

CHAPTER 1.1 – FIELDS AND CAREERS IN BIOLOGY

Biology

- » **Detailed study** of living things in the natural environment
- » Allows us to understand the structure, function in organisms, the relationships and interactions between organisms with their environment
- » Comes from the **Greek** word
 - Δ **'Bios'** means life
 - Δ **'Logos'** means study
- » **Botany**
Study of plant life
- » **Physiology**
Study of the function and mechanisms in organisms
- » **Genetics**
Study of inheritance and genetic variation
- » **Microbiology**
Study of microorganisms
- » **Ecology**
Study of interaction between organisms and their environment

Careers in Biology

- ◇ Doctors
- ◇ Surgeons
- ◇ Pharmacists
- ◇ Biologists
- ◇ Ecologist

The contribution of Biology in everyday life

- **Medical**
In Vitro fertilisation, family planning, plastic surgery and gene therapy
- **Food Production**
Use of microorganisms in the production of cheese, soy sauce, tapai and tempe
- **Pharmaceutical**
Production of synthetic vitamins, vaccines, insulin and synthetic enzymes
- **Agriculture**
Transgenic crops and animals, hydrophobic and aeroponic technology

CHAPTER 1.2 – SAFETY AND RULES IN BIOLOGY LABORATORY

Laboratory equipment

- + **Emergency Shower Station**
 - ♥ Used when chemicals or hazardous substances come into contact with the skin
- + **Fume Hood**
 - ♥ To avoid breathing in hazardous gases like **chlorine**, **bromine** and **nitrogen dioxide**
- + **Eye Wash Station**
 - ♥ Used to wash the eyes when exposed to chemicals or hazardous substances
- + **Laminar Flow Cabinet**
 - ♥ Provides a flow of filtered air for a clean work area
- + **Biological Safety Cabinet**
 - ♥ Provides an enclosed work space to study materials that have been contaminated by pathogens

Substances that can be disposed inside the sink

- ❖ Chemicals with pH values between 5-9
- ❖ Harmless low concentration liquids and solutions (**sucrose** solution, dye solution, distilled water)



Laboratory personal protective equipment

- ⊞ **Goggles**
 - ↳ To protect the eyes from hazardous chemicals
- ⊞ **Face Mask**
 - ↳ To protect against smoke, vapour and dust that may affect the respiratory system
- ⊞ **Lab Gloves**
 - ↳ To handle biological samples
- ⊞ **Handwash**
 - ↳ To remove germs on hands
- ⊞ **Lab coat**
 - ↳ To protect the skin and clothes from dangerous chemical splashes
- ⊞ **Lab shoes**
 - ↳ To prevent injury from glass shards and chemical spills

Substances that cannot be disposed inside the sink

- Organics solvents (**acetone**, **alcohol**, **benzene**)
- Substances with pH values < 5 or > 9
- Chemicals (acids, greases, oils)
- Solid waste (glass, rubber)
- Heavy metals (**mercury**)
- Volatile substances
- Toxic substances
- Organic waste (microorganisms, carcasses)
- Reactive substances
- Radioactive substances

Methods for managing biological waste

Biological waste	Example	Management method
Sharp wastes	Syringes, needles, glass, scalpel	Placed into a special bin sharp material disposal and does not need to be sterilised
Non-sharp wastes	Gloves, tissue papers, petri dishes, plastic culture containers and hardened agar	<ol style="list-style-type: none"> 1. Packed in autoclave biohazard plastic bags 2. Sterilised in an autoclave for decontamination 3. Placed into a biohazard bin
Animal carcasses	Animal carcasses, organs and tissues	<ol style="list-style-type: none"> 1) Wrapped carefully in absorbent material 2) Packed carefully into biohazard plastic bag 3) Frozen
liquids	Broth culture, blood	<ol style="list-style-type: none"> I. Decontaminated in autoclave II. Disposed immediately

Accidents in the laboratory

⊕ Steps to Handle General Chemical Spills

- 1 Inform your teacher
- 2 Declare the spill area as a **restricted zone**
- 3 Prevent the chemical spill from spreading using sand
- 4 Scoop up the chemical spill using appropriate equipment
- 5 Dispose it safely

⊕ Steps to Handle Mercury Spills

- 1 Inform your teacher
- 2 Declare the spill area as a **restricted zone**
- 3 Sprinkle **sulphur** to cover the mercury spills
- 4 Call the fire and rescue department

Practices in a Biology laboratory

Δ Clothing Ethics

- ♥ Use a lab coat, gloves, safety shoes and goggles when appropriate

Δ Laboratory Safety Rules

1. Do not work alone in the lab without supervision
2. Wash your hands before and after conducting experiment
3. Do not bring irrelevant item in
4. Clean your workstation using disinfectant
5. Disposed wastes according to **SOP**
6. Do not eat and drink
7. Identify all safety symbols before use

*SOP → Standard Operating Procedure

Δ **Safety Measures for Fire**

- 1) Stop work immediately, switch off all nearby power sources and unplug all appliances
- 2) Exit the lab according to the emergency exit plan
- 3) Call the fire and rescue department
- 4) Do not panic and stay calm
- 5) Do not recollect your belongings
- 6) Assembly at the assembly point

Δ **Handling Glass and Chemicals**

- A. Be cautious when handling hot glassware
- B. Report any damaged equipment to teachers immediately
- C. Keep flammable substances away from fire sources
- D. Do not touch, taste and smell chemicals directly

Δ **Handling Live Specimens**

- I. Use appropriate gloves when handling biological specimens
- II. Harmless specimens that have been dissected should be buried or frozen
- III. Wash hands with antiseptic detergents before and after experiment
- IV. All workstations should be cleaned and disinfected before leaving

Δ **Emergency Help**

- ① Inform your teacher
- ② Call the fire and rescue department
- ③ Remove the victim from the scene
- ④ Give emergency treatment
- ⑤ Make the place of accident as a restricted area

CHAPTER 1.3 – COMMUNICATING IN BIOLOGY

Tables

- » Used to record and present data
- » Allows you to organise data systematically
 - a) The manipulated variable is placed on the left side
 - b) The responding variable is placed on the right side

Example:

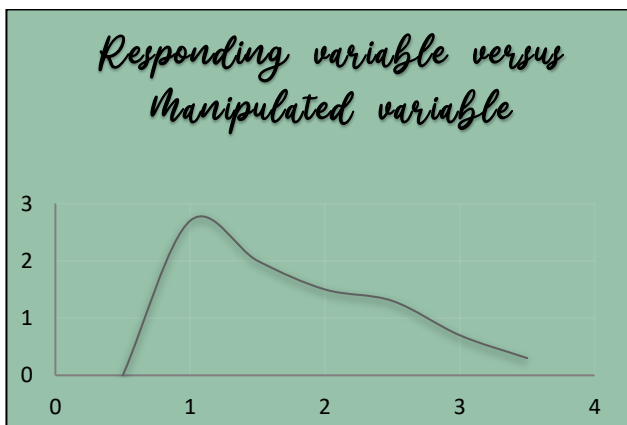
Manipulated variable (unit)	Responding variable (unit)
1	10
2	20

Graphs

- An illustration that shows the relationship between manipulated variable and responding variable
- There are three types of graphs
 - 1 Line graph
 - 2 Bar chart
 - 3 Histogram

LINE GRAPH

Example of line graph:



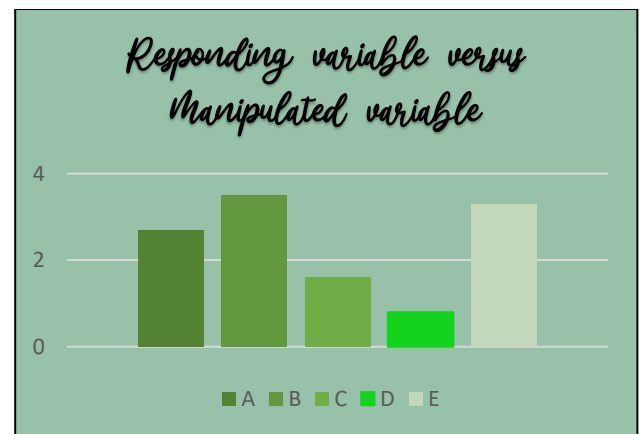
GENERAL METHOD OF DRAWING A GRAPH

- ⊕ The responding variable is represented by the vertical axis (y-axis)
- ⊕ The manipulated variable is represented by the horizontal axis (x-axis)
- ⊕ The scaling must be uniform
- ⊕ Mark the points with an appropriate symbol
- ⊕ The title :
(responding variable) versus (manipulated variable)

BAR CHART

- ✓ Used to present data using vertical bars that are not attached to each other

Example of bar chart:



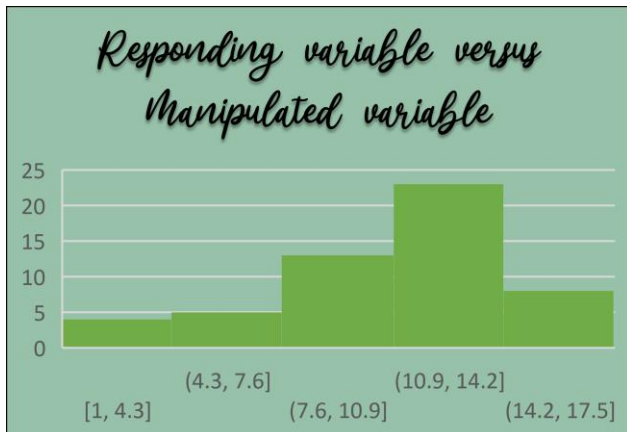
GENERAL METHOD OF DRAWING A BAR CHART

- ↳ Draw two axes, the x-axis to represent the manipulated variable and the y-axis to represent the responding variable
- ↳ Each width needs to be uniform
- ↳ The bar height depends on the frequency of the data
- ↳ Bar chart are used to make comparisons between two or more items at a time

HISTOGRAM

- Shows the visual distribution of data and the frequency of a value in a data set

Example of histogram:



GENERAL METHOD OF DRAWING A HISTOGRAM

- Draw two axes where the x-axis represents the data that has been divided into groups according to the appropriate range while the y-axis shows the frequency
- Insert labels and units on the axes
- The size or width must be the same for all class gap with no spacing between bars

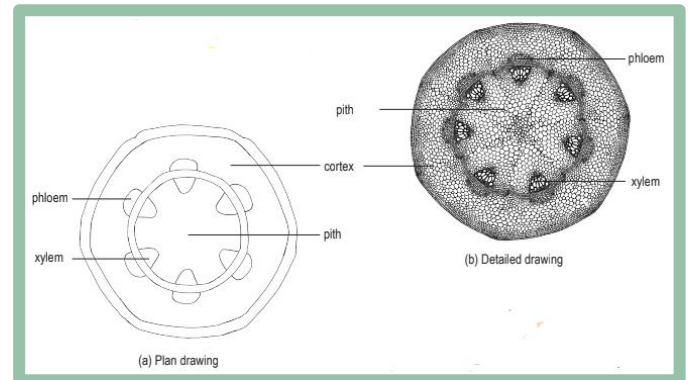
Biological Drawings

CHARACTERISTICS OF BIOLOGICAL DRAWINGS

- Large and accurate
- Not shaded artistically
- Line drawn must be clear, clean and continuous
- Drawings must be labelled
- Drawings must have titles
- Each structure must be placed in the correct position
- Each size of the structure should be proportionate to the rest of the structures
- A **plan drawing** is line drawing that shows the outline of a structure
- A **detailed drawing** shows the cells in a structure

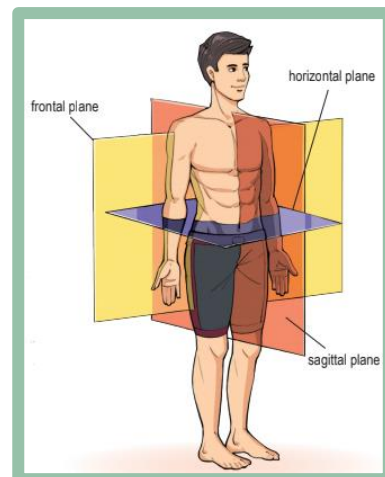
- The magnification factor of a drawing must be stated,

$$\frac{\text{length of drawing in cm}}{\text{length of specimen in cm}}$$



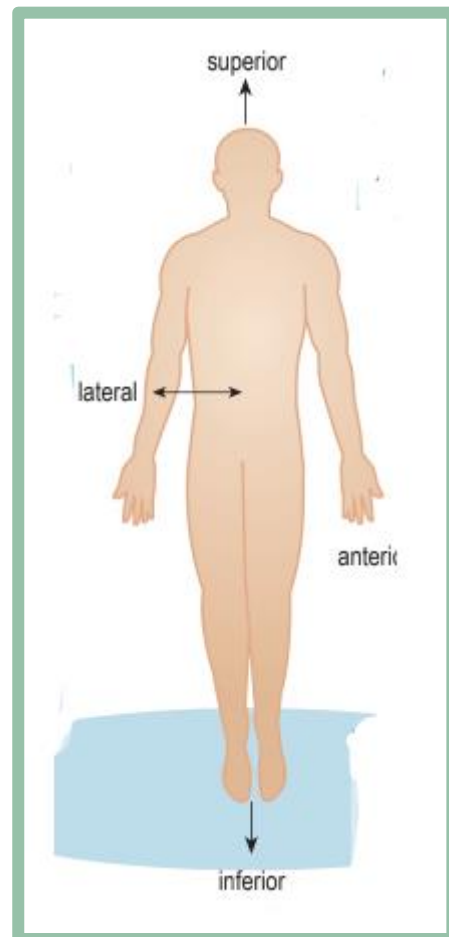
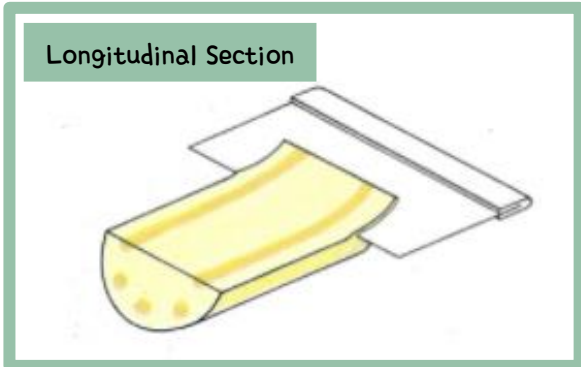
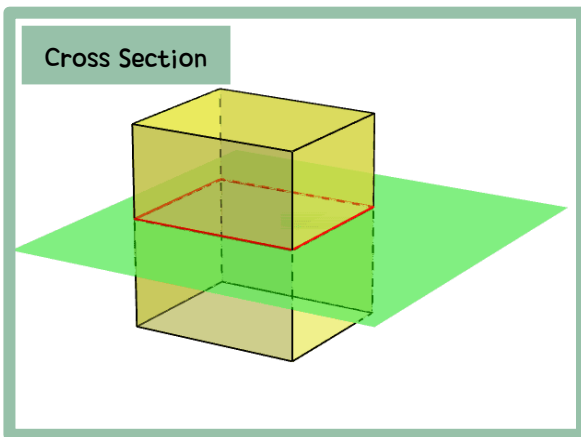
PLANE

- Plane refers to a flat surface of shadow passing through the body
- Sagittal plane → divides the body into right and left parts
- Frontal plane → divides the body into frontal and rear parts
- Horizontal plane → divides the body into upper and lower parts



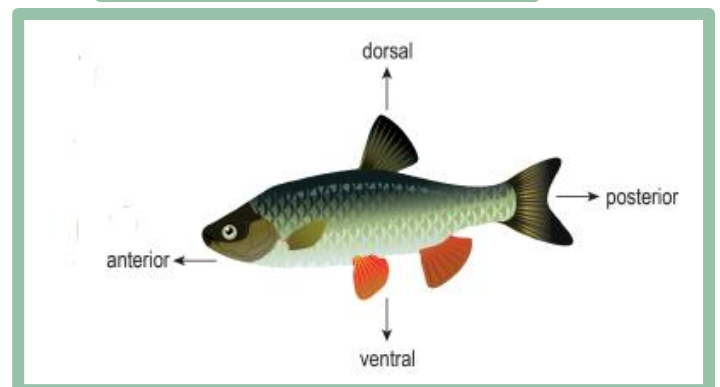
SECTION

- Cross section → divides the structure into upper and lower portions horizontally
- Longitudinal section → divides the structure into left and right portions



DIRECTION

- Superior → towards the head
- Lateral → far from the midline or at the side of the body
- Inferior → towards the feet
- Ventral → towards the lower parts of the body
- Dorsal → towards the upper parts of the body
- Anterior → towards the front of the body
- Posterior → towards the back of the body



CHAPTER 1.4 – SCIENTIFIC INVESTIGATION IN BIOLOGY

Steps in scientific investigation

- 1 Identifying problems that can be tested using a scientific investigation
- 2 Forming a hypothesis
- 3 Identifying and controlling variables and data collection method
- 4 Planning and carrying out a scientific investigation
- 5 Collecting data
- 6 Interpreting data and results through scientific reasoning
- 7 Forming a conclusion
- 8 Writing a report

