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Commentary

Chromosome and its Formation

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DESCRIPTION

A chromosome is a long winded DNA molecule that contains part or all of an organism's genetic material. Histones are proteins that adhere to and condense DNA molecules to keep them intact in most eukaryotic chromosomes with the help of chaperone proteins. These chromosomes have a complicated three-dimensional structure that influences transcriptional control. Only during the metaphase of cell division, when all chromosomes are aligned in their condensed form in the centre of the cell, are chromosomes visible under a light microscope. Genetic variation is mostly determined by chromosomal recombination during meiosis and subsequent sexual reproduction. The cell may undergo mitotic catastrophe if these structures are altered inappropriately by mechanisms such as chromosomal instability and translocation. Normally, this causes the cell to undergo apoptosis, which leads to its own death, but mutations in the cell can obstruct this process, causing cancer to grow. Some people use the term chromosome in a broader meaning to refer to the personalised regions of chromatin in cells that can be seen under light microscopy or not. Others use the term in a more limited meaning to describe to the personalised regions of chromatin visible under light microscopy during cell division due to high condensation. Uncondensed DNA resides in a semi-ordered arrangement in eukaryotes' nuclear chromosomes, where it is wrapped around histones to create chromatin, a composite material.

Interphase chromatin

Interphase is the period of the cell cycle where the cell will not be dividing. Here two types of chromatin are distinguished such as Euchromatin and Heterochromatin. Euchromatin is a type of chromatin that is densely packed and abundant in genes, and it is frequently (sometimes not) under active transcription. Within the cell nucleus, euchromatin is the most active region of the genome. Heterochromatin is a type of DNA that is basically inactive. During the chromosomal phases, it appears to fulfill structural purposes.

Metaphase chromatin

During the metaphase, mitosis takes place. During the cell cycle, mitosis is the partition of replicated chromosomes into two new nuclei. When a cell divides, it produces genetically identical cells with the same number of chromosomes. The chromatin double helix becomes further condensed during the early stages of mitosis or meiosis. They stop functioning as accessible genetic material (transcription) and transform into a small, portable form. The loops of 30-nm chromatin fibres are anticipated to fold inwards even more to generate mitotic cells' compact metaphase chromosomes. As a result, the DNA is compressed by 10K times. Individual chromosomes are visible in this highly compact form, and they form the traditional four-arm structure, a pair of sister chromatids connected at the centromere. The shorter arms are referred to as p arms, while the longer arms are referred to as q arms. Individual chromosomes can only be seen with an optical microscope in this natural setting. A linearly structured longitudinally compressed array of consecutive chromatin loops best describes mitotic metaphase chromosomes.

Enzymes control the dynamic character of chromatin. Changing the location of the DNA strands within a nucleosome, for example, can release chromatin. The strand loosens due to chromatin re-modeling enzymes that slide nucleosomes along the DNA strand so that other enzymes can reach it. This is a tightly controlled procedure that allows certain genes to be accessible in response to metabolic signals within the cell.

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