### What are the three different types of DNA?

The three different types of DNA include:

* A-DNA
* B-DNA
* Z-DNA

### How is Z-DNA different from other forms of DNA?

Z-DNA is a left-handed double helix. The helix winds to the left in a zig-zag manner. On the contrary, A and B-DNA are right-handed DNA.

### What type of DNA is found in humans?

B-DNA is found in humans. It is a right-handed double-helical structure, discovered by Rosalind Franklin

## What is DNA Packaging? Why is DNA Packaging required?

Have you ever wondered how a DNA is present in a nucleus smaller than it? This can be explained by the process of DNA packaging.

The DNA is an organic, complex, molecular structure, found in both prokaryotic and eukaryotic cells and also in many viruses. It is a hereditary material which is found in the nucleus of the cell and is mainly involved in carrying the genetic information.

**DNA Packaging in a Prokarytotic cell:**

Prokaryotic cells can be distinguished from the [eukaryotic cells](https://byjus.com/biology/eukaryotic-cells/) by the presence of a well-defined nucleus. However, their negatively charged DNA is arranged in a region called nucleoid. They appear as a loop wrapped around a protein molecule having a positive charge.

**DNA Packaging in a Eukarytotic cell:**

All eukaryotes have a well-defined nucleus that contains the DNA. DNA is a negatively charged polymer which is around 2.2 meter long that need to be accommodated within the nucleus which is only a few micrometres in diameter (10-6 m). In order to fit in the DNA molecules into the nucleus, it needs to be packed into an extremely compressed and compact structure called chromatin.

DNA packaging is achieved three orders of packaging:

1. The first order DNA packaging – Nucleosome.
2. The second order DNA packaging – Solenoid fibre.
3. The third order DNA packaging – Scaffold loop of Chromatids / Chromosome.

**Structural Organisation of Chromatin**

* Chromatin consists of DNA and associated proteins. DNA is packaged in a highly organised manner in chromosomes
1. **Nucleosomes**are the basic unit of chromatin.
	* DNA packing is facilitated by proteins called **histones.**DNA is wound around histone proteins to form a nucleosome
	* There are 5 types of histone proteins in the eukaryotic chromosomes, namely H1, H2A, H2B, H3 and H4, last four being part of **Nucleosome octamer**.
	* Histones are positively charged due to the presence of amino acids with basic side chains like lysine and arginine and wrapped around with negatively charged DNA.
	* Histone proteins play an important role in gene regulation
	* Nucleosomes are made up of 200 base pair of DNA helix
	* Nucleosomes prevent DNA from getting tangled
2. Linker DNA and the fifth histone (H1) pack adjacent nucleosomes to a **compact solenoid fibre or chromatosome.**
3. These fibres form a large coiled loop held together by non-histone proteins (actin, 𝛂 and 𝛃 tubulin, myosin) called **scaffolding proteins to form chromatin fibres.**
4. Chromatin further condenses with the help of protein known as**condensin,**it binds to DNA and wraps it into coiled loops and we get the compacted chromosome as seen during metaphase stage of cell division.

Differential packaging and Regions:

Chromatin regions that are essential for the synthesis of proteins are loosely packed and are known as **euchromatin and stains light.**. Whereas the tightly packed region of chromatin is known as **Heterochromatin** which stains dark and transcriptionaly inactive.

### What role do histones play in DNA packaging?

Histones are proteins responsible for DNA packaging. The DNA wraps around the histones. Histones are positively charged proteins and hence can easily bind to the negatively charged DNA. Histones are also involved in controlling the expression of the genes.

### How does acetylation and phosphorylation affect DNA packaging?

Acetylation and phosphorylation makes the DNA more negatively charged and loosens the packaging of DNA. The enzymes that add acetyl groups to histones are called acetyltransferases.