Comparison of prokaryotic and eukaryotic cells

- Alice Smith

Prokaryotic and Eukaryotic cells

	Similarities	Differences
Prokaryotic cells	Plasma membrane	Nucleoid
		Pili
		Cell wall (apart from in plant eukaryotic cells)
	Cytoplasm	
		Capsule
		Plasmid
Eukaryotic cells	Flagellum	Nucleus
	Ribosome’s	Nuclear pore
		Chromatin
		Nuclear envelope
		Nucleolus

Mitochondria

Cytoskeleton

Golgi apparatus

Secretory vesicle

Centrosome

Lysosome

Smooth endoplasmic reticulum

Rough endoplasmic reticulum

There are many differences and similarities between prokaryotic and eukaryote cells, designed so they can do their jobs.

Prokaryotic cells have a nucleoid whilst eukaryotic cells have a membrane-bound nucleus.

The nucleus contains the nucleolus, where RNA (ribonucleic acid) is situated and where the RNA is synthesized into ribosome.

The nucleus is surrounded by the nuclear envelope which is a double membrane, this absorbs substances through its pores and also allows the release when the two membranes fuse, and this is how the nucleus feeds.

The nucleus contains all the genomic DNA which is the genetic information carried by the chromosomes and is different from the nucleoid in a prokaryotic cell because the nucleoid holds information in a circular double stranded DNA. Plasmids carry DNA, which are separate from the nucleoid and are used to transfer information from one prokaryotic cell to another. This process is called conjugation.

Prokaryotic cells have pili (eukaryotic cells do not) these are to help the cell attach itself to bacteria or bacteria attach to itself.

They both however have a flagellum to help the cell manoeuvre itself.

Both cells have ribosome and cytoplasm.

The cytoplasm is fluid that fills the cell, inside this there is ribosome. These ribosomes float freely around the cytoplasm; they are used for the cells to combine proteins into a form that can be used in the cells.

The cell wall that is found in prokaryotic cells and eukaryotic plant cells provides the cell with support and makes it tough and flexible. The reason animals cells do not have a cell wall is because they do not require this support as they get it from the skeleton and muscles.

Another trait of the eukaryotic cell is the smooth and rough endoplasmic reticulum. This is the organelle that acts as a transport system. The substances move from parts of the cell to where they need to be using this process.

There are two kinds of endoplasmic reticulum smooth and rough. The smooth endoplasmic makes protein, carbohydrates and lipids. The rough endoplasmic reticulum help make the proteins that will be used within the cell or in the environment in which the cell is.

The Golgi apparatus is found in eukaryote cells and looks a bit like a stack of pancakes. The Golgi apparatus sorts the proteins and lipids in the vesicles and sends them to destinations in the body where they are needed.

The vesicles wait until a protein opens up a channel when coming into the cell membrane so they can get out to complete their jobs.

The mitochondria act as a digestive system for the cell. They bring the nutrients in and break them down into more energy rich molecules.

A eukaryotic cell has these mitochondria where as a prokaryote doesn’t.

Word count 509

The sperm cell

The role of a sperm is to fertilise a female egg or female gamete. Its specialised structure to carry out its role would be its shape.

Sperm cells are small and straight, they have a long flagellum or tail called a spermatozoon to mobilise and propel them towards the egg. The middle piece of the sperm contains mitochondria; this helps produce energy for the movement of the sperm. The head of the sperm cell contains a nucleus which includes chromosomes and genetic information.

This information is passed to the egg to make a whole organism.

In the head there are enzymes which help the sperm break through the outer layer of the egg

Word count 116

The red blood cell

The role of a red blood cell is to transport oxygen across the body.

The red blood cells are small; this is so they can pass through capillaries to get to where they are needed. Red blood cells are the shape of a coin which facilitates a higher surface area so the cell can defuse more oxygen.

Red blood cells have a thin membrane so they can diffuse oxygen quicker and more effectively throughout the body.

They contain haemoglobin which enables the cell to absorb oxygen in the lungs and release it into the rest of the body.

The cell doesn’t have a nucleus which allows more room for haemoglobin

Word count 114

The fluid mosaic model

All cells need a cell membrane to survive. This protects the cell from the outside world. The cell membrane is made up of three structures; these are phospholipids, cholesterol and proteins.

Phospholipids have a round head with two fatty acid tails. The phospholipids are packed very tightly in the cell membrane and lie tail to tail; this is because the head attaches to water where as their tails repel it. All the phospholipids build up the phospholipid bilayer. The bilayer agreement occurs because the lipids are amphipathic. This means they have both polor and non –polor parts in them.

Cholesterols inserts it in-between phospholipids. A cholesterols job is to maintain fluidity within the membrane. Depending on the temperature, cholesterol will increase or decrease the cell fluidity.

Proteins will appear in a lot of different ways in the membrane. An intergil protein or a Trans membrane protein crosses the whole of the cell membrane. Some proteins sit on the cell membrane or on another protein, these are called proifial protein. In rare cases proteins can go half way through the membrane or inside the cell membrane. These proteins appear randomly throughout the cell. The protein’s role is to communicate to the cell to tell it what is going on in the outside world. There other job is to transport the molecules in and out of the cell.

Carbohydrates called glycoproteins or glycolipids play a big role in communication too. These carbohydrates recognise other cells within the

body. These are on the outside of the membrane and usually found on top of lipids or proteins.

The phospholipids and proteins can move around and across the cell membrane. They can move in a lot of different directions. This is called the fluid mosaic model.

Word count 295

Passive and Active transport

Just like any other living organism cells need everything e. g. food, oxygen and carbon dioxide to live.

The transport systems (active and passive) are how the cells transport these molecules across the membrane. These transport systems will also remove the waste products. Passive transport means no energy was used for molecules to get across the membrane. There are three different types of passive transport:

- simple diffusion
- osmosis
- Facilitated diffusion.

Simple diffusion is the process involving the movement of molecules from areas of high concentration to low concentration over the phospholipid bilayer. This is called diffusing down a concentration gradient, because of the difference in concentration the process requires no energy and is how molecules such as carbon dioxide and oxygen get in and out of the cell.

These molecules can pass at any point along the cell membrane. How the molecules get across the cell membrane are affected by different factors. These include, how steep the gradient is i. e. such as if it is a high steepness the molecules diffuse faster i. e. if the temperature is high, the molecules will diffuse faster and, if the molecules are more permeable it will diffuse faster throughout the membrane. *Facilitated diffusion* is when the molecules require a carrier because they are too large to pass and cannot dissolve into the lipids in the phospholipid bilayer. In this case the molecules are called polar. The way these molecules get though the cell membrane is through protein channels. The proteins make a channel for the molecules to get through, this channel is water filled so water- soluble molecules can get from one side of the cell to the other.

A protein carrier is when a molecule passes through the protein via a protein channel; however these proteins combine with the molecule and make a conformational change whilst moving through the channel to get to the cell or outside the cell. Glucose is an example of the type of molecule that uses facilitated diffusion.

Osmosis i s how water molecules get across the membrane.

Water molecules are polar and some may not be able to pass through, however they are small enough to cross the membrane freely. The molecules move from a high concentration to a low concentration across a partially permeable membrane. In most cases the molecules move from outside to the inside the cell or vice versa to balance out the concentration. Active transport is when the molecules move against a concentration gradient (low

to high concentration). Active transport requires chemical energy (ATP). These molecules such as hydrogen – a charged ion uses a protein to pass through the membrane, however ATP gives the protein energy to transfer the ion across the membrane.

Endocytosis and exocytosis are types of active transport.

Endocytosis is a large molecule entering the cell. The surrounding membrane forms a vesicle for the cell enabling the molecule to reach inside the cell effectively.

Endocytosis is important because it enables large and vital molecules to pass through the membrane.

Exocytosis is the reverse, where large molecules leave the cell in the same way. Exocytosis is important because this is how cells get rid of their waste.

Word count 527

Mitosis and Meiosis

Mitosis is the reproduction of cells to replace cells lost due to damage or death. In this process the cell reproduces to make two identical daughter cells and identical to its parent cell. An example of this would be if you cut yourself, your body uses mitosis to repair the cut. Both cells have the same genetic information. If the cell is not reproducing it is in what is called the interphase or the resting state.

Prophase is the first stage of mitosis and in this phase the cell copies its DNA and gets the cell into the right position for the process to happen. The

chromatids join the centromere and the kinetochores connect to the microtubules.

The second phase of mitosis is the prometaphase is when the outside of the cell called the nuclear envelope dissolves.

Metaphase is the next stage. The chromosomes line up on the central axis (or middle) of the cell.

Anaphase is the next stage, in this the chromosomes move to opposite ends of the cell towards the poles.

Telophase is the next stage – in this the cells form nuclei round the chromosomes. the cells then create a new nuclear envelope.

Cytokinesis is what happens at the end of the telophase and where the cells divide and pull apart from each other by forming a cleavage furrow.

Once the cells are completely apart the cycle is complete and 2 new identical cells have now been developed and these cells enter into the interphase or resting phase before the whole cycle starts all over again.

Meiosis is very similar to mitosis, however in mitosis the cell creates 2 identical cells, in meiosis the cell creates 4 different cells. Meiosisoccurs ineukaryoticorganisms thatreproduce sexually. This includesplantsandanimals. The stages are all the same as mitosis but in meiosis they do go through the stages then do it all again (meiosis I and meiosis II) this is because meiosis if for reproduction. In meiosis the interphase only happens once and before meiosis begins.

The cell starts with one chromosome from each gamete (female and male sex cell) In the first prophase the chromosomes line themselves up with their homologous pairs and cross over. Homologous means the cells are around the same size and contain the same type of information. During prophase I crossing over happens, this is when the chromosomes transfer and exchange their DNA between each other. This is why we look different from our siblings and parents because the cells are not identical. The cells also use a genetic variation called independent assortment. The chromosomes line up randomly during metaphase I so they get a mix of the two different gamete cells.

In the end there is 4 cells created, they each have 23 chromosomes which is half the genetic information of a normal cell. This cells are known as haploid cells. This means they contain one complete set of chromosomes. These are normally sperm and egg.

When the sperm and egg cell come together they create an embryo which will have the right amount of chromosomes.

Word count 521

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