**Lecture 10 Chromosomes Structure**

Chromosomes: the microscopic threadlike part of the [cell](https://www.britannica.com/science/cell-biology) that carries the [hereditary](https://www.britannica.com/science/heredity-genetics) information in the form of [genes](https://www.britannica.com/science/gene) consisting of DNA and associated proteins in the nucleus. Each chromosome has a constriction called the [centromere](https://www.sciencedirect.com/topics/medicine-and-dentistry/centromere), which divides chromosomes into short (p for petite) and long (q) arms (Figure 3)

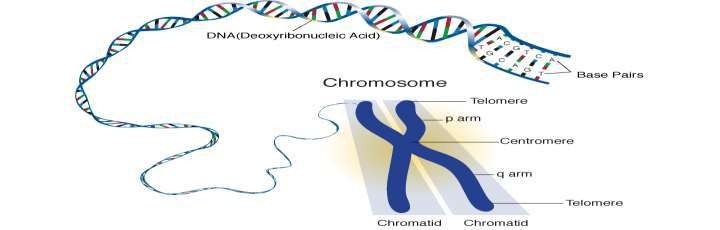
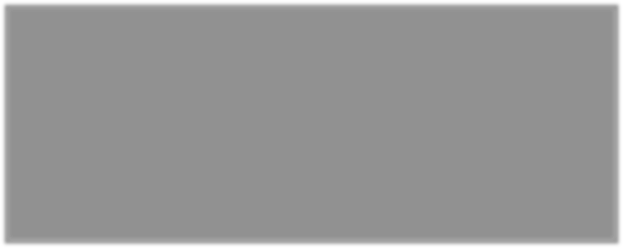


Figure 3: Chromosomes structure

**The centromere:** is the point of attachment of the kinetochore

**Kinetochore:** a protein structure that is connected to the spindle fibers.

**Spindle fibers:** Part of a structure that pulls the chromatids to opposite ends of the cell. During the middle stage in cell division, the centromere duplicates, and the chromatids pair separates; each chromatid becomes a separate chromosome at this point. The cell divides, and both of the daughter cells have a complete (diploid) set of chromosomes. The chromosomes uncoil in the new cells, again forming the diffuse network of chromatin.

The tip of each chromosome is the [telomere](https://www.sciencedirect.com/topics/medicine-and-dentistry/telomere) it‘s important for sealing the end of the chromosome and maintaining stability and integrity. The telomere comprises mainly tandem [DNA repeats](https://www.sciencedirect.com/topics/medicine-and-dentistry/repetitive-dna), and the size of the telomere is maintained by an enzyme known as [telomerase](https://www.sciencedirect.com/topics/medicine-and-dentistry/telomerase). Humans have 22 sets of [autosomes](https://www.sciencedirect.com/topics/medicine-and-dentistry/autosome) and 2 [sex chromosomes](https://www.sciencedirect.com/topics/medicine-and-dentistry/sex-chromosome), i.e., a total of 46 chromosomes. In the nucleus, chromosomes are packed tightly, which allows a

large amount of DNA to be located within a small space. Packing also plays a role in [gene regulation](https://www.sciencedirect.com/topics/medicine-and-dentistry/gene-control).

**Types of Chromosomes**

Chromosomes are divided into two parts (p and q arms) with a constriction point called a centromere in the middle. The centromere can be located in different positions and this forms the basis for the four different classes of chromosome (Figure 4).

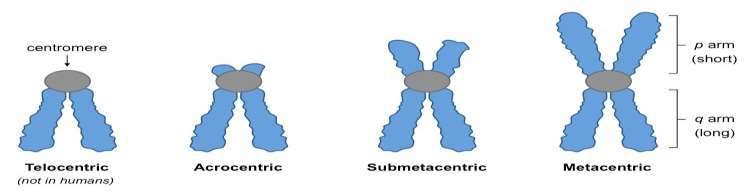
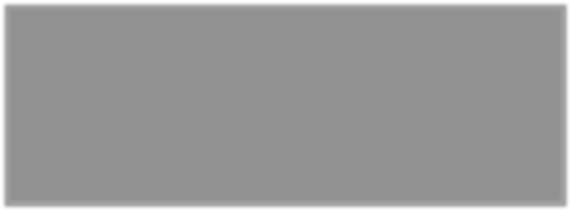


Figure 4: Types of chromosomes

**Metacentric:** Centromere is in middle, meaning p and q arms are of comparable length. **Submetacentric:** Centromere off-centre, leading to shorter p arm relative to q arm. **Acrocentric:** Centromere severely off-set from centre, leading to much shorter p arm. **Telocentric:** Centromere found at end of chromosome, meaning no p arm exists (chromosome not found in humans).

**Virus DNA Structure**

Just as in cells, the nucleic acid of each virus encodes the genetic information for the synthesis of all proteins. While the double-stranded DNA is responsible for this in prokaryotic and eukaryotic cells, only a few groups of viruses use DNA. Most viruses maintain all their genetic information with the single-stranded RNA. There are two types of RNA-based viruses. In most, the genomic RNA is termed a plus strand because it acts as messenger RNA for direct synthesis (translation) of viral protein. A few, however, have negative strands of RNA. In these cases, the virion has an enzyme, called RNA-dependent RNA polymerase (transcriptase), which must first catalyze the

production of complementary messenger RNA from the virion genomic RNA before viral protein synthesis can occur.

A virus is a small collection of genetic code, either DNA or RNA, surrounded by a protein coat. A virus cannot replicate alone. Viruses must infect cells and use

