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Reading

Chromosomal Basis of Inherited Disease

Learning Objectives

Differentiate between histones and nucleosomes

Define the terms karyotype

Describe the differences in organisms with respect to chromosome numbers

Define the abnormalities in chromosomal numbers: polyploidy, aneuploidy: trisomy and monosomy, and mosaicism and their causing mechanisms.

Define the abnormalities in chromosomal structure: deletions, duplications, translocations, and inversions.

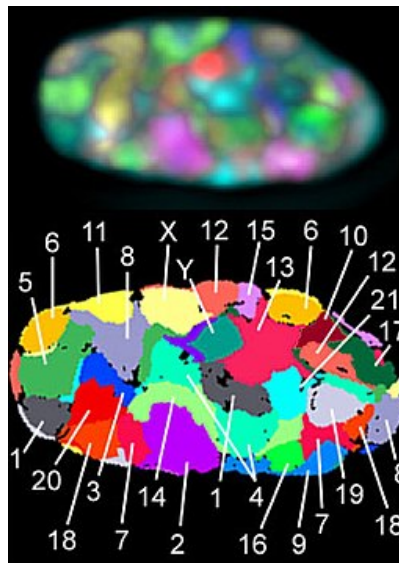
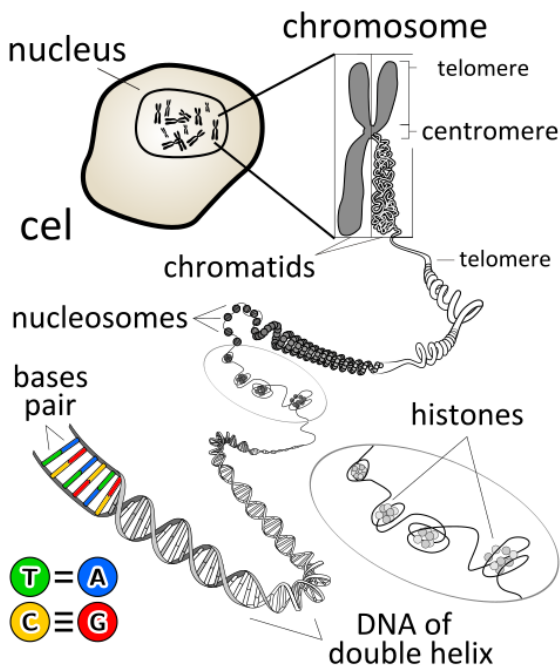
Distinguish among the following “mistakes” in meiosis: non-disjunction, deletion, duplication, inversion, and translocation; give an example of each.

Distinguish among Down’s syndrome, Klinefelter syndrome, and Turner syndrome.

Know what amniocentesis is, and compare it to chorionic villus sampling.

Distinguish between physiological therapy, protein therapy, and gene therapy.

Chromosome Packaging



False color representation of chromosomes in a nucleus illustrating the 24 types of human chromosomes in their decondensed state. Credit: Andreas Bolzer, Gregor Kreth, Irina Solovej, Daniela Koehler, Kaan Saracoglu, Christine Fauth, Stefan Müller, Roland Eils,

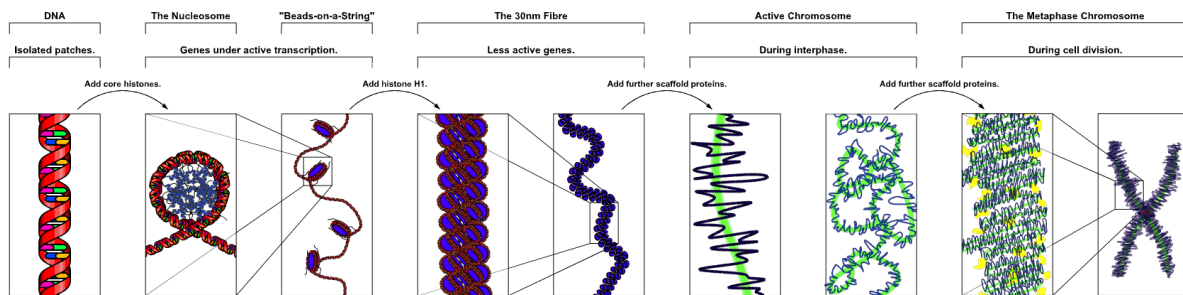
Chromosomes are made of double stranded DNA molecules wound about histones and condensed into the familiar X-shape. Under regular functioning, these chromosomes are decondensed in the nucleus and not recognizable. Credit: KES47 [CC BY 3.0]

Christoph Cremer, Michael R.

Speicher, Thomas Cremer [CC BY

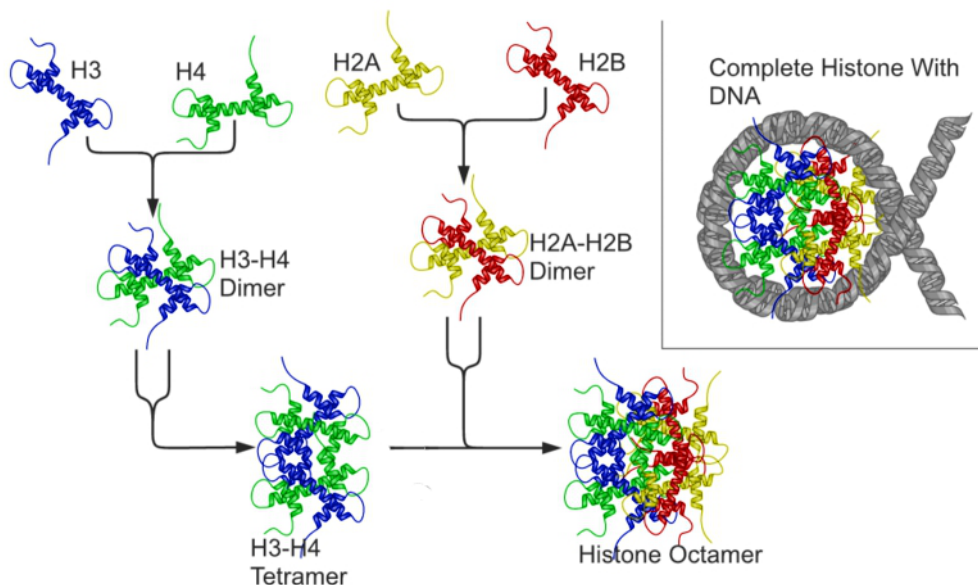
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Chromosomes in Interphase are not visible individually and are loosely packaged within the nucleus. In preparation for nuclear division (mitosis or meiosis), they begin to organize tighter and condense in preparation for movement to subsequent daughter nuclei. The animation below illustrates the process of histone packaging and the molecular visualization of DNA replication. **Histones** are proteins that aid in packaging of the chromosomes into organized coils that give rise to the recognizable chromosomes during metaphase.



Credit: Richard Wheeler [CC-BY-SA-3.0]

DNA is negatively charged due to the Phosphate backbone. Histones are positively charged proteins that associate with eukaryotic DNA to spool and compact the DNA. They form into basic units called nucleosomes. The basic nucleosome core is composed of an octamer of histone proteins (H2A, H2B, H3 and H4).





21. Chromosomes

Nucleosome structure illustrating the spooling of DNA around the core histone octamer. Credit: Richard Wheeler (Zephyris), Rekymento [CC-BY-SA-3.0]