

There are two terms to learn and understand – namely, anatomy and physiology:

- **Anatomy** is the study of structure
- **Physiology** is the study of function.

Levels of organization

The body consists of many components, starting with the smallest of them – the atom – and towards the largest, the body is organized in this way:

- The atom – e.g. hydrogen, carbon
- The molecule – e.g. water, glucose
- The macromolecule (large molecule) – e.g. protein, DNA
- The organelle (found in the cell) – e.g. nucleus, mitochondrion
- The tissues – bone, muscle
- The organs – e.g. heart, kidney
- The organ system – e.g. skeletal, cardiovascular
- The organism – e.g. human, cat.

Characteristics of life

All living organisms have certain characteristics in common. Although these characteristics may differ from organism to organism, they are important for the maintenance of life.

These characteristics are:

- 1• **Reproduction** –reproduction is essential because the new cells are important to maintain the efficiency and growth of the organism
- 2• **Growth** – essential for the development of an organism
- 3• **Movement** –This characteristic is essential to allow the organism to seek out nutrition and partners for reproduction, as well as to escape predators
- 4• **Respiration** – respiration is important for obtaining oxygen and releasing carbon dioxide (or obtaining carbon dioxide and releasing oxygen if a green plant) .
- 5• **Responsiveness** – this allows the organism to respond to changes, for example in the environment or to other stimuli.
- 6• **Digestion** – this is the breakdown of food substances, so that the organism can produce the energy necessary for life.
- 7• **Absorption** – the movement of substances (including digested food) through membranes and into body fluids, including blood and lymph, which then carry the substances to the parts of the organism requiring them.

8• Circulation – the movement of substances through the body in the body fluids

9• Assimilation – the changing of absorbed substances into different substances, which can then be utilized by the tissues of the body.

10• Excretion – the removal of waste substances from the body. These waste substances are either removed because they are of no use to the body or because they are harmful to the body.

Body requirements

There are five essential requirements that all organisms, including humans, require:

(1) Water:

- Water is the most abundant substance found in the body. At birth, 78% of a baby is water, at one year of age, this has dropped to 65%, whilst in adult males has dropped to 60% and in adult females is 55% (females have more fat than males as a percentage of their body which accounts for the difference).
- Water is required for the various metabolic processes which are necessary for an organism's survival.
- Water is necessary to transport essential substances around the organism.
- Water regulates body temperature – a human, for example, operates within a very narrow temperature range and has a very small tolerance for temperature change within the body. If body temperature exceeds this range, then death will occur.

(2) Food:

Food supplies the energy for the organism which is necessary for all characteristic features of life example: reproduction and movement .

(3) Oxygen:

Oxygen forms 20% of air and is used in the release of energy from the assimilated nutrients.

(4) Heat

Heat is a form of energy that partly controls the rate of metabolic reactions.

(5) Pressure:

There are two types of pressure that are required by an organism:

- Atmospheric pressure which is important in the process of breathing.
- Hydrostatic pressure which keeps the blood flowing through the body.

Electrolytes

Electrolytes are substances that move to oppositely charged molecules in fluids. If molecules that are bonded together ionically are dissolved in water within the body cells, then they undergo a process where the ions separate, i.e. they become dissociated. These ions are now known as electrolytes.

However, this does not apply to molecules that are produced by other types of bonding (e.g. covalent bonding). Molecules that are produced as a result of other types of bonding are called non - electrolytes, and these include most organic compounds, such as glucose, urea and creatinine.

Electrolytes are particularly important for three things within the body:

- (1) Many are essential minerals.
- (2) They control the process of osmosis.
- (3) They help to maintain the acid base balance, which is necessary for normal cellular activity.

Elements

A chemical element is a pure chemical substance . Each element consists of one type of atom . Some common examples of elements found in the body include:

- Iron
- Hydrogen
- Carbon
- Nitrogen
- Oxygen
- Calcium
- Potassium
- Sodium
- Chloride
- Sulphur
- Phosphorous.

There are three classes of elements:

- (1) Metals .
- (2) Non - metals .
- (3) Metalloids .

Homeostasis

Homeostasis is the body ' s attempt to maintain a stable internal environment by achieving some sort of balance. The body is normally able to achieve a relatively stable internal environment even though the external environment is constantly changing – from cold to hot, or from dry to wet, etc. The body uses various homeostatic mechanisms to

monitor and maintain a dynamic state of equilibrium within the body within quite narrow limits. The homeostatic mechanisms include:

- Receptors – these receptors sense external and internal environmental changes and provide information on the changes to the control centre
- Control centre – the control centre determines what a particular value (e.g. blood pressure) should be and sends out a message to the effectors
- Effectors – once they have received the information from the control centre, the effectors cause responses to take place within the body 's internal environment which hopefully will produce the changes that will return the internal environment to return to normal values.

Organic and inorganic substances

All substances are classed either as organic or inorganic depending upon their molecules.

Organic molecules:

- Contain carbon (C) and hydrogen (H)
- Are usually larger than inorganic molecules
- Dissolve in water and organic liquids
- As a group include carbohydrates (sugars), proteins, lipids (fats) and nucleic acids (part of DNA).

Inorganic molecules:

- Do not generally contain carbon (C)
- Are usually smaller than organic molecules
- Usually dissolve in water or they react with water and release ions
- As a group, include water (H_2O) carbon dioxide (CO_2) and inorganic salts.

Examples of organic substances

Carbohydrates

Monosaccharides (one of the group of sugars known as carbohydrates) provide energy to cells as well as supplying the materials that allow for the building of the various structures of the cell . They contain carbon (C), hydrogen (H) and oxygen (O) and their structure can be depicted by the chemical formula $C_6H_{12}O_6$. There are three types of carbohydrates:

- Monosaccharides – glucose and fructose
- Disaccharides – sucrose, lactose
- Polysaccharides – glycogen, cellulose.

Fats (lipids)

Fats are lipids (known as triglycerides) and are soluble in organic solvents. They are mainly used to provide energy. Like carbohydrates, they consist of carbon (C), hydrogen (H) and oxygen (O), but because the

numbers and proportions of these molecules are different from the carbohydrates, they have different properties. The chemical formula for stearin (one type of lipid) is $C_{57}H_{110}O_6$. One important group of lipids is the steroid group which is used to synthesize hormones. Cholesterol is an important member of the steroid group of lipids

Proteins

Proteins are built up from amino acids . Proteins are very important as they provide the structural material for the body as well as being an energy source. They also help to form many other substances, including hormones, receptors, enzymes and anti bodies.

Examples of inorganic substances

Water (H_2O)

Water is a major component of all body fluids. It has an important role to play in most metabolic reactions as well as transporting chemicals in the body. Water can both absorb and transport heat, so it plays a crucial role in maintaining body temperature.

Oxygen (O_2)

Oxygen is necessary for survival. It is used by the organelles of the nucleus to release energy from nutrients .