BODY STRUCTURE & FUNCTION

Cells are the smallest functioning units in the body. They group together to form tissues such as blood, muscle and bone. These tissues form organs for example the heart and brain. Organs group together to form systems which work together, performing specific functions, to maintain homeostasis within the body.The structure of a cell can be broken down into 3 main parts, the cell membrane which is a structure that provides support and protection by separating the cell from the environment. The membrane is a key factor in controlling the entry and exit of substances in and out of the cell. The Nucleus is the main organelle within the cell and is home to the cell's DNA (Deoxyribonucleic acid). Between the cell membrane and the nucleus is the cells cytoplasm, which consists of cytosol and the cells organelles for example, mitochondria, ribosomes and Golgi apparatus amongst others. There are 2 main types of cells, these are Eukaryotic and Prokaryotic. The main difference being that Eukaryotic cells have a nucleus that contains DNA which have double stranded chromosomes, but the Prokaryotic cell has no nucleus therefore the DNA is contained in a central area called the nucleoid which doesn't have a membrane. Prokaryotic cells tend to have small rings of DNA called plasmids. Because Prokaryotic cells are bacteria they are unicellular compared to the multi celled Eukaryotic cells. (Ross & Wilson).

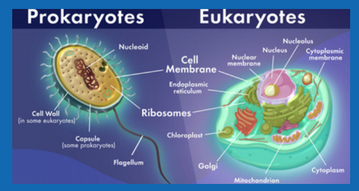

Fig 1. Prokayotes v Eukaryotes (How stuffworks.com 2021).

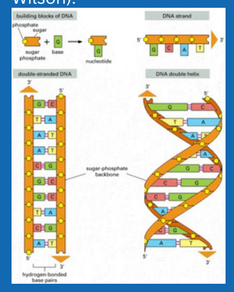

Fig 2. DNA and its building blocks. The Cell. Alberts, Johnson and Lewis et al.

DNA is a nucleic acid contain in the nuclei of human cells. It contains 3 main parts. 4 nitrogenous bases, these being adenine (A), thymine (T), cytosine (C), and guanine (G). Adenine and guanine are called purines and are larger in size compared to thymine and cytosine, which are single ring bases called pyrimidines. These bases are hydrogen bonded together. A phosphate group connected to a 5 carbon sugar called deoxyribose are the backbone of the DNA strand which the bases are attached to and then in turn the whole thing is twisted into a double helix shape. (Tortora & Derrickson)

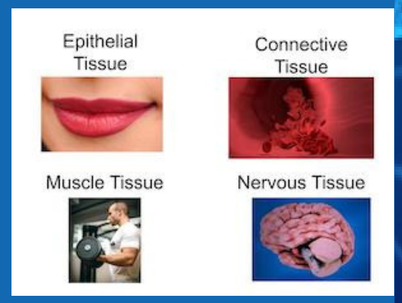

Fig 3. 4 types of tissue

Cells form together to become tissues, of which there are four main types that make up the human body. Epithelial tissue is avascular and provides protective boundaries around hollow organs, body cavities, ducts, and glands. It is involved in the diffusion of ions and molecules and has a high cellularity. Connective tissue protects and supports the body and its organs. It is the most abundant type of tissue and binds organs together, store energy reserves of fat, and help provide the body with immunity to disease causing organisms.Muscle tissue is composed of cells specialised for contraction and generation of force. In the process, muscular tissue generates heat that warms the body. It can be broken down further into skeletal for example the biceps and triceps, cardiac which is the heart and smooth which lines the GI tract. Nervous tissue detects changes in a variety of conditions inside and outside the body and responds by generating electrical signals called nerve action potentials or impulses that activate muscular contractions and glandular secretions.

The circulation of blood around the body is a continuous motion. It is broken down into 2 elements, pulmonary and systemic. They are organised in a sequence so that the output of one becomes the input of the other. The left side of the heart receives oxygenated blood into the left atrium via 4 pulmonary veins that come from the lungs. This oxygen rich blood then flows through the mitral valve into the left ventricle before being pumped out to the body through the aorta and then the other systemic arteries. Once the blood has reached its destination and exchanged the oxygen it is carrying for carbon dioxide, it makes its way back to the heart, entering the right atrium via the superior and inferior vena cava. This deoxygenated blood flows into the right ventricle through tricuspid valves, that prevent back flow, and then pumped to the lungs, via the left and right pulmonary arteries. This is the pulmonary part of the circulation system where deoxygenated blood that is pumped into the lungs will release the carbon dioxide picked up from the body and swap it for oxygen through a process of gas exchange before coming back to the heart where the whole process starts again. Within the circulatory system there are 5 main types of blood vessels. Arteries, these carry blood away from the heart. They are large and elastic, they divide into medium and small sized arterioles, which divide further down into capillaries that are small enough to allow the exchange of substances between the blood and body tissues. Groups of capillaries form venules which in turn form veins that lead back to the heart. (Tortora & Derrickson).

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TAKE ME AWAY

Blood contributes to homeostasis in the body by transporting oxygen, carbon dioxide, nutrients and hormones to and from cells. It aids the regulation of body temperature and pH levels as well as providing protection against disease. The main components of blood are Plasma, Red Blood cells, White blood cells and Platelets which we'll take a look at here:

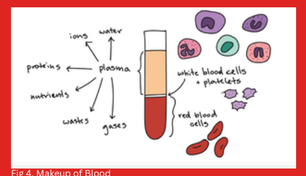

Fig 4. Makeup of Blood

Plasma is a light yellow or straw like liquid found in your blood that carries platelets, red blood cells and white blood cells around the body. Plasma makes up approximately 55% of your blood, it comprises of 91% water with the remainder being a mixture of coagulants such as fibrinogen which aids in blood clotting, and plasma proteins like albumin and globulin that are there to help maintain the colloidal osmotic pressure at about 25mmHg (millimetres of mercury). Plasma also contains antibodies, known as immunoglobulins, which fight off infection, electrolytes, nutrients and gases.

According to the NHS Blood and Transport service there are over 17,000 people in England that rely on plasma medicines. There are over 50 different conditions can be treated with medicines made from plasma. This can be from weakened immune systems, cancers and other diseases such as Haemophilia (A+B), Von Willebrand Disease which is a common bleeding disease including symptoms such as nose bleeds and excessive menstrual bleeding. Immunoglobins in Plasma can be used to help treat conditions like Primary Immunodeficiency Disease (PID) and Kawasaki Disease which primarily affects children under 5 and is a leading cause of heart disease. (www.blood.co.uk).

Red blood cells or erythrocytes contain haemoglobin, an oxygen carrying protein whose pigment gives RBC's their red colour. They have a strong and flexible membrane which allows them to distort without bursting as they squeeze through narrow blood capillaries. RBC's are dedicated to oxygen transport and as such have no nucleus or other organelles typically found within cells as to maximise their internal space for their task. They have a biconcave disc shape which gives the cell a greater surface area allowing for greater diffusion of gas molecules in and out of the cell. (Tortora & Derrickson).

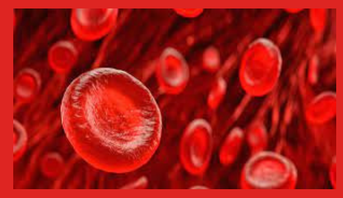

Fig 5. Red Blood cell

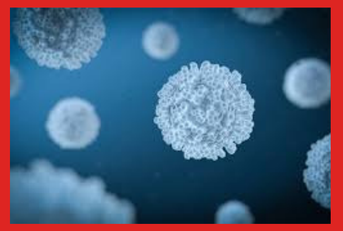

Fig 6. White Bloodcell

Unlike their counterparts, White blood cells or Leukocytes, have nuclei and other organelles but don't contain haemoglobin. They are the soldiers of the body and provide a protective force against invading microbes, strenuous exercise, anaesthesia and surgery. Once pathogens enter the body, these soldiers go to work by a process called phagocytosis. Contrary to RBC's, WBC's aren't contained in the bloodstream and can leave by a process of emigration to get to their desired destination. High levels of WBC's in the body can infer that the person has a disease, such as cancer, that needs help from healthcare providers to try and cure. (Tortora & Derrickson).

Platelets make up the last major component of blood. These are tiny cells that help your body form clots to stop bleeding. If one of your blood vessels gets damaged, it sends out signals to the platelets which then rush to the site and form a clot to fix the damage. The process of spreading across the surface of the blood vessel is called adhesion because of tentacles that help them stick to one another. Once at the site they send out chemical signals to attract more platelets to the area, this is called aggregation. (University of Rochester Medical Center).

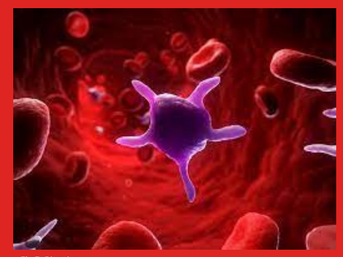

Fig 7. Platelet