TOPIC 7: NUCLEIC ACIDS

7.1 DNA STRUCTURE

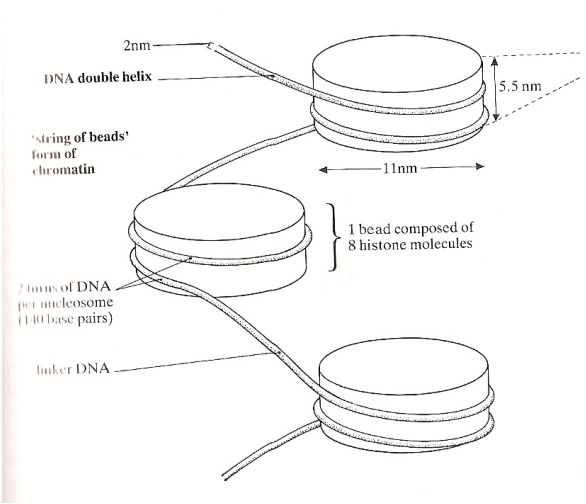
All eukaryotes and prokaryotes use DNA as their genetic material and use the same genetic code, but there are differences in the way that the DNA is used.

1) In **eukaryotes** the DNA is associated with proteins to form **nucleosomes**, whereas in prokaryotes the DNA is naked

Nucleosomes

- DNA has negative charges distributed along its length, and positively charged (basic) protein molecules called **histones** are bonded to it. This DNA protein complex is called chromatin.
- DNA helix combines with groups of eight (8) histone molecules to form structures known as **nucleosomes** having the appearance of “beads on a string”.
- Nucleosomes help to supercoil chromosomes and help to regulate transcription. Therefore, supercoiling allows a great length of DNA to be packed into a much smaller space in the nucleus.

Nucleosome structure:



2) Replication of DNA begins at special **initiation points.** Eukaryotes have many initiation points along its chromosome. Most prokaryotes have only one point on their DNA molecule where replication is initiated.

3) Much of the DNA (5 - 45 %) in eukaryotes consists of **repetitive base sequences (satellite DNA).** These sequences are **not genes.** They are used for DNA profiling (ταυτοποίηση, αναγνώριση), but their role in eukaryotes is not certain. Prokaryotes do not usually have repetitive sequences.

→ One such area of repetitive sequences occurs on the ends of eukaryotic chromosomes called **telomeres.**

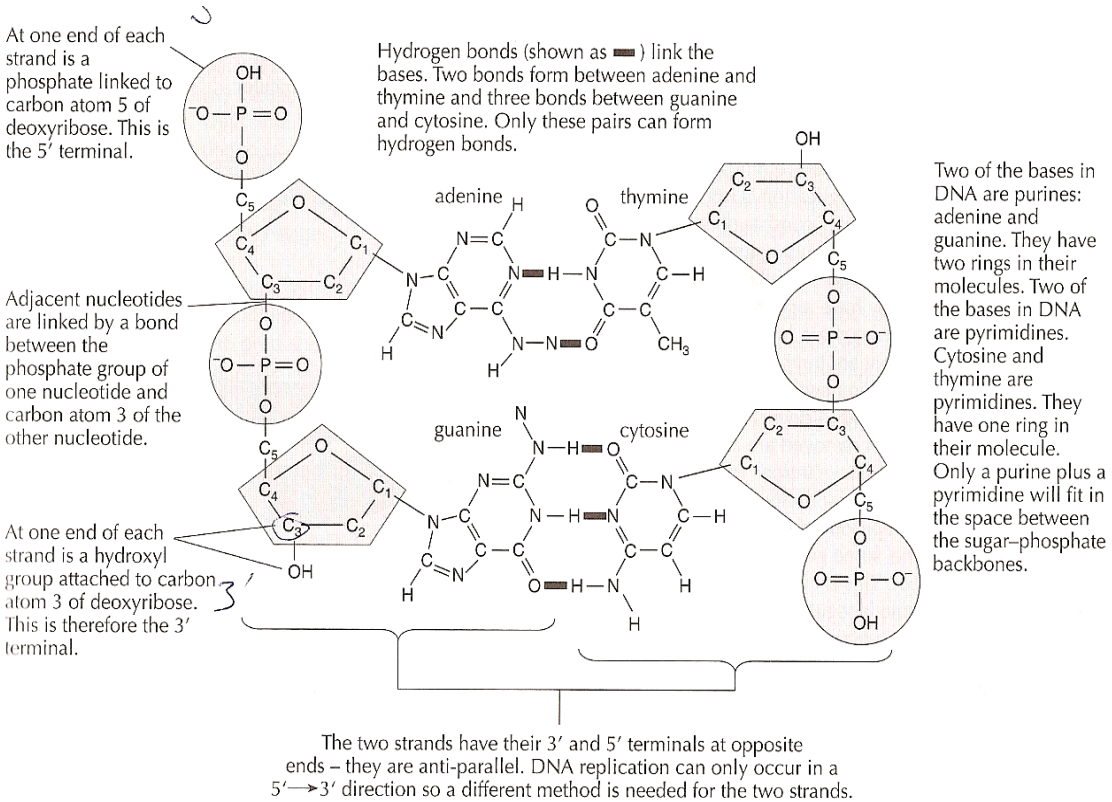
→ Only a small proportion of the DNA in the nucleus constitutes genes (unique or single copy genes) and the majority of DNA consists of repetitive sequences.

Genes are made of DNA and they are part of a much larger DNA molecule called chromosomes. Genes are the basic units of inheritance of the genetic code (DNA).

4) Many genes in eukaryotes contain **introns**. These are non-coding sequences that are transcribed but not translated. They are found in newly transcribed mRNA but are removed (i.e they are not translated into proteins).

The sequences that are not removed are called **exons**. Prokaryotes do not usually have introns in their genes.

Diagram of DNA structure:



The four bases in DNA:

a) Pyrimidines

- Cytosine
- Thymine

b) Purines

- Adenine
- Guanine

The Hersey – Chase experiment:

Analysis of the results of the Hersey – Chase experiment in the 1950's provided evidence that DNA is the genetic material.

Until the 1940's it was thought that proteins were the hereditary material due to their great variety. In their experiment they took advantage of the fact that the DNA contains phosphorus but not sulphur, while proteins contain sulphur but not phosphorus.

They cultured viruses that contained proteins with radioactive sulphur (^{35}S) and they separately cultured viruses that contained DNA with radioactive phosphorus (^{32}P).

They infected bacteria separately and the cells were expected to have the radioactive genetic component of the virus in them. The result revealed that phosphorus (hence DNA) was the genetic material of viruses.