



Nucleus

The nucleus is the largest of the organelles and is at the centre of the cell. It is the storage site of the cell's DNA. Here DNA is copied and processed into RNA by transcription. This is the first step in the process of protein synthesis. The nucleus is surrounded by a double membrane system called the nuclear envelope that contains holes known as nuclear pores. These pores allow large molecules such as proteins to pass in and out of the nucleus. Inside the nucleus is a round structure known as the nucleolus. This is where ribosomes are formed.

Chromosomes

Chromosomes are thread-like structures, made of DNA wrapped around a scaffold of proteins. Each human cell contains 46 chromosomes. 23 are passed down from the mother and 23 are passed down from the father. Each chromosome contains specific regions of DNA, known as genes. These are sections of DNA that carry information required to make a molecule, usually a protein. A human has between 23,000 and 25,000 genes. We talk about genes having different characteristics. For instance, if you hear about 'genes for eye colour', it means that these genes code for protein pigments in the iris of each of our eyes.

DNA

DNA, or deoxyribonucleic acid, is a molecule that contains our genetic instructions. It is made up of four chemical bases: adenine (A), cytosine (C), guanine (G) and thymine (T). The order, or sequence, of these bases forms a set of instructions. DNA has a double helix structure; two molecules of DNA are twisted together and held together by pairs of bases (A with T, and C with G). All of the DNA in an organism is known as the genome. The human genome contains 3 billion bases and provides all the information needed to make a human. It is packaged into chromosomes inside the nucleus.

Rough endoplasmic reticulum

The endoplasmic reticulum is an organelle that forms an extensive network of flattened sack-like membranes known as cisternae. The endoplasmic reticulum extends out from the nuclear membrane into the cytoplasm of the cell. The surface of the rough endoplasmic reticulum (RER) is covered by millions of ribosomes that produce proteins. These ribosomes give the rough endoplasmic reticulum a “rough” or studded appearance under a microscope, hence its name. The RER is involved in the production, folding and transport of proteins produced by the ribosomes on its surface.

Smooth endoplasmic reticulum

The endoplasmic reticulum is an organelle that forms an extensive network of flattened sack-like membranes known as cisternae. The endoplasmic reticulum extends out from the nuclear membrane into the cytoplasm of the cell. Unlike rough endoplasmic reticulum, the smooth endoplasmic reticulum (SER) does not have ribosomes on its surface, hence its “smooth” appearance. It is mostly involved in the production of lipids and steroids (hormones) needed by the cell. The smooth endoplasmic reticulum can also play a detoxifying role in the cells, converting organic chemicals such as ethanol (derived from drinking alcohol) to safer water-soluble products.

Golgi apparatus

The Golgi apparatus is a complex structure consisting of stacks of membrane-bound flattened sack-like structures known as cisternae. It can be described as a cellular “post office” which receives, sorts, labels and dispatches proteins around the cell to where they are needed. The Golgi apparatus receives proteins and lipids from the endoplasmic reticulum and modifies them, for example it can add a sugar molecule. The modified protein is then packaged into vesicles (small membrane-bound sacks or bubbles) that can be transported to the surface of the cell where they can be secreted.

Mitochondria

Mitochondria are rod- or sausage-shaped organelles found inside cells. They are the power stations of the cell providing chemical energy in the form of adenosine triphosphate (ATP). Like the nucleus, mitochondria have a double membrane. The outer membrane is smooth but the inner membrane has multiple folds, known as cristae. Sugar is combined with oxygen in the cristae to produce ATP. Although most of a cell's DNA is contained in the nucleus, mitochondria have their own circular DNA. In humans mitochondrial DNA (mtDNA) is inherited exclusively from the mother.

Lysosomes

Lysosomes are round, membrane-bound organelles that contain powerful digestive enzymes. They are the recycling centre, responsible for the disposal and recycling of waste materials within the cell. Enzymes in the lysosomes are used to break down invading microorganisms and to digest old or unwanted proteins and cell organelles. The membrane of the lysosome is essential for containing these powerful enzymes and maintaining them at an optimal pH of 4.8. It also protects the cytosol and the rest of the cell from the digestive enzymes inside the lysosome.

Ribosomes

Ribosomes are tiny organelles that can be found in the cytoplasm or on the surface of the rough endoplasmic reticulum. They are where new proteins are made. Ribosomes can be seen as protein-making, molecular machines that are made up of RNA and protein. They translate messenger RNA (mRNA) produced in the nucleus and assemble chains of amino acids delivered by transfer RNA (tRNA) to make polypeptides and proteins.

Centrioles

Centrioles are a pair of organelles found in the cell that consist of small tubes of proteins known as microtubules. These organelles play an important role in mitosis (cell division). The centrioles organise fibres called microtubules into spindles which attach to the chromosomes and move them during cell division. The centrioles are also thought to play an important role in the positioning of the nucleus in the cell.