Difference Between Chromatin and Nucleosome

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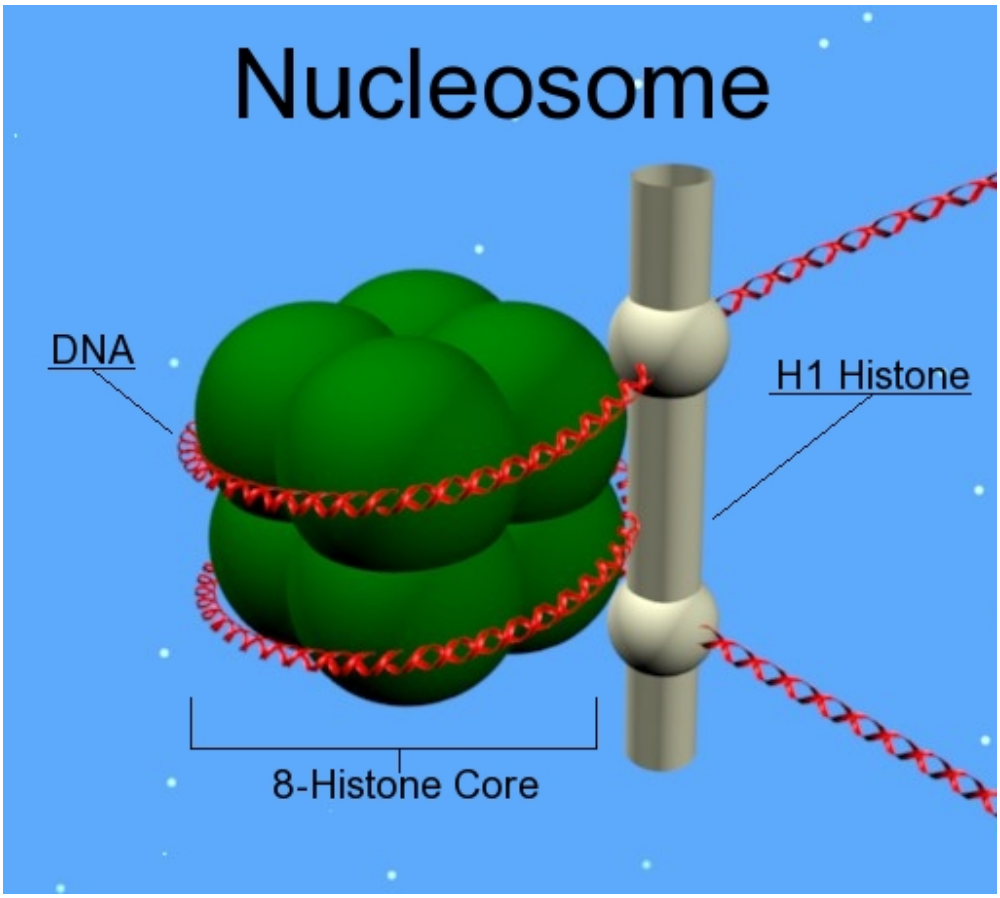

Key Difference – Chromatin vs Nucleosome

DNA resides in the nucleus of eukaryotic organisms and contains the heredity information which is passed to the next generation. Due to its importance, DNA is tightly wrapped around histone proteins and condensed into a highly stable structure within the chromosomes of eukaryotic cells to protect it from damages. This highly condensed, complex structure of DNA with histone proteins is known as chromatin. Chromatin is made up of basic structural units called nucleosomes. Nucleosome can be defined as a small length of DNA wrapped around eight histone proteins. The key difference between chromatin and nucleosome is that **chromatin is a whole structure of complex DNA and proteins** while **nucleosome is a basic unit of chromatin.**

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CONTENTS

1. Overview and Key Difference
2. What is Chromatin
3. What is Nucleosome
4. Side by Side Comparison – Chromatin vs Nucleosome
5. Summary

What is Chromatin?

DNA in the nucleus does not exist in free linear strand form. It is associated with proteins called histones and condensed into a structure called chromatin. Hence, chromatin can be defined as the highly condensed form of DNA with histone proteins. Under the microscope, chromatin appears as a string made up of beads as shown in figure 01. One bead is known as nucleosome, and it is the basic structural unit of chromatin. Chromatin forms the chromosomes of eukaryotic organisms and is packaged inside the nucleus. The structure of chromatin is visible only during the cell division under the microscope.

There are two forms of chromatin namely euchromatin and heterochromatin. Euchromatin is the less condensed form of chromatin which can be transcribed into RNA during the expression. Heterochromatin is the highly condensed form of chromatin which is not normally transcribed into RNA. Highly condensed supercoiled DNA in the form of chromatin is best suited to pack inside the nucleus which has a small volume.

The main function of chromatin is to pack DNA efficiently inside the nucleus which has a very small volume. Chromatins also perform additional functions such as protecting DNA structure and sequence, allowing mitosis and meiosis, preventing chromosomal breakages, regulating gene expression, and DNA replication.

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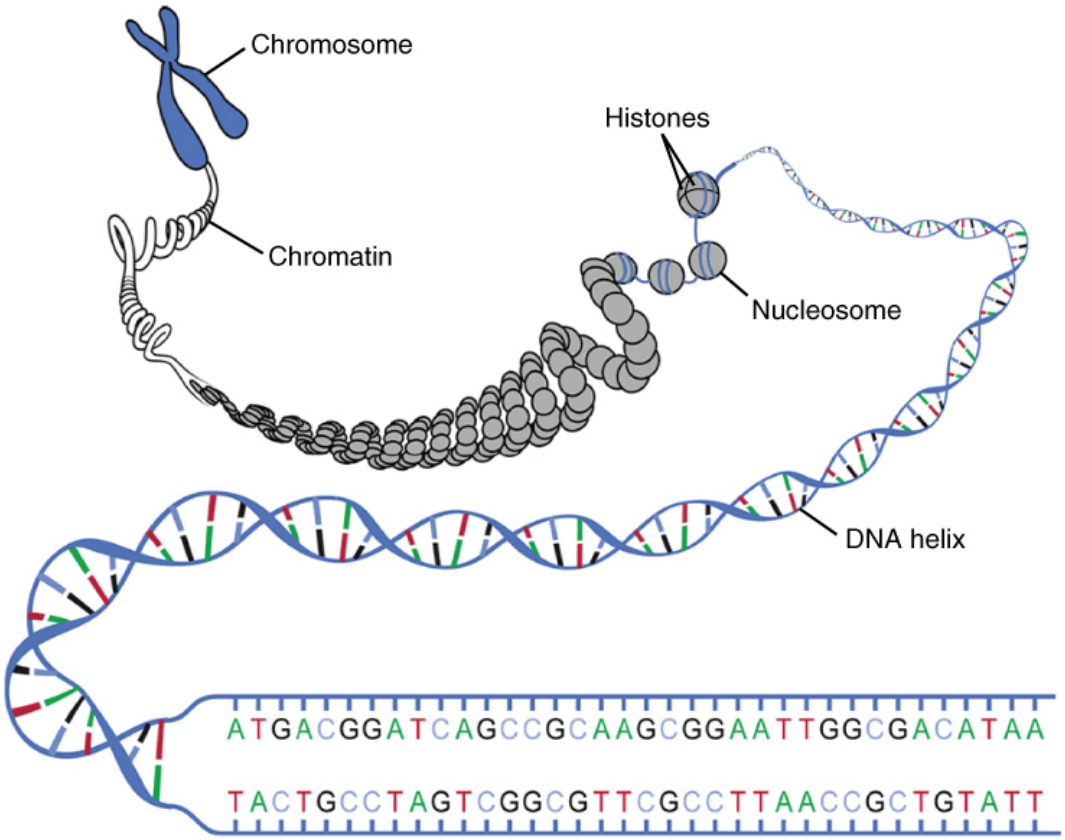

Figure 01: Chromatin

What is Nucleosome?

Nucleosome is a small section of chromatin which is wrapped around the core histone protein. It looks like a bead in a string. Core histone protein is an octamer composed of eight histone proteins. Two copies from each histone protein are in the core octamer. The histone protein composition in the core octamer is H2A, H2B, H3 and H4. Core DNA tightly wraps around the globular core histone octamer and makes a nucleosome. Nucleosomes are then arranged into a chain like structure and wrapped around additional histone proteins tightly to make the chromatin in the chromosomes.

The length of the core DNA strand which wraps around the histone octamer in the nucleosome is approximately 146 base pairs. The approximate diameter of the nucleosome is 11 nm, and the spiral of nucleosomes in the chromatin (solenoid) has a diameter of 30 nm. Nucleosomes are supported by additional histone proteins to package into tightly coiled structure inside the nucleolus.

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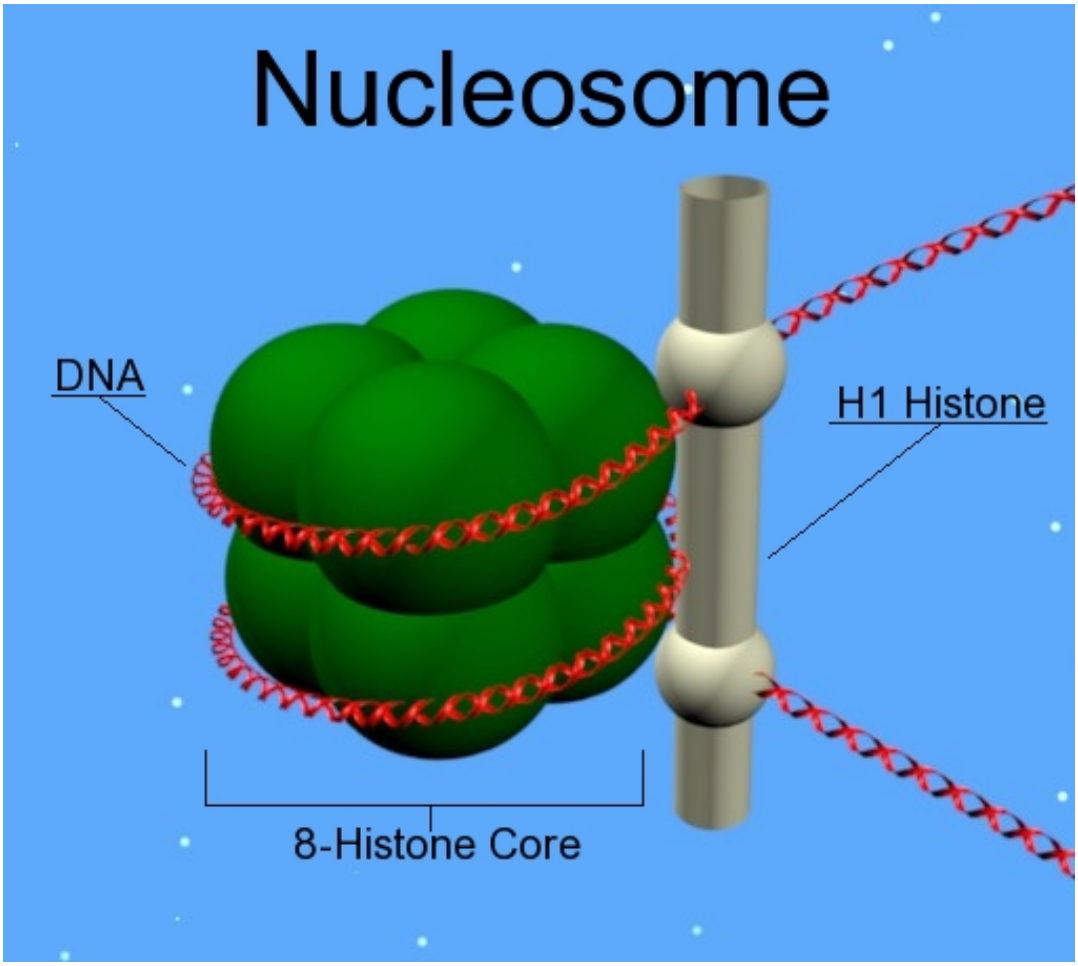

Figure 02: A Nucleosome

What is the difference between Chromatin and Nucleosome?

Chromatin vs Nucleosome	
Chromatin is the highly condensed form of DNA with histone proteins.	Nucleosome is a fundamental unit of chromatin in the nucleous.
Composition	
Chromatin is composed of DNA and histone proteins.	Nucleosome is composed of 147 base pair length DNA and eight histone proteins.
Appearance	
Chromatin looks like a supercoiled fiber structure.	Nucleosome looks like a bead in a string

Summary – Chromatin vs Nucleosome

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Chromatin is a complex of DNA and histone proteins. It is comprised of a chain of nucleosomes wrapped with histone proteins. Nucleosome is the basic unit of chromatin which is composed of 147 base pairs length DNA and eight histone proteins. A chain of nucleosomes wraps with histone proteins and condenses into a highly organized chromatin structure which is the most stable form of DNA to be packed inside the nucleus. This is the difference between chromatin and nucleosome.

References

1. “Chromatin structure and function: a guide.” Chromatin Structure & Function: a guide by Abcam. N.p., 20 Apr. 2017. Web. 20 Apr. 2017
2. Luger, Karolin, Mekonnen L. Dechassa, and David J. Tremethick. “New insights into nucleosome and chromatin structure: an ordered state or a disordered affair?” Nature reviews. Molecular cell biology. U.S. National Library of Medicine, 22 June 2012. Web. 20 Apr. 2017

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