# Chapter 1: Characteristics and classification of living organisms

IGCSE Biology

# 1.1 Characteristics of living organisms

## Objectives:

**Describe** the characteristics of living organisms by defining the terms: *movement, respiration, sensitivity, growth, reproduction, excretion,* and *nutrition*

# Characteristics of living things

- In groups of approximately 5, create a list of characteristics of living organisms
  - Hint: what are things that all living organisms do?

# Characteristics of living things

- In your group of approximately 5, come up with a definition for each of the 7 characteristics of living organisms
  - *Movement*, *Respiration*, *Sensitivity*, *Growth*, *Reproduction*, *Excretion*, *Nutrition*

# Movement

an action by an organism causing a change of position or place

- Plants move when they grow
  - Roots move down into soil, leaves and stems move up toward light
- Animals move to obtain food/avoid being caught

# Respiration

the chemical reactions in cells that break down nutrient molecules and release energy

- Involves chemical reactions happening in cells to breakdown glucose
  - Oxygen is usually needed
- Glucose + oxygen → carbon dioxide + water
- Use energy for movment, growth, repair and reproduction

## Sensitivity

the ability to detect and respond to changes in the environment

- Plants respond to the sun by moving leaves to face the light
  - Some flowers open/close at day/night
- Animals have sense receptors (cells) for detecting light, sound, touch, pressure, and chemicals in the air and in food

# Growth

permanent increase in size

- Involves making more complex molecules such as proteins
- Plants grow throughout their lives
- Animals stop growing when they reach a certain size

# Reproduction

the processes that make more of the same kind of organism

- **Asexual reproduciton** involves one parent giving rise of offspring that are often identical to each other and to the parent
- **Sexula reproduction** involves two parent organisms producing **gametes** (sex cells) which fuse to give rise to the next generation
  - Offspring show **variation** - they are not identical to each other or to their parents

# Excretion

removal from organisms of toxic materials and substances in excess of requirements

- **Metabolism** is all the chemical reactions that occur in an organism
- Plants store waste substances in their leaves so they are removed when leaves fall off
- Animals breathe out carbon dioxide; other wastes leave the body in the urine

# Nutrition

taking in of materials for energy, growth and development

- Green plants - **photosynthesis**
  - energy from sunlight is absorbed and used to turn $CO_2$ and water into simple sugars
- Animals
  - eat plants/animals to gain energy and nutrients
  - process of taking in food is called **ingestion**

# Acronym to remember

M ovement

R espiration

S ensitvity

G rowth

R eproduction

E xcretion

N utrition

# 1.2 Classification

## Objectives:

- State that organisms can be classified into groups by the features that they share

# Classification

- Living organisms can be classified into 5 *major* groups called **kingdoms**:
  - Animals
  - Plants
  - Fungi
  - Protists
  - Prokaryotes (bacteria)
  - Organisms in each kingdom show similar features

# Classification

- Smallest grouping of organisms: **species**
- Kingdoms are subdivided into **phyla** (singluar: phylum)

- Kingdom, Phylum, Class, Order, Family, Genus, Species

# 1.2 Binomial System

## Objectives:

- **State** that organisms can be classified into groups by the features that they share
- **Define** species
- **Define** and **describe** the binomial system of naming species

# Binomial System

- Binomial system means ‘two names’
- A **species** is a group of individuals that look alike
  - live in the same habitat and breed together producing fertile offspring which can breed with one another
- Each species is given two name

# Binomial System

- First name is for the **genus**
  - group of species that are closely related but do not breed with one another
- Second name is the **trivial** name that is applied to one **species** within the genus
  - never use the trivial/species name on its own

# Writing the Binomial Name

- *Genus species* or <u>Genus species</u>
  - The Genus is always capitalized
  - The species is always lowercase
  - the full name must always be *italicized* (computer) **or** <u>underlined</u> (hand written), never both!

## Examples - try to guess the common name of the following animals and plants

1. *Canis latrans*
2. *Lynx rufus*
3. *Hadrurus arizonensis*
4. *Cercidium floridum*
5. *Carnegiea gigantea*

## Examples - try to guess the common names of the following animals and plants

1. *Canis latrans*
2. *Lynx rufus*
3. *Hadrurus arizonensis*
4. *Cercidium floridum*
5. *Carnegiea gigantea*

1. Coyote
2. Bobcat
3. Arizona Desert Scorpion
4. Palo verde tree
5. Saguaro cactus

# 1.2 Invertebrates

## Objective:

- List main features used to place invertebrate into the following phyla: nematodes, annelids, and molluscs

# Invertebrates

- Animals without a **vertebral column** or backbone
- 3 phyla of invertebrate (there are more than 3, but we're only talking about these three):
  - Nematodes
  - Annelids
  - Molluscs

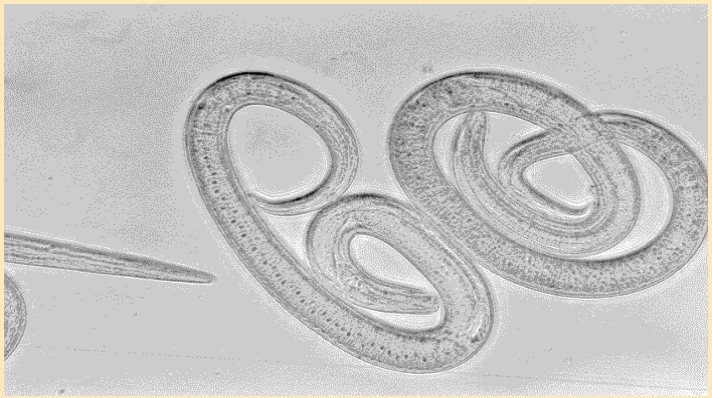
# Classifying Invertebrate Activity

In your table groups of 3, look through each of the pictures of invertebrates provided to you. On a separate sheet of paper, write the name of each organism and list characteristics that they show (describe each organism). Group the pictures together of which are similar based on your list of characteristics and determine if each group is a nematode, annelid, or mollusc.

# Nematodes/Roundworms

Characteristics

- Thread-like body
  - Tapers at the mouth and anus
- No obvious head
- No legs
- Non-segmented (smooth) body



Above: *Trichinella spiralis*
Below: *Mermis nigrescens*

# Annelids

Characteristics

- Soft bodies
  - made up of segments
- Some have paddle like extensions for moving
- Chaetae or bristles for making contact with mud/soil
- Most species live in the sea
  - Some live in soil and freshwater (streams, lakes, rivers)

Above: *Allolobophora chlorotica*
Below left: *Filogranella elatensis*
Below right: *Hermodice carunculata*

# Molluscs

Characteristics

- Soft bodies
  - non-segmented
- Muscular ‘foot’ (for burrowing/movement)
- Most species have 1-2 shells for protection
  - Some don’t have a shell

Above left: *Arion vulgaris*
Above right: *Theba pisana*
Below: Clams

# Molluscs

Characteristics

- Soft bodies
  - non-segmented
- Muscular ‘foot’ (for burrowing/movement)
- Most species have 1-2 shells for protection
  - Some don’t have a shell

Above: *Wunderpus photogenicus*
Below: *Histioteuthis heteropsis*

# 1.3 Arthropods

## Objective:

- List the main features used to place organisms into groups within the animal kingdom, limited to the main groups of arthropods: *myriapods*, *insects*, *arachnids*, *crustaceans*

# Arthropods

- Largest of the phyla in the animal animal kingdom
  - contains the largest number of species
- All arthropods have the following:
  - segmented body
  - external skeleton (**exoskeleton**)
  - jointed legs

# Exoskeletons

- allow arthropods to live on dry land
- when arthropods grow too big for their exoskeleton, they *moult* and grow a new one
  - some arthropods moult throughout their entire lives
  - others only moult at the beginning of their lives

# Crustaceans

- Body divided into:
  - **cephalothorax** (head-thorax)
  - abdomen
  - chalky exoskeleton
    - protection
  - 2 pair of antennae
  - 5-20 pairs of legs
  - Breathe using **gills**
  - **Compound eye**
  - Most live in water

# Myriapods

## Centipede

- long body with many segments
  - 1 pair of legs per segment
- fast moving
- carnivores
- powerful jaws
  - paralyze prey

## Millipede

- long body with many segments
  - 2 pair of legs per segment
- slow moving
- herbivores

# Insects

# Insects

This is the largest group in the arthropod phylum!

- bodies divided into 3 parts:
  - head, thorax, and abdomen
    - thorax has 3 pairs of leg (6 legs total)
    - 1 pair of antennae on head
    - compound eyes
    - breathe through **spiracles** (holes in the side of their thorax and abdomen)
  - Covered in a waterproof **cuticle**
    - prevents water loss on land
  - Can fly!
    - 2 pairs of wings

# Arachnids

- Bodies divided into 2 parts:
  - cephalothorax
  - abdomen
- 4 pair of legs (no wings)
- No antennae
- Several pairs of simple eyes
- Paralyze prey with poison fangs
- Spiders weave silk webs with **spinnerets**

# Exit Ticket *Name:* _____

Complete the following table, use either numbers or single words only!

| Feature | myriapods | crustaceans | insects | arachnids |
|---|---|---|---|---|
| # of pairs of legs | | | | |
| # of body regions | | | | |
| # of pairs of antennae | | | | |
| type of eyes | | | | |
| wings (yes/no) | | | | |

# 1.7 Dichotomous Keys

## Objective:

- Use simple dichotomous keys based on easily identifiable features

# Dichotomous keys

- are used to identify living things
- Dichotomous means: dividing into two

# Example

| | | |
|---|---|---|
| 1 | Has legs | Go to 2 |
| | Has no legs | Go to 4 |
| 2 | Has 6 legs | Go to 3 |
| | Has 8 legs | Spider |
| 3 | Has 1 pair of wings | Housefly |
| | Has 2 pair of wings | Wasp |
| 4 | Has a shell | Snail |
| | Has no shell | Earthworm |