UNIT 2

The cell and the classification of living things

REVISION ACTIVITIES

SCIENCE PRACTICAL

Observing eukaryotic cells

WORK ON YOUR KEY COMPETENCES LS

Different types of cells

How is it possible that living things, such as bacteria, mushrooms or people, are very different, but are made up of the same units, cells?

Because living things are very different, it's logical to think that their cells are also very different.

To show that this isn't the case, in this task you'll investigate the similarities and differences between prokaryotic cells, eukaryotic plant cells and eukaryotic animal cells.

To present your results, you'll make a poster showing the different types of cells and their characteristics.

OXFORD INVESTIGATION

Go to your GENiOX Desktop.

Think and discuss

1. What does the title of the article make you think about?
2. The text mentions an action that fulfils Sustainable Development Goals (SDGs) 14 and 15. What are they?
3. What does the word *biodiversity* mean?
4. What does the word *conservationist* mean?
5. Are biological reserves the solution to loss of biodiversity?
6. Discuss how you, as students in ESO 1, could contribute to conserving biodiversity.

A marine reserve to fight the loss of biodiversity

Panama has taken a great step towards protecting its seas. This Central American country, rich in biodiversity, but threatened by climate change, has created a marine reserve in the Pacific Ocean. The reserve covers 67 742 km^2, which is almost the same size as the land mass of the country.

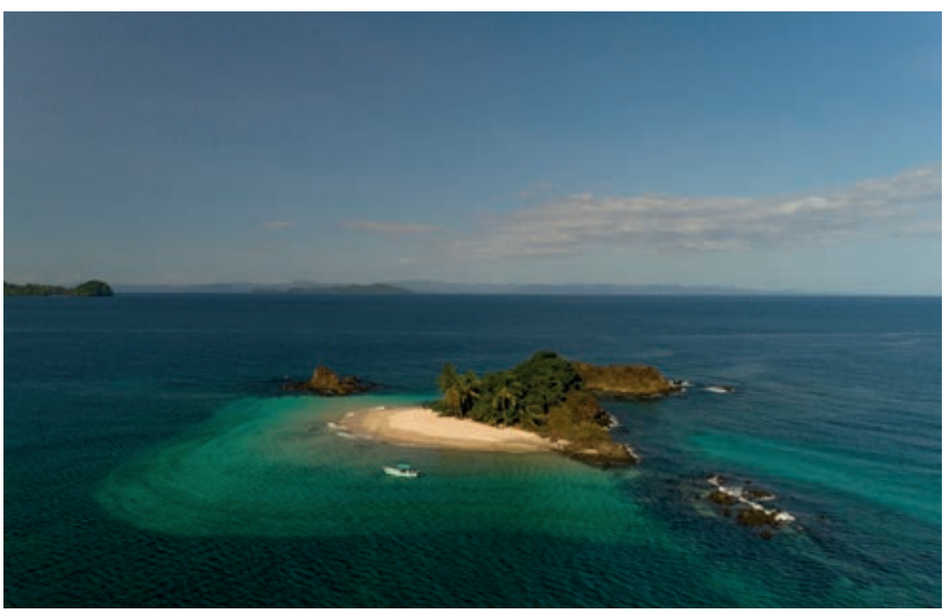
This protected area includes nine submerged mountain ranges, with underwater mountains that are sometimes over 3 000 m high. The zone is a feeding and breeding ground for sea turtles, marlins (or sailfish), sharks and whales, including species that are vulnerable or in danger of extinction.

The reserve is in the Cordillera de Coiba, which is a large area, rich in resources for fishing and also an important place for marine species to find food. Panama is one of the countries that is most affected by climate change, and by creating this reserve they fulfil the protection goals of the Convention on Biological Diversity, which was signed by 196 countries to conserve and promote the sustainable use of marine resources. Together with the neighbouring reserves in Colombia, the protected area is 121 341 km^2, making it the third largest marine reserve in the tropical Pacific.

Conservationists are very excited about this new reserve, created by decree last Tuesday afternoon, on World Oceans Day [...]

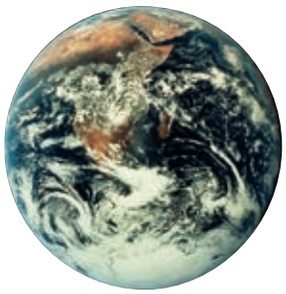
Protecting these areas is an investment for the future for people who live from marine resources and, indirectly, for the population of the world within the framework of the Sustainable Development Goals (SDGs).

Carlos Salinas Maldonado *El País*, June 2021 (Adapted)



Granito de Oro Island, Coiba National Park, Panama. Nature reserves are protected spaces which are created to conserve ecosystems which have great value. This may be because of their rarity, fragility, importance or uniqueness.

1 The special characteristics of the Earth

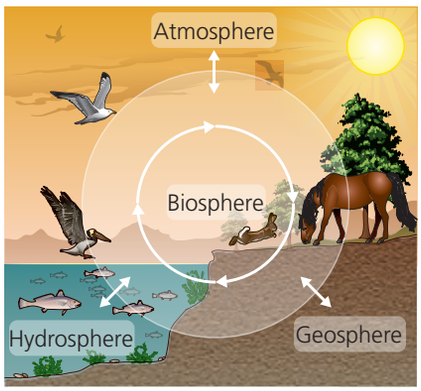


The Earth has a range of characteristics that allow life on our planet to exist.

- It is 149.6 million kilometres away from the Sun.
- It has an atmosphere.
- It has liquid water.
- It has basic chemical elements such as hydrogen, nitrogen, carbon, oxygen, and others.

How do these characteristics allow the development of life on our planet?

[1]**mild:** not severe or strong.



Interaction between the Earth's spheres.

The Earth is a dynamic combination of levels or subsystems that interact with each other.

- **The atmosphere.** This is the gaseous layer that surrounds the Earth. It controls the climate and the atmosphere we live in and allows us to breathe.
- **The hydrosphere.** This consists of all the bodies of water in their different states on the surface of the Earth. Aquatic life forms live and develop in the areas of liquid water.
- **The geosphere.** This is the solid part of the Earth. It mainly consists of rocks and minerals. This supports the development of life on Earth.
- **The biosphere.** This is not an actual layer, but consists of all the living things on the Earth, together with the areas they inhabit. So the biosphere includes all living things, part of the atmosphere (the troposphere), the hydrosphere and the surface of the geosphere.

1.1. The Earth, the planet of life

These are the characteristics that make life possible on the Earth.

- **The distance between the Earth and the Sun** allows the presence of mild temperatures on the Surface. Although these temperatures aren't constant, because the Earth's orbit is elliptic not circular, they are always habitable. This characteristic means there is liquid water.
- **The presence of liquid water** is essential for cellular processes and the vital functions of living things. The interior of our cells as well as the liquids we produce mostly consist of water.
- **The Earth's atmosphere** protects living things from UV radiation and creates the greenhouse effect. The greenhouse effect helps to keep the Earth's temperatures mild. It also contains essential gases for life to exist, such as oxygen for respiration and carbon dioxide, which together with water and sunlight, allow photosynthesis.
- **The presence of basic chemical elements.** When these elements are combined, they become the molecules that build organic matter. Important elements are carbon, oxygen, hydrogen and nitrogen.

CLIL activities

1 There are currently numerous space missions which are studying the planets and satellites of our solar system looking for life, and also to see if they could be appropriate for human habitation in the future, if it is necessary. In small groups, discuss why these missions probably won't discover a place for humans to live in our solar system.

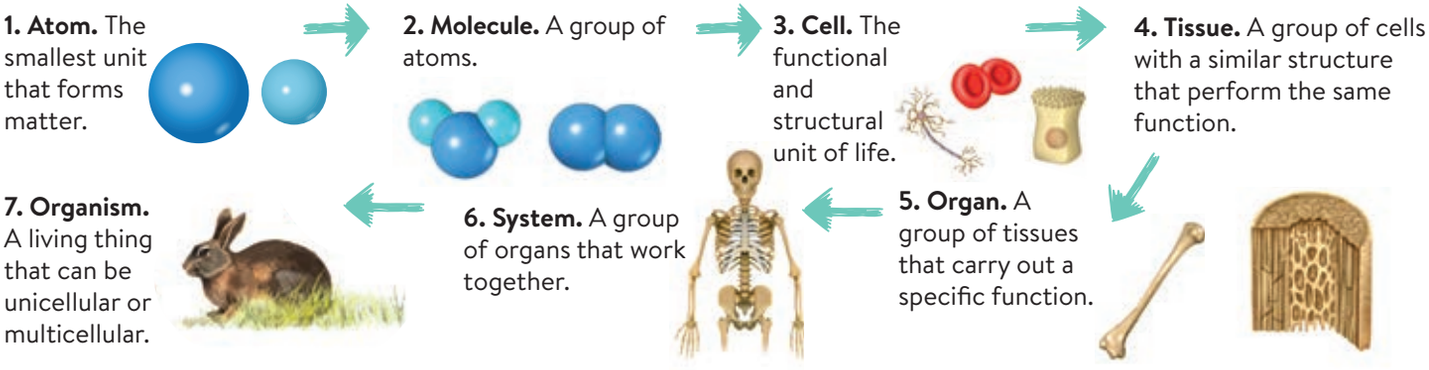
CLIL activities

2 In groups of four, prepare a short presentation about the Earth's special characteristics.

3 Listen to the four statements and, in your notebook, write *true* or *false*. Correct the false statements.

2 The differences between living and non-living things

The diagram below shows levels of organisation in the structure of the matter that forms living things. *Which of these levels do both living and non-living things share?*

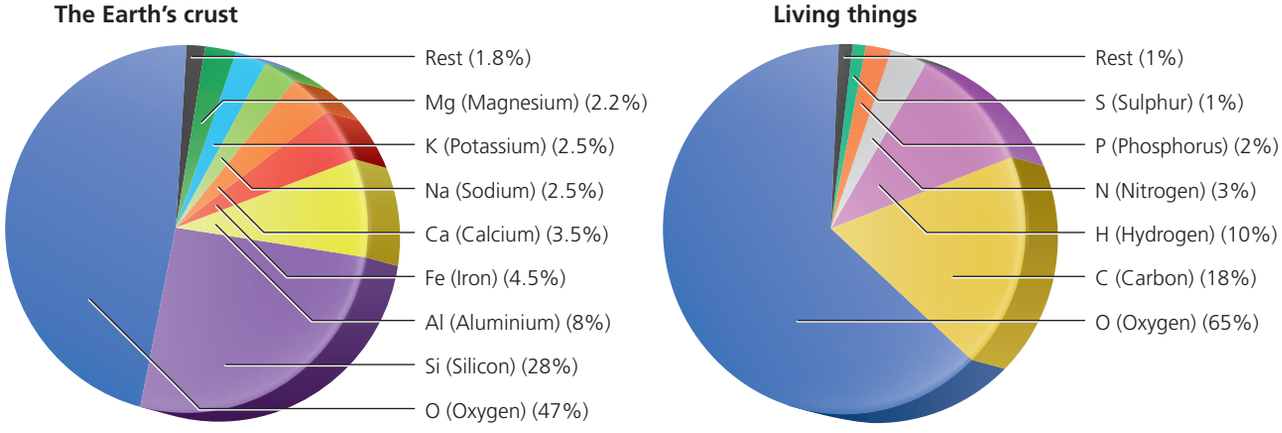


All matter in the Universe, including all living things on Earth, is made up of tiny particles called **atoms**. Atoms of the same type group together to form **chemical elements**. Chemical elements group together to form **molecules**.

There are many different living things on Earth, but they all have some characteristics in common.

- Their **chemical elements** are different from the chemical elements in non-living things. Living things have **exclusive molecules** that can't be found in non-living things.
- They are made of **cells**.
- All perform the **vital functions**: nutrition, interaction and reproduction.

2.1. Chemical elements that are only found in living things



Percentages of chemical elements that form the Earth's crust and living things.

Which is the most abundant element in both living and non-living things? Which elements are most common in living and in non-living things?

As you can see, some elements are abundant in living things, but are not so abundant in the Earth's crust. The elements that form living things are called **bioelements**.

CLIL activities

4 STEAM **The table below shows the amount of water that different living things contain. What's the average amount of water?**

Organism	Water (%)
Adult person	63
River crab	77
Snail	80
Jellyfish	95
Algae	98
Fungus	91
Lichen	55

To do this, add all of the percentages and divide by the number of entries (in this case seven).

Are vitamins biomolecules?

Vitamins are organic biomolecules which have various chemical compositions.

They help with the regulatory functions of an organism, such as obtaining energy, bone calcification and the formation of red blood cells.

2.2. Differences between living and non-living things

Bioelements are the units that make up living matter.

The most abundant **biolements** are also known as **primary biolements**. They're **carbon** (C), **hydrogen** (H), **oxygen** (O), **nitrogen** (N), **phosphorus** (P) and **sulphur** (S).

Other bioelements, such as **calcium** (Ca), **sodium** (Na), **potassium** (K) and **iron** (Fe) are less abundant, but they're still essential for living things.

Bioelements combine to create **biomolecules**. Living things are made up of biomolecules.

There are two types of biomolecules.

- **Organic**. They're only found in living things and their main element is carbon. They can be carbohydrates, lipids, proteins or nucleic acids.

Biomolecules	Functions	Examples
Carbohydrates	They release energy immediately in the organism.	Glucose, lactose and sucrose
Lipids	They store energy that may be needed in the future.	Fats, waxes and cholesterol
Proteins	They form structures such as skin, hair and muscle.	Haemoglobin, collagen and keratin
Nucleic acids	They store genetic information which is needed for cells to work adequately.	DNA and RNA

- **Inorganic**. They're found in living things and non-living things. They're water and mineral salts. Water is the most abundant inorganic biomolecule in living things.

Biomolecules	Functions	Examples
Water	It takes part in multiple functions, such as transport of substances or thermal regulation.	Water
Mineral salts	They participate in the formation of rigid structures in the body, such as bones, and are involved in important cellular processes.	Calcium carbonate and calcium phosphate

CLIL activities

5 **Listen and write *organic* or *inorganic*.**

6 **In your notebook, write two true sentences and one false sentence about living and non-living things. Then test a classmate.**

7 **Classify the following molecules as organic or inorganic:** calcium carbonate, lactose, sodium chloride, haemoglobin, cholesterol, water and DNA

8 **Which biomolecule is described in each sentence?**

a. It's the most abundant biomolecule in living things.
b. I need these when I run really fast.
c. I need these to have strong, healthy muscles.
d. It's responsible for controlling the information in cells.

3 Cells

Groups of organic and inorganic compounds form complex structures called **cells**. Cells are the smallest structures that can perform vital functions. Cells are the smallest living things that exist.

Cells are the structural and functional **units**[1] of living things.

Do you know how many cells we have in our body? And in a plant? And in a bacterium?

A human body that weighs approximately 70 kg and is 170 cm tall has around 30 billion cells. A plant of a similar size would have fewer cells because plant cells are bigger than animal cells. Bacteria, in contrast, are just one individual cell.

Living things can be:

- **unicellular**. Formed by a single cell. Examples of unicellular organisms can be bacteria, protozoa, certain fungi or algae.
- **multicellular**. Formed by many cells, like plants and animals. Their size varies depending on the number of cells in the organism.

3.1. Cell theory and the discovery of cells

In 1665, the scientist **Robert Hooke** described a cell for the first time. He looked at a thin layer of **cork**[2] with a microscope that he had made and saw repeated small polygonal structures. He named these structures *cella*, a Latin word which means 'inner chamber' or 'small room'.

Key points of cell theory

- All living things are made of cells.
- All cells come from the division of other pre-existing cells.
- Cells are the basic unit of life.

In 1838, **Matthias Schleiden** and **Theodor Schwann** proposed the idea called **cell theory**, which was later developed by other scientists.

Why can't we see cells?

Most cells are too small for us to see because they're microscopic. The unit of measurement that we use for cells is the **micrometre** (μm):

$$1\ \mu m = 0.001\ mm = 0.000\,001\ m$$

$$1\ m = 1000\ mm = 1000\,000\ \mu m$$

[1]**unit:** complete, individual thing that can be a component of something bigger.

[2]**cork:** impermeable, floating material that comes from a tree.

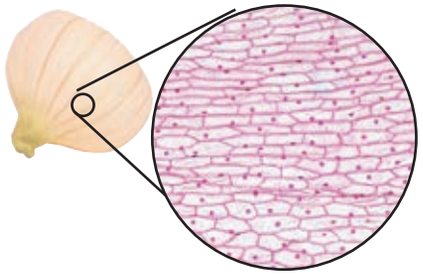
CLIL activities

9 **Why are cells called 'the building blocks of life'? Discuss your ideas with a classmate.**

10 **Find information and classify the following living things as unicellular or multicellular:** yeast, Staphylococcus, Ephemeroptera, Lepiota, diatom and Fucus.

11 **Discuss the importance of the statements of cell theory. Have a class debate to do so and answer the following questions:** *Are there living things with no cells in them? Do cells carry out vital functions? Is there a smaller level of organisation than cells that's alive?*

12 **Listen to the interview about cell theory and make a list of five key ideas in your notebook. What has more cells, an animal or a plant?**



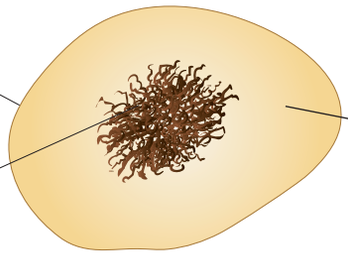
Cells in onion skin seen using an optical microscope

3.2. Cell types

All cells have the same three basic components: plasma membrane, cytoplasm and nucleic acid.

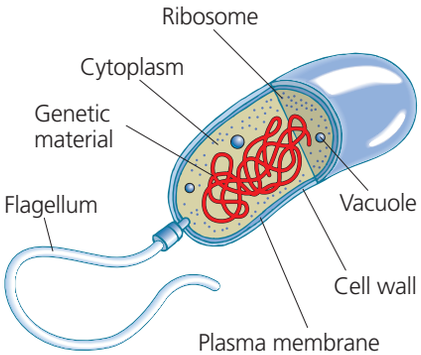
Plasma membrane. This layer surrounds the whole cell and allows the entrance and exit of substances.

Nucleic acids. They contain genetic information which is essential for the **adequate functioning of the cell.**



Cytoplasm. The fluid inside the cell where we find **organelles.** Organelles are specialised structures that perform **specific** cell functions. Examples of these functions are obtaining energy for the cells or storing substances.

Cells can be eukaryotic or prokaryotic depending on their internal structure.



Prokaryotic cells

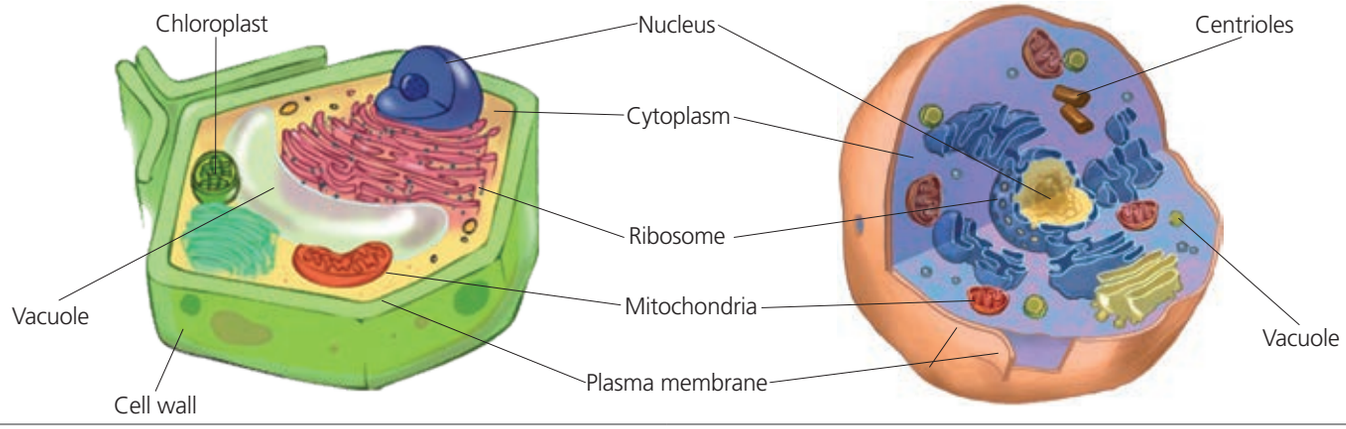
- They are between 0.5 and 10 μm in size.
- They carry genetic material (DNA) in the cytoplasm.
- A **cell wall** surrounds the plasma membrane.
- They don't have many organelles. They have ribosomes, which create proteins, and vacuoles, to store substances.
- Some have additional structures, such as a **flagellum**, to help them move.

Eukaryotic cells

- They are between 10 and 150 μm in size.
- The **cell's nucleus** contains genetic material.
- Not all of them have a cell wall around the plasma membrane.
- They have a variety of organelles.

The two main types of eukaryotic cells are **animal cells** and **plant cells**.

Plant cell	Animal cell



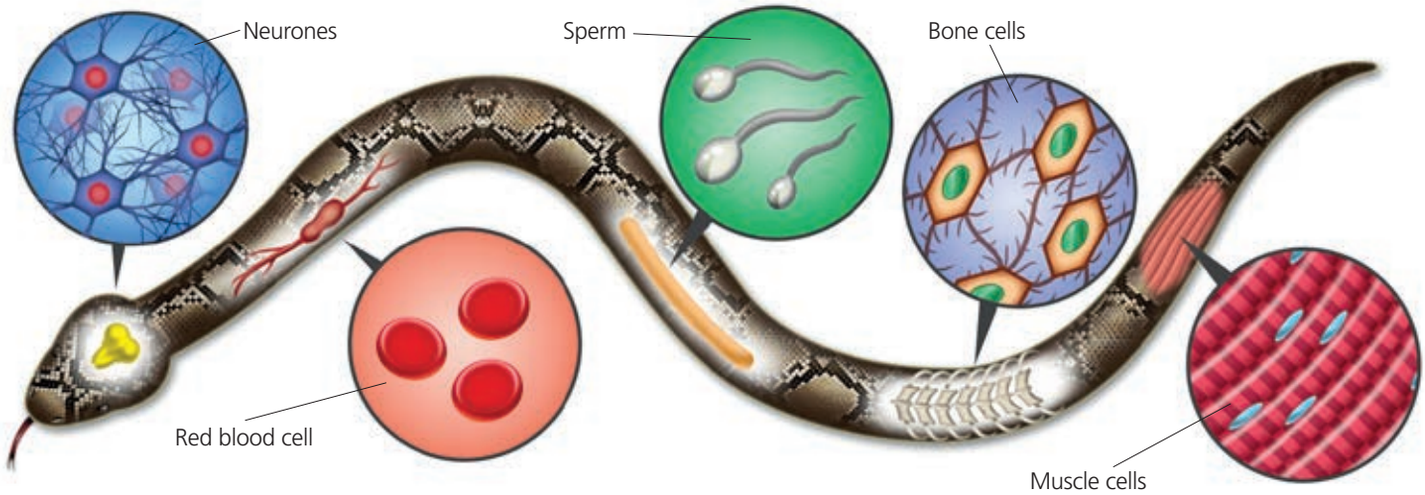
CLIL activities

13 LS **Compare the structures of animal and plant cells. Which structures do plant cells have that animal cells don't and viceversa?**

14 **Listen to the podcast. Draw a table in your notebook to write down what they say about eukaryotic and prokaryotic cells.**

Cell specialisation

Multicellular eukaryotic organisms contain **specialised cells** that have different functions. Each cell uses different **DNA** information to carry out its specific function.



Cell specialisation has a series of advantages.

- **Longevity**. Damaged cells or old cells are replaced by new cells. This allows multicellular organisms to have more chance of survival.
- **Division of labour**. Each cell type performs a particular function, so all the cells in an organism can perform different tasks at the same time.
- **More efficiency**. Given that cells are specialised in doing a particular task, they are better at it.

CLIL activities

15 Can a bacterium have different types of cells? Why?/Why not?

16 LS Draw a eukaryotic plant cell and an animal cell. Discuss their differences with a classmate.

17 LS In your notebook, write the name of the eukaryotic cell part that performs the following functions:

a. It regulates the entrance of substances.
b. It stores and protects genetic material.
c. It gives consistency to a plant cell.
d. It contains organelles.

18 LS What advantages and disadvantages do unicellular organisms have compared to multicellular ones?

19 Identify the organelle responsible for:

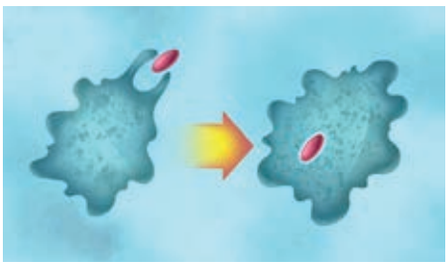
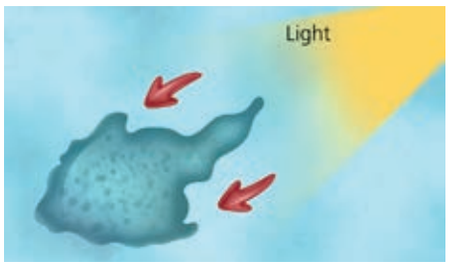
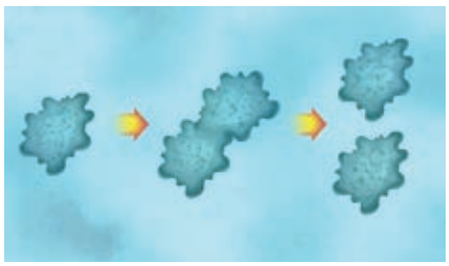
a. protein synthesis.
b. photosynthesis.
c. cell respiration.
d. storing substances.

20 With a classmate, make a Venn diagram to compare and contrast a bacterium cell and a white blood cell. Which is more complex?

21 Is the shape of cells related to the function they perform? Find examples to illustrate your answer.

4 The vital functions of living things

Living things come in all shapes and sizes, but they all perform the vital functions. *Do you know how plants perform the vital functions? And bacteria? What's the purpose of each vital function?* You can think about vital functions of animals to help you answer the questions.

Nutrition	Interaction	Reproduction
		
		
		

[1]**perpetuate:** make something continue in the future.

[2]**feed on:** eat something as food regularly.

Organisms need matter and energy to live and **perpetuate**[1] their species. In order to do this, they need to interact with their environment.

Living things perform the vital functions of nutrition, interaction and reproduction.

4.1. Nutrition

The objective of nutrition is to take in **matter** to renew and maintain the organism's structures and to **produce energy** to perform the vital functions.

Depending on the matter, nutrition can be autotrophic or heterotrophic.

Autotrophic	Heterotrophic
Living things that take in inorganic matter from the environment and transform it into organic matter perform autotrophic nutrition. Examples are plants, algae and some bacteria. Autotrophic organisms are food for heterotrophic organisms.	Living things that take in organic matter from the environment are heterotrophic organisms. They **feed on**[2] other living things or their remains. Examples are animals, fungi, protozoa and some types of bacteria.

4.2. Interaction

Living things need to **sense changes** in their environment and in their bodies so they can **respond** to them. This process is called **interaction**.

- Changes in the environment are known as **stimuli** (for example, changes in the amount of sunlight or temperature or the presence of chemical substances). Stimuli are perceived by **receptors** (for example, sense organs in animals and some specialised cells in plants).
- Living things process stimuli and produce responses from **single cells** or from **complex coordination systems** such as the nervous system in animals.
- **Effectors** are complex structures that execute responses to stimuli. Muscles, for example, generate movement and glands secrete chemical substances and eliminate toxins.

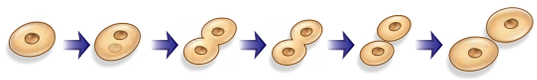
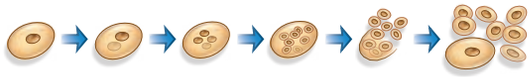
[1]**offspring:** young of an animal or plant

[2]**split:** divide into separate parts

4.3. Reproduction

Reproduction is the creation of **offspring**[1]. Offspring guarantee the survival of the species.

There are three types of reproduction:

Asexual	Sexual
• A single individual generates multiple identical descendants. • Unicellular organisms and some multicellular ones reproduce this way. There are three main types: • **Binary fission.** One cell **splits**[2] into two cells of a similar size.  • **Gemmation.** One cell splits into two cells of different sizes.  • **Sporulation.** The nucleus of a cell divides multiple times, creating lots of cells. 	• It requires the reproductive cells (gametes) of two individuals (male and female) to join together. • Multicellular organisms perform sexual reproduction. • It takes longer than asexual reproduction. • Descendants are not identical to their parents.
	Combination of sexual and asexual
	• Some species can reproduce both sexually and asexually during their life cycles. Examples of these organisms are mosses, ferns and jellyfish.

CLIL activities

22 Explain to a classmate what the vital functions are and why they are important.

23 What is the difference between autotrophic and heterotrophic nutrition? What is the relationship between organisms that perform autotrophic and heterotrophic nutrition?

24 LS When you touch a hot pan accidentally, you remove it immediately. Identify the stimulus, the response to it and the body structures involved.

25 Find two main differences between sexual and asexual reproduction. Discuss the differences with a classmate.

26 In groups of three, choose a living thing and give a short presentation about its vital functions.

27 Listen to the reporter. Summarise the difference between sense organs and effector organs in one sentence.

5 The classification of living things

A friend has given you a bag that has a lot of different types of biscuits in it. You want to organise them in a box to see the different types easily, instead of taking a biscuit from the bag and not knowing which it is. To do this, you've decided to put similar biscuits in groups to make it easier to choose the biscuit you want.

What criteria would you use to put the biscuits into groups? There's an example given here.

Biscuits with a filling

Biscuits without a filling

What do you think about the criterion 'it's very tasty' to find a particular type of biscuit? Would everyone find the biscuit you're referring to? Is it useful to use the criterion 'dough without chocolate' in relation to the group of biscuits without a filling?

CLIL activities

28 What is a classification criterion? Write three criteria to divide your class into three groups.

29 Listen and explain the meaning of *classification* in your notebook. Then identify the phylum and class of a ladybird.

Classifying is grouping different elements according to common characteristics. These criteria are known as **classification criteria**.

The criteria to classify living things must be:

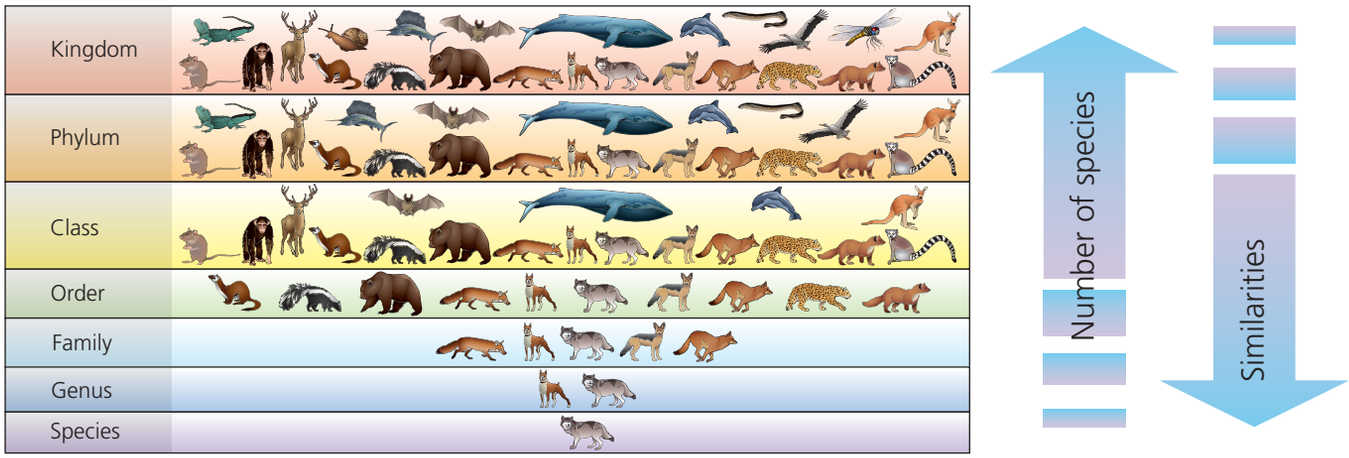
- **natural**. They must be based on functional or anatomical aspects, not on random criteria.
- **objetive**. They can't depend on the likes and dislikes of an individual.
- **discriminatory.** They must be characteristics that some of the elements we're classifying have, but not all of them.

Can you think of ways to classify the biscuits by creating smaller groups of similar biscuits? Can you do so until you only have one left? You can see an example below.

Taxonomy is the science of **classifying** living things according to **natural criteria**. It classifies living things into groups of organisms that have shared characteristics.

Each group of living things, or taxon, is assigned to a **taxonomic category**. The most basic category is the species.

Taxonomic categories



Taxonomic categories

A **species** is a group of individuals that have many common characteristics and can reproduce and have **fertile**[1] offspring.

To name species we use the system of **binomial nomenclature**, invented by **Carl Linnaeus** in 1753. Each species has a name with two Latin words written in italics. The first word is the genus. The second word describes a specific characteristic of the species.

For example, the binominal nomenclature of a cork oak is:

Quercus suber

Quercus is the name of the genus.

suber means cork in Latin.

[1]**fertile:** able to reproduce.

[2]**dichotomous key:** sets of pairs of short, objective, discriminatory descriptions that allow the identification of a species.

CLIL activities

30 Complete the following **dichotomous key**[2] in your notebook to classify a fish, a bear, a bird and a bat.

1. It has fins.
   It's a ...
   It doesn't have fins. Go to 2.
2. It has a beak.
   It's a ...
   It doesn't have a beak. Go to 3.
3. It can fly.
   It's a ...
   It can't fly. It's a ...

31 Research and classify a dog and a holm oak. Start with the kingdom and finish with the species.

32 Can a genus include members of different families or members of different species?

33 In groups, write a series of questions using the taxonomic categories table. Then do a class quiz.

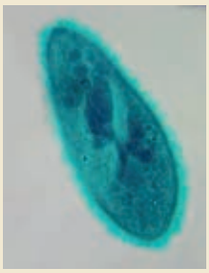
Explain how ...

Why do ...?

What's the difference between ...?

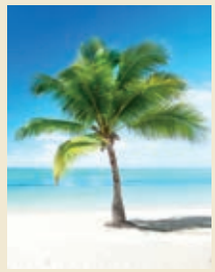
6 The classification of living things: the five kingdoms

Imagine you're a biologist. *What are the biggest differences between the pairs of living things in the photos? Would you be able to identify groups of living things that share the characteristics you've described?*

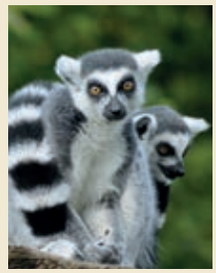

Protozoa


Mushroom


Bacteria


Palm tree


Olive tree


Lemur

In 1969, **Robert H. Whittaker** proposed five kingdoms based on three criteria: type of cell, number of cells and type of nutrition.

Then, in 1985, **Lynn Margulis** improved the classification and gave names to the five kingdoms.

Kingdom	Monera	Protoctista	Fungi	Plant	Animal
Example					
Type of cell	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
Cell organisation	Unicellular	Unicellular or multicellular	Unicellular or multicellular	Multicellular	Multicellular
Tissues	No	No	No	Yes	Yes
Type of nutrition	Autotrophic or heterotrophic	Autotrophic or heterotrophic	Heterotrophic	Autotrophic	Heterotrophic
Living things	Bacteria	Protozoa and algae	Yeasts, moulds and fungi	Hepaticae, mosses, ferns and spermatophytes	Invertebrates and vertebrates

In 1990, **Carl Woese** suggested a new category to go above the kingdom: the **domain**. There are three domains: *Archaea*, *Bacteria* and *Eukarya*.

CLIL activities

34 **In your notebook, identify the kingdoms these living things belong to:** porcupine, oak, shiitake mushroom, streptococcus and green algae.

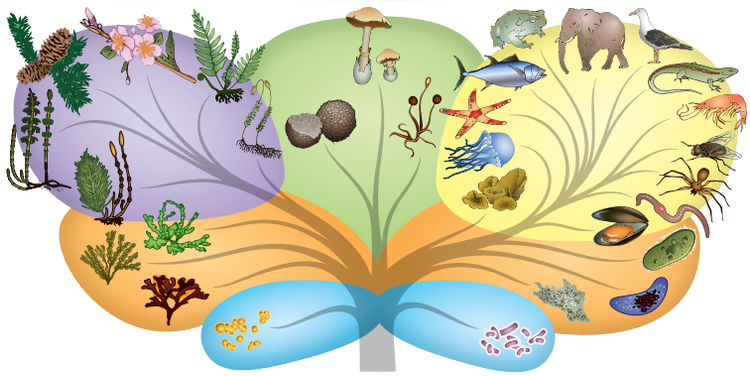
35 **Which kingdoms have both tissue and eukaryotic cells?**

36 **Listen to the students make statements about the five kingdoms and write *true* or *false* in your notebook. Correct the false statements.**

7 Biodiversity

Did you know that scientists have described 1.75 million species of living things? Did you know that the total estimated number of species is 50 million? How is it possible that so many species of living things have originated from a single organism?

All living things come from the first cell that existed. This cell is the base of the 'tree of life'. The branches of the tree are made up of the descendants of that original single cell. They reproduced and multiplied as they changed over millions of years. Those changes allowed some individuals to adapt better to their environment and to survive and reproduce.



The 'tree of life'. *Where would you be?*

This process, which is called **biological evolution**, continues to take place today. It's this process which has allowed millions of different species of living things to exist on the Earth.

The variety of different living things on the Earth is called **biodiversity**. It includes the variety of individuals within a species, as well as of species and ecosystems.

Preserving[1] **biodiversity** is essential for several reasons:

- Living things provide us with a great variety of materials, food and medicines. Some also maintain the quality of water and soil.
- The extinction of one species affects all the other species that interact with it. If habitats are damaged or destroyed, the living things that live there are also affected.

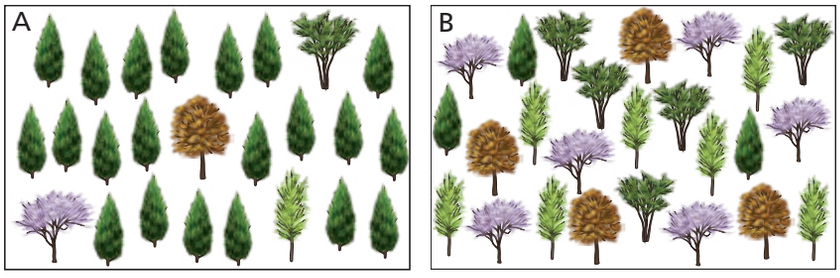
[1]**preserve:** protect, keep something in its original state.

CLIL activities

37 STEAM **Our planet's current deforestation rate is equal to the size of 20 football fields disappearing every minute. One football field is 5 000 m². Calculate how many square metres of forest disappear:**

a. in one day. **b.** in one week.

38 **The biodiversity of an ecosystem is not exactly equal to the number of species that live in it; we must also consider how abundant the species are, which means finding out the total number of individuals of each species. Which of the two ecosystems would you say has a greater biodiversity, A or B? Give reasons for your answer.**



39 **In groups, discuss how humans can have a negative effect on biodiversity. Give examples and share your ideas with the class.**

40 **Why is it important to preserve biodiversity? In your notebook, give examples of the effects of the disappearance of a species.**

Revision activities

The special characteristics of the Earth

41 **Explain why these statements are true or false.**

- **a.** The presence of water is essential for life.
- **b.** The atmosphere is not essential for life to exist.
- **c.** If the axis of rotation of our planet was perpendicular instead of tilted, we would still have the same amount of species on our planet.

42 **The table below shows the percentages of three gases in the atmosphere of different planets:**

Planet	Carbon dioxide	Nitrogen	Oxygen
Venus	96%	3%	0%
Earth	0.036%	78%	21%
Mars	95%	3%	0%

- **a.** What are the main differences in the composition of the atmosphere of Venus, Earth and Mars?
- **b.** Do you think there's a link between the composition of the atmosphere and the presence of life? Explain your answer.

Differences between living and non-living things

43 **Identify three characteristics that differentiate a rock and an organism.**

44 **Define *atom*, *molecule* and *organism*. Are levels of organisation exclusive to living things? Give reasons for your answer.**

45 **A doctor visited an ESO 1 class to talk about the importance of a good diet for the proper functioning of our cells. She said that we need to eat foods rich in some bioelements to avoid suffering from certain diseases. For example, eating nuts such as hazelnuts, walnuts or pistachios, certain lean red meats (veal), liver, and black pudding, helps to prevent anaemia.**

- **a.** What is anaemia?
- **b.** What bioelement do each of the foods mentioned have?
- **c.** Which important function do those particular bioelements perform in our body?

46 **Which biomolecule stores the essential information needed for a cell to function? Which one performs an energy function?**

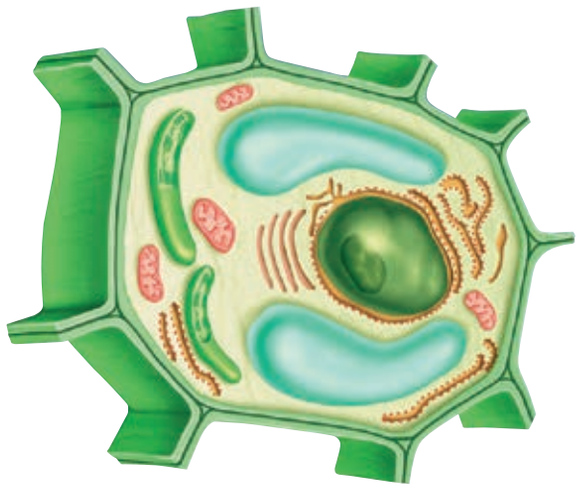
The cell

47 **Write the function performed by the following cell structures:**

- **a.** nucleus.
- **b.** plasma membrane.
- **c.** chloroplast.
- **d.** mitochondria.

48 **Explain what cell specialisation is, which organisms have it and its advantages.**

49 **LS Copy the following diagram in your notebook and answer the questions.**



- **a.** Say what type of cell it is and locate and label the following cell structures: cytoplasm, mitochondria, nucleus, plasma membrane, cell wall, vacuole and chloroplast.
- **b.** Which of the structures are found in all cells?
- **c.** Which structures are found in animal eukaryotic cells but are not in this diagram?
- **d.** Explain why this cell is larger or smaller than a bacterium?

The life processes of living things

50 **The PE teacher has asked pupils in ESO 1 to run with a partner for 10 minutes. One student fainted after 5 minutes, but his partner continued and had no problems. The boy that fainted didn't have breakfast but the girl that finished did.**

- **a.** What's the relationship between eating breakfast and physical activity?
- **b.** Which vital function is related to this?

51 Make a table and show if these concepts relate to autotrophic or heterotrophic nutrition, or both: *it's carried out by plants, they take organic matter from the environment, protozoa do this, they produce organic matter, they take inorganic matter from the environment, it's carried out by some bacteria, it's performed by animals.*

52 Identify the vital function that relates to the following examples:

- **a.** A zebra escapes when it senses the presence of a lion.
- **b.** A sunflower turns towards the Sun.
- **c.** A bird incubates its eggs in a nest.
- **d.** Adding humus to a plant helps the plant grow.
- **e.** The pollen of some plants is transported by the wind.

53 STEAM A colony of bacteria is growing in a lab. Each bacteria can split into two every 30 minutes, thanks to the process of binary fission. If there were 4000 bacteria to start with, how many would we have after 1 hour?

54 In a biology class, students have watched a documentary about the enormous amount of plastic in our seas and oceans. In the documentary, there were images of dead sea animals that had their stomachs full of plastics.

- **a.** Why did those animals die?
- **b.** How do plastics affect living things?

The classification of living things

55 If you had to classify living things, would you use external appearance as a criterion? Give reasons for your answer.

The five kingdoms

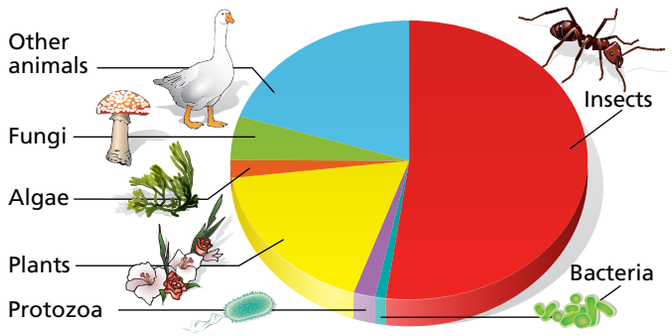
56 If we classified living things using six kingdoms instead of five, which kingdom would you split into two? Give reasons for your answer.

57 Make a table and identify the characteristics of each kingdom.

- **a.** Type of cell
- **b.** Cell organisation
- **c.** Presence of tissues
- **d.** Nutrition

Biodiversity

58 Look at the pie chart and order the kingdoms according to how biodiverse they are.



59 Define biodiversity. If we estimate that currently there are 5 million species, why do you think it's so important to protect them? What are the possible consequences of a species becoming extinct?

Study skills

I Prepare a summary of the unit that answers the following questions:

- *How are living and non-living things different?*
- *What are the main biomolecules that make up living things?*
- *What is a cell?*
- *What are the similarities and differences between a prokaryotic and a eukaryotic cell?*
- *What are the vital functions of living things?*
- *What are the large groups of living things and what are their characteristics?*
- *What are the origins of biodiversity?*

II Create a mind map that contains the following concepts: *levels of organisation, fungi, eukaryote, bioelements, plant cell, reproduction, biomolecules, nutrition, cells, Protista, vital functions, animal cell, kingdoms, Monera, plants, animals, relationship and prokaryote.*

III Create your own glossary of scientific vocabulary.

Define the following terms:

biodiversity, bioelement, biomolecule, cell, cytoplasm, species, stimulus, eukaryotic, plasma membrane, organelle, prokaryotic, receptor, kingdom.

Complete your glossary with other terms related to the subject.

Passnotes Digital Revision activities Concept map

Science practical

Observing eukaryotic cells

The discovery of the cell is closely linked to the invention of the microscope. In this practical activity you'll be observing eukaryotic plant cells and eukaryotic animal cells in order to note some of their differences.

Before completing the activity, you can watch how to do it in the video

OBJECTIVES

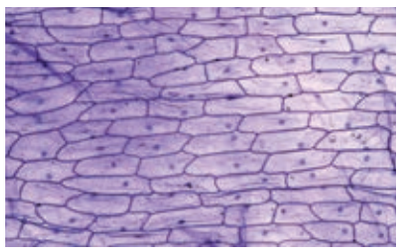
- Learn to use a microscope
- Differentiate eukaryotic plant and animal cells

MATERIALS

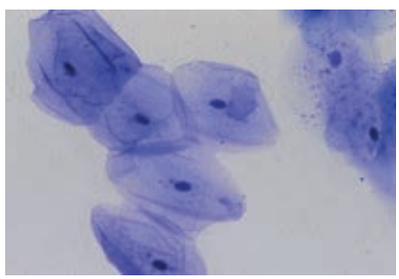
- microscope
- blotting paper
- water
- slides
- cover slips
- tweezers
- onion
- toothpick
- methylene blue

METHOD

1. Cut the onion and separate a part of the thin inner layer.
2. Use the tweezers to place the thin layer on the slide. Try to extend the layer evenly over the slide.
3. Add a drop of water to the sample and spread it well. Remove excess water using the blotting paper.
4. Add a drop of methylene blue. Leave it to act for 5 minutes and remove any excess liquid with blotting paper.
5. Place a cover slip over the sample.
6. Scratch the inside of your cheek with a toothpick and spread the sample over another slide.
7. Repeat steps 4 and 5. Next, place one of the samples in the microscope and hold it with the tweezers so that it doesn't move.
8. Begin by observing the sample using the lowest magnification. To focus, first change the course adjustment and then the fine adjustment.
9. Write in your notebook the characteristics of the cells observed and make your own drawings.
10. Use the highest magnification of the microscope to observe the sample. Draw the sample and make notes describing everything you see



Cells of the skin of the onion



Cells of the oral mucosa

Analyse the experiment

1. **What magnification did you use first?**
2. **Answer the questions taking into consideration the magnification of the eyepiece and objective.**
   a. What was the total magnification you used when you used the lowest magnification lenses?
   b. And when you used the highest magnification?
3. **What's the reason for using methylene blue?**
4. **What's the darker dot inside the cells?**
5. **Draw your own conclusions about this practical activity and explain the differences you have observed between the two cell types.**

Experiment video Lab report

Work on your key competencias

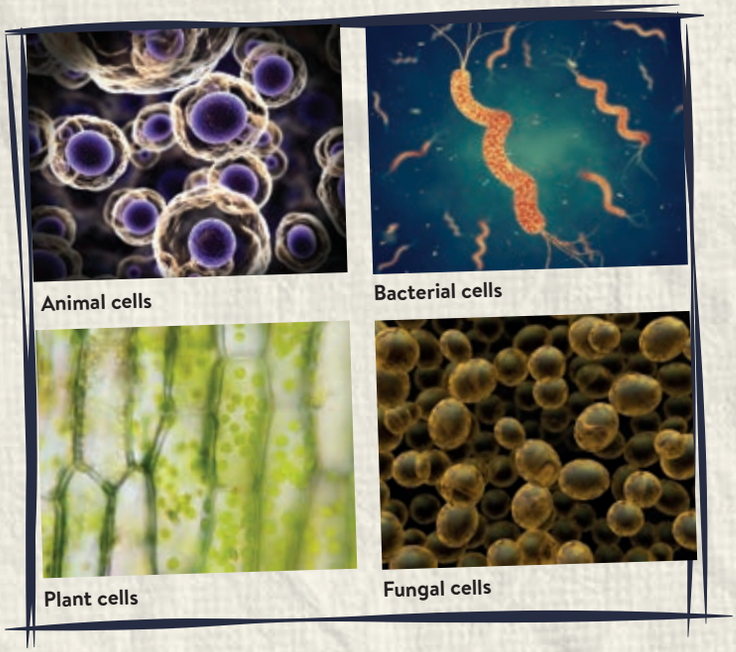
Different types of cells Poster

How many types of cells are there in nature?

All living things are made up of cells, or at least one. All cells share three components. The first is an external layer, the plasma membrane, which surrounds the cell and allows the entrance and exit of substances. The second is an internal liquid, the cytoplasm, which contains specialised structures called organelles. The third is a nucleic acid molecule, which contains the genetic information.

Different species of living things have different numbers of cells and these cells have different internal structures.

The **aim** of this task is to investigate the similarities and differences between the cells that make up living things: prokaryotic cells, animal eukaryotic cells and plant eukaryotic cells. You'll create a poster to present the results of your investigation.



Research

1. Find out about the parts of a cell and the function of each one. Don't use only one source of information, consult various sources to check the data you find.
2. After your research, draw a diagram of the steps you should follow in order to observe cells with their internal organelles. It may be useful to watch the video of the experiment, *Observing eukaryotic cells*.
3. Find out which the main cellular organelles are and the advantages and disadvantages of each type of cell.
4. Using the previous information, answer this question: What is the relationship between the function of organelles in eukaryotic cells and the vital functions of a multicellular living thing?

Development and writing up

5. Prepare a list of the characteristics of each type of cell and make a table to show the similarities and differences between each cell.
6. Create a poster with all the information you have selected. Remember the instructions for making a poster described in Unit 1:
   - Use a short title and define clear objectives. Don't forget the names and surnames of the authors.
   - Organise the work in paragraphs or sections.
   - Use images to clarify the information in the text. You can use your own photos if you have done practical research in the laboratory.
   - Include a bibliography with all the sources you consulted (texts and images).

Share your findings

7. Present the poster you have made and discuss your results with the rest of the class.