

# It's in Your DNA! Analyzing the Structure of Chromosomes

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## Introduction

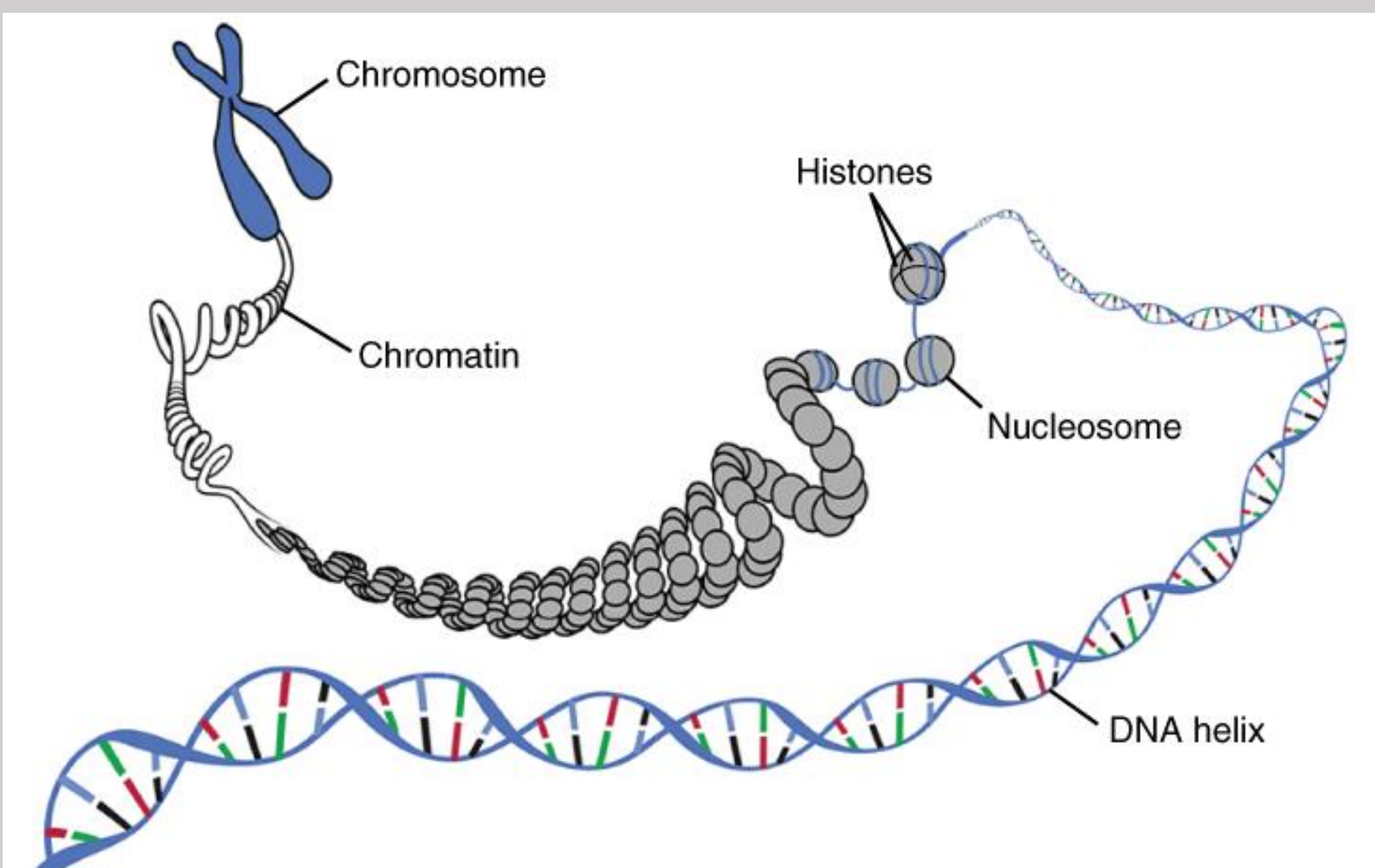


Fig 1: Chromosome to Nucleosome to DNA

Nucleosomes are the building blocks of chromosomes

A nucleosome is a group of 8 histone proteins wrapped in a DNA double helix.

Histone tails are sites of Post Translational Modifications (PTM). PTMs regulate various cellular processes.

In this paper, the authors used crystallography to decipher the structure of nucleosomes. Crystallography is x-ray used on crystals of proteins to obtain an electron density map (EDM). The EDM is then processed using computer software to construct a high resolution 3D structure.

The purpose of this analysis was to understand nucleosome structure for advanced level research with respect to regulation of cellular processes.

<https://cnx.org/contents/9TxHOD3O@4/The-Nucleus-and-DNA-Replication>

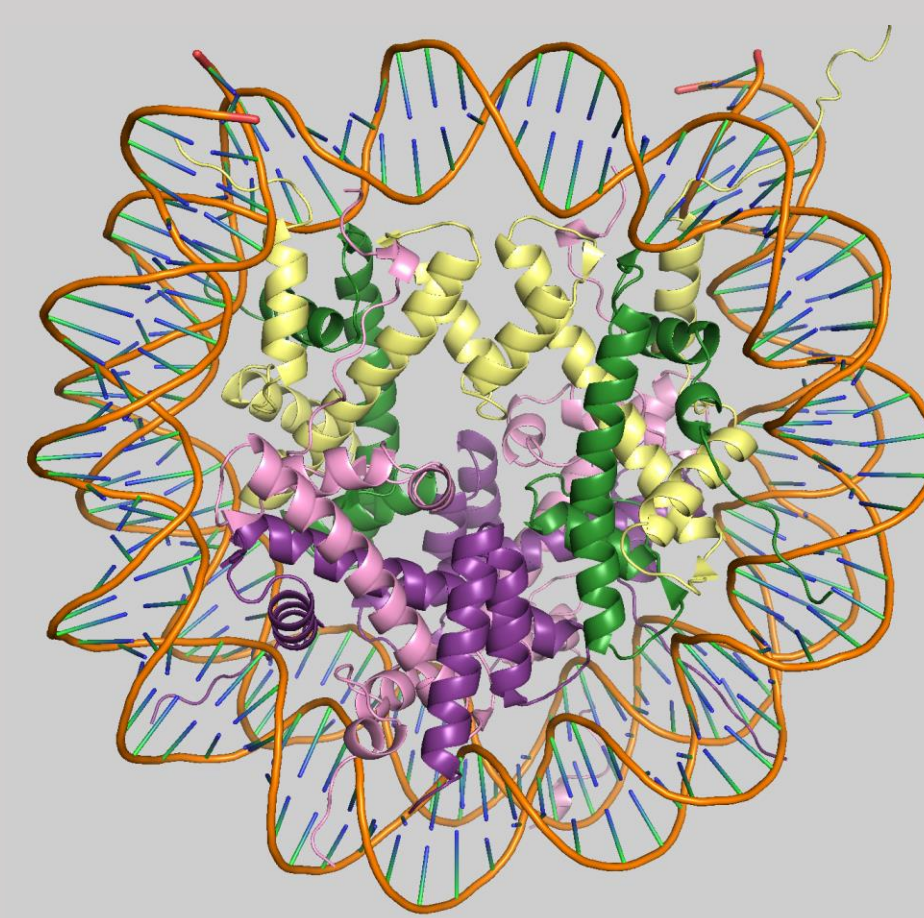


Fig 2: nucleosome structure

## Results

### DNA Architecture

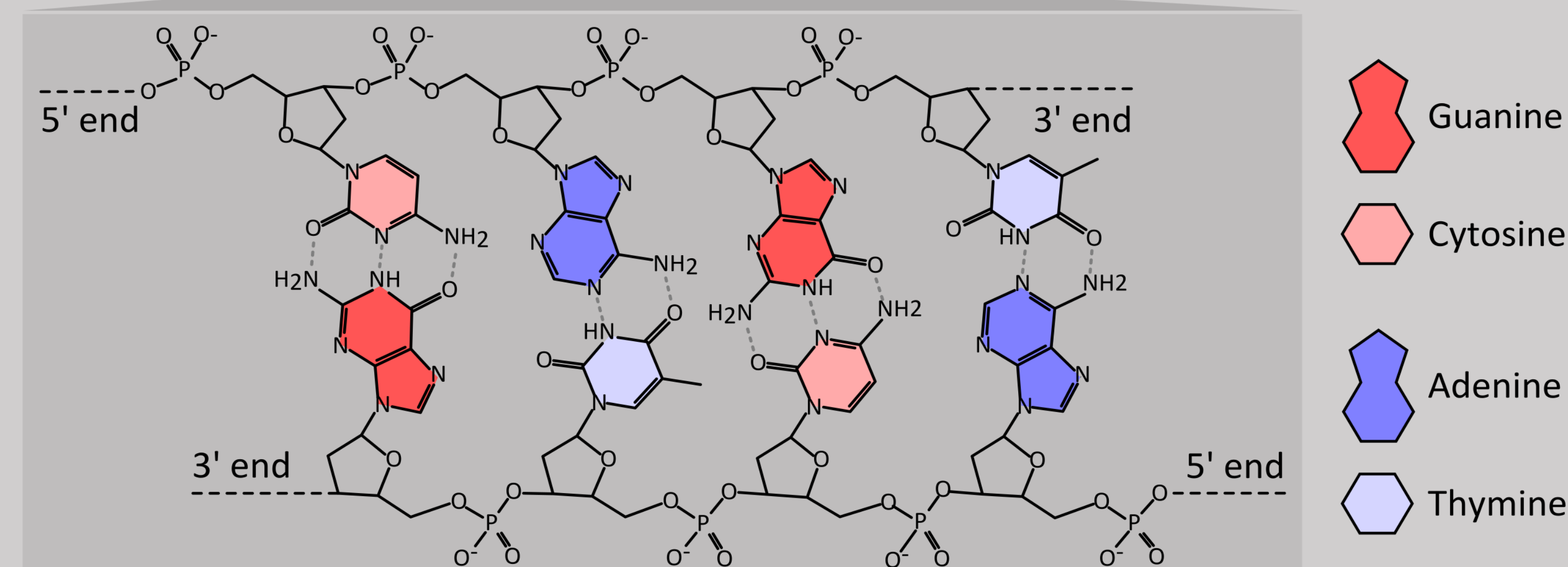


Fig 5: The chemical structure of DNA

- DNA is made up of nucleotide bases linked to deoxyribose sugar. The sugars are connected via phosphodiester bond.
- 146 bp of double stranded DNA wraps around histones 1.65 times to form an intact nucleosome.

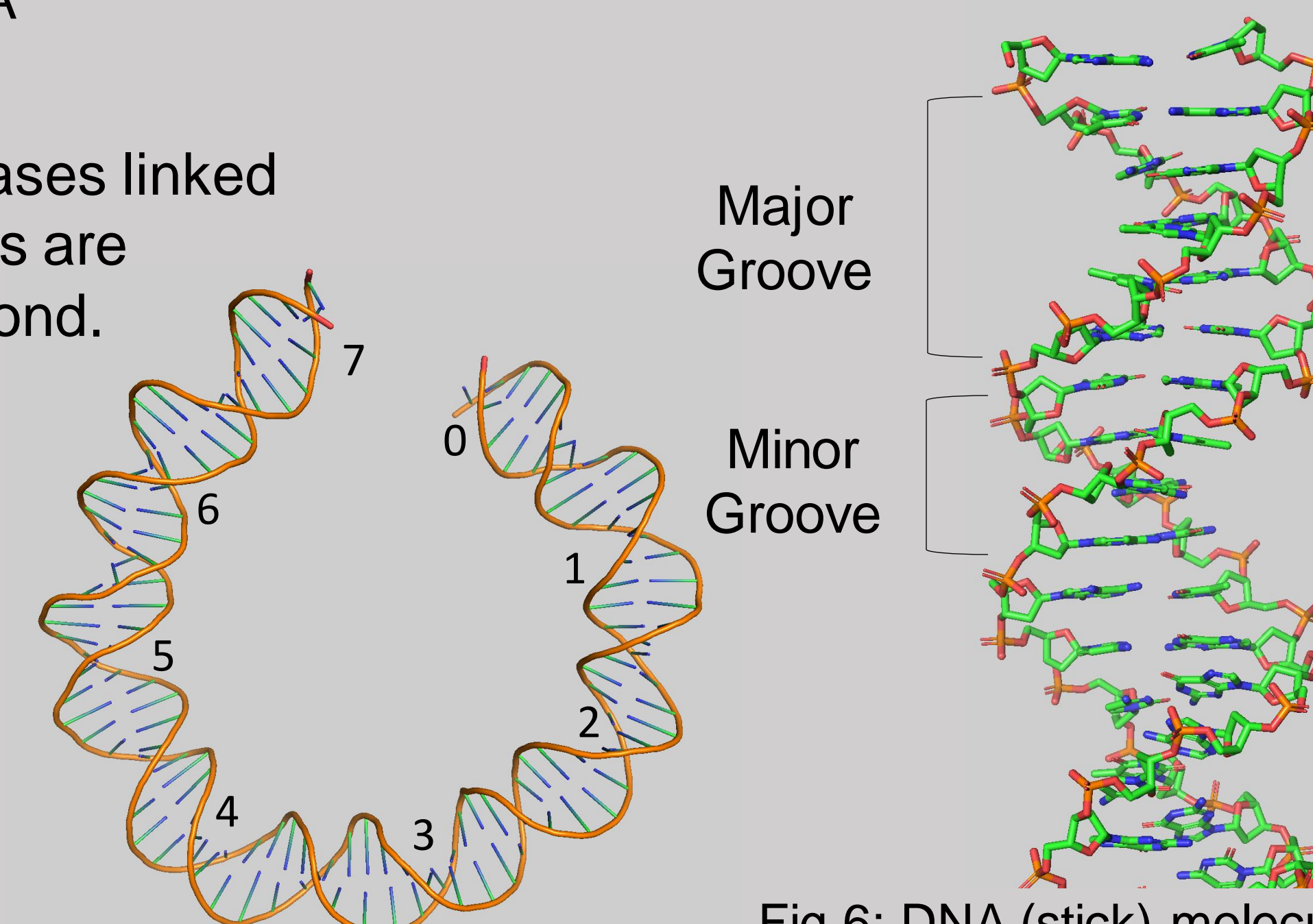


Fig 7: Nucleosomal DNA with labelled SHL (superhelix location)

Fig 6: DNA (stick) molecule with labelled major/minor grooves

## Results

### Secondary Structures of Histones

- There are 4 types of histones, and there are 2 copies of each inside a single nucleosome.

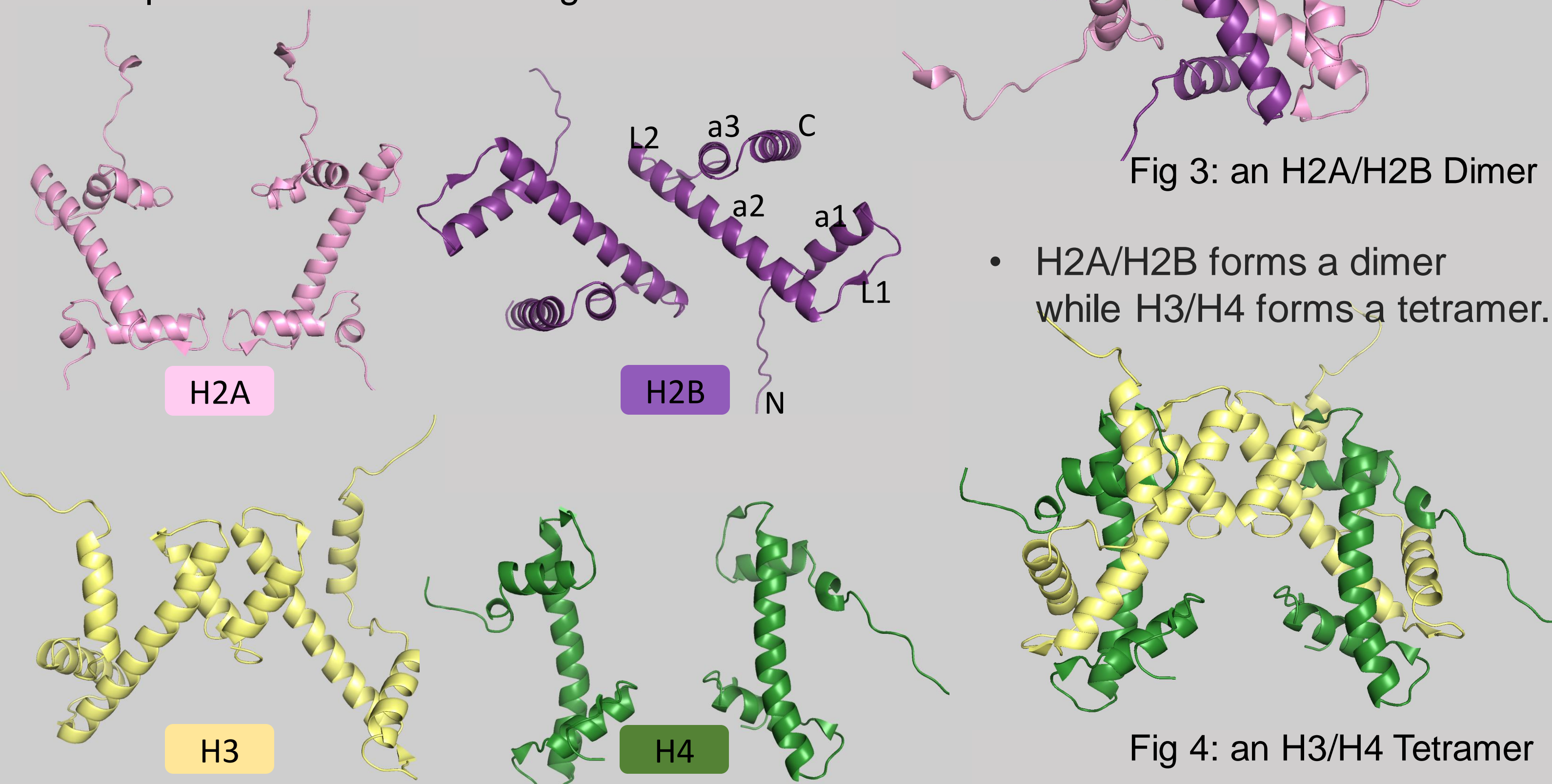
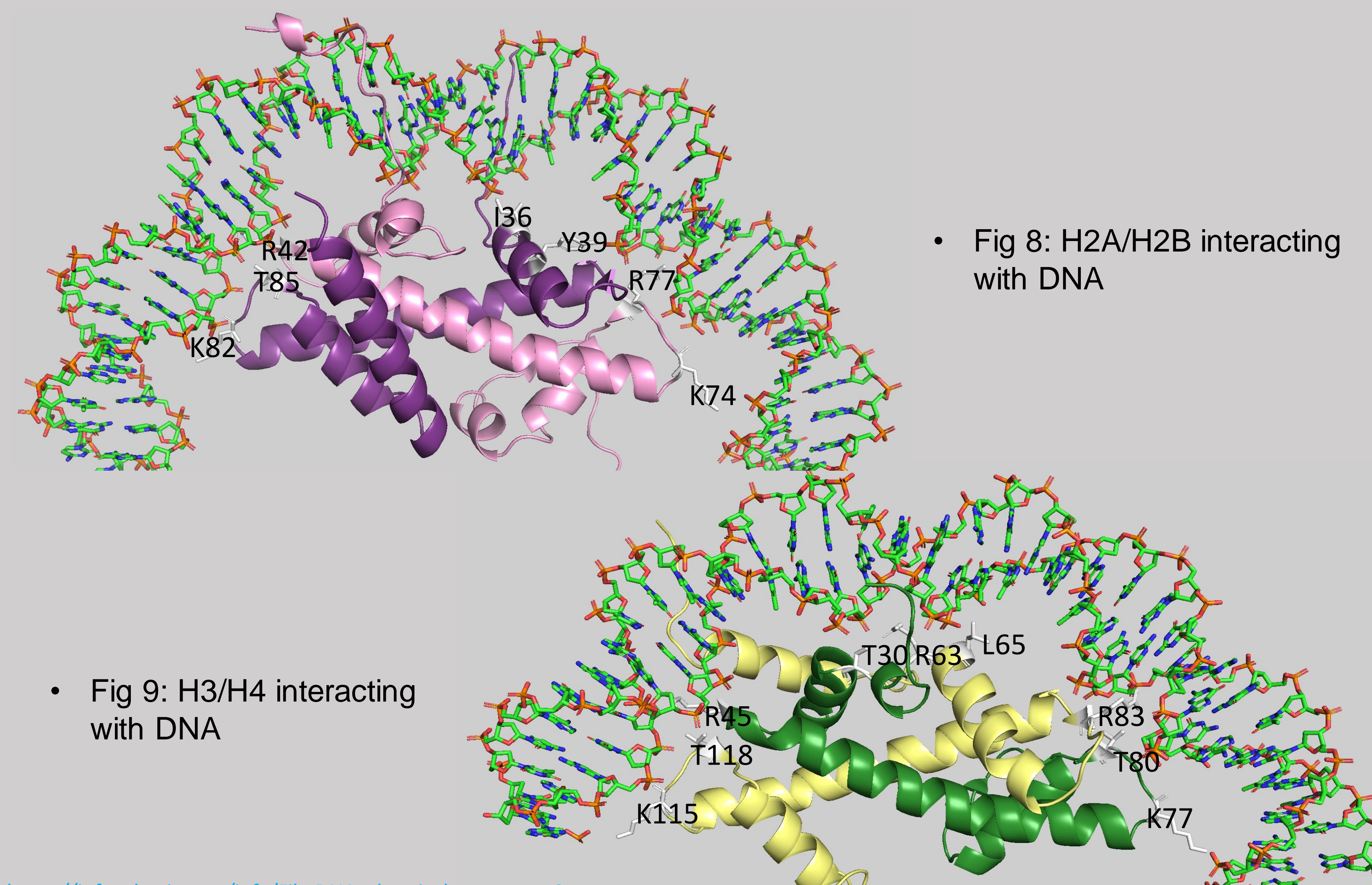


Fig 3: an H2A/H2B Dimer

- H2A/H2B forms a dimer while H3/H4 forms a tetramer.

Fig 4: an H3/H4 Tetramer

### Histone/DNA interaction



- Fig 8: H2A/H2B interacting with DNA

- Fig 9: H3/H4 interacting with DNA

[https://infogalactic.com/info/File:DNA\\_chemical\\_structure\\_2.svg](https://infogalactic.com/info/File:DNA_chemical_structure_2.svg)

## Conclusion

This literature review helps understand protein-protein and protein-DNA interactions that happen in a nucleosome.

These interactions stabilize the DNA double helix and thus protects the genome from harmful effects and also aids in various cellular processes.

## References

Luger, K., Mäder, A. W., Richmond, R. K., Sargent, D. F., & Richmond, T. J. (1997). Crystal structure of the nucleosome core particle at 2.8 Å resolution.

*Nature*, 389(6648), 251–260.

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