

DNA binding by histone proteins

PDB 1AOI

In eukaryotes, DNA has several levels of packing, serving several purposes. This allows DNA to take up less space in the nucleus, but it also protects it from physical damage and regulates how accessible it is to proteins. For instance, when DNA is very tightly packed, the proteins that usually 'read' it cannot access it, making some genes inactive.

The first level of DNA packing relies on a family of proteins, called histones. Several histones come together and wrap DNA around them to form a structure called the **nucleosome**.

Open the EzMol start page (<http://www.sbg.bio.ic.ac.uk/~ezmol/index.html>). Load PDB 1AOI, which contains a complete nucleosome.

Describe the overall structure and shape of the nucleosome.

The nucleosome has a disk-like structure (made by the histones), around which DNA is wrapped.

How many times is DNA wrapped around the histones of a single nucleosome?

DNA is wrapped twice around the histones of a single nucleosome.

Make a figure in which each type of histone protein is shown in a different colour such as is Figure 6.

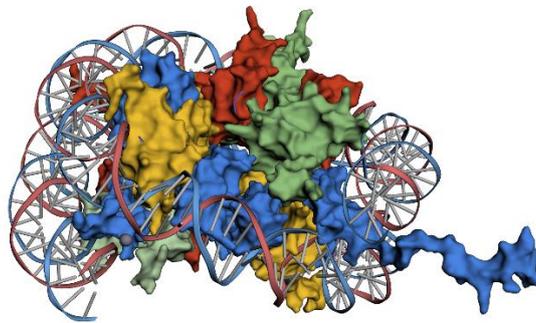


Figure 6 | A complete nucleosome with the histone proteins displayed as surfaces and the DNA wrapped around them displayed as a cartoon.

How many histone proteins make up the nucleosome?

The nucleosome contains 8 histones, making it an octamer.

Make a figure with the surface of the histones coloured according to charge.

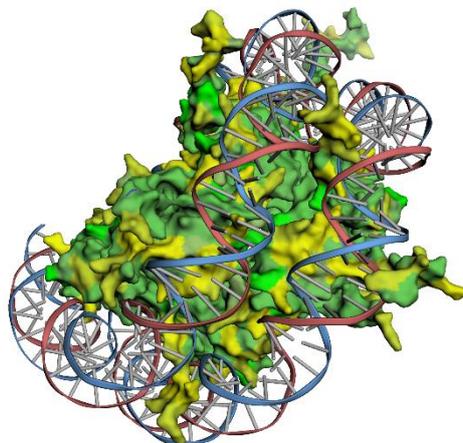


Figure 7 | A complete nucleosome with the histones displayed as surfaces coloured according to charge. Dark green: negatively charged residues; light green: neutral residues; yellow: positively charged residues.

How do histones bind DNA? (Hint: think about the charge of the DNA backbone and look at the figure you have just produced).

The outside of the disk formed by histones is lined with positively charged residues, which interact with the negatively charged backbone of DNA.