 3' direction is copied to produce the lagging strand.
The unwinding direction and the direction in which the DNA polymerase is working are opposite. So the DNA polymerase has to copy an unwound piece of DNA and then go back and copy the next piece of unwound DNA, and keep repeating. The strands produced are the **Okazaki fragments**.
6. DNA ligase is an enzyme that catalyzes the joining together of two nucleotides with covalent phosphodiester bonds during DNA replication.
DNA ligase connects neighboring nucleotides with phosphodiester bonds to form the sugar-phosphate backbone of the new DNA molecule.

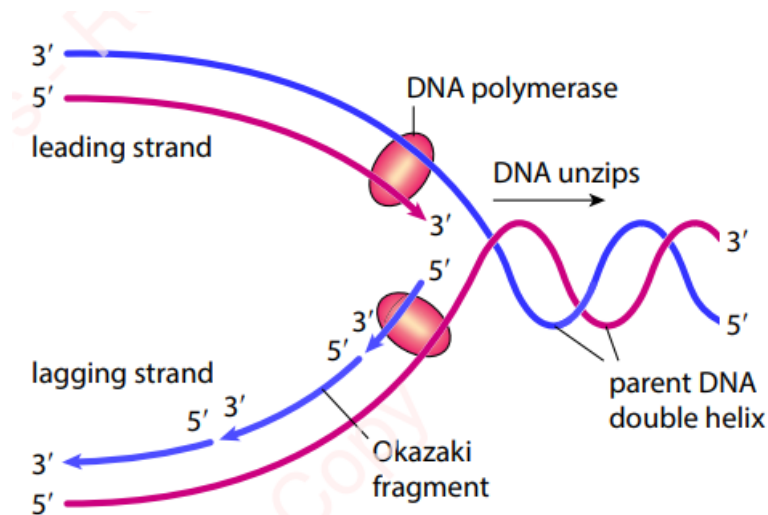


Figure 6.9: Diagram of DNA replication. The lagging strand can only be made in short fragments as the DNA unwinds.

▼ 6.3. The genetic code

▼ Gene

A part of a DNA molecule, where the nucleotide sequence codes for just one polypeptide.

One DNA molecule contains many genes.

▼ What are the features of the genetic code?

1. It is a triplet code.
2. The code is universal. (This means that each triplet codes for the same amino acid in all living things.)
3. The code has punctuations. (3 codes act as a full stop, and some act as start signals)
4. The code is described as redundant or degenerate. (This means that some amino acids are coded for by more than one triplet.)

▼ Mutation and alleles

A change in the nucleotide sequence of gene, which may then result in an altered polypeptide, is called a mutation. Most genes have several different variants called alleles, which originally arose by the process of mutation.


▼ 6.4. DNA, RNA and protein synthesis

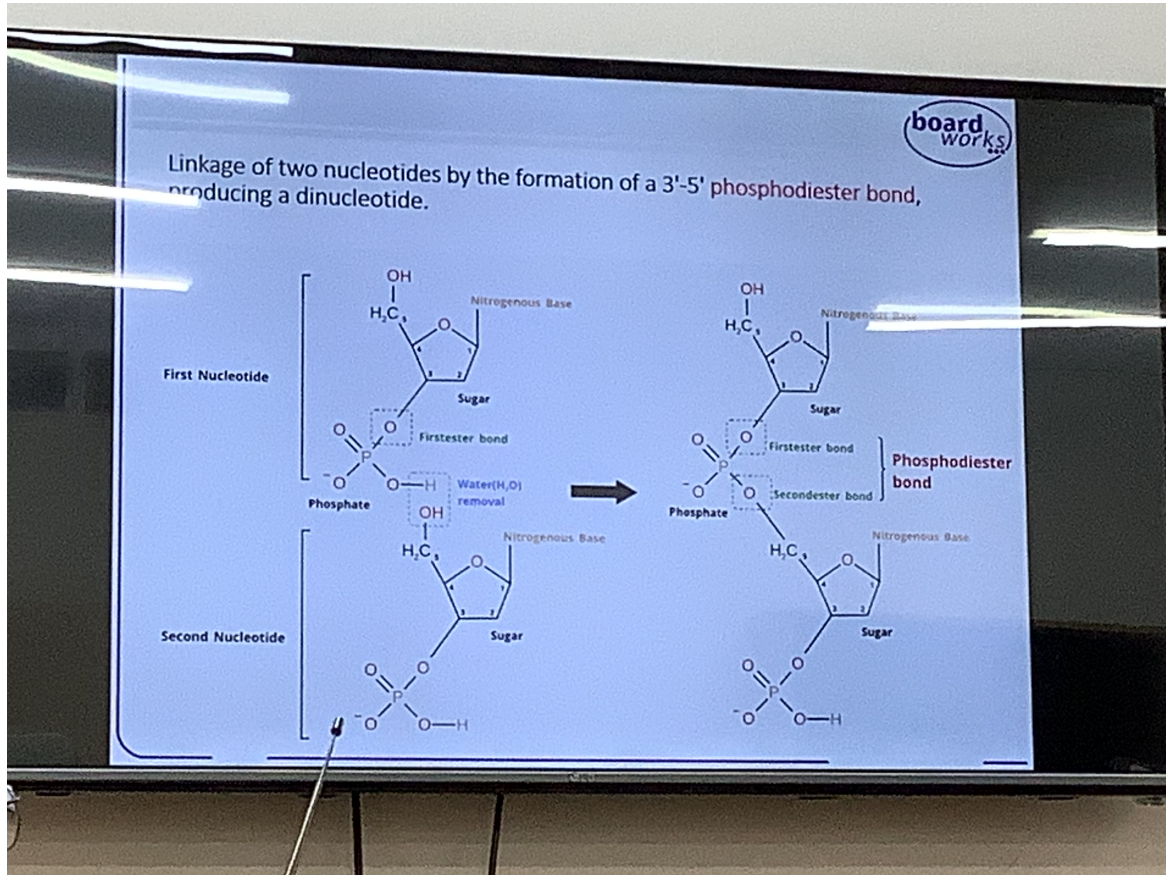
▼ DNA controls protein synthesis

All chemical reactions in cells, and therefore all the cells' activities, are controlled by enzymes, which are proteins. The DNA controls which proteins are made so DNA controls the cell's activities.

▼ The triplet code is read in which direction?

The code is read from 5' to 3' direction

 Protein synthesis



If you have any questions reach out to: **23C Chinguun.M**, IG: **@chinguun__0511**, FB: **Chinguun Tsetsgee**.

Or post questions on the discord server for help!