

UNIT 1: HUMAN BEINGS AND HEALTH.

1. Levels of organisation

Human beings are multicellular. We are made up of different types of cells that work together. Our different body structures are ordered in levels of complexity known as levels of organization. Each level contains fewer elements than the level below it, but has a more complex structure.

Abiotic levels (these structures are non-living and belong to inert matter): Subatomic, Atomic (bioelements), Molecular (inorganic and organic biomolecules), Subcellular.

Biotic levels (living structures that carry out the three vital functions): Cellular, Multicellular (it includes Tissues, Organs and Systems), Population (this level includes living things which belong to the same species and share a particular area), Community (It is formed by populations of different species that inhabit the same environment), Ecosystems and Biosphere.

2. Cell organisation.

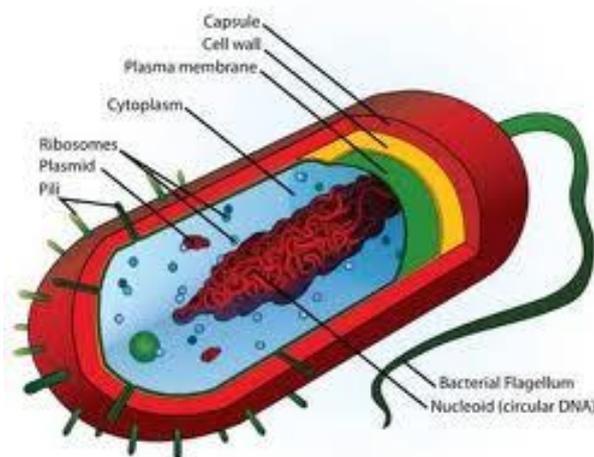
All living things are made of cells. A cell is the basic unit of life that can perform the three vital functions (Nutrition, Interaction and reproduction).

- The **cell theory** has three basic ideas:
All organisms are composed of cells.
Cells are the basic unit of structure and function in organisms.
All cells come from pre-existing cells.
- **Types of cells.**
Human cells are animal eukaryotic cells and have three basic structures: the plasma membrane, the cytoplasm and the genetic material.

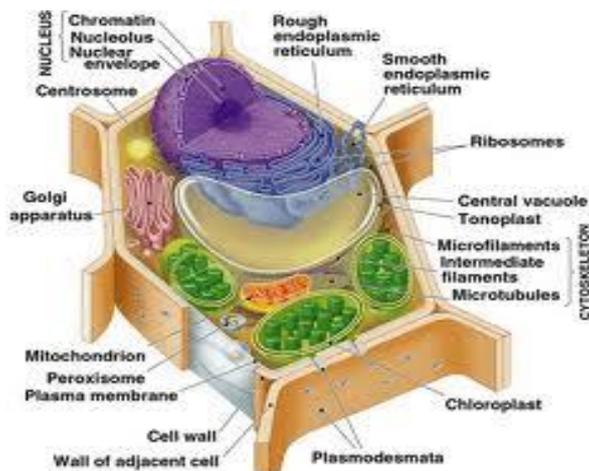
****Remember!**

There are two types of cells: prokaryotic and eukaryotic. In prokaryotic cells, the DNA floats in the cytoplasm (bacteria, Monera kingdom). In eukaryotic cells, the DNA is found inside an organelle called the nucleus (Protoctists, Fungi, Plants and Animals).

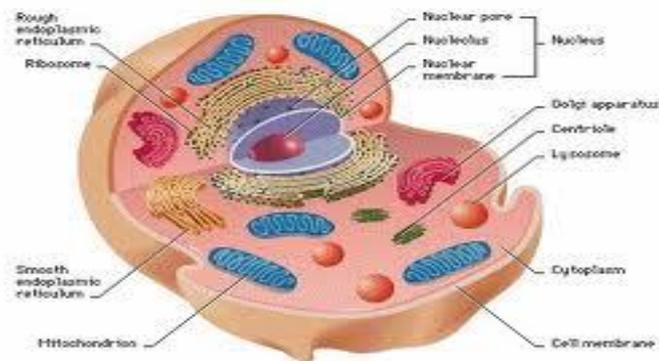
A prokaryotic cell:



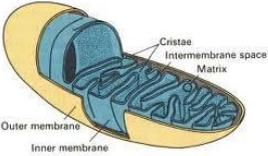
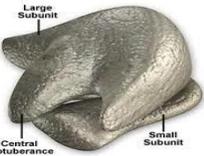
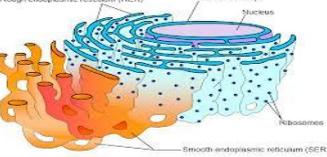
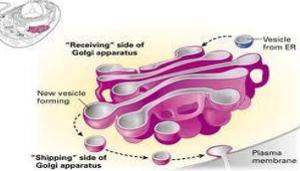
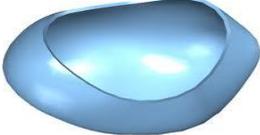
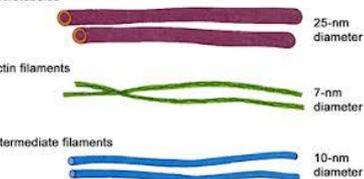
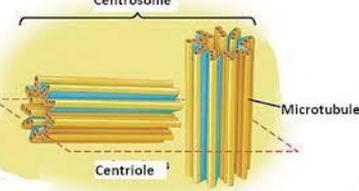
Plant eukaryotic cell:



An Animal eukaryotic cell:



- **The cell membrane.**
Structure: It is a very thin elastic layer that covers the cell.
Function: The cell membrane controls which substances go in and out, detects stimuli from the environment and enables cells to communicate with each other.
- **The cytoplasm.**
Structure: It is a jelly-like or gel-like substance which fills the cell. It contains organelles: mitochondria, ribosomes, endoplasmic reticulum, Golgi body, membranous vesicles, lysosomes, vacuoles, cytoskeleton and centrioles.
Function: A lot of chemical reactions take place in the cytoplasm.
- **The nucleus.**
Structure: It is formed by a nuclear membrane, DNA and nucleolus.
The nuclear membrane has a double membrane with pores, through which it communicates with the cytoplasm.
The DNA is a complex chemical substance in which the necessary information for the life of the cell is contained. During cell division DNA condenses together in tiny packs called chromosomes. When the nucleus is not dividing the nucleic acid appears as tiny granules of chromatin. The nucleus also holds the **nucleolus**, which produces granules like ribosomes.
Function: It controls the activities of the cell through DNA.
- **Cell organelles.**

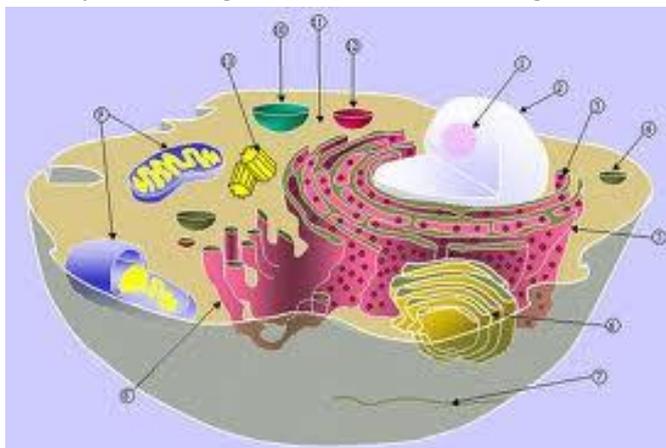
Organelle	Structure	Function
<p>Mitochondria</p> 	<p>The mitochondria have a double membrane: the outer one is smooth while the inner one forms folds called cristae</p>	<p>Cellular respiration takes place in them. On the net www.anayadigital.com you will find the presentation "Cellular respiration"</p>
<p>Ribosomes</p> <p>Ribosome Structure</p>  <p>Figure 1</p>	<p>The ribosomes are composed of two sub-unit. They are the smallest cell organelles.</p>	<p>Ribosomes take part in the process of making cellular proteins.</p>
<p>Endoplasmic reticulum</p> 	<p>The endoplasmic reticulum is formed by a series of interconnected sacs and canals (SER). Some of them have ribosomes attached to the membrane (RER)</p>	<p>The rough e.r. stores proteins formed in the ribosomes and transports them within the cell. The Smooth e.r. stores lipids.</p>
<p>Golgi body/apparatus</p> 	<p>The Golgi body is composed of flattened membranous sacs, from which vesicles emerge.</p>	<p>It receives substances from the endoplasmic reticulum and transports them outside the cell by means of vesicles formed within the Golgi body</p>
<p>Membranous vesicle</p> 	<p>Membranous vesicles are small membranous sacs full of different materials. Traditionally, they were called vacuoles.</p>	<p>It stores nutrients, materials absorbed by the cell and waste substances.</p>
<p>Lysosomes</p> 	<p>They are small vesicles that are generated in the Golgi bodies.</p>	<p>Lysosomes are vesicles full of digestive substances.</p>
<p>Cytoskeleton</p> 	<p>It is a series of long, thin filaments which extend around the entire cytoplasm.</p>	<p>The cytoskeleton holds the organules, gives shape to the cell and takes part in cellular movements.</p>
<p>Centrioles</p> 	<p>The centrioles are two hollow cylinders composed of filaments.</p>	<p>Centrioles organise the separation of chromosomes during cell division and take part in the formation of filaments, cilia and flagella.</p>

Activities.

1. What is the main difference between a prokaryote and a eukaryote? What organisms have each of these types of cells?
2. Write down:
 - a. Three things that both plant and animal cells have.
 - b. Three things that plant cells have, but animal cells don't.
3. Which cells are biggest? Investigate by looking on the Internet:
 - a. What is the average size of a plant cell, an animal cell and a prokaryote?
 - b. Do bigger organisms have bigger cells? Do elephants have bigger cells than rabbits, and do trees have bigger cells than grass?
4. Give the name of the organelle...
 - a. ...that intervenes in the formation of the flagella.
 - b. ...that is composed of two subunits.
 - c. ...that carries out cell digestion.
 - d. ...that transports substances.
5. Explain what function the mitochondria perform and draw a diagram of one.
6. Complete this table into your notebook:

Organelles	Function
Plasmatic membrane	
Nucleus	
Ribosome	
Lysosome	
Golgi body	
Endoplasmic reticulum	

7. Identify the cell organelles shown in the image.



3. Human tissue.

Tissues consist of a group of cells which have a similar shape and structure that work together to carry out a specific function. Most tissue cells are held together by their own intercellular substances. Human tissue is classified into four basic types: epithelial, connective, muscle and nervous.

Epithelial tissue: consist of one or several layers of cells (epithelial cells) that are situated very close to one another and cover both external and internal surfaces of the body, acting as a barrier between distinct

environments. There are two types: **covering and lining epithelium** (covers the outside of the body and also lines internal organs and cavities. This tissue has different cell structures and layers depending on its function) and **glandular epithelium** (it forms **exocrine glands** which secrete substances for different purposes and **endocrine glands** that secrete hormones into the blood).

Connective tissue: consists of cells that are surrounded by fibres and an intercellular substance called the matrix, which acts as a connector and provides support. There are various types of connective tissue that support, protect and connect other tissues:

- **Connective tissue proper** is very common in the human body. It surrounds and connects organs and has a gel-like intercellular matrix. Tendons and ligaments (connect bones) are examples of this tissue.
- **Cartilaginous tissue** supports the skeleton by forming cartilage. It has a solid, elastic intercellular matrix and cells known as chondrocytes.
- **Bone tissue** has a hard, solid extracellular matrix that contains calcium phosphate. Its rigidity allows it to support the body, along with cartilage. Bone cells are called osteocytes. There are two bone tissue types: compact bone tissue (forms the hard outer layer of bones) and cancellous (spongy) bone tissue (forms the interior of bones. This tissue has an irregular network of holes that contain red bone marrow).
- **Adipose tissue** stores lipids for protection and energy reserves, using cells called adipocytes.
- **Blood tissue** is formed of a liquid intercellular matrix called plasma, red and white blood cells and platelets. It is responsible for the transport of nutrients, hormones and waste, as well as for protecting against illness.

Muscle tissue: consists of elongated cells that group together to make muscle fibres. It is responsible for body movement. There are various types of muscle tissue, which contain different types of cells:

- **Smooth muscle tissue** is found in the walls of hollow organs, such as blood vessels and intestines. Its contraction and relaxation is responsible for the involuntary movements of these organs.
- **Cardiac muscle tissue** only exists in the heart. Heart muscle contractions involuntarily pump blood around the body.
- **Skeletal muscle tissue** covers the skeleton. It is responsible for most voluntary movement, from walking to facial expressions, and also helps to keep bones and joints in place.

Nervous tissue: consists of neurons and glial cells. Neurons are star-shaped cells that collect and transmit information. Neuroglia cells are responsible for neuron nutrition, defence and support.

4. **Organs and organ systems.**

In human beings, tissue comes together to form **organs**; as they do so, the functions each organ performs complement each other, leading to even more complex functions. **Organs** are composed of various tissue types that work together. Examples of organs are the stomach, the heart, skin and muscles.

Organ systems consist of two or more organs that work together. Some systems contain very different organs that carry out a single function, like the digestive system. Other organ systems are formed of organs that performed similar functions. In the case of these systems, the organs involved are also generally constructed of similar tissues. For example, in the circulatory system, the heart, veins and arteries are all mainly formed of muscle and epithelial tissue.

Organ systems can be classified according to whether their function relates to nutrition, interaction or reproduction.

Nutrition is the group of processes that allow us to use and transform the substances we need in order to stay alive. Four systems carry out nutrition: digestive system, respiratory system, circulatory system and excretory system.

Reproduction ensures our survival over time. The male and female reproductive systems are involved in this function.

Interaction takes place due to the existence of the nervous, endocrine, skeletal and muscular systems as well as the sense organs.

Activities

1. Identify the tissue that relates to the following definition: "its cells are found in all organs covering and connecting other tissues".
2. What type of tissue is predominant in the following organs?
a) Brain b) glands c) bone d) heart e) skin f) lung
3. Identify the relevant tissue, organ or systems corresponding to the following functions.
a) Lining the body and protection
b) Regulating and controlling the organism
c) Protecting internal cavities
d) Hormone production
e) Supporting the organism
4. Describe the differences between compact and cancellous bone tissue. Which is denser? Why?
5. Write a paragraph to explain how different organ systems are involved in the actions of running a race and eating an apple.

5. Health and illness.

Health can be defined as a state of physical, mental and social well-being and not merely the absence of disease or infirmity.

The factors that affect and determine our health are included in three categories:

environmental(pollution, radiation, toxic substances, pathogenic microorganisms),

lifestyle(balanced diet, physical exercise, stress levels, consumption of alcohol, tobacco and drugs)

and **genetic** (genetic inheritance-resistance to disease/congenital disease, age-health often deteriorates with age).

Illness (disease) occurs when one or more of the body's organs do not function correctly. This often causes pain or discomfort.

There are two indicators of illness: symptoms and signs. **Symptoms**, such as pain or tiredness, are only felt by the ill person. **Signs**, such as high or low blood pressure or temperature, can be seen by other people or detected in tests.

Illness can be classified as infectious or non-infectious. **Infectious illness** is caused by transmittable pathogens or microorganisms, such as bacteria and viruses that enter the body and multiply. **Non-infectious illness** is not caused by pathogens so cannot be transmitted between human beings.

There are many types of non-infectious illness. They can be related to genetic, lifestyle and environmental factors (cardiovascular illness, respiratory illness, diabetes, cancer, ...).