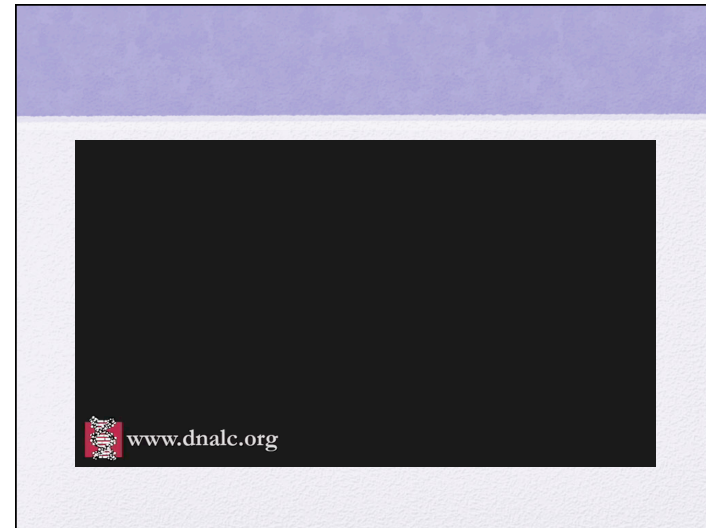


# DNA and the Cell Cycle



## Why does DNA condense into chromosomes?

- DNA in its extended form is 50,000 nm in length and would be as tall as you are!
- Therefore DNA must be coiled up to fit inside the nucleus of the cell and make it easier to move during cell division.

The diagram illustrates the levels of DNA organization. At the bottom is a 'DNA helix' (a double helix). Above it is a 'Nucleosome', where DNA is wrapped around a core of histones. Above the nucleosome is 'Chromatin', which consists of DNA and histones coiled into 30 nm fibers. At the top is a 'Chromosome', which is a highly condensed structure of DNA and histones.

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## Forms of DNA in the Cell Cycle

**Chromosomes (prophase and metaphase)** – Replicated DNA super coiled into a “X” joined at the kinetochore.

**Chromatin (G<sub>1</sub>)** – DNA and histones coiled into 30 nm fibers

**Nucleosomes (G<sub>1</sub>)** – DNA wraps around histone proteins.

**Nucleotides** – Monomers of DNA, phosphate groups are negatively charged.

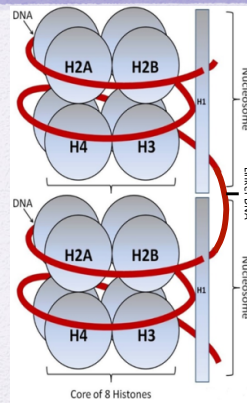
**DNA Helix (G<sub>1</sub>)** – Simple polymer of nucleotides in an uncoiled form; allows protein expression or replication to occur.

ATGACGGATCAGCCGCAAGCGGAATTGGCGACATAA  
TACTGCCTAGTCGGCGTTCGCCTTAACCGCTGTATT

The chemical structure shows a phosphate group (a phosphorus atom bonded to four oxygen atoms), a nitrogenous base (adenine), and a sugar (deoxyribose). The adenine base is attached to the 1' carbon of the sugar, and the phosphate group is attached to the 3' carbon of the sugar.

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## What are nucleosomes?



- Nucleosomes are the basic unit of DNA packaging in eukaryotic cells.
- Made up of 8 histone proteins (octamer) in a core with 2 wraps of DNA, plus one H1 histone protein.
- Linker DNA – the DNA between two adjacent nucleosomes
- H1 histone – links adjacent nucleosomes together and binds DNA to the octamer core.
- DNA remains attached to the histone proteins due to positively charged amino acids attracting the negatively charged DNA.

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