Chromatin

Chromatin is a substance within chromosome consisting of DNA and protein. DNA carries cell's genetic instructions. Major proteins in chromatin are histones, which help package the DNA in a compact form that fits in the cell nucleus.

Heterochromatin

The area of the chromosomes which are intensely stained and are relatively condensed is known as heterochromatin. They are the tightly packed form of DNA in the nucleus. Organization of heterochromatin is so highly compact in the way that these are inaccessible to the protein which is engaged in gene expression. Even crossing over is not possible and they are transcriptionally as well as genetically inactive.

Heterochromatin is of two types: Facultative heterochromatin and constitutive heterochromatin. Genes which get silenced through the process of Histone methylation or siRNA through RNAi are called as facultative heterochromatin. They contain inactive genes and are not a permanent character of every nucleus of the cells.

Repetitive and structurally functional genes are called Constitutive heterochromatin. These are the continuing nature of the cell's nucleus and contain no gene in the genome. This structure is retainable during the interphase of the cell cycle.

The main function of the heterochromatin is to protect the DNA from the endonuclease damage; it is due to its compact nature. It also prevents the DNA regions to get accessed to proteins during gene expression.

Euchromatin

That part of chromosomes, which are rich in gene concentrations and are loosely packed form of chromatin, is called euchromatin. They are active during transcription.

Euchromatin covers the maximum part of the dynamic genome to the inner of the nucleus and is said that euchromatin contains about 90% of the entire human genome. To allow transcription, some parts of the genome containing active genes are loosely packed. Wrapping of DNA is so loose that DNA can become readily available. Euchromatin actively participates in transcription from DNA to RNA. The active genes present in euchromatin get transcribed to make mRNA and further encoding to functional proteins is the main function of euchromatin. They are considered as genetically and transcriptionally active. Housekeeping genes are the examples of euchromatin.

Key differences between Heterochromatin and Euchromatin

1. Tightly packed form of DNA in the chromosome is called as heterochromatin, while the loosely packed form of DNA in the chromosome is called as euchromatin.
2. In heterochromatin, density of DNA is high and is stained dark, whereas in euchromatin density of DNA is little and is lightly stained.
3. Heterochromatin is found at the periphery of the nucleus in eukaryotic cells only, and Euchromatin is located in the inner body of nucleus of prokaryotic and eukaryotic cells.

4. Heterochromatin shows little or no transcriptional activity and is genetically inactive; whereas Euchromatin actively participates in transcription and is also genetically active.
5. Heterochromatin is compactly coiled and is late replicative, whereas Euchromatin is loosely coiled and early replicative.
6. Regions of heterochromatin are sticky, but the areas of Euchromatin are non-sticky.
7. In Heterochromatin part, phenotype remains unchanged of an organism, though variation may be seen, due to the effect in DNA during the genetic process in the Euchromatin.
8. Heterochromatin permits gene expression regulation and maintains structural integrity of the cell though Euchromatin results in genetic variations and allows genetic transcription.

Comparison Chart

BASIS FOR COMPARISON	HETEROCHROMATIN	EUCHROMATIN
Meaning	Tightly packed form of DNA in the chromosome is called heterochromatin.	Loosely packed form of DNA in the chromosome is called as euchromatin.
DNA density	High DNA density.	Low DNA density.
Kind of stain	Stained dark.	Lightly stained.
Where they are present	These are found at the periphery of the nucleus in eukaryotic cells only.	These are found in the inner body of the nucleus of prokaryotic and eukaryotic cells.
Transcription	They show little or no transcription.	They actively participate in transcription.
Other features	They are compactly coiled.	They are loosely coiled.
	They are late replicative.	They are early replicative.
	Regions of heterochromatin are sticky.	Regions of euchromatin are non-sticky.
	Genetically inactive.	Genetically active.
	Phenotype remains unchanged of an organism.	Variation may be seen, due to the affect in DNA during the genetic process.
	It permits gene expression regulation and maintains structural integrity of the cell.	It results in genetic variations and permits the genetic transcription.

Source: https://biodifferences.com/difference-between-heterochromatin-and-euchromatin.html