UNIT 1 - LIFE

1. LIVING THINGS AND NON LIVING THINGS

In this unit we are going to study "**LIFE**". Biology is the study of living things. Consider what this means for a minute or two. Think about the different kinds of living things you know. The study of living things teaches us that, in life, there is a great **diversity**, but also a great **unit**.
All living things have certain characteristics in common. We are going to find them out.

ACTIVITY 1

Look at the pictures below and name each one with one of the given words: tree, ball, apple, stone, rabbit, moon, snake, mushroom, fire, frog, water, starfish, spider, car, bacterium, and flower.

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UNIT 1 - LIFE

Make a list of living things and another one of nonliving things.

LIVING THINGS	NONLIVING THINGS

Can you find any organisms that are neither plants nor animals? Which ones?

ACTIVITY 2

For each statement below, decide if it describes
- only living things (L),
- only nonliving things (N)
- both (B)

…….. use energy

…….. can reproduce

…….. can grow

…….. breathe

…….. get rid of waste

…….. have no cells

…….. respond to changes in the environment

…… can move

…… die

Write down some basic functions of life. Begin the sentence with:

All living things …

ACTIVITY 3

Cells are the smallest units of living things.

Tick the places where we can find cells:

In a person's arm

In a mushroom

In a rock

In a piece of wood from a table

In a frog's leg

In a plastic pen

In animal's blood

In a bone

In a seed

ACTIVITY 4

Do you know the difference between nonliving things and a dead organism? Fill in the blanks using these words: alive (2), reproduce, time, dies , cells, environment.

Nonliving organisms have never been…… They have never done the three basic functions of organisms: Feed, interact with the …… and …… Nonliving things are not made up with …….
A dead organism has been …… for certain …… and finally it ……

2. FEATURES OF LIVING THINGS (Powerpoint)

Living things move, have senses, feed, respire, excrete, reproduce, grow…

We can group all the features of living things in three vital functions: Nutrition, Interaction and Reproduction.

Nutrition means using matter and energy. All living things need matter to grow and to repair their body and energy for movement and work. Nutrition is the way living things take and use food. Animals, for example, need to digest food (**digestion**) in order to obtain nutrients. When nutrients combine with oxygen in the cells, it produces energy (this is **respiration**). This process also produces wastes. When we breathe out, we produce waste products (water and carbon dioxide). Some waste is poison and we must remove it by **excretion**. Plants do not get their energy from food. They make their food by **photosynthesis**. This means that they catch energy from sunlight and they trap this energy in food (sugar). To take energy from food, plants respire, so they combine sugar with oxygen and this process produces wastes: carbon dioxide, and water vapor.

Interaction means responding or reacting to changes in the surroundings. For example, when we are hot, we sweat and when we are cold we shiver. These are body responses to the temperature changes. Plants also respond by moving towards or away from the sunlight (**phototropism**).

Reproduction is the way living things make more of themselves. It allows each kind of living thing to exist on Earth for a period of time.

Most animals reproduce using **sexual reproduction**. This requires two parents- a male and a female. Males make sex cells called **sperm** cells and female make sex cells called **egg cells**. Each cell contains a nucleus and they join in a process called **fertilization**. For fertilization to happen, the sperm cells need to get the egg cells. In some animals, this process occurs in water, this is external fertilization. In other animals, the male places the sperm inside the female. This is called internal fertilization. In plants, sexual reproduction also occurs. For this to happen, pollen from one flower needs to get to the stigma of another flower. This is called **cross-pollination**. If pollen of a flower lands on the stigma from the same plant, we call this **self-pollination**.
The sexual reproduction produces offspring which are similar to their parents. They are not identical. The offspring have traits from both parents.
When reproduction requires only one parent, it occurs **asexual reproduction**. Sponges and cnidarians reproduce by **budding.** A bud forms in the adult body. The bud breaks off after some time and develops into a new animal. Another kind of asexual reproduction is **regeneration.** Sponges and planaria reproduce through regeneration. A whole animal develops from just a part of the original animal.
The asexual reproduction produces **clones**. A clone is an exact copy of its parent. The clone's traits are identical to the traits of its parent.

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ACTIVITY 1

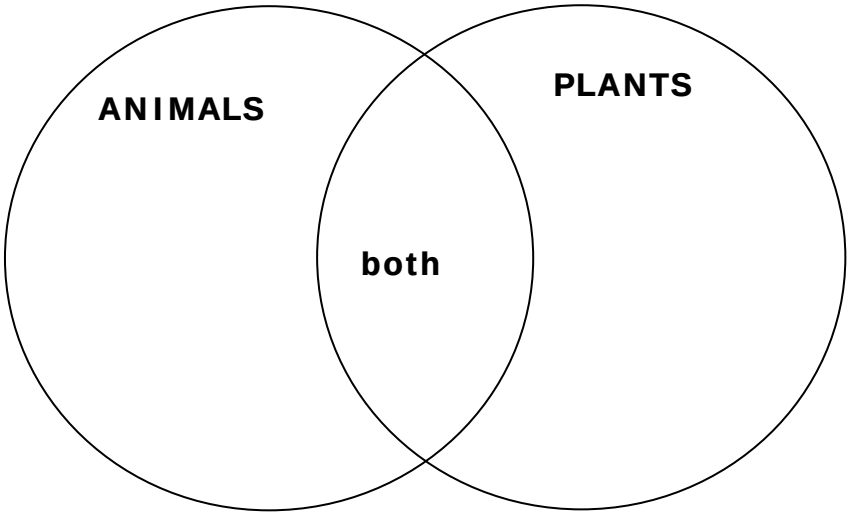
Classify the following verbs into the three vital functions.

Run, eat, mate, grow, see, breath, listen, drink, taste, reproduce, digest, smell, talk, excrete.

ACTIVITY 2

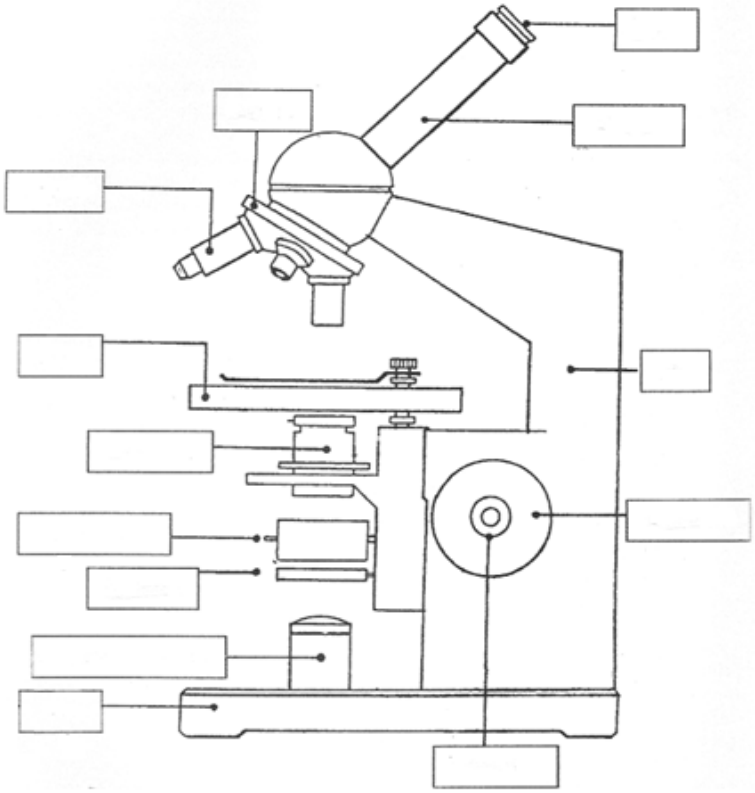
Draw a Venn diagram using the following categories:" Animals only", "Plants only" and "Both animals and plants".

Excretion, photosynthesis, movement from place to place, respiration, growth throughout life, eating other living things, growth towards light, growth stops when adult size is reached, reproduction.



3. THE MICROSCOPE

Fill in the gaps using the words below, and listening to what the teacher explains about each one:



1. Turret/Revolving nosepiece
2. Objectives
3. Stage
4. Condenser
5. Diaphragm
6. Filter
7. Light
8. Base
9. Fine focusing knob
10. Coarse focusing knob
11. Arm
12. Optic tube
13. Eyepiece

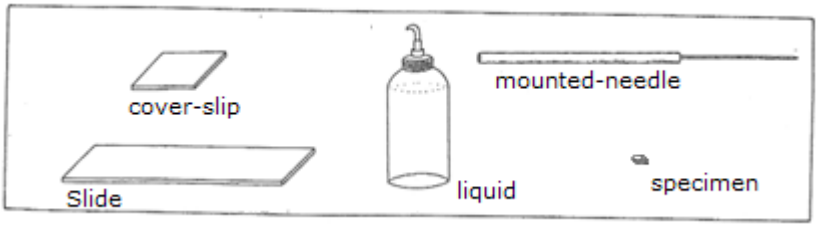
MAGNIFICATION:

When a microscope makes an object bigger, we say the object has been magnified. Magnification is how much bigger the object looks than it really is. You can find the total magnification by looking on the side of the objective lenses and the eyepiece lens.

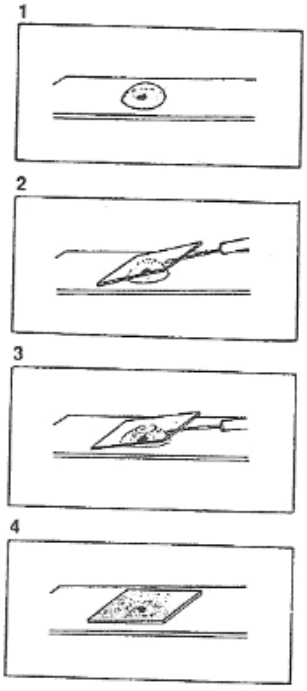
Total Magnification(X) = M. of objective lens X M. of eyepiece lens

➡ A microscope has a X10 eyepiece lens and a X15 objective lens. What is the total magnification?

This is the material that is normally used to prepare a microscope slide:



Complete the following sentences about the steps that are needed to prepare a microscope slide. Use the words in the box above.



- Place the _____ on a_____ (in the centre) with a drop of _____ (water).

- Lower carefully with a _____ in order not to get any air bubbles.

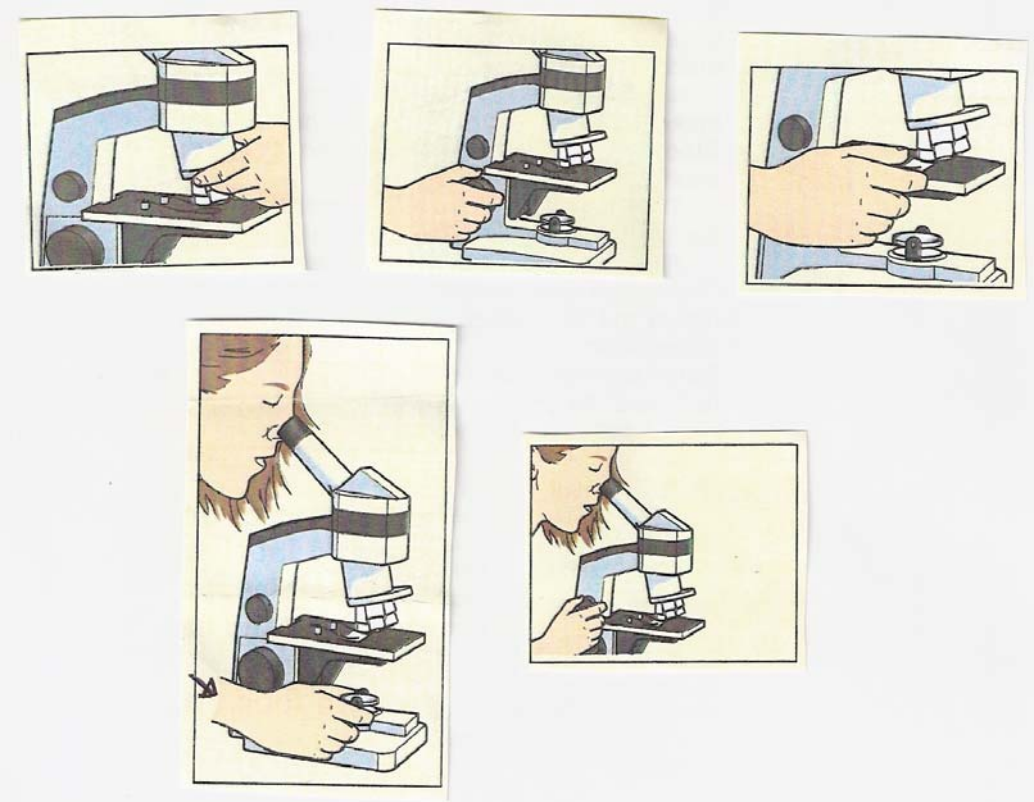
- The _____ slide is _____ to be looked at.

- Cover the _____ with a _____.

4. HOW DO WE USE A MICROSCOPE?

Write the following instructions in the correct order below the pictures:

A- Look into the eyepiece lens.
B- Turn the coarse focusing knob to focus.
C- Place the smallest objective lens over the hole in the stage.
D- Adjust the light source.
E- Place the slide under the clips of the stage.



ACTIVITY 1 Answer the following questions using the answers given (there are extra answers and one is left)

Questions:

1. Why does a specimen need to be thin?

2. Why do we use cover-slips?

3. Why do we have to adjust the light source?

4. Why can we use stains in the drop of water we place on the slide?

5. Why can we sometimes get some air bubbles when we prepare things to be looked at with a microscope?

Answers:

A. Because we need light to go up through the hole in the stage.

B. Because we don't lower the cover-slip carefully and slowly.

C. Because light has to pass through it.

D. Because we need to have the object magnified.

E. Because they hold the specimen in place and stop it drying out.

LABORATORY 1- MAKING A SLIDE OF ONION CELLS

LAB REPORT:

Aim: This experiment aims at looking at plant cells.

Material: Onion

Instruments	Substances
• Forceps,slide,cover-slip,mounted-needle, microscope	• Iodine solution

Procedure:

First, we cut a small piece of onion.
Then, we peel off the inner surface with forceps or finger nails.
Next, we put the piece of onion ”skin” on a slide and we add two drops of iodine solution.
After this, we lower the cover-slip using a mounted-needle.
Finally, we place the slide on the stage of the microscope and focus carefully with the lower objective.

Results:

We can distinguish plant cells with.....

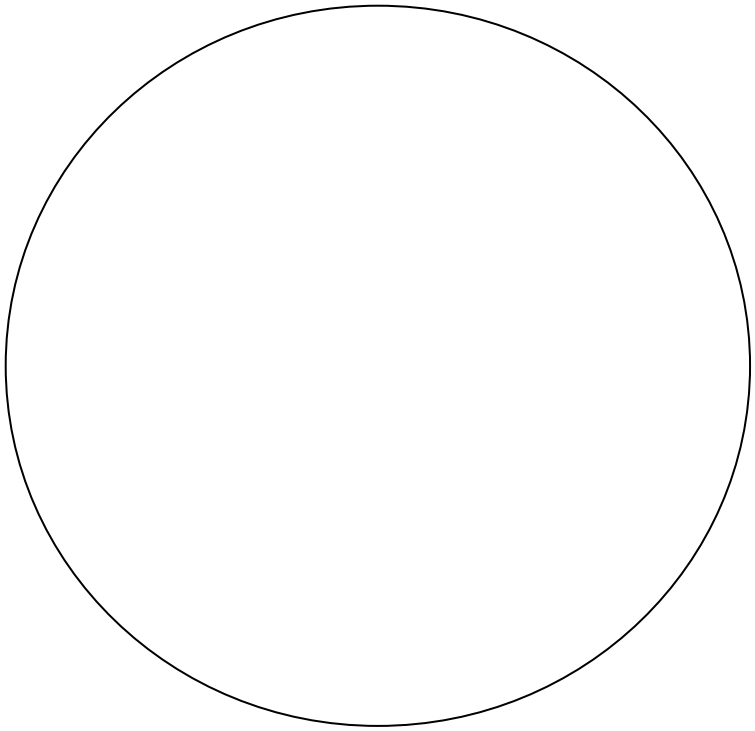
We cannot see chloroplasts because.....

Conclusions:
The experiment has shown that.....

I have learnt that.....

The most interesting thing is...

Drawing:



Discussion:
In groups of four try to evaluate your drawings. Think about the criteria to be assessed.

5. WHAT ARE CELLS?

Living things or organisms have cells. A **cell** is the smallest part of an organism. Cells keep the organism alive. That is why cells are called the basic units of life.

Cells have different **structures**. Some structures make food. Some structures give the cell energy. Other structures move material from one place to another.

Different organisms have different kinds of cells. Plant cells are different from animal cells.

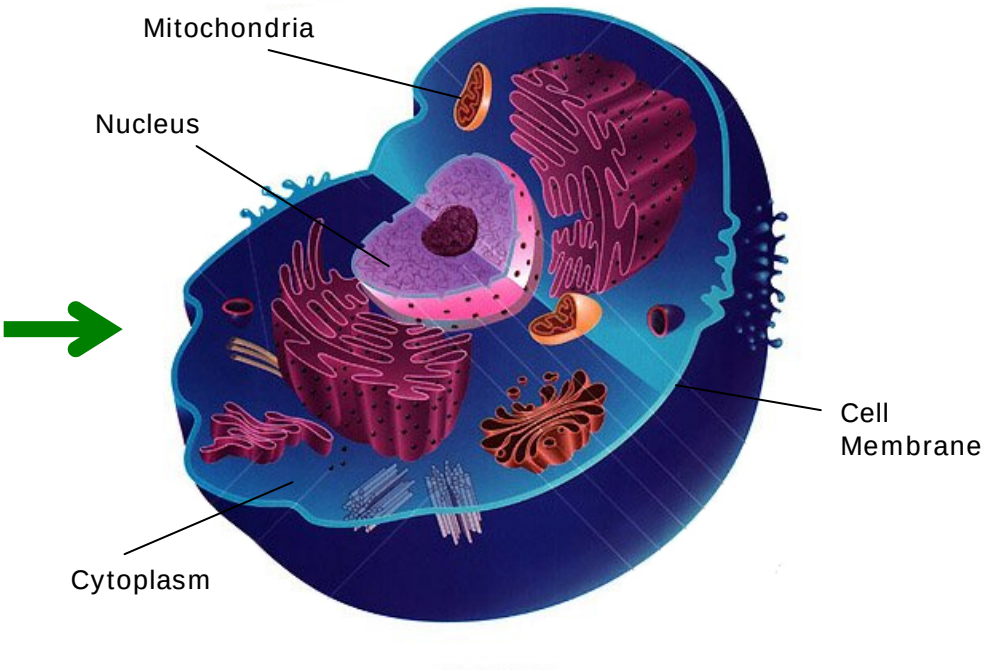
Plant cells have a chemical called **chlorophyll**. Chlorophyll uses sunlight to make food. It also makes the plant green. Chlorophyll is in the chloroplasts.

Plants and trees rise up from the ground. They need to "stand" by themselves. This is why plant cells have a cell wall. Cell walls are rigid. They make the plants strong.

Animal cells do not have cell walls. They do not have chloroplasts either. But animal cells have many of the same structures. For example, plant cells and animal cells have a **cell membrane, nucleus** and **cytoplasm**. In the cytoplasm they have **mitochondria** and **vacuoles**. The nucleus controls everything the cell does. The cytoplasm is the liquid inside the cell. The mitochondria give the cell energy. The cell's vacuoles store food, water, and waste. The cell membrane holds the cell together.

Inside an animal cell

Your cells are not very different from the cells of a frog, a cat or a horse. In fact, all animal cells have these parts:



- **Cell membrane**. This is a thin skin around the cell. It lets some things pass through, but stops others.

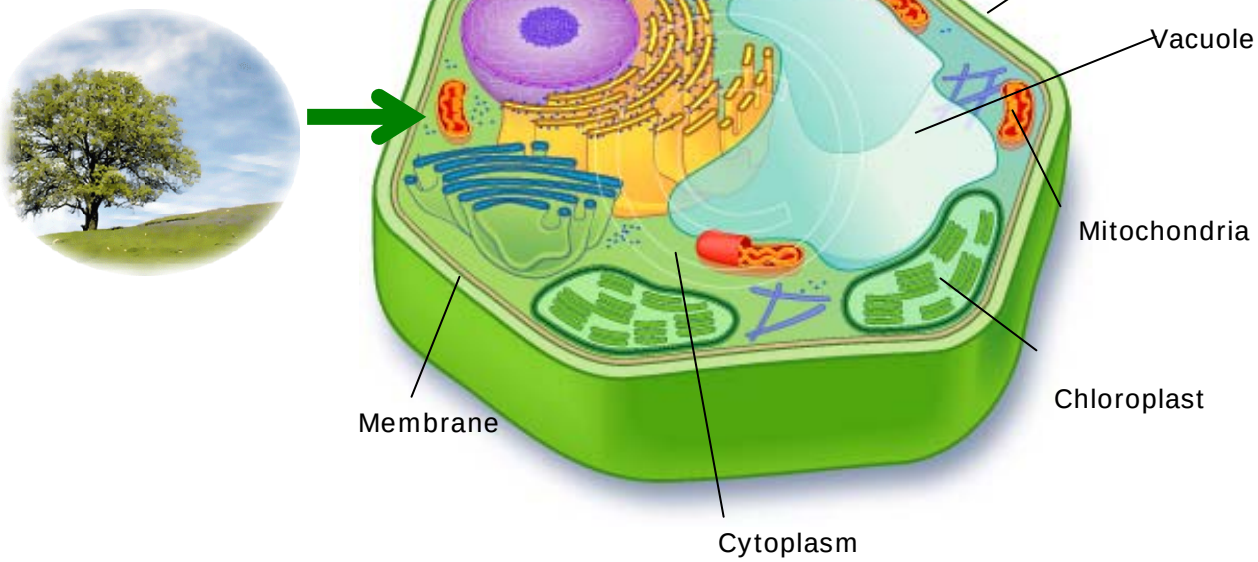
- Cytoplasm. This is a jelly containing hundreds of chemicals. Lots of chemical reactions go on in it. It fills the cell. It contains structures that give energy: the **mitochondria.**

- Nucleus. It controls what a cell does, and how it develops.

- Vacuole. This is a space within the cell containing air, liquids, or food particles. Animal cells usually have several small vacuoles.

Inside a plant cell

All plant cells have these parts:



- Cell wall of cellulose. It covers the cell membrane.

- Cytoplasm. All plant cells have this. The liquid inside it is called cell sap.

- Vacuole. They store food. Mainly starch.

- Chloroplasts. These are tiny discs full of a green substance called chlorophyll.
They trap the light energy that plants need for making food by photosynthesis.

- **Mitochondria**. Plants also need to burn the food they make to get energy.

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ACTIVITY 1

a. Write the differences between plant and animal cells:

Plant cells	Animal cells
1	**1**
2	**2**
3	**3**
4	**4**

b. Write down the common features of animal and plant cells:

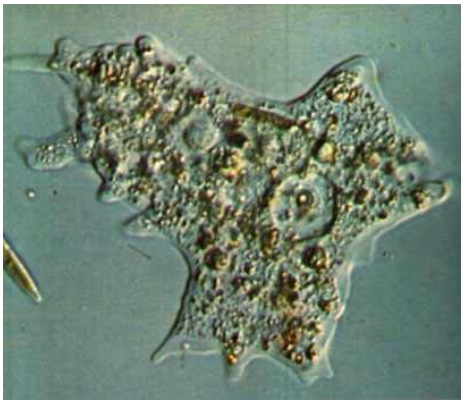
1.

2.

3.

All organisms are made up of cells but some of them are made up of only one cell. You need a microscope to see them. If you look at a drop of pond water under a microscope, you may find organisms made up of one cell. For example, amoebas or paramecia are one-celled organisms that may be in water, soil, or air. Bacteria are also one-celled organisms. We can find them on material from teeth and inside animal bodies.

Amoeba:



Paramecium:

ACTIVITY 2 **(internet searching)**

Find out information about the cells of **bacteria**. Draw a typical cell of a bacterium and compare it with an amoeba, an animal cell and a plant cell.

True or false:

- Amoebas have a nucleus and a cytoplasm.
- Bacteria have a cell membrane and a nucleus.
- Bacteria have a cell wall.
- Bacteria have mitochondria.
- Amoebas and bacteria are one-celled organisms.
- Plant cells have a cell wall.
- Animal cells have chloroplasts.
- Plant cells do not have mitochondria.
- Bacteria cells are simpler than animal and plant cells.
- Animal and plants are many-celled organisms.
- All bacteria are harmful.

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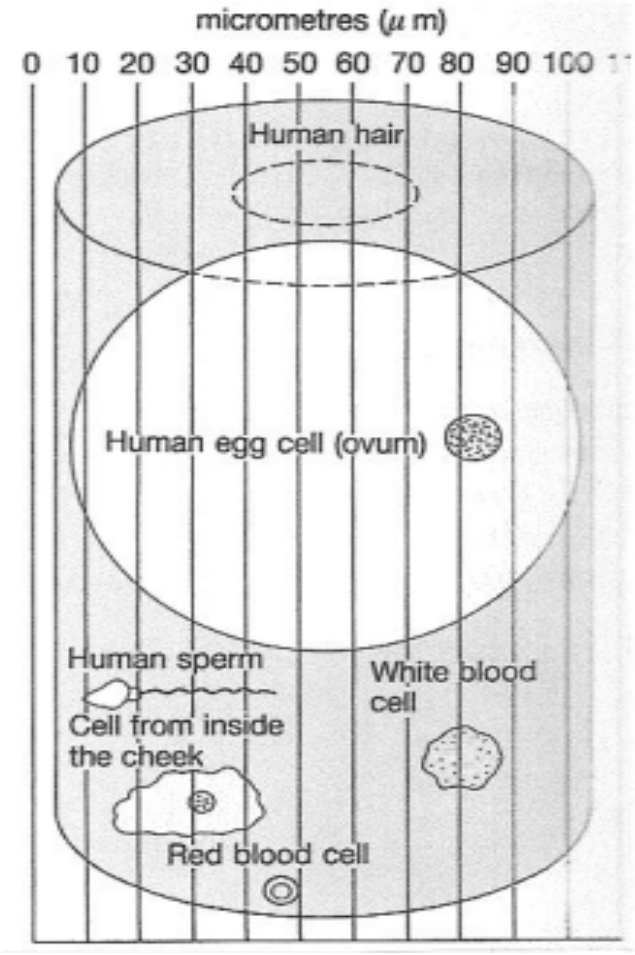
6. SIZE AND SHAPES OF ANIMAL CELLS



a) How wide is a hair in micrometres µm?

b) How wide is a red blood cell in µm?

c) About how many red cells side-by-side equal the diameter of a hair?

d) About how many times would you have to enlarge a cheek cell to make it the same diameter as a tennis ball?

7. SPECIALIZED CELLS

Animal cells usually look very different from the cells we have seen before. By looking at their features you can tell which is which. The shape and structure helps each one to do its job properly. We say cells are specialized because they have special structures for special functions.

Unjumble the words and use them to fill in the table below. After this, draw the picture according to the description.

REPSM
LLECS LCSEMU
DER ODOLB LLECS
ORNUNE

	NAME	PICTURE
They carry oxygen and in order to give space they have no nucleus. They are disc-shaped.		
They are produced by male animals and they have a long tail in order to swim to find the egg.		
They carry messages around the body. They are long and branched at the ends to pick up and deliver messages.		
They area able to change length. They allow us to move.		

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8. HOW IS AN ORGANISM PUT TOGETHER?

Look at these pictures. What do they suggest to you?
Can you compare them to the levels of organisation of your body? Say how.

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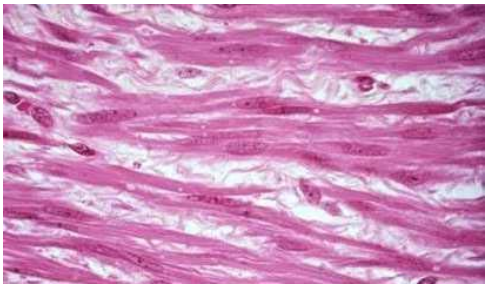
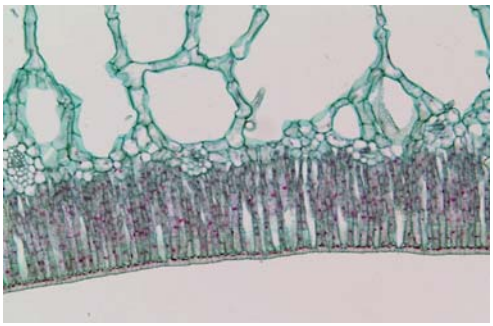
A human and a euglena are both organisms. But a euglena is a **one-celled organism** and a human is a **multi-celled organism**. We are made of millions and millions of cells. All the cells work together. Plants and animals are multi-celled organisms. In multi-celled organisms there are different kinds of cells. For example, in your body there are blood cells, bone cells, skin cells… A plant has root cells, stem cells, and leaf cells.

Cells work together in groups. These groups are called **tissues**. A tissue is a group of similar cells that work together to do a job. For example, skin cells are flat and wide to cover and protect our body. Plant cells are also organized into tissues. The leaves of a plant have tissues that help the plant to make food.

Muscle tissue: It allows us to move.



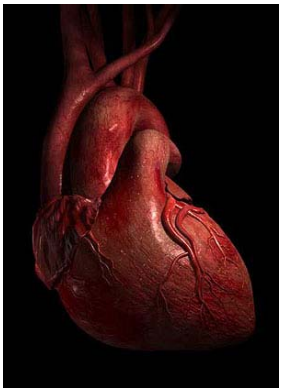
Palisade tissue: It forms a layer near the top of leaves to help the plant make food.



Tissues are grouped together in your body. Your heart contains muscle tissue, nerve tissue, and blood tissue. Your heart is an example of **organ**. An organ is a group of tissues

that work together to do a job. The job of your heart is to pump blood through your body.

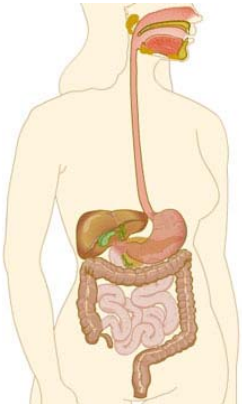
Heart: It contains muscle and nerve tissues.



A group of organs that work together to do a life function is an **organ system**. The roots, stem and leaves of plants are organ systems. Your digestive system is an organ system. It is made of your mouth, oesophagus, stomach, small and large intestine, and liver. This system breaks down food and absorbs the nutrients you need to live.

Root:

Digestive system:



All the organ systems together make up an **organism.**

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One-celled living things are organisms that carry out all their life activities in just one cell.

After reading this text can you review the answers you have given in the introduction?

ACTIVITY 1 **(internet; in pairs)**

Research on the function of an organ system. Use encyclopaedias, internet, and other resources to learn about the function of an organ system in your body. What happens if this organ system does not work correctly? Explain it to the rest of the class.

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ACTIVITY 2

Fill in the blanks with the appropriate word of the list the text you will be given. The words are:

Circulatory system, tissues, red blood cells, heart, organs , daughter, stomach, muscle cells, cell division, brain, organism, specialized, nerve cells, digestive system, nervous system, organ systems, white blood cells.

Hello, my name is _____ and this is the story of my BIOLOGICAL LIFE.

I started life as a single cell that became a fertilized egg cell. I grew because that cell divided to make two cells, these divided to make four, and so on. This is called [.....]. When a cell divides it makes two [.....] cells, which are identical. These divide to make four identical cells, which divide again and again to make a ball of cells.

Some cells in the ball grow and change shape to do a particular job – they become [.....]. Cells that do the same job group together to form [.....]. Some cells become specialized [.....]. These form tissue which can tighten up and relax. [.....]are specialized to carry messages around the body. [.....] carry oxygen and [.....] kill germs.

Different tissues combine to make [.....]. The [.....] is an organ which pumps blood around the body. The [.....] is an organ which digests food. The [.....] is an organ which controls parts of the body.

An [.....] is made up of many different organs. Some of its organs work together to form [.....]. The [.....] is made up of the heart and blood vessels.

The ..... is made up the gullet, the stomach and intestine. The ..... is made up of the brain, spinal cord, and nerves.

9. WE NEED GROUPS OF CLASSIFICATION…

Elephants and earthworms belong to the animal kingdom because they have some common features, but elephants have a backbone and earthworms do not.

We need to divide kingdoms into smaller groups: All animals with backbones belong to the same **phylum**. The phylum of *Vertebrates* includes seals, dogs, fishes, frogs, snakes,… and humans. Earthworms are grouped in a phylum together with other animals that do not have a backbone. They are the *Invertebrates.*

Each phylum is divided into smaller groups called **classes**. For example, Class *Mammals* includes animals that have fur and feed their young with milk.

There are members of a class that have more in common. We put them together in the same **order**. For example, Mammals with sharp teeth and claws for eating meat are classified in the order *Carnivore*.

The members of an order that have the most in common are put into the same **family**. The members of a family that have the most in common are classified into the same **genus**.

The most similar members of a genus are grouped in **species**. All members of a species are very similar and can mate together and reproduce.

Each living thing is given a **scientific name** based on its genus and species. Latin is used in scientific names to make them easier to understand.

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ACTIVITY 1

Stick the pictures of the animals the teacher will give you in the chart. The chart shows the groups from largest to smallest.

HELP! There are fewer organisms in each group as you move down the chart.

KINGDOM
PHYLUM
CLASS
ORDER
FAMILY
GENUS
SPECIES

ACTIVITY 2

Find one characteristic in common and one characteristic which is different between the following pairs of organisms:
Example
Snail and spider: Neither have a backbone. Snails have a shell and spiders do not.

* Goldfish and hamster:

* Mushroom and geranium:

* Jellyfish and cuttlefish:

* Bird of paradise and gorilla:

* Mosses and roses:

* Horsetail and pine:

ACTIVITY 3:

Viruses are not included in the kingdoms of living things. They are not made of cells. Viruses can reproduce. Visit some websites to do a research on the differences between viruses and bacteria.

10. DIVERSITY AND ADAPTATIONS

Living beings adapt, or change, to survive. For example, the snowshoe hare changes colour. It is white in the winter. It is brown in the summer. Why would this animal want to be white in the winter?

The traits that animals have to help them survive in their environments are called **adaptations.** Some adaptations protect animals from **predators**. Predators are animals that eat other animals.
One of these adaptations is **mimicry.** Mimicry is when an organism looks like something else. For example, the syrphid fly is an insect that does not sting, but it has black and yellow stripes that make it look like a yellowjacket. Yellowjackets sting. Predators think that syrphids are yellowjackets and they stay away.

syrphid fly

yellowjacket

Camouflage is another adaptation. When an animal is camouflaged, it looks as its surroundings. For example, the wings of a butterfly are shaped as leaves. Birds look for the butterfly but they only see leaves. Sometimes it is the colour what protects animals from predators. For example, there were two kinds of moths in England. One moth was lighter and the other one was darker. Birds ate both kinds of moths. When factories began to make dark smoke, it stuck to the trees. The trees became dark. Birds could see the lighter moths better, so they started to eat more of the lighter moths. The lighter moths started disappearing. This did not happen to the darker moths because their colour protected them from predators.

Moths

These examples of animal adaptations show that to be diverse is good for animals. Diversity helps animals to survive because the environment is always changing. Animals that do not adapt

may not live. Sometimes, some changes in the environment can hurt an entire species. A species an even become **extinct**, or die. This almost happened to the bald eagle. Bald eagles lived in almost every part of North America a long time ago. Today, most bald eagles live in Alaska. Species that are in danger of becoming extinct are **endangered species.**
Plant also adapt to their environment. Plants in the desert can collect, store and save water. Some plants cannot get enough nutrients from the soil. They have adapted to become carnivorous. They eat insects.

ACTIVITY 1

Here are a few physical adaptations that help animals survive. Complete the sentences choosing the following species: elephant, male cardinal, giraffe, horse, fish, polar bear, and turtle.

Gills and fins allow a …… to breathe and swim underwater.
White fur helps a …… blend in the snow.
The legs of a …… help it to run fast.
The neck of a …… allows it to reach leaves high up in trees.
A hard outer shell protects a ……´s body.
A trunk helps an …….. to grab things and feed itself.
The red body of a …… …… helps it attract a mate.

ACTIVITY 2

Many types of animals have special behaviours that help them survive. When a squid senses danger, it shoots a dark liquid.
What responses do these animals to survive?

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armadillo

porcupine

ACTIVITY 3 (at home) (in small groups of 3-4 students)

Prepare a power point presentation (10 slides) about an endangered species. Follow the instructions that your teacher will give you. This activity will serve as an assessment. You will explain to the rest of the class all the information.

Plants also are adapted where they live

Plants also change to adapt to their environments. A cactus is adapted to living in the desert:

cactus

- no leaves, but spines, which means the cactus loses less water than a plant with leaves
- stem stores water
- Roots cover a large area to absorb as much water as possible when it rains.

There are also changes throughout the year. In winter, some trees lose their leaves since there is not much light for photosynthesis. These are **deciduous** trees. **Evergreen** trees have tougher leaves and keep them all year round. Evergreen trees often grow quite far north where the summers are short.

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evergreen tree

deciduous tree

ACTIVITY 1

Complete the sentences:

A …….. tree loses its leaves in winter.

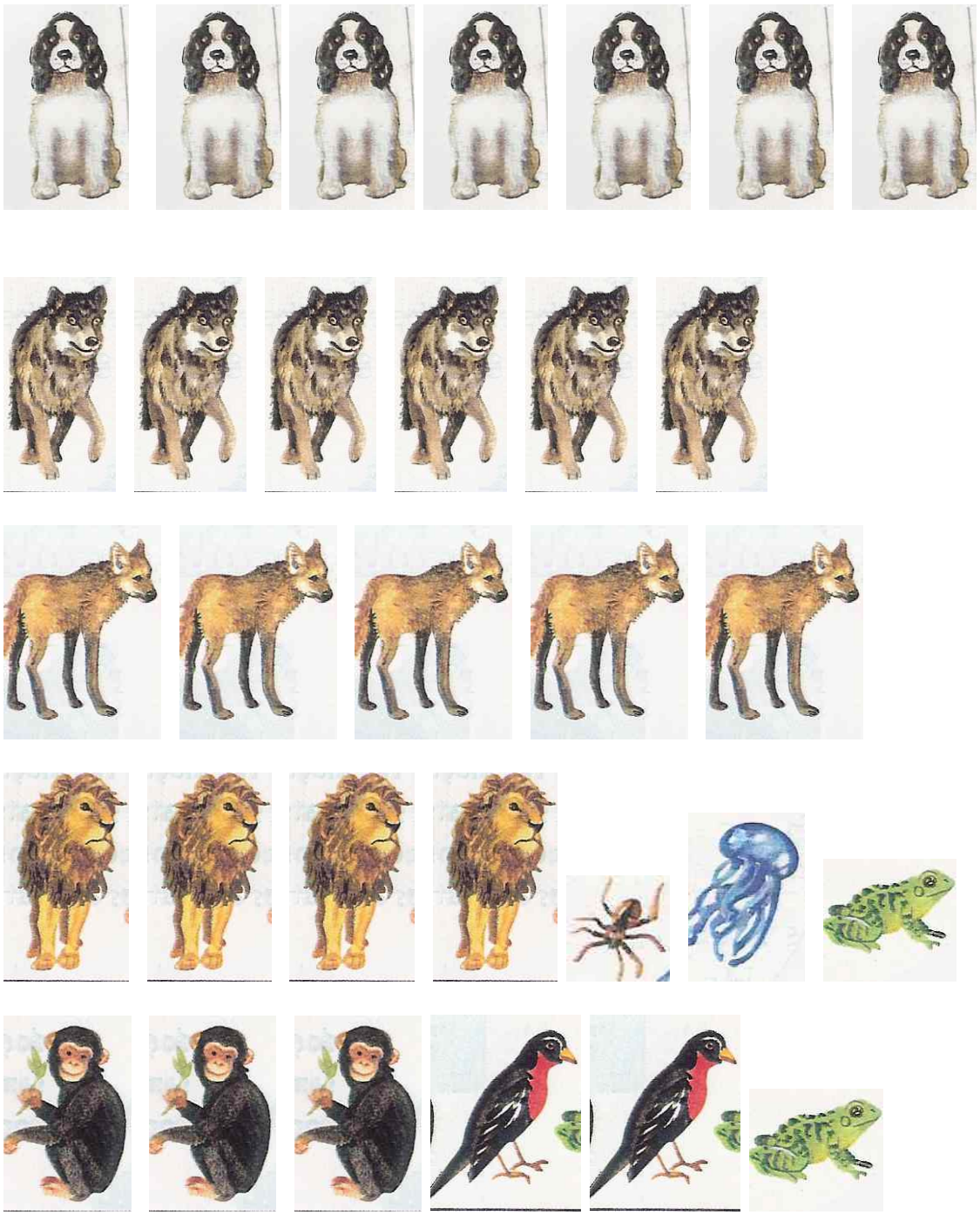
An …… tree keeps its leaves in winter.

ACTIVITY 2

Find out the name of three different deciduous trees and three evergreen trees. Write down the name in English, Catalan, Spanish and Scientific name.

COMPLEMENTARY MATERIAL

Part 9, activity 1:



UNIT 2 – LIVING THINGS

1. HOW DO WE CLASSIFY ORGANISMS

Scientists study many **characteristics** to **classify** organisms into groups. They look at the organism's shape, the number of cells (one or many), if the cells have nucleus and other cell parts, how it gets food, if it moves from place to place, how it grows and develops before it is born.

To describe organisms, scientists developed a classification system. This system divides the organisms into large groups called **kingdoms**.

Organisms in each kingdom share basic traits or characteristics. Organisms that belong to one kingdom are similar to others in that kingdom. They are different from organisms in other kingdoms.

2. THE NEED OF CLASSIFICATION (English class)

The science that studies all the diversity and the relationships between different organisms is called SYSTEMATIC. To become aware of the need and the characteristics of a classification here you have some questions to answer.

STUDY OF SYSTEMATIC

a) Imagine a supermarket where you can buy all these products:

Folders	Wine	Cheese
Ice-cream	Pens	Books
Thread	Jam	Ham
Milk	Detergent	Needles
Buttons	Fruit	Cleaning products
Notebooks	Fish	Frozen vegetables
Zippers	Frozen meat	Liqueur

What do you think is it necessary to make any product (such as a 50-cm-long red zipper) easier to find?

b) When is making a classification necessary?

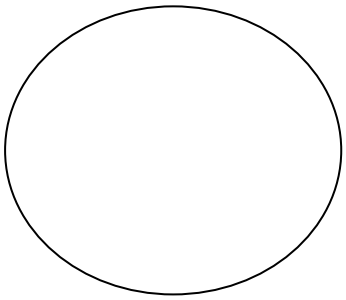
c) How is it made?

d) What is the difference between a group and a classification?

LABORATORY 1- EUGLENA, IS IT A PLANT OR AN ANIMAL?

1. Make a slide of pond water with Euglena in order to look at its characteristics. Make a drawing and a little description.
In case we cannot look directly into the microscope, we could begin this activity by watching a movie at:

http://www.microscopyu.com/moviegallery/pondscum/euglena/



2. Write a prediction, first individually and afterwards in a small group about what kind of organism you think the Euglena is.

3. You will be given the charts with the facts about the Euglena and a sheet of paper with a chart to place them. You will do this in small groups. You have to give your verdict about whether the Euglena is an animal or a plant or neither an animal nor a plant, using convincing arguments.

4. Every group will say their verdict and explain the evidence using convincing arguments. The others can assess and discuss it.

5. Finally the teacher will explain what scientists have decided about Euglena and why. The teacher will also explain that discussions like this are very frequent among scientists and that this is a way of controlling and advancing scientific knowledge.

UNIT 2 – LIVING THINGS

The following chart can help you organize information about the organisms in each kingdom:

Kingdom	Number of cells	Nucleus	Food	Move from place to place
Monera	one	no	Make or obtain	some
Protist	one or many	yes	Make or obtain	some
Fungi	one or many	yes	Obtain	no
Plant	many	yes	Make	no
Animal	many	yes	obtain	yes

Organisms that can make their own food are **autotrophic.**
Organisms that obtain food from others are **heterotrophic.**

Complete:

Fungi and Animals are …….
Plants are ……
Monera and Protists can be …….. or …….

➡ Can you name the five kingdoms?

ACTIVITY 1

Now complete the following chart beginning with: It can be…

Does the organism …	If yes, …	If no, …
…have a nucleus?	It can be an animal, plant, fungus or protist.	
… have many cells?		
… obtain food?		
… move?		

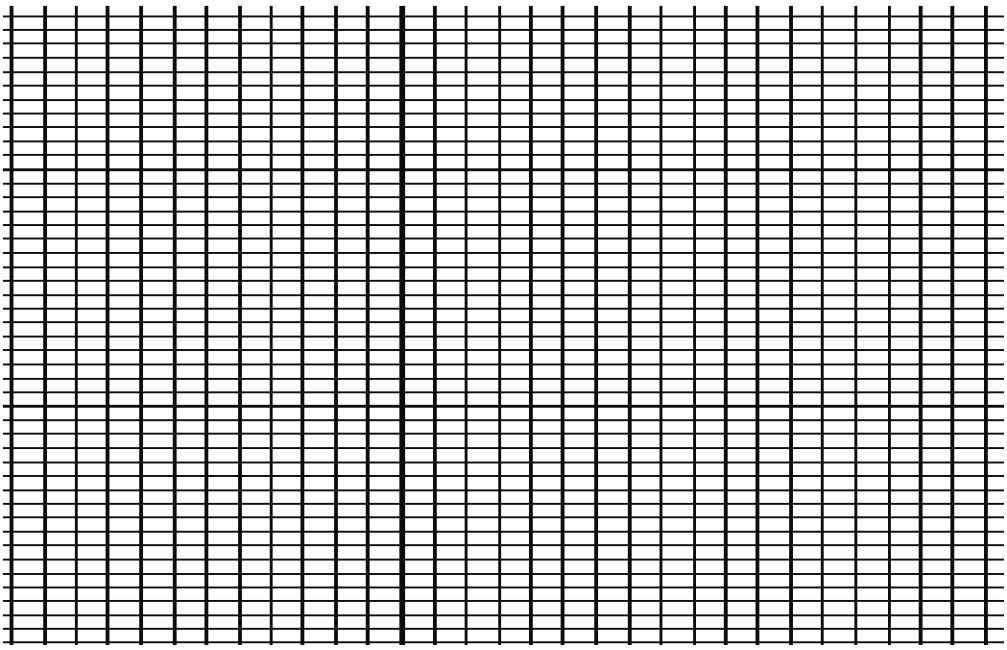
ACTIVITY 2

On the Earth there are two million described species of living things, and every year we discover new ones. In fact, we calculate that these two million species represent a low percentage of the total amount, maybe only 1%. In the table below you can observe the number of known species in each kingdom of eukaryotic organisms:

EUKARYOTIC KINGDOMS	NUMBER OF KNOWN SPECIES
PROTIST	22.500
PLANTS	270.000
FUNGI	100.000
ANIMALS	800.000

1. Which percentage of species corresponds to each of the four kingdoms of eukaryotic living things?

2. Make a bar graphic that represents the perceptual distribution of species in the four eukaryotic kingdoms.



3. Which is the kingdom that includes a bigger number of organisms?

Of all the known animals, only 45.000 are vertebrate animals. Which percentage corresponds to vertebrates in relation to the total number of animals?

And in relation to eukaryotic organisms?

And in realation to the total number of living things, if there are two million?

ACTIVITY 3

CONSTRUCT DYCHOTOMIC KEYS

Scientists visited an uninhabited island and discovered some previously unknown insects shown below. Construct a key which would enable a visitor to the island to identify them.

a) Begin by choosing one feature which sorts the insects into two groups.

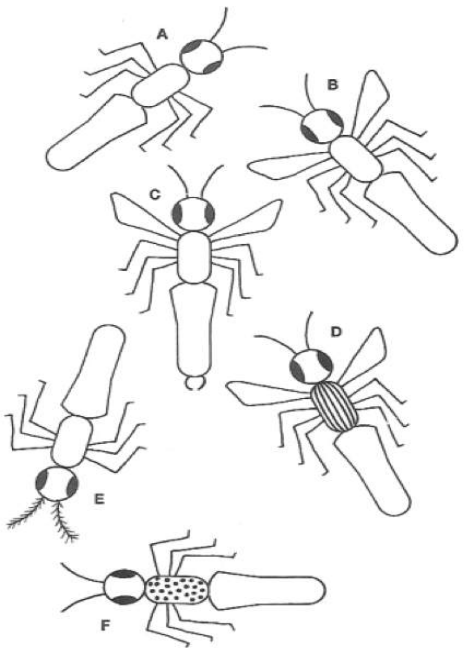
b) Sort the two groups into smaller groups by choosing other differences, then look for one feature which separates each insect from all the others.

c) Produce a key using the features you have chosen by arranging the features into numbered pairs.

d) The first pair of features should separate the insects into two groups, and subsequent pairs should either identify an insect or lead on to another pair of features.

These words will help you:

Thorax	Antennae	Legs
Wings	Sting/pincers	
Spots	Stripes	Hairs



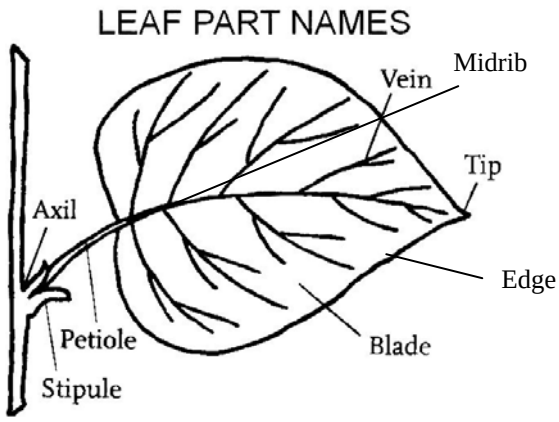
LABORATORY 2- OBSERVATION AND CLASSIFICATION OF LEAVES

Part One: Observation

The leaf is one of the most important parts of the plant because it is in charge of photosynthesis, respiration and transpiration.

Parts of the leaf:

There are different types of leaves, which allows us to distinguish the different kinds of plants, but essentially, each leaf is formed by the following parts:



The **blade** is the expanded part of the leaf. Inside the blade we can distinguish the following parts:
- The **veins** are like wrinkles or pipes running along the blade.
- The **midrib** is the main vein.
- The **edge** is the limit of the blade.

The **petiole** is the connection of the stem to the blade. The leaves having petiole are called **petiolated**, the leaves without petiole are called **stalkless** or **sessile**.

Part Two: Classification

There is an enormous variety in the shapes and sizes of leaves in the plant kingdom. In pairs, use the following steps to create your own classification system.

1. **Collect samples** from the garden:
Collect as many different samples of leaves as possible. Remember, pine needles are leaves!

2. **Establish criteria** for classifying the samples:
a. Separate the leaf samples into two different groups. You must use discriminating and objective criteria so everybody will decide on the two different groups, without personal opinions.
b. Now choose new criteria to separate these groups into two more groups.
c. Repeat this process again with the new groups, until all the leaf samples in a particular group have similar characteristics.

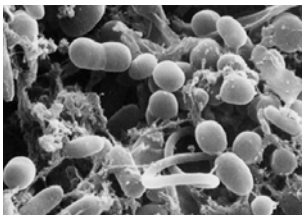
3. **Create a key** to explain the classification.
a. Write down your selection criteria.
For example: *Group A: leaves shaped like needles*.
b. Test your classification system and key. Ask a classmate to add new leaf samples to a group. If this is done correctly, you will know your classification works.

ACTIVITY 4: The Five kingdoms

Cut and paste the following organisms in the boxes below. Then, write the main characteristics of each kingdom.

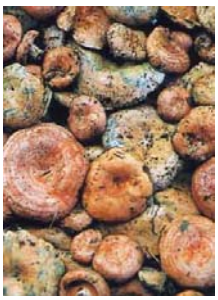
PENICILLIUM MOLD

SNAIL



BACTERIA

EUGLENA



MUSHROOM

AMOEBA

TULIP

HUMAN

MOSS

TORTOISE

PARAMECIUM

SLIME MOLD

PENGUIN

BEE

GREEN ALGAE

ANT

PINE

MAGNOLIA

FERN

SEA CUCUMBER

KINGDOM MONERA Main characteristics

KINGDOM PROTISTS Main characteristics

KINGDOM FUNGI Main characteristics

KINGDOM PLANTS Main characteristics

KINGDOM ANIMAL Main characteristics

3. MONERA, THE KINGDOM OF BACTERIA

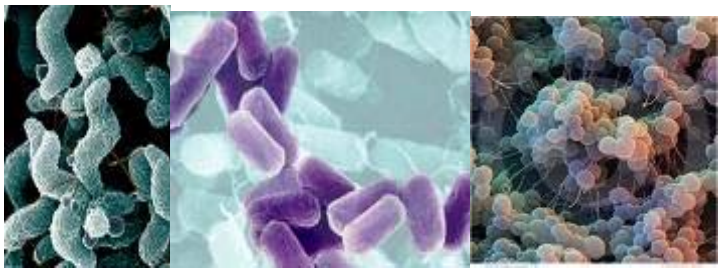
Bacteria are **microbes**. Microbes are living things which are so small that can only be seen through a microscope. They are one-celled organisms. They do not have a cell nucleus. Bacteria have a cell wall. Most bacteria do not make their own food. They break down or decompose living or dead things. Some bacteria (*Cyanobacteria*) make their own food.

•They are grouped into two groups:

The **eubacteria**, or "true bacteria", a group that includes bacteria that cause diseases and decay matter in soil.

The **archaebacteria**, or "ancient bacteria", a group that includes bacteria that were found on Earth long ago. These bacteria are usually founding salt marshes, sulphur springs and volcanic vents on the ocean floor.

Bacteria come in three shapes. They can be shaped like a spiral, like a rod, or like a sphere.



Photos of different shapes of bacteria

ACTIVITY (internet searching)

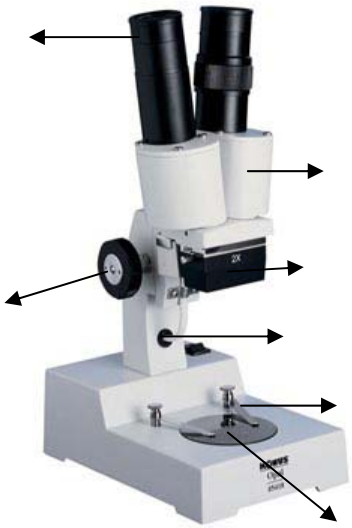
There are bacteria that cause illnesses, but many of them are helpful. For example, some help us make foods such as cheese and buttermilk and other break down dead plants and animals.

* Find out three illnesses caused by bacteria and name three bacteria that are helpful.

* Describe what a virus is. Explain if a virus is living or nonliving and give some reasons why you think so.

LABORATORY 3- OBSERVATION OF DIFFERENT PROTISTS (SEAWEEDS) USING THE STEREOSCOPIC MICROSCOPE.

Part One: The Binocular lens



Description and function:
- You take the binocular lens out of the box.
- You turn the adjusting knob.
- You adjust the body tube.
- You tighten the knob to keep the ring in place.
- You place the material on the stage.
- You adjust the eyepiece lens as required.
- While you are looking, you focus with the focusing knob.
- For every observation, you must make a detailed drawing with a short explanation. Do not forget the magnification.

Questions

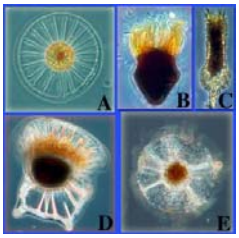
1- Write down the parts of the stereoscopic microscope.

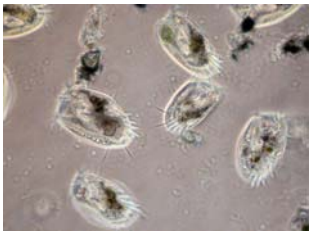
2- Say the differences between the microscope and the stereoscopic microscope.

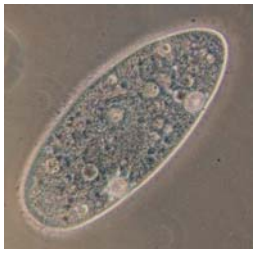
	Binocular lens	Microscope
Illumination		
Image (dimension)		
Image (sense)		
Magnification		
Slide		

Part Two: Observation of different protists

INTRODUCTION: Protists make up the most diverse of the kingdoms. This kingdom includes one-celled organisms like Euglena. It also includes larger organisms. So, we can find one-celled organisms and multi-celled organisms in this kingdom. There are also protists that can make their own food and others that take in food from their surroundings.







The **aim** of this laboratory class is to study the seaweeds. We will need samples of seaweeds and binocular lens.

A. View without lens(naked eye) and draw the algae you have in the Petri dish. Then, look through the binocular lens to see the differences. Draw what you can see.

Naked eye:	Binocular lens: magnification:.....

B. Answer the questions with a complete sentence (for example, Seaweeds belong to the kingdom...):

- Which kind of cells are protists made up of?

- Which kingdom do seaweeds belong to?

- How are the cells organized?

- How do they get their food? So, you can say that their nutrition is...

C. Take a book about different algae and have a look. Can you find the exact algae you are studying? If not, you can use the most similar one to complete the following description card:

- Common name:

- Scientific name:

- Living place:

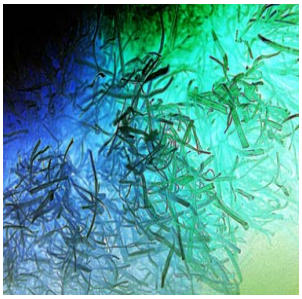
- Description and other characteristics:

4. PROTIST KINGDOM

Protozoa are animal-like protists. They move by a variety of methods:

- Some have **flagella** that look like whips. Euglena can move around using its flagellum.
- Other protozoa move by using tiny hairs called **cilia**. A Paramecium and several other protozoa move by using cilia.
- Other species move by extending **pseudopodia** or false feet. For example, amoeba.
-


Algae or seaweeds are protists that make their own food. They are classified according to the type of pigment, or colour. They are brown, green and red algae but they are not really plants because they have no proper roots, stems or leaves.
They can be small seaweeds to giant kelps. They all produce their own food as plants do.

5. KINGDOM FUNGI

Fungi (the plural of fungus) are mostly multi-celled organisms, but there are some one-celled organisms. Fungi cannot make their own food. They absorb and digest food out of the body. They are classified into different groups:

- Some are microbes, one-celled organisms called Yeasts. Some are parasites but others are useful for making bread, wine, and beer.
- There are moulds. You may know the blue-black moulds on bread, on other foods…but there are moulds useful to humans. In 1928, Alexander Fleming discovered that the mould *Penicillium notatum* killed bacteria. Scientists were able to make an antibiotic called penicillin. Today, people all over the world use penicillin.
- Mushrooms are another group of fungi. They are an important source of food.

Moulds

Mushrooms

LABORATORY 4- OBSERVATION OF DIFFERENT FUNGI.

Aim

Observation of different fungi.

Material

Bread, mould, mushroom and Binocular lens.

Observation

a) Bread mould

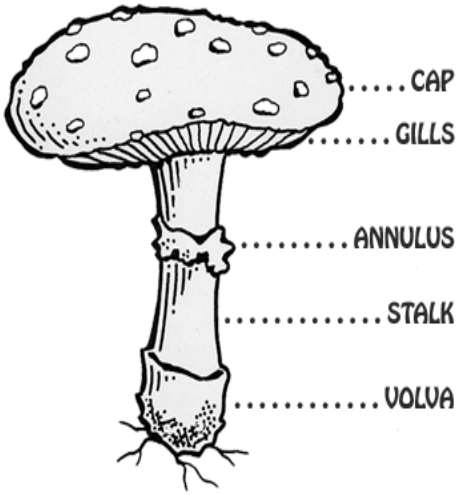
- View without the lens (naked eye) and draw the mould which you see. Draw what you can see and identify hyphae (threads) and spores (dots).

Naked eye:	**Binocular lens:** magnification:.....

- What kind of cells are fungi made up of?

b) Mushroom

- Draw the mushroom you have on the tray and identify its parts compared with the picture below:

Picture:	**Naked eye:** (Write down the scientific Catalan, Spanish and English names)
	

- Why do you think mushrooms were included in the plant kingdom?

- Why don't we consider moulds and mushrooms plants anymore?

Some moulds and mushrooms feed on dead things that are called saprophytes. Others feed on living things and cause diseases. They are called parasites. Ringworm in humans and mildew in plants are caused by parasitic fungi. Backet fungi kill trees, then digest the wood, so it is a ..... .

- Find out four mushrooms that you can eat and four that are poisonous. (In Catalan.)

6. PLANT KINGDOM

The plant kingdom is made up of many cells, which form tissues, eukaryotic, autotrophic living things. They live attached to the soil but they are able to make some movements, for example, they grow towards the light.
Usually they have roots, stems and leaves.

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

- **Non-flowering plants** are simple plants without flowers or seeds.

  - **Mosses:** They are small and they have no conductor vessels. This means that they do not have conductor vessels to move water and minerals. They are **nonvascular** plants. They have to be low to the ground in wet places. Mosses do not have roots, but they have **rhizoids**, fibres that look like hairs that help them to stick to their surroundings.
    Mosses are **seedless.** They grow from **spores**. Spores are cells that become new organisms. They are tiny and they grow in a small container called a spore capsule.

Mosses

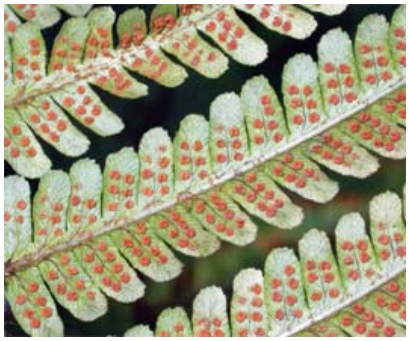
Liverworts

- **Ferns:** Like mosses, ferns are seedless plants, but they are **vascular.** This means that they have vascular tissue. Vascular tissue has cells that look like long tubes. These cells move water and minerals inside the plant. Vascular plants do not have to be low to the ground. This is why they can grow very tall.

Ferns

A long time ago, the Earth had huge forests of ferns. You can still find ferns in the woods. Maybe you grow ferns at home. Leaves of ferns are called **fronds**. On the bottom of a leaf you can find **spore cases.** The spore cases have millions of spores. Sometimes spore cases open. They spray spores on the ground. The spores can then grow into new ferns. Fronds are connected to a stem under the ground. This stem is called **rhizome. Roots** are also connected to the rhizome. The roots keep the plant in the ground or stuck to a tree.

Fronds with spore cases:



ACTIVITY 1 Internet searching

Find out the life cycle of a fern. Draw a diagram about it. Ferns, like mosses, have two steps in their life cycle. What does this mean?

LABORATORY 5- OBSERVATION OF MOSSES AND FERNS

Aim

Study of non-flowering plants.

Material

Moss, ferns, water.

Instruments

Microscope, binocular lens, slide, cover-slips, mounted-needle, dropper.

Observation

1) Identify the moss and the fern.

2) Write down the parts that you know.

3) Write a short description of each.

A

- Is this plant vascular or non-vascular? Why?

- How does it get water?

- Does this plant grow from seeds?

B

- Is this plant vascular?

- Does this plant grow from seeds?

On the bottom of a leaf you can find spore cases which have millions of spores. You can look at spores through a microscope. Just scrape the spore case with a toothpick and put the spores on a slide.

. Flowering plants: These plants are more complex, with **flowers** and **seeds**. They are also vascular. This means that they have tubes to move water and nutrients. They also have roots, stems, and leaves. Most of the plants you see everyday are seed plants. For example, trees, grass, bushes…

Flowering plants are divided into two groups related to reproduction:

- **Gymnosperms**: They have seeds inside a **false fruit**, like a pinecone.
- **Angiosperms**: They have seeds inside a **real fruit**.

Gymnosperms:

They are the oldest seed plants. They appeared on Earth 250 million years ago. The Earth was cold and dry. That is why they are adapted to cold and dry climates. For example, they do not have wide leaves. They have thin needles. A thick **cuticle** protects them in order to lose less water than flowering plants.

Most Gymnosperms are **evergreens**, like pine trees and sequoias.

Flowers of Gymnosperms are small. They group together into inflorescences or cones. These cones are male and female. Male cones have pollen grains with **sperm cells**. Female cells have **egg cells.** Pollen grains fall. The wind pushes them through the air and they can land on a female cone. That is how sperm cells can fertilize an egg cell. The fertilized cell becomes a seed inside the female cone. The seeds can germinate if they land in the right place.

Photo of a pine tree with male cones, which contain pollen and female cones, called pinecones, which contain seeds, called pine nuts.

Angiosperms:

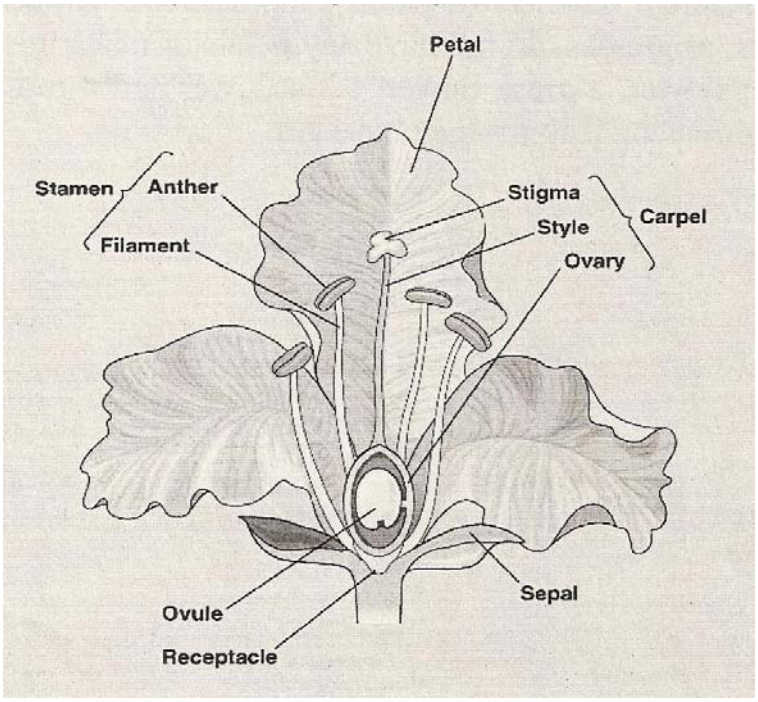
They appeared more recently than gymnosperms. This group is the largest division of the plant kingdom. There are many different kinds of angiosperms but all of them have flowers and seeds inside a **fruit**.
Flowers are for reproduction, we will study the parts in the lab.

They live in different climates. They can also be different sizes. Some of them cannot make their own food because they do not have chlorophyll. They are **parasitic**. They live on other organisms.
To classify angiosperms scientists use the number of **cotyledons**. A cotyledon is a tiny structure in the seeds. It looks like a leaf. Some angiosperms have one cotyledon. These are called **monocots**. Coconut palms, corn, rice, wheat, and grass are monocots.
Some angiosperms have two cotyledons. These are called **dicots.**
Bean plants, maple trees, rose plants, and cactuses are dicots.

LABORATORY 7- OBSERVATION OF A FLOWER

Part One

Observe the parts of a flower and complete the text below:



Humans have male and female sex organs, and so do flowering plants. If you slice a flower open you will see something like this:

The male sex organ is called.....

Its parts are: the ..... made up of pollen sacs, full of pollen grains that contain the male sex cells of the plant. The stalk or ..... of the stamen.

The female sex organ is called.....

The ..... is where pollen grains stick during pollination.

The ..... that protects the ovule. The ovule contains the female sex cells.

Some petals are coloured and scented to ..... insects.

Insects help plants to make seeds.

Sepals ..... the flower when it is in bud.

Part Two

Draw the flower you have brought. Identify all its parts and identify the function they carry out.

The flower

UNIT 2 – LIVING THINGS

ACTIVITY 2 ABC Dictation **"The life cycle of an Angiosperm"**

The class is divided into three groups: A, B, C. Each student will be given a piece of paper and will cut or tear it in four strips. You will be given a dictation of twelve sentences about "The life cycle of an Angiosperm". You only have to write down the information when the teacher says your letter. Use a different slip of paper each time, so you will have four sentences. Afterwards, you compare the sentences you have written with mates of the same letter groups. You have to check your sentences and send a messenger to the teacher if you have gaps or differences. Then, in groups with at least one A, one B, and one C you will have to put the slips of paper in the right order. The teacher will read out the text, this time in the correct order. You will write the sentences of the text.

ACTIVITY 3 MIND MAP (small groups)

The teacher will prepare a list of words connected to the topic "Plants". You will have to organize and categorize vocabulary by grouping words in similar categories. You will be given a skeleton of the mind map with blanks to fill in. If you want, you can add other words. We will correct the mind map.

PLANTS

7. ANIMAL KINGDOM

The animal kingdom is made up of multi-cellular, eukaryotic, heterotrophic organisms. They are sensitive to their environment.
Animals are classified in two groups:

. Invertebrates: Animals with no backbone. Some, like worms or jellyfish, have no skeleton. Others, like insects or spiders, have an external skeleton.
. Vertebrates: Animals with a backbone which is part of their internal skeleton.

INVERTEBRATES:

ACTIVITY 4 (English class): DICTOGLOSS (small groups)

You will be given some cards with key words about the main characteristics of invertebrates: Porifera or Sponges, Cnidaria, Worms, Molluscs, Arthropods and Echinoderms. Every group will have different cards. The teacher will select key words taken from the text she will read. As the teacher reads the text you have to place the key words in the order in which you hear them. Afterwards, every group will edit their texts from memory using the key words to help them. The text does not have to be word for word as the original. The teacher will read the text again and finally she will give the students a copy of the original text.

ACTIVITY 5 Which group of invertebrates does each animal belong to? Justify your answer.

jellyfish
starfish
crab
butterfly
urchin
snail
earthworm
sponge
coral
squid

ACTIVITY 6 **(at home)** Find out which invertebrates local sea food markets sell. Make a list.

VERTEBRATES:

All vertebrates have an endoskeleton with a backbone. The body is made up of a head, a trunk, and many have a tail. They have articulated limbs, a well-developed nervous system and bilateral symmetry.

Photos of different vertebrates

Fish:

They are aquatic: Some live in fresh water and some in salt water.
The body is wider in the middle than in the ends.
They have fins. Most have dorsal, pelvic and caudal fins.
They are covered with scales.
Their skeleton can be made of cartilage or bone.
They have a sensory organ that detects vibrations: the lateral line system.

They are cold-blooded. As a result, they cannot regulate their body temperature.
They use gills to obtain oxygen from water. The gills can be protected by a cover (flap), the operculum.
Most of them are carnivores.

Fertilisation takes place externally in the water and they are oviparous.

Photo of cartilaginous fish and bony fish

Bony fish are weightless in water because their bodies contain a swim bladder full of air.

LABORATORY 8- OBSERVATION OF A FISH

Scientific diagram of a fish:

1. Put the fish on a tray. Be sure you can see the parts you want to draw.
2. Observe the size and shape. Draw the outline and the main elements. The diagram must have the correct proportions.
3. Fill in the outline with the other parts of the fish.
4. Colour the drawing. You must use the correct colours. It must be realistic.
5. Label all the parts: eye, nostril, head, lateral line, scales, operculum, dorsal fin, caudal fin (tail), pectoral fin, and pelvic fin.

Scientific name:
English name:

Catalan/Spanish names:

Amphibians:

All amphibians begin life in water, and they always live in wet places. However, the adults live on land.
They have four limbs or legs.
Their skin is moist and has no covering.
They are the only vertebrates that undergo **metamorphosis**.
As a result, the adults do not look like the young.

ACTIVITY **The metamorphosis of a frog**

Put the following sentences in the correct order and draw four diagrams to show the life cycle of a frog.

- The tail and gills disappear. Legs develop.

- The female lays eggs in the water and the male fertilises them.

- The adult frog lives on land and has very strong back legs.

- A tadpole with gills and tail emerges from the egg and lives in the water.

ACTIVITY

Fill in the gaps using the following key words:

oviparous, lay, tadpoles, carnivorous, cold-blooded, lungs, limbs, moist, through (2).

Amphibians have four ……. and …….. skin. They can live on land or in water. On land they breathe using …… In water they breathe…… their skin.
Amphibians are ……, so they …… their eggs in water. These hatch into …….. , which swim using tails, and breathe ……. gills.
Most amphibian are ……., but young frogs are herbivores.
Amphibians do not usually live in cold places because they are ……

Reptiles:

Reptiles were the first animals to grow out of water. Reptiles breathe with lungs. Most have waterproof scales. The scales keep reptiles from drying out. Reptiles lay eggs (they are oviparous). The eggs have a hard covering which keeps them from drying out.
Most reptiles are carnivores. They have teeth to capture their prey. Turtles, however, have beaks. Many snakes have fangs connected to glands that produce poison.
Reptiles are cold or warm depending on the environment: they are cold-blooded.

ACTIVITY

Write down 4 questions about Reptiles using: What, Where, When, Which... Ask your classmates.
Example:

What do Reptiles/ use to/ keep moist?

-

-

-

-

Birds:

The bird's body is adapted for flight (aerodynamic). The neck is sometimes very long. They have four limbs, the back ones are legs and the front ones are wings. Strong wing muscles are attached to the sternum or keel. The body is covered with feathers. Bird bones are hollow in order to make their body light to fly more easily.
Birds have a beak whose shape depends on the food they eat. They use lungs to breathe. Lungs are connected to air sacs.

Birds are oviparous. The eggs are incubated until the chicks hatch.
Birds are warm- blooded.

ACTIVITY

Associate each beak with how the birds feed:

Strong, curved	it filters water
Short	it feeds on grain
Long, pointed	it captures insects
Wide, flat	it catches its prey
Strong, short	it fishes in shallow water

Mammals:

Most mammals are terrestrial animals. They use lungs to breathe. Some are aquatic like dolphins, but only one, the bat, can fly.
Mammal bodies are covered with hair or fur which keeps them warm. They are warm blooded.
They have four articulated limbs (legs, fins or wings).
They have a head joined to the trunk by a neck. The spinal column finishes in a tail.
Mammals have teeth. Their shape depends on the food they eat.
The most important glands they have are the mammary glands. They produce milk. Young mammals drink milk from their mother.
Most mammals have larger brains than other vertebrates.

ACTIVITY (internet)

Part One: In groups find out information about the three groups of mammals: **Monotremes**, which are born from eggs and have a beak, **Marsupials** which finish their development inside the mother's pouch, and **Placentals**, which develop inside their mother's uterus.

Part Two: Find out information about mammals in danger of extinction that are at Barcelona's Zoo. Adopt one of them.

ACTIVITY

Complete the table:

	LIMBS	SKIN	BREATH	BLOOD	OTHERS
FISH					
AMPHI BIANS					
REPTILES					
BIRDS					
MAMMALS					

UNIT 3 – HOW DO LIVING THINGS WORK?

VITAL FUNCTIONS

You already know (unit 1) that all living things can carry out three vital functions: nutrition, interaction and reproduction. In this unit we are going to learn more about these functions.

ACTIVITY 1 (individually)

What do you remember?

From the following words, indicate those which are related to obtaining energy (N), those which are related to reproduction(R) and those that are involved in interaction(I).

. heart
. CO2
. ovary
. stem
. sunlight
. embryo
. food
. bone
. nucleus
. seed
. mitochondrion
. brain
. leaf
. spermatozoid
. nerve
. mineral salts
. protein
. egg cell
. photosynthesis
. stamen

Write a definition of the vital functions:

Nutrition is the process which ……..

Interaction is ……..

Reproduction is ……..

NUTRITION

ACTIVITY 2

In groups of four you will complete the mind map the teacher will give you. It is about nutrition and you will have to answer to four questions:

Why do organisms need food?

What matter do organisms need?

How do organisms obtain food?

How do nutrients become useful for organisms?

Afterwards, we will put the information together and we will make a new mind map with the contributions by each group.

ACTIVITY 3

Now, read the following text and correct the mistakes (7):

Nutrition consists of all the processes through which a living thing obtains the substances it needs to live.
Through nutrition, organisms obtain matter and energy. They are necessary to build new cells, to increase in size, to renew cells, to reconstruct lost parts etc. Energy is required to carry out some processes. There are processes that do not require energy, for example when we sleep we don't use energy.
Depending on the way in which they obtain nutrients, there are heterotrophic organisms, like plants, for example. They make their own food. And there are the autotrophic organisms, like animals and fungi, which need to have food made by other living things.
Plants do not respire because they photosynthesise. This process only takes place in leaves. Nutrition in animals involves digestion, circulation, respiration and excretion. Plants do not digest food and do not have a circulatory system either. Plants do not remove waste.

ACTIVITY 4 (at home)

Copy the composition of the milk you drink at home.

Energy (it is measured in Kilocalories)
Protein
Carbohydrate
Fat
Other:

a) What is the percentage of protein, fat and carbohydrate in milk?

b) Which mineral does milk contain? What is its function?

c) After looking at the milk label, can you say if milk is highly nutritious? Why?

UNIT 3 – HOW DO LIVING THINGS WORK?

THE MATTER THAT LIVING THINGS ARE MADE UP OF

In the mind map we have seen that organisms need different kinds of matter. Milk is a product made by mammals.
The substances that make living things are called **biomolecules**. Biomolecules are required as a source of energy and for the manufacture of new cells. We can find biomolecules only in living things (nowadays some of them can also be made in laboratories).
The chemical reactions that take place inside cells are called **metabolism**.

Some biomolecules are:

- **Carbohydrates (Glucids)**: They are used mainly as a source of energy. Some of them are called sugars because they are sweet. They are soluble in water. Examples: glucose (the "fuel" for living things"), sucrose (common sugar) and starch which is the energetic reserve of plants and is stored in their cells.

- **Fats (Lipids)**: They are generally used as store of energy and for insulation. They are insoluble in water. In this group there are oils and animal fats, which float in water.

- **Proteins**: They are made of basic units, the amino acids, which are held together by chemical bonds. They are generally used for building new cells. Other proteins help reactions take place in the cells. Proteins that control metabolism are called enzymes.
  We can find proteins in the muscles, in the blood, the connective tissue, hair and feathers.

- **Nucleic acids**: They are also made of basic units, the nucleotides. They store and transmit genetic information (heredity), like, for example, the DNA. DNA is in the nuclei of all cells.

Other essential substances for organisms are **water** and **mineral salts**.

The cell cytoplasm is made up of about 75% **water**. It plays an important part in the transportation of materials around the body, in the removal of waste products, in maintaining a constant body temperature and in all the chemical reactions taking place inside our bodies.

Mineral salts cannot be made by living things. We acquire them from food. We need them in small quantities for a variety of purposes: for example, calcium is required for bone formation, teeth and blood clotting; sodium is a constituent of body fluids and iron is used for the formation of red blood cells.

Water and salt, two necessary substances for organisms.

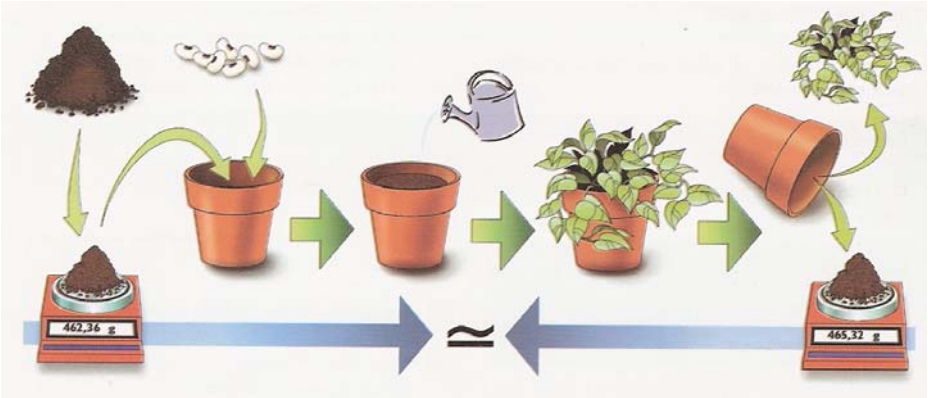
UNIT 3 – HOW DO LIVING THINGS WORK?

NUTRITION IN PLANTS

ACTIVITY 1

Imagine the following experiment:

We plant some plant seeds in a flowerpot. Beforehand, we have to weigh the soil. We water the plant until it grows. When the plant is big enough and has got fruits, we extract it from the pot and we weigh the plant and the soil. The soil weighs more or less the same as when we began the experiment.



a) From where has the plant obtained the matter needed to grow?

b) How does this plant get the matter?

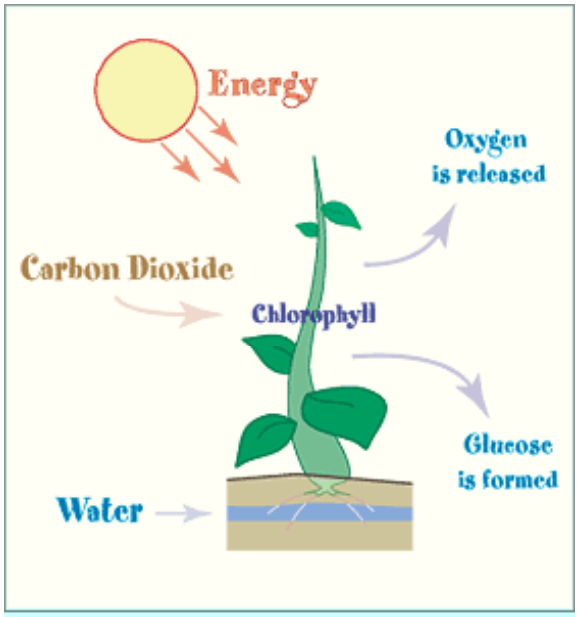
c) Which is the path followed by it?

d) How does the plant get energy?

UNIT 3 – HOW DO LIVING THINGS WORK?

ACTIVITY 2

Look at this diagram and complete the text below:



Photosynthesis

Photosynthesis takes place inside _____where we can find a green substance called _____ .It can trap energy from the sun.
The process begins when plants get _____ and minerals from the soil by the plant's roots and move up to the leaves.
The plant also takes in _____ from the air.
Thanks to sunlight, water and carbon dioxide combine to make _____ and _____ that goes into the air.
Plants can only photosynthesise in the light, so photosynthesis only takes place during the _____.

We can show **photosynthesis** as this word equation:

_____ + _____ + light energy →

_____ + _____

(Use: H2O for water, CO2 for carbon dioxide, O2 for oxygen)

How do plants get energy from nutrients? Do plants respire? Where does **respiration** take place?

Plants cells respire, just as animals cells do. If they stop respiring they will die. Respiration is carried out by roots, stems and leaves.
Plants respire all the time, whether it is dark or light. They are always taking in oxygen and releasing carbon dioxide.
They combine oxygen with glucose, to get the energy they need to live and produce other bio molecules like protein and fats.
So, what happens to a plant depends on whether it is in the dark or the light and how bright the light is.

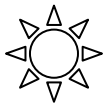
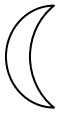
We can show **respiration** as this word equation:

_____ + _____ →

_____ + _____ + chemical energy

ACTIVITY 3

With all the information that is given to you try to complete this chart.

Conditions	Photosynthesis and/or Respiration
	
	

UNIT 3 – HOW DO LIVING THINGS WORK?

LABORATORY 1- TESTING LEAVES FOR STARCH

http://www.footprints-science.co.uk/Starch.htm

INTRODUCTION

Plants are autotrophic, they make their own food by carrying out photosynthesis. Then, they store the food made in the form of starch.

AIM

The aim of the experiment is to compare a covered part of a leaf to an uncovered part of a leaf to see which part produces starch.

MATERIAL

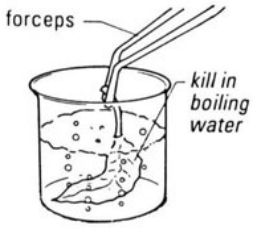
- baker for boiling water.
- boiling tube, 1 for each type of leaf used
- leaf
- forceps
- iodine solution
- Bunsen burner
- Petri dish
- water
- ethanol
- dropper

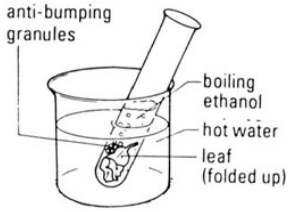
PROCEDURE

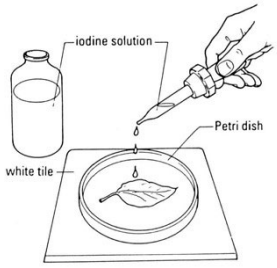
We are going to test the presence of starch in two types of leaves: one leaf has been covered with foil for three days and the other leaf is in normal conditions. We use iodine solution to test the presence of starch.

- Collect the leaves from the plant to be tested.
- Hold the leaf with forceps and dip it into a beaker of boiling water for about 30 seconds. Using forceps, remove the leaf from the boiling water and note how it has changed.
- Drop the leaf into a boiling tube and push it to the bottom. Add enough ethanol to cover the leaf, and stand the boiling tube in your beaker of hot water.
- Watch as the ethanol boils and the green colouring (chlorophyll) is removed from the leaf. This will take a few minutes.
- Using forceps, remove the leaf from the boiling tube and

rinse the leaf in cold water.







- Put the leaf in a Petri dish. Add iodine solution to the leaf from the dropper bottle. Make sure the leaf is completely covered with iodine.
- Watch for a few minutes to see if a blue-black colour develops in any part of the leaf. A blue-black colour with iodine solution indicates that starch is present.

RESULTS

Answer these questions.

- What has happened with the covered leaf? Why?

- What has happened with the non- covered leaf ? Make a drawing.

CONCLUSIONS

UNIT 3 – HOW DO LIVING THINGS WORK?

Plants, as you know, have got leaves, stem and roots.
How are all these parts connected? They are connected by the **vascular system**.
The **vascular system** is a group of vessels that go all along the plant, and its function is to transport water and minerals from the roots to the leaves **(xylem**), and nutrients from the leaves to the rest of the plant **(phloem)**


Slice of a tree showing the vascular system

Remember that there is a group of plants that don't have a vascular system, can you name it? How can they survive?

Which is the name of the vascular system in animals?

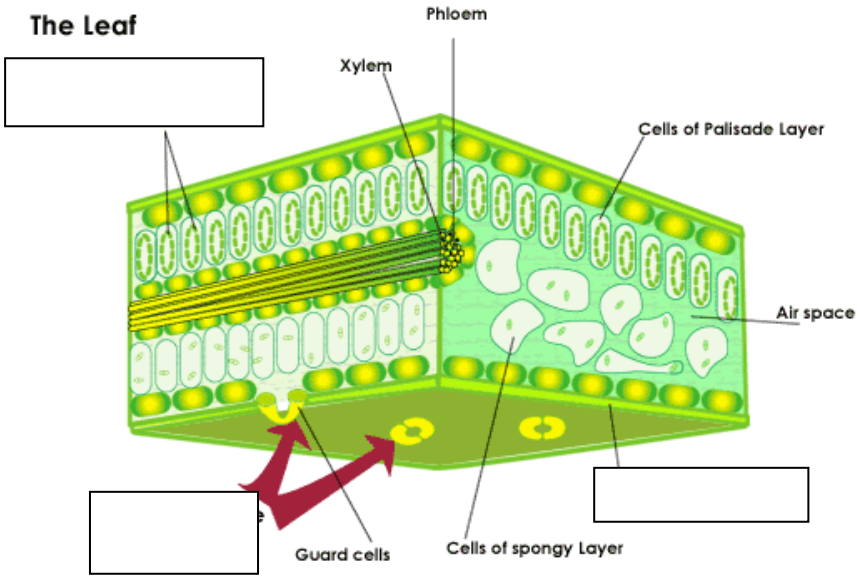
UNIT 3 – HOW DO LIVING THINGS WORK?

MORE ABOUT PHOTOSYNTHESIS

Photosynthesis is carried out in all green parts. But let's look at a leaf:
All leaves have the same parts. These parts work together to help the plant. The **epidermis** is the top layer of cells. The cells of the epidermis make a thin coating called the **cuticle**, it stops water from leaving the leaf. The leaf has cells that make food for the plant. These cells have **chloroplasts**. Chloroplasts need sunlight, water, minerals and carbon dioxide to make food. Most leaves have pores called **stomata** (stoma in singular) in their lower surface. One stoma is a hole between a pair of **guard cells**. Stomata let carbon dioxide into the leaf and oxygen and water vapour pass out.

ACTIVITY 1

With the information that is given to you in the text above complete the following scheme of a slice of leaf under a microscope:



UNIT 3 – HOW DO LIVING THINGS WORK?

LABORATORY 2- LOOKING AT STOMATA

INTRODUCTION.

Most leaves have pores called **stomata** in their lower surface. One pore or stoma is a hole between a pair of guard cells. Stomata let carbon dioxide into the leaf and oxygen and water vapour pass out.

Look at the diagram above and complete the text:

When a plant has plenty of water the _____ become curved and the _____ between them opens. This allows _____ to escape from the leaves of the plant.

When a plant begins to lose water faster than its _____ can take it up, guard cells become less _____. This _____ the stomata and slows down the loss of water from the plant.

- What are stomata?

- Where can we find them?

- What is their function?

UNIT 3 – HOW DO LIVING THINGS WORK?

MATERIAL

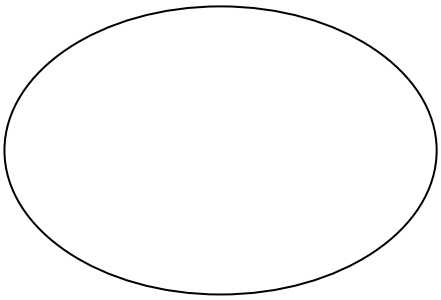
- leaves
- microscope
- slide
- cover slip
- mounted needle
- dropper
- nail varnish

PROCEDURE

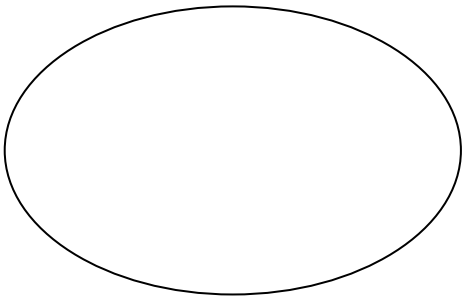
We are going to view stomata in different parts of the leaf and in different leaves.

The easiest way to view stomata is to take a nail varnish impression of it. Notice that their shape, number and position in the leaf are very different.

- Paint about one square centimetre of the lower and upper surface of the leaf with transparent nail varnish.
- Wait about 20 minutes in order to let it dry out.
- Peel off and place them on a microscope slide. Stomata leave a visible impression in the nail varnish.
- Make a drawing, and count the number of stomata you can see.



lower surface



upper surface

Finally, say if the following sentences are true or false and correct the mistakes:

The stoma opens when a plant has plenty of water.

The loss of water from the plant slows down when the guard cells are curved.

The tiny holes in a leave are stomata.

The stoma closes when the guard cells become curved.

Plants adapted to dry climate have got more stomata than the ones wet climate.

ACTIVITY 2 (Self assessment) (10 minutes-10 points)

Answer these questions:

1. Which of these is not a job of the root of the plant?
a. To make food
b. To hold the plant in place
c. To take in water and minerals from the soil

2. The part of the plant that respires is:
a. roots, stems and leaves
b. leaves
c. all green parts

3. The parts of the plant that are mainly in charge of making food for the plant are the:
a. roots
b. all green parts
c. leaves

4. Little openings in the leaf that allow for the taking in of carbon dioxide and the emission of oxygen during photosynthesis are:
a. xylem
b. cuticle
c. stomata

5. Stomata have _____ on either side of the stomata to help regulate the amount of carbon dioxide and oxygen that flows in and out of them.
a. guard cells
b. xylem
c. phloem

6. The part of the vascular system which carries nutrients from the green parts to the rest of the plant is:
a. phloem
b. xylem
c. stomata

7. In photosynthesis ……. energy is transformed into …… energy.
a. chemical/light
b. light/light
c. light/chemical

ACTIVITY 3

Answer the following questions:

- All the plants make photosynthesis? What is the condition to make photosynthesis?

- What would happen to a plant if we put it in a dark place for too long? Why?

- What would happen to the atmosphere if all plants and algae became extinct? Why?

ACTIVITY 4 (in groups)

People eat many different parts of plants. We all know that an apple is a fruit—it contains the apple tree's seeds. But can you say which plant part each food is? Justify your answer.

Asparagus

- Roots
- Stems
- Leaves
- Flowers

Carrots

- Roots
- Stems
- Leaves
- Fruits

Onion

- Roots
- Stem
- Leaves
- Flower

Peach

- Roots
- Stems
- Fruit
- Flower

Broccoli

- Stems
- Flowers
- Leaves
- Fruits

Peanuts

- Fruits
- Flowers
- Seeds
- Leaves

UNIT 3 – HOW DO LIVING THINGS WORK?

NUTRITION IN ANIMALS

ACTIVITY 1

Look at the pictures and think about how these animals obtain their food. Then, fill the gaps with the words given.




triturate	chew	suck in	filter

Insects …… the nectar of flowers.
Whales …… water to obtain food.
Tiger …… meat.
Cows …… plants.

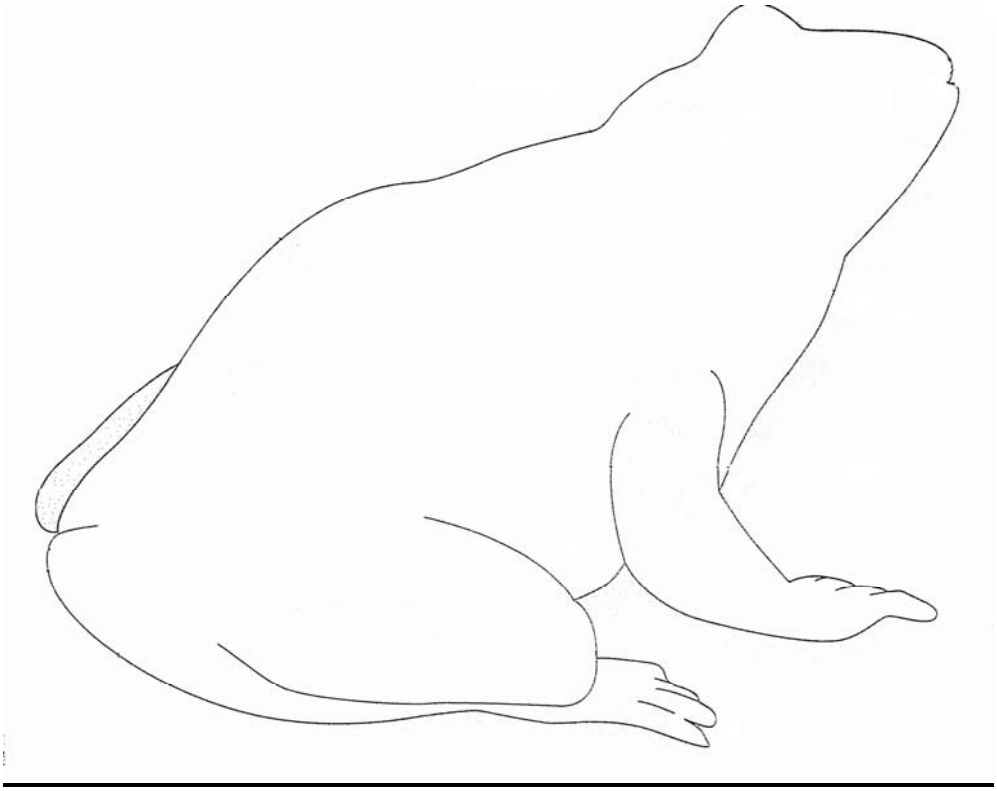
Can you say which of these are herbivores, carnivores or omnivores?

Do you remember what the way of obtaining food from other living things is called?

UNIT 3 – HOW DO LIVING THINGS WORK?

ACTIVITY 2

Draw in the picture below the path that an insect eaten by the frog would follow from the mouth to the cells.



Food must be changed into a liquid inside the body in order to be used.
Digestion is the process of breaking down food molecules into smaller ones. These small molecules (called nutrients) go to the cells to be used for energy, growth and cell repair.

ACTIVITY 3

In the text below some words are coloured according to a code. Can you break the code in less than 5'? DO NOT READ THE TEXT.

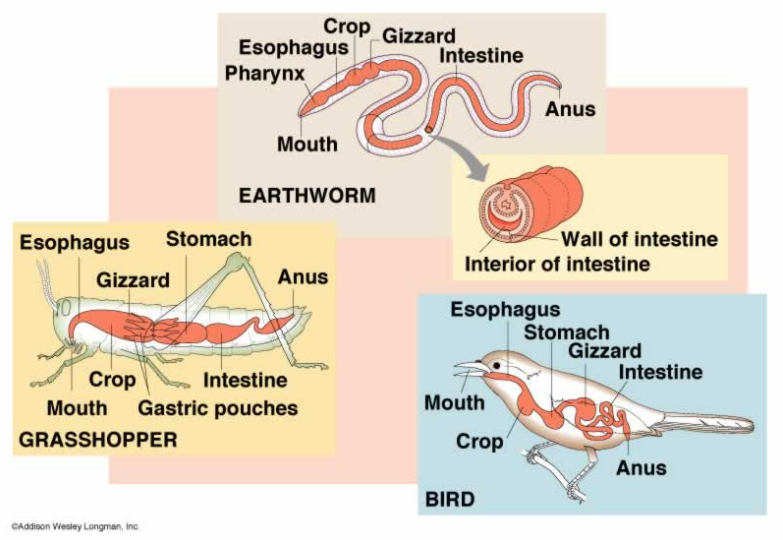
UNIT 3 – HOW DO LIVING THINGS WORK?

Digestion starts in your mouth. There food is chewed and mixed with saliva. Food becomes a bolus and moves into the oesophagus or gullet. From the gullet, food passes to the stomach.
In the stomach muscles squeeze and relax mixing the food with gastric juice. From the stomach the food passes into the small intestine. There three liquids are mixed with the food:
The juice of the pancreas, the juice from the liver (bile) and the intestinal juice. Digested food is absorbed into the blood through the wall of the small intestine. Undigested food passes into the colon and becomes a solid waste called faeces.

Yellow means ……
Red means ……..
Blue means ……..

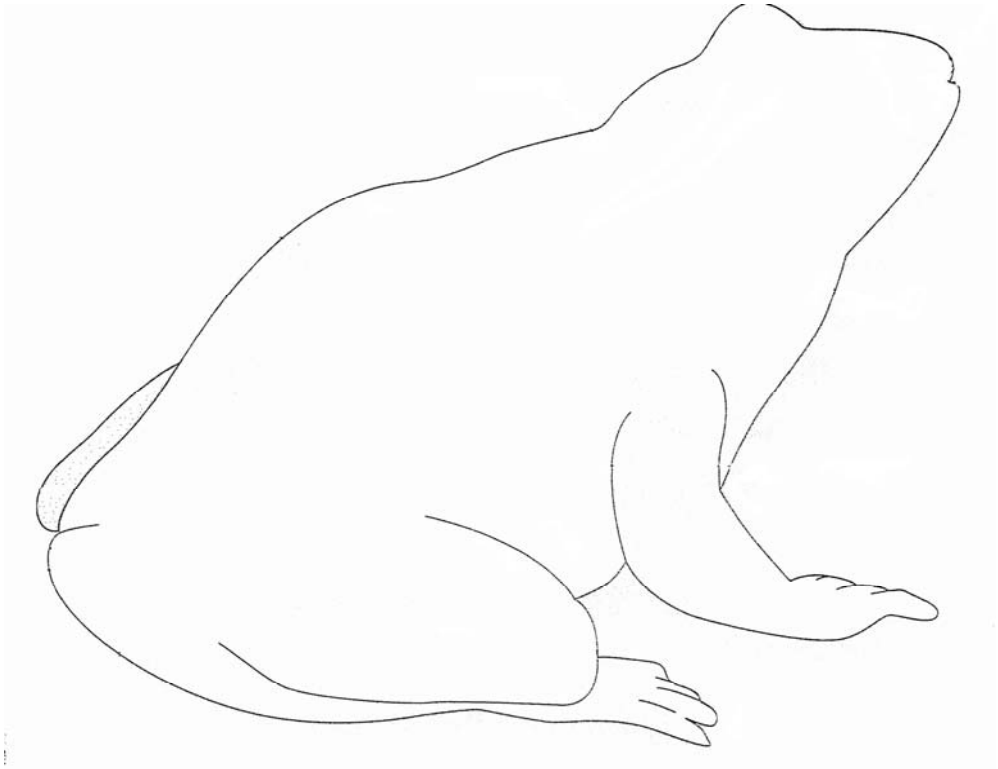
ACTIVITY 4

Identify some common characteristics of the digestive tube of the following animals:



ACTIVITY 5

Draw (in red) in the frog the path followed by the digested fly (nutrients). Which is the system that transports them to the cells? What makes them flow?

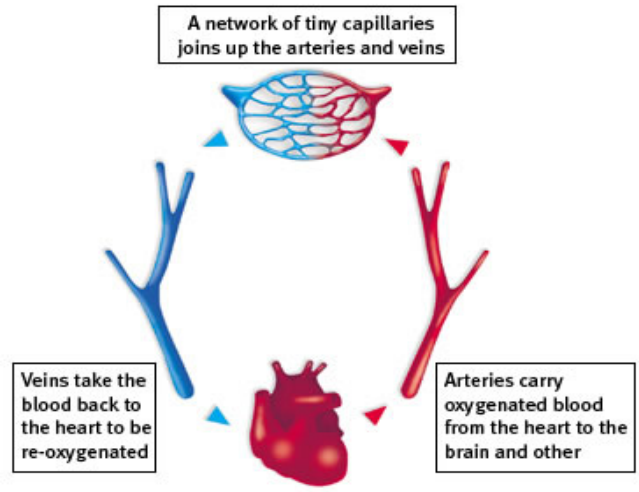


Draw (in blue) in the frog the path that oxygen will follow from the air to the cells. How does oxygen arrive at the cells?

CIRCULATION:

Read the following text:

Circulation is the transport mechanism in which nutrients and oxygen go through all cells from the body and remove all waste matter from them.



The circulatory system is made up of the heart, the blood and the vessels (arteries and veins).The **heart** is a muscle that pumps blood around the body. **Arteries** are tubes that carry blood away from the heart to the body. The arteries branch into tiny little tubes called **capillaries**. The walls of capillaries are very thin and liquid from the blood can pass through them. The capillaries join together to form **veins**. Veins bring blood to the heart from all parts of the body except the lungs.

RESPIRATION

All animals respire. A lot of people think respiration means breathing - this is not true. Respiration is a chemical process that produces energy thanks to nutrients and oxygen. It takes place inside every cell of every living thing. Respiration usually needs oxygen and produces carbon dioxide as a waste product.

Do you remember the part of the cytoplasm where respiration takes place?

There are 4 types of external respiration or breathing in animals:

	Cutaneous	Branchial	Tracheal	Pulmonary
Main characteristic	Gas exchange is carried out through the **skin** which is very thin and moist.	Gas exchange takes place through the **gills**. Gills are thin extensions on the surface of the body, surrounded by blood vessels.	Gas exchange takes place through internal tubes or **tracheae**. The tracheae end in orifices called **spiracles** where the air enters	Gas exchange takes place in the **lungs**. Lungs are internal cavities which have very thin walls full of blood vessels
Examples	earthworm	fish	arthtropoda	Birds mammals

ACTIVITY 6

Here you have a list of different kinds of animals. Can you write which type of respiration or breathing they carry out?

Elephant
Snake
Spider
Snail
Earthworm
Crocodile
Dog
Pigeon
Frog
Grasshopper
Tadpole
Mussel

EXCRETION:

Excretion is the process of collecting waste products and expelling them outside the body.

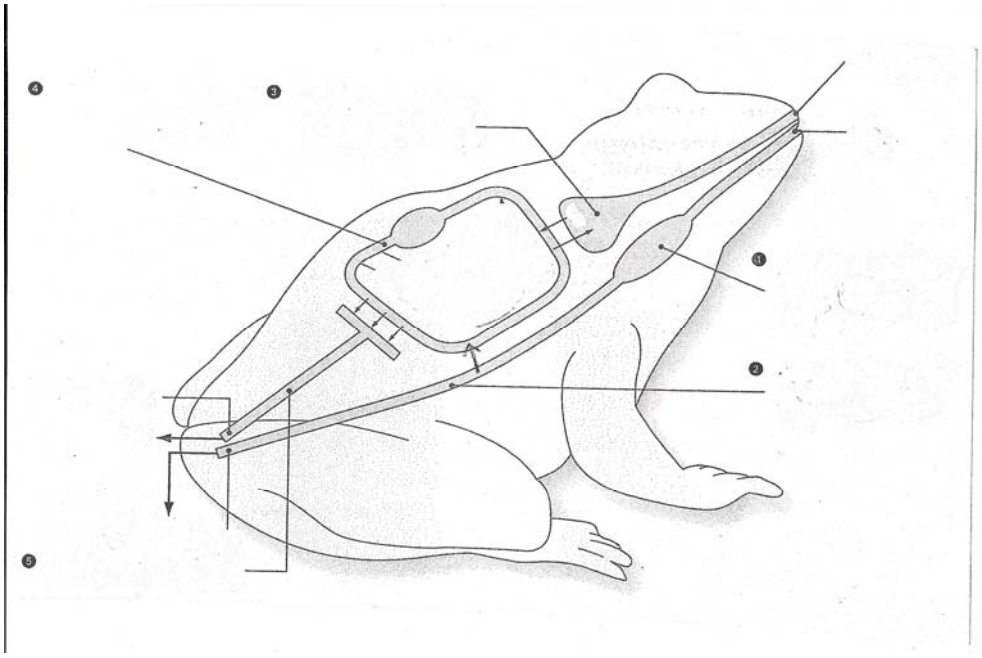
Insects use **Malphigian tubules** to expel waste products. The excretory system in vertebrates consists of various organs. Our **lungs** excrete carbon dioxide. Our main excretory organs are the **kidneys** that remove urea, water, and other unwanted substances from the blood. Urea is a waste produced by the liver.

ACTIVITY 7

Apart from kidneys, do you know another way which human can expel waste products like water and salts? (Hint: it is the largest organ in our body).

ACTIVITY 8

This is a diagram of the frog with the four systems related to nutrition. Identify them. Label: mouth, nostril, O2, CO2, cells, urea, urine, faeces.



3.2. INTERACTION

Mind map about interaction

In groups of four students you will complete the mind map the teacher will give you. It is about interaction and you will have to answer three questions:

1. Which changes can organisms perceive?
2. How are stimuli perceived?
3. What responses can organisms give?

Afterwards, we will put the information together and we will make a new mind map with the contributions by each group.

UNIT 3 – HOW DO LIVING THINGS WORK?

Interaction in plants

In the case of plants the capacity of reaction is known as **excitability or sensitivity**. The most important difference between plants and animals is that plants do not move from place to place. Plants can perceive external stimuli (stimulus in singular) and produce responses. Gravity, light, and water are examples of stimuli. The responses can be classified into **tropisms** and **nastics**.

Tropisms are the movements of the plants towards (positive) or away from (negative) the stimulus. For example, roots have positive geotropism because they respond by growing down into the ground. Stems and leaves have positive phototropism because they bend towards light.

Nastics are responses that have a passing effect and that consist of a movement that is not a change in the direction of the growth of the plant. For example, the mimosa leaves close when they are brushed, the stomas close when it is very hot, some leaves or flowers change their position at sunset.

UNIT 3 – HOW DO LIVING THINGS WORK?

Plants produce automatic responses. They do not need to decide the response.

On the other hand, animals have **sensorial organs**, which collect information, a **nervous system** which give information about what is happening, and **effector organs**, which allow them to react.

UNIT 3 – HOW DO LIVING THINGS WORK?

LABORATORY 3- INTERACTION IN PLANTS

In this picture there are two plants: a spike and a field bindweed. In spring it is easy to see these plants in the woods. Look at them carefully. Can you tell the plants apart? Are you a good researcher? Find out!

Plan of action

- Colour the plants according to the colour code and answer the related questions.
- Interpret the picture.

Colouring

Colour code:

1)SPIKE:
a. Colour the STEM yellow
b. Colour the LEAVES yellow
c. Colour the FLOWER yellow
d. Colour the SPIKE yellow

2) FIELD BINDWEED:
a. Colour the STEM green
b. Colour the LEAVES green
c. Colour the FLOWERS rose

Questions

What does field bindweed do to expose its leaves to the sun? How does it do it?

1. In pairs, use what you learnt about stimuli and responses and try to answer these questions. Prepare to answer to the class.

2. Marc, Ariadna and Rosa are students in 2n ESO. This is what they answered to these questions. Which explanation is the best? Use checklist 1 to decide.

a)Marc:
It is a response to stimuli. When a plant changes the direction of its growth, the process is called tropism. This process is called thigmotropism.

b) Ariadna:
Bindweed makes runners when it contacts with an object like a spike. This is a response to contact. Then, runners twist themselves around the spike in order to grow towards the sunlight.

c) Rosa:
I think field bindweed is a beautiful plant. It reacts to sunlight by running around a spike to get more light.

3. Can you write a better explanation? Try!

4. Check your explanations in pairs. Use checklist 1 & 2.

Assessment Checklists

Checklist 1:

The text ....

CONTENT & LANGUAGE	Exemplary	Adequate	Poor
A. says **what** the plant does? (it describes the relevant aspects in the picture).			
B. Explains **how** the plant does so. (it relates stimuli and response).			
C. Says why the plant does so (it justifies how useful the mechanism is).			
E. Uses appropriate scientific terms.			
F. answers the initial questions (it doesn't include other information referring to the plant).			
D. is an explanatory text (there are suitable connectors: because, due to, consequently, etc.; and verbs in the present tense: grows, wraps around, etc.			

Checklist 2:

WRITING CONVENTIONS	Always	Sometimes	Never
G. Sentences are short or medium length (less than 15 words).			
H Every sentence begins with a capital letter and ends in a full stop (.).			
I. Every sentence begins with a SUBJECT and has a VERB.			
J. The spelling is correct.			

UNIT 3 – HOW DO LIVING THINGS WORK?

Interaction in animals

In animals there are **receptors** to receive stimuli from the environment. The receptors are the sense organs. Then, the **coordinating systems** process the information. Finally, the responsive organs or **effectors** produce a response.

Receptors

The receptors in animals are the **sense organs**. These detect stimuli.
Senses are: **sight, smell, taste, hearing and touch**.

ACTIVITY 1

Complete the following chart about senses. Use the words given:
Pressure, touch, pain and temperature changes, taste, sound, light, nose, ears, touch, chemical substances dissolved in water, sight, smell.

Sense	Sense organ	Stimuli detected
	Eyes	
		Chemical substances dissolved in water or in air
	Tongue	
Hearing		
	Skin, in most animals	

Coordination systems

Animals have two coordination systems: **the nervous system** and the **endocrine system**. The nervous system works by means of specialised cells called **neurons** which transmit information through nerve impulses. The speed of response is quick. The endocrine system regulates the body functions by means of chemical substances called **hormones**. Hormones are produced by glands and are transported in the blood. The speed of response is slow.

3.3. REPRODUCTION

Mind map about reproduction

In groups of four students you will complete the mind map the teacher will give you. It is about reproduction and you will have to answer three questions:

1. What are the two ways of reproduction?

2. What are the differences between both ways?

3. Which types of reproduction you know in plants and in animals?

Afterwards, we will put the information together and we will make a new mind map with the contributions by each group.

UNIT 3 – HOW DO LIVING THINGS WORK?

Reproduction in plants

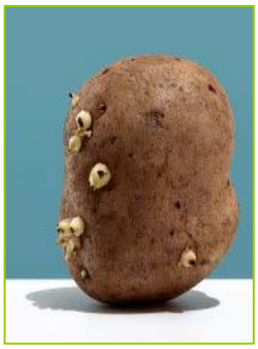
You know that there are some techniques used in agriculture to rapidly reproduce roses, tulips, geraniums, strawberries, fruit trees, potatoes, onions…

In spring you can see a lot of large and coloured flowers and bees or butterflies carrying pollen from flower to flower, or the wind carrying pollen from flowers that do not attract insects.
These situations show that plants reproduce, so they multiply and produce new individuals.

Plants can reproduce sexually or asexually.

Flowers have male and female organs. When a male cell joins a female cell, the ovule becomes a seed. When the seed "comes to life", the embryo germinates and a new plant grows.
Plants without flowers reproduce asexually, for example by spores, buds, stolons, stem tubers, cuttings, grafts…






We studied in unit 2 different kinds of plants: mosses, ferns, flowering plants without fruits and flowering plants with fruits.

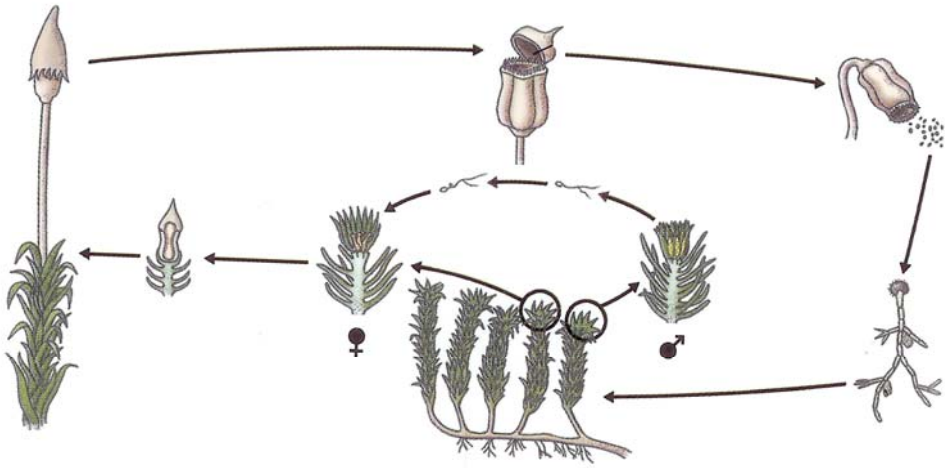
Mosses and ferns have two steps in their life cycle. One step is asexual and the second step is sexual.

UNIT 3 – HOW DO LIVING THINGS WORK?

ACTIVITY 1

Fill in this diagram about life cycle of a moss:

Use the following words: spores, egg, fertilized egg, leafy moss, sperm, female branch, male branch, spore case, new moss plant.

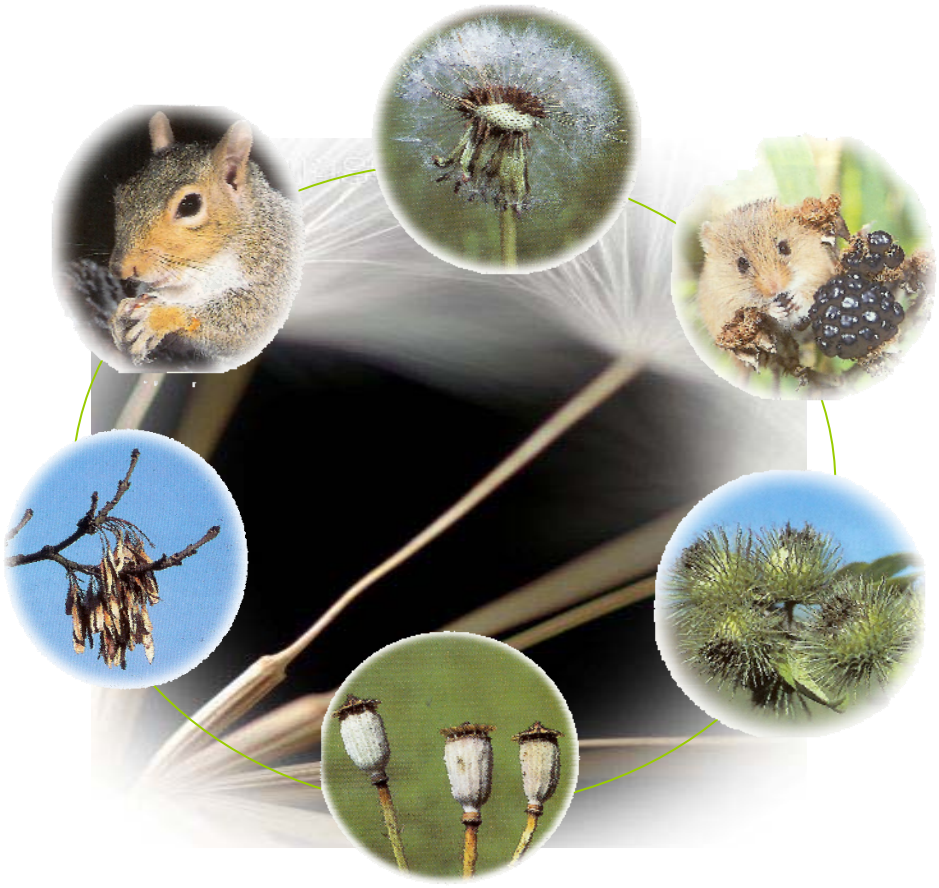


We studied the life cycle of angiosperms in unit 2.

Most plants produce hundreds of seeds at the same time. Fruits and seeds need water, minerals and light, so they must be dispersed. The dispersal can be by animals, by the wind or by plants.

ACTIVITY 2

a) Name the kind of dispersal of the following fruits and seeds



b) Describe how you may have helped disperse seeds without knowing it.

Reproduction in animals

You already know that reproduction is the creation of new living things. There are two ways it can happen: by asexual reproduction, or by sexual reproduction.

Asexual reproduction

Remember that in asexual reproduction there is only one parent, and its young are exact copies of itself.

There are many invertebrates, including sea stars and sea anemones for example, that reproduce by asexual reproduction. Common forms of asexual reproduction include:

Budding

In this form, an offspring grows out of the body of the parent.

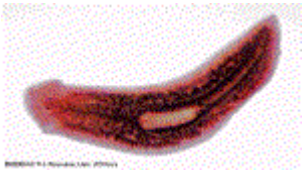
- Hydras exhibit this type of reproduction.


Hydra Budding

Fragmentation

In this form, the body of the parent breaks into distinct pieces, each of which can produce an offspring.

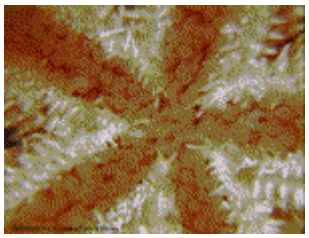
- Planarians exhibit this type of reproduction.


Planarian

Regeneration

In this type of reproduction, if a piece of a parent is detached, it can grow and develop into a completely new individual.

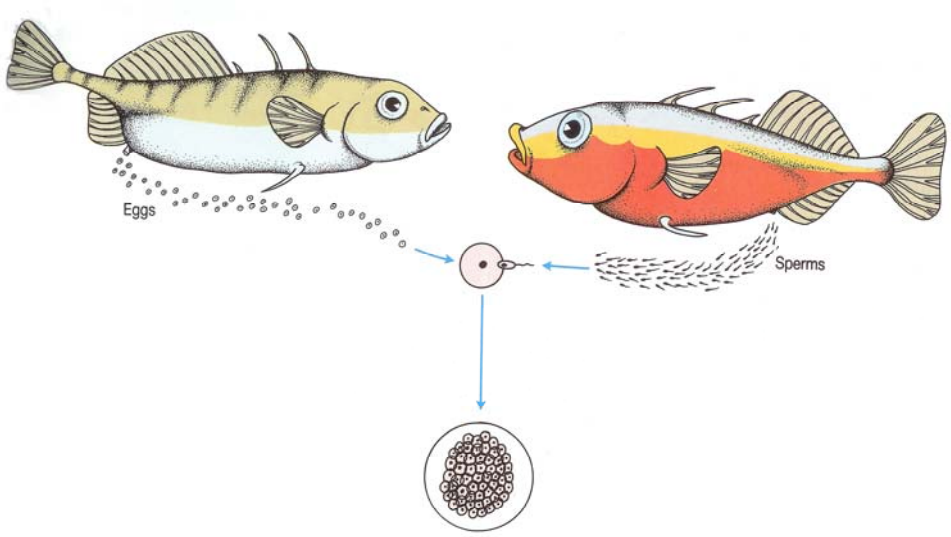
Echinoderms exhibit this type of reproduction.



Oral surface of a star fish.

Sexual reproduction

In sexual reproduction there are two parents, and each has sex organs, which produce **sex cells**. Male sex cells are **sperms** produced by sex organs called **testes**. Female sex cells are **eggs or ova** (ovum in singular), produced by sex organs called **ovaries**. In **fertilization** sperm enters an egg. A fertilized egg divides many times to form a ball of cells. The cells develop into a baby. A partly-formed baby is called an **embryo.**



When eggs are fertilized outside the female's body, it is called **external fertilization.**

In insects, reptiles, birds, and mammals the male puts his sperm into the female's body. So the eggs are fertilized inside her. This is called **internal fertilization.**

Development:

Animals **oviparous** can lay eggs with little or no other embryonic development within the mother. This is typical of fish, amphibians, reptiles, all birds, most insects and arachnids.
Some animals are **ovoviviparous**. The eggs are hatched inside the mother's body (or, in case of sea horse inside the father's). Non-oviparous fish, amphibians and reptiles are ovoviviparous.
Placental **viviparity** is employed by almost all mammals.

ACTIVITY 1

There are two mammals native to Australia that are oviparous. Which are they?

.