

## UNIT 6. THE BIOSPHERE

### 1. The biosphere.

The biosphere is the sum of all **living things** on the Earth. Life has developed on the Earth because of the following factors: optimal **temperature**, the **atmosphere** that has **gases** such as carbon dioxide and oxygen and the **ozone layer** and finally the presence of **liquid water**.

### 2. Living things.

#### 2.1 What do all living things have in common?

- All living things have a **similar chemical composition**.
- All living things are made up of one or more **cells**.
- All living things also carry out three functions: **nutrition, interaction with the environment and reproduction**.

#### 2.2. What are living things made up of?

The living matter that makes all organisms is made up of different elements found in Nature (**bioelements**). The most important are **Carbon (C)**, **hydrogen (H)**, **oxygen (O)**, and **nitrogen (N)**, because they make up more than 99% of the mass of living things.

Combinations of these elements form molecules of living matter called **biomolecules**. Living things are made up of two kinds of substances: **inorganic and organic**.

- **Inorganic biomolecules (or compounds or substances).**

They do not contain carbon. They are present in living things and non-living things. The principle inorganic substances are water and mineral salts.

**Mineral salts** have various functions: they make up different structures, like shells, bones and teeth. They are present in internal fluids, like tears, sweat and blood.

**Water** is the most abundant substance in living things. Living things obtain water directly by drinking it, or indirectly from substances that contain water. Plants obtain water from environment. Water is necessary for chemical reactions and to transport all other substances.

- **Organic biomolecules.**

They are unique to living things. Carbon is their principal element. Organic substances present in living things are:

Biomolecules	Example	Use/ Function
Glucides or Sugars	Glucose Cellulose	To provide energy To make structures
Lipids or Fats	Fatty acids Cholesterol	To provide energy reserves To make structures
Proteins	Haemoglobin Antibodies Queratine	To transport oxygen To fight microorganisms that cause disease To make structures: hair, nails
Nucleic acid	DNA, RNA	To control cell function and heredity

### 3. What functions do all living things carry out?

**Nutrition** refers to all the processes which enable living things to obtain energy and matter they need to live. For nutrition to take place, living things take in substances from their surroundings, transform them and use them. Finally they expel the waste matter. Living things can be classified into two groups depending on how they feed.

- **Autotrophs** produce the organic substances which they need from inorganic substances. They take substances like water, mineral salts and carbon dioxide from the soil and the atmosphere. To obtain these organic substances, autotrophs need energy. They get energy from sunlight through a process called **photosynthesis**. Chlorophyll enables them to do this. Plants, algae and some bacteria are autotrophs.
- **Heterotrophs** feed on organic matter which is already elaborated: for example, living things or their remains. Animals, fungi, some bacteria and all protozoa are heterotrophs.

**Interaction with the environment:** all the processes which enable living things to react to changes in their environment. For example, plants grow towards the light; animals flee from predators.

**Reproduction:** refers to all the processes which enable living things to create new living things. There are two basic types:

- **Asexual reproduction** involves one living thing. For example: a sponge can produce buds which give rise to new sponges.
- **Sexual reproduction** involves living things of different sexes. Each one provides a sex cell or gamete. The two sex cells join to form the first cell of a new living thing, the zygote.

### 4. What are cells?

Organic and inorganic biomolecules join together to make more complex structures called cells. Most cells are too small to see, so we need to use a microscope to see them. Cells are the smallest unit of life. They are structural and functional units for all living things.

- All living things are made up of one or more cells.
- Cells carry out the function of nutrition, interaction with the environment and reproduction.
- All cells come from other cells.

#### 4.1 How is a cell organized?

- The **cell membrane** covers the whole cell. It is a thin layer that surrounds and protects the cell. It regulates which substances enter and exit the cell.
- **Cytoplasm** is the inside of the cell .It is a jelly-like substance. It is mainly made up of water, in which various salts are dissolved. Many of the chemical reactions of the cells take place here. **Organelles** are small structures in the cytoplasm. They are responsible for respiration, making and storing nutrients, digesting food substances, disposing of waste, etc.
- **Genetic material** controls and regulates how cells work. This **DNA** contains the hereditary information that is passed from one cell to the daughter cell. DNA makes up the chromosomes.

#### 4.2 What are the two basic types of cells?

- **Prokaryotic cells** have no nucleus. They have no nuclear membrane. Genetic material is dispersed throughout the cytoplasm. They are simpler and smaller than eukaryotic cells. Bacteria are made up of prokaryotic cells.
- **Eukaryotic cells** have a nucleus, separated from the cytoplasm by the nuclear membrane. Algae, protozoa, fungi, animals and plants have eukaryotic cells.

Eukaryotic cells can be **plants or animal cells**. We know if they are plant or animal cells because plant cells have a **rigid cell wall** (made of cellulose) outside the plasma membrane. Plant cells also contain special organelles, called **chloroplasts**, where **photosynthesis** takes place.

#### 5. Classification of living things.

Classification systems are used to organise and compare all living things on Earth. The first classification systems were **artificial**. They only included the visible, external characteristics of living things. This caused mistakes, such as including birds, flies and bats in the same group because they all had wings.

The system of classification we used today is a **natural** classification system based on **evolution**. This means the system is based on the real biological relationships that exist between living things.

Taxonomy is the science of classifying living things. Organisms are classified into groups called **taxa** (singular: taxon). The seven taxonomic levels from the largest to the smallest are: **Kingdom, Phylum, Class, Order, Family, Genus and Species.(PCOFGAS)**.

#### 6. What are the five kingdoms?

Scientists classify all living things into five kingdoms by three main criteria: type of cells, how the cells are grouped and nutrition.

The American biologist **Lynn Margulis** (1938–2011) proposed the classification of organisms into **five kingdoms: Monera, Protocist, Fungi, Plants and Animals**. This is one of the most widely accepted classifications of living things.

Kingdom	Type of cell	Number of cells	Nutrition	Tissue?
Monera	Prokaryotic	Unicellular	Autotrophic Heterotrophic	NO
Protocist	Eukaryotic	Multicellular	Autotrophic Heterotrophic	NO
Fungi	Eukaryotic	Unicellular Multicellular	Heterotrophic	NO
Animals	Eukaryotic	Multicellular	Heterotrophic	YES
Plants	Eukaryotic	Multicellular	Autotrophic	YES

### SUMMARY

#### 1. Fill in the summary.

- a. Three characteristics all living things have in common are .....
- b. The principal inorganic substances in living things are .....
- c. The principal organic substances in living things are.....
- d. The three life functions are .....
- e. Based on nutrition, living things can be classified into two groups: .....
- f. Cells are .....
- g. The three basic structures all cells have in common are.....
- h. In..... cells, genetic material floats freely throughout the cytoplasm.
- i. In.....cells, genetic material is contained in a nucleus.
- j. Taxonomy is .....
- k. The five kingdoms of living things are .....

## UNIT 7. Monerans, protoctists and fungi.

### 1. What is the Monera Kingdom?

The Monera kingdom contains unicellular, microscopic, prokaryotic organisms. They do not have an organised nucleus.

Bacteria belong to the Monera kingdom. They can live almost anywhere. They sometimes form **colonies**, but each individual cell remains independent. The first living things on Earth, more than 3,500 million years ago, were probably bacteria.

#### 1.1. Vital functions of bacteria.

##### Bacterial nutrition

Bacteria can be autotrophic or heterotrophic organisms. Most bacteria are **heterotrophic**: they do not produce their own food.

- **Parasites** feed on living things. They cause illnesses like tuberculosis and cholera.
- **Saprophytes** live on dead or decomposing matter. They transform organic substances into inorganic substances. Some saprophytes are useful: lactobacilo is used to make yoghurt.
- **Symbionts** live on the bodies of other living things to provide mutual benefit. They can be found in the digestive system of many mammals. There, intestinal bacteria help with digestion.

Some bacteria are **autotrophs**. For example, cyanobacteria make their own food through photosynthesis.

##### Bacterial interaction

Some of these organisms do not move, some swim by means of **flagella** and some slide over surfaces. They live in all types of environment, even extreme ones, such as thermal waters.

##### Bacterial reproduction

Bacteria reproduce asexually by **binary fission**, producing two daughter cells. Each daughter cell grows, and then divides again. In this way they can form groups of millions, and these groups are called colonies.

##### How many groups are there?

Bacteria are classified into four groups according to the shape of their cells:

- **Coccus**. Cocci are spherical in shape. They usually come in twos (diplococci), in bunches (staphylococci) or in chains (streptococci).
- **Bacillus**. Bacilli are long and cylindrical in shape.
- **Spirillum**. Spirilla are spiral shape.
- **Vibrio**. Vibrios are shaped like a comma.

## 2. What is the Protocist kingdom?

The Protocist kingdom includes unicellular and multicellular living things. They are all eukaryotes and have no tissues.

Algae and protozoa are found in this kingdom.

### 2.1. What are algae?

The main characteristics of algae are:

- **Unicellular** or **multicellular**. Unicellular algae sometimes form colonies. Each cell can carry out the vital functions. All the cells of multicellular algae look the same and have the same functions. Therefore, algae have no true tissues or organs.
- **Autotrophs**. They contain chlorophyll and other pigments which capture sunlight for photosynthesis. They can be classified by their pigment: green, brown or red.
- Some live in salt and fresh water, but others live on tree trunks or rocks. Some unicellular algae, like diatoms, float on water forming phytoplankton, and are food for aquatic animals.

Algae provide food for humans too, for example, ice cream is made from algae. Industrial uses include medicines and fertilizers.

### 2.2. What are protozoa?

The main characteristics of protozoa are:

- **Unicellular**. A single cell carries out all the vital functions.
- **Heterotrophs**. They feed on bacteria, organic remains and other microscopic organisms.
- They live in both salt water and fresh water. Some protozoa float on water, zooplankton, and are food of aquatic animals.
- Some are **parasites**, and cause illnesses.

#### How many groups are there?

There are four groups of protozoa. They are classified according to the way they move.

- **Flagellates** use one or two flagella to move around. They are nearly all parasites, but some live freely. *Trypanosoma brucei* is a parasite found in the blood of vertebrates. In humans it produces sleeping sickness, which is transmitted by the tsetse fly.
- **Ciliates** have many cilia that they use to move with. They also use them to move water. The most common example is the **paramecium**. Ciliates can be parasites or live freely.
- **Rhizopods** have cytoplasm extensions (**pseudopods**) that they use to move around and catch food. Some of them live freely, such as the **amoeba**, and some are parasites, such as *Entamoeba histolytica*.
- **Sporozoa** are non-motile organisms: they don't have any organs for movement. They are all parasites. They reproduce asexually by spores. *Plasmodium malariae* causes malaria, which is endemic in many African countries. Malaria attacks the red blood cells and causes high fevers.

### 3. What is the Fungi kingdom?

The Fungi kingdom includes unicellular and multicellular living things. They are all eukaryotes, heterotrophic organisms and have no tissues. Fungi grow in the soil, in dark and damp places or on the organic matter they feed on. The fungal body consists of thread-like structures called hyphae, which form the mycelium.

#### 3.1. Vital functions of fungi.

**Nutrition.** Fungi are **heterotrophic**. They get the nutrients they need in different ways.

**Saprophytes.** Fungi feed on dead or decomposing organic matter from other living things. They transform organic substances into inorganic substances. Most fungi belong to this group.

**Parasites.** Fungi cause diseases in plants and animals.

**Symbiotic** fungi establish symbiotic relationships with other organisms. Lichens are organisms formed by a symbiotic relationship between a fungus and an alga. Both organisms contribute to and benefit from this relationship. The fungus provides moisture (a small amount of a liquid (water) that makes something wet) and mineral salts. The alga provides food produced through photosynthesis.

**Reproduction.** Most fungi reproduce **asexually** by producing spores or gemmation. Spores are produced in multicellular mushrooms on special cells located on the underside of the cap. Some fungi reproduce sexually.

**Interaction.** Fungi response to stimuli such as humidity and mineral salts. They are immobile.

**How many groups are there?**

**Yeasts.** They are **unicellular** organisms. Some of them are harmful and other are used in the food industry.

**Moulds.** They are **multicellular** organisms. They grow on decomposing organic matter, like tree trunks, fruit, cheese and bread.

**Mushrooms.** They are **multicellular** organisms. It is a specialized reproductive structure that has a cap, a foot and spores.

#### ACTIVITIES

1. Choose the correct words.
  - a. Protozoa are single-cell *autotrophs/heterotrophs*.
  - b. Protozoa are classified by how they *move/feed*.
  - c. Ciliates have *no/two* nuclei.
  - d. Most flagellates *live freely/are parasites*.
  - e. Flagella are *short/long* extensions of cells.
  - f. Rhizopoda use pseudopods to *catch food/reproduce*.
  - g. Sporozoa are *motile/non motile*.
  - h. Sporozoa use spores to reproduce *sexually/asexually*.
2. Choose the correct words.
  - a. *Most/All* algae contain chlorophyll.
  - b. Algae *are/are not* in the plant kingdom.
  - c. Algae are *heterotrophic/autotrophic* organisms.
  - d. The colour of algae depends on their main type of *phytoplankton/pigment*.

## UNIT 8: PLANTS

### 1. What living things make up the plant kingdom?

The first terrestrial living things were plants. They developed about 500 million years ago from green algae.

Most plants are green and have adapted to living on land. They are usually attached to the ground; most of them are non-motile.

The plant kingdom is made up of **multicellular, eukaryotic, autotrophic** organisms.

All plants:

- Have **roots, stems and leaves**. These vary according to the species.
- Are **multicellular**: made up of many cells which form tissues.
- Have **eukaryotic** cells. These cells have a nucleus and organelles surrounded by membranes. They are surrounded by a **cellulose wall**. They have chloroplasts which contain **chlorophyll**. Chlorophyll is necessary for **photosynthesis**.
- Are **autotrophic** beings: they can make their own food through photosynthesis.
- **Live attached to the soil**. However, they are able to make some movements. For example, they grow towards light.

### How are plants classified?

Plants are classified in two groups: non-flowering and flowering.

- **Non-flowering plants** are simple plants without flowers, fruits or seeds.
  - **Mosses and Liverworts**. They are small, and **non-vascular**: they have no conductor vessels.
  - **Ferns**. They are bigger than mosses. They are **vascular**: they have conductor vessels to distribute water and nutrients.
- **Flowering plants** are more complex, with flowers and seeds.
  - **Gymnosperms**. They have seeds inside a false fruit, like a pinecone.
  - **Angiosperms**. They have seeds inside a real fruit, like a water lily, an oak tree, or a barrel cactus.



## 2. What functions do leaves, stems and roots have?

Plants have three main organs: **leaves**, **stems** and **roots**.

### Leaves

Photosynthesis takes place in leaves. The leaves take in and expel gases from the atmosphere. They eliminate excess water in the form of water vapour. This process is called **transpiration**.

The main part of a leaf is called the **blade**. A leaf has a **topside** and an **underside**. A **petiole** joins the leaf to the stem. Gases and water vapour enter the leaf and are expelled through small pores.

These pores, **stomata**, are found on the underside of the leaf.

### Stems

Plant stems are usually above ground. The stem keeps the plant upright and supports it. It also carries substances to other parts of the plant. Some stems, for example, the potato, accumulate reserves of water and food.

Leaves and branches are joined to the stem at **nodes**. The part of the stem between the nodes is called the **internode**. Stems grow upwards from the **apical bud**. Lateral branches grow out of **auxiliary buds** along the stem.

### Roots

Plant roots have two functions: to fix the plant to the ground, and absorb water and minerals. Some roots, for example, carrots and beetroots, accumulate food reserves.

The root surface is covered with many tiny hairs which absorb the water and minerals (absorbent root hairs). Each root ends in a **root cap**.

## 3. What is plant nutrition?

Plants are autotrophic: they produce their own food. They use their leaves, stems and roots to carry out these processes:

1. **Absorption**. Plants absorb water and mineral salts from the soil through their roots. When mineral salts dissolve in the water, **raw sap** (or xylem sap) is produced.
2. **Transportation**. The raw sap travels up the conductor vessels (xylem) from the roots to the stem and leaves.
3. **Transpiration**. Excess water is expelled through the **stomata** as water vapour. As a result, raw sap goes up into the leaves.
4. **Photosynthesis**. Raw sap is transformed in the **leaves** into **elaborated sap**: a mixture of water and organic substances. It contains sugars. Sunlight provides the energy needed for this process. During photosynthesis, the plant absorbs carbon dioxide through its leaves. The leaves then expel oxygen through the stomata.

Finally, the elaborated sap is distributed throughout the plant cells by the conductor vessels (phloem).

5. **Respiration**. Plants breathe. During respiration, plant leaves take in oxygen from the air and release carbon dioxide.

#### 4. How do plants reproduce?

- **Asexual reproduction.** Only one plant is involved. When you take a cutting of a geranium and replant it, asexual reproduction takes place. There are two types of asexual reproduction: **vegetative**, such as rizomes, stolons, tubers and bulbs and **spore reproduction** characteristic of ferns and mosses.
- **Sexual reproduction.** Sexual cells from two different plants join together to produce a new plant. Flowering plants have sexual reproduction. In sexual reproduction flowers are hermaphrodite (they contain both female and male sexual cells) or unisex.

##### Main parts of a flower

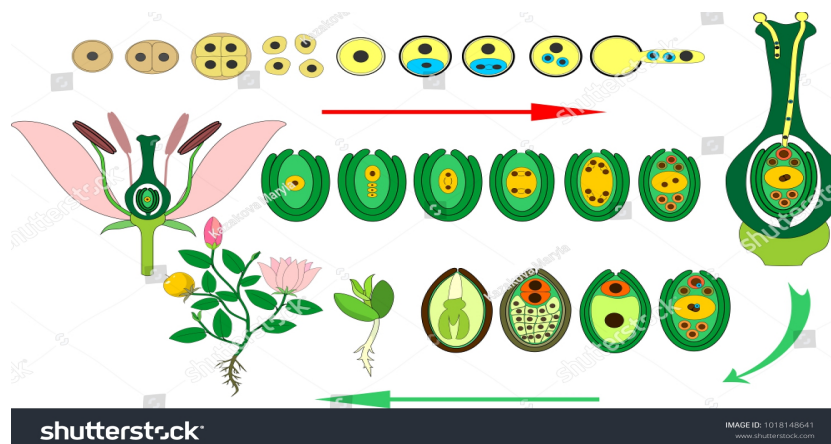
Flowers are the reproductive organs of angiosperms and gymnosperms. Flowers have two parts: the reproductive part and the protective part.

- Reproductive parts: the **stamen** (male reproductive part) and the **pistil** (female part). The **ovules** are found inside the **ovary**. During reproduction, the ovules come into contact with the **pollen** which is produced in the stamen.
- Protective parts: the **petals**, which make up the **corolla**, and the **sepals**, which make up the **calyx**.

##### The reproductive stages

Plant reproduction has the following stages: pollination, fertilization, formation of fruit and seeds, dispersal and germination.

- **Pollination.** Pollen from one flower's anther reaches another flower's stigma.
- **Fertilisation.** Pollen reaches the stigma, penetrates it, and fertilises the ovules inside the ovary.
- **Fruit and seed formation.** The fertilized flower is transformed. The corolla and the calyx dry up. The ovary changes into the fruit. The ovules are transformed into seeds inside the fruit.
- **Dispersal.** The ripe fruit falls off the plant or releases the seeds.
- **Germination.** The seeds fall on the ground and germinate. A small root and shoot grow.



### 5. How do plants interact with the environment?

Plants receive information from the environment (stimuli) and react to them (responses). There are two types of plant responses: tropisms and nastic movements.

**Tropisms.** They are growth responses to external stimuli. They result in a permanent change. They can be **positive** (towards the stimulus) or **negative** (away from the stimulus). Tropisms have different names depending on the related stimulus: **phototropism** (light), **hydrotropism** (water) and **gravitropism** (gravity).

**Nastic movements.** They are temporary responses. When the stimulus stops, the plant returns to its original position. Nastic movements have different names according to the stimulus: **photonasty**, response to changes in light; **seismonasty**, response to touch; **thermonasty**, response to temperature and **chemonasty** response to chemical substances.

### ACTIVITIES

1. Fill in the gaps.

Nutrition. It includes five stages:.....  
.....

Interaction. Plants respond to the environment in two ways: permanent changes such as .....and temporary changes such as.....

Reproduction. There are two types: Asexual: one progenitor using parts such as stolons, .....Sexual: male and female .....

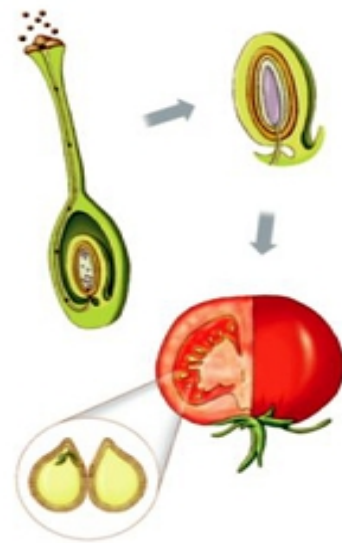
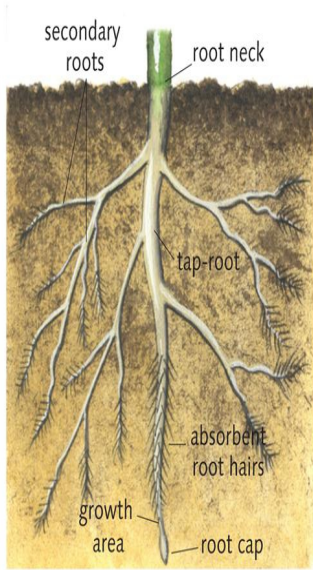
2. Match the columns. Write the letter with the number.

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>a) Leaf</li> <li>b) Stem</li> <li>c) Root</li> <li>d) Top</li> <li>e) Root cap</li> <li>f) Bud</li> <li>g) Petiole</li> <li>h) Stomata</li> </ul> | <ul style="list-style-type: none"> <li>1. Absorbs substances from the soil</li> <li>2. It protects the end of the root.</li> <li>3. Shoots of a stem that allow it to develop</li> <li>4. Joins the leaf to the stem</li> <li>5. Upperside of the leaf</li> <li>6. Axis that provides support to a plant</li> <li>7. Small holes on the leaves use for gases exchange</li> <li>8. Part of the plant that carries out photosynthesis</li> </ul> |
|--|--|

3. Decide if these plants are angiosperms or gymnosperms.

	Gymnosperms	Angiosperms
Cypress		
Orange tree		
Cedar		
Pine		
Olive tree		

4. Label the diagrams.



5. Fill in the diagram.

1 ovary   2 style   3 anther   4 filament   5 petal   6 sepal   7 stigma

