CHAPTER 1.1

Fields and Careers in Biology

BIOLOGY

- The word 'Biology' comes from the Greek word, 'bios' meaning life, and 'logos' meaning study.
- Biology is a detailed study of living things in the natural environment
- Biology allows us to understand the structure and function of organisms, as well as the relationships and interactions between organisms with their environment

EXAMPLES OF BIOLOGICAL RESEARCH AREAS

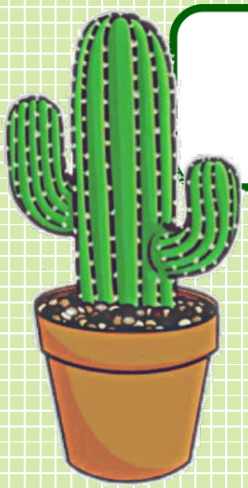
BOTANY
Study of plant life

MICROBIOLOGY
Study of microorganisms

PHYSIOLOGY
Study of the function and mechanisms in organisms

ECOLOGY
Study of the Interactions Between organisms and their environment

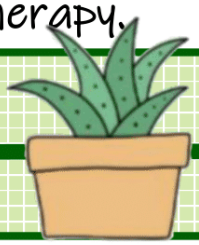
GENETICS
Study of Inheritance and genetic variation



THE CONTRIBUTION OF BIOLOGY IN EVERYDAY LIFE

medical

In vitro fertilisation, family planning, plastic surgery and gene therapy.



Pharmaceutical

Production of synthetic vitamins, vaccines, insulin and synthetic enzymes

FOOd PRODUCTION

Use of microorganisms in the production of cheese, soy sauce, tapai and tempe.

agriculture

Transgenic crops and animals, hydroponic and aeroponic technology.

CAREERS iN BiOLOGY

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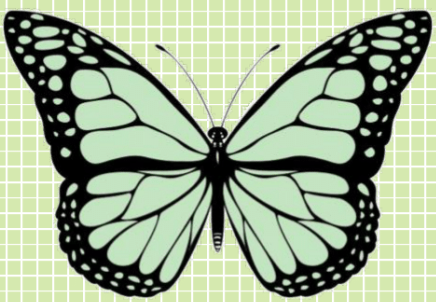
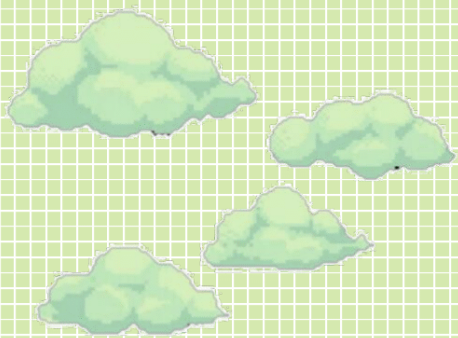


- pharmaciest
- wildlife biologist



CHAPTER 1.2

Safety and Rules in Biology Laboratory

EMERGENCY SHOWER STATION

Used when chemicals or hazardous substances come into contact with the skin

EYE WASH STATION

Used to wash the eyes when exposed to chemicals or hazardous substances

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FUME HOOD

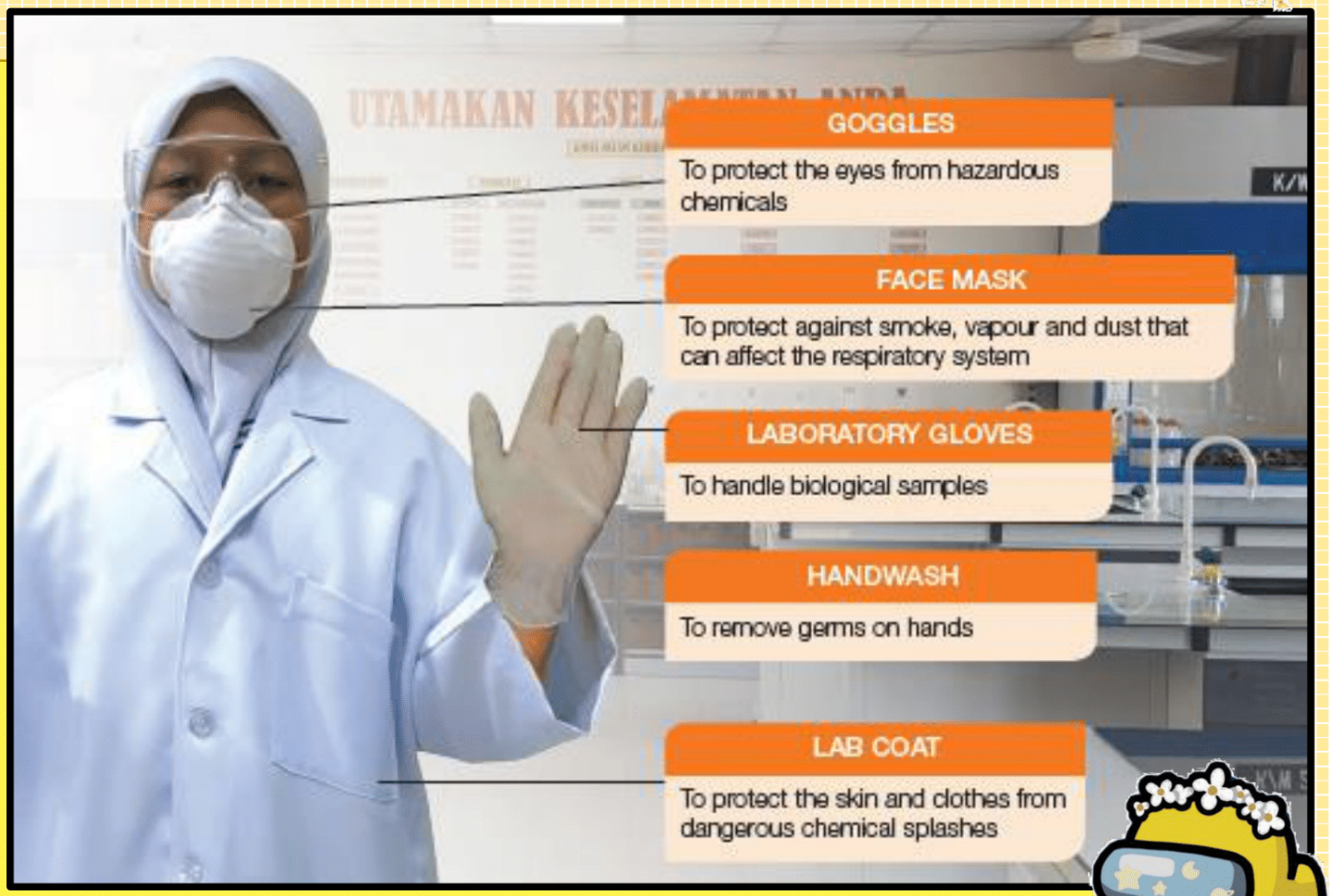
To avoid breathing in hazardous gases like chlorine, bromine and nitrogen dioxide.

LAMINAR FLOW CABINET

Provides a flow of filtered air for a clean work area in the laminar flow cabinet

BIOLOGICAL SAFETY CABINET

Provides an enclosed work space to study materials that have been (or are likely to have been) contaminated by pathogens



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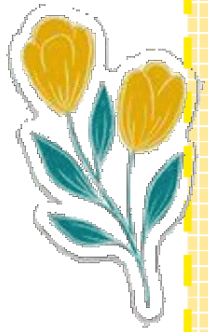
SUBSTANCES THAT CAN BE DISPOSED INTO THE SINK

- Chemicals with pH values 5–9
- Low concentration liquids and solutions that are harmless to users (sucrose solution, dye solution, distilled water)

SUBSTANCES THAT CANNOT BE DISPOSED INTO THE SINK

- Organic solvents (acetone, alcohol, benzene)
- Substances that have a pH value of less than 5 or more than 9
- Chemicals (acids, greases, oils)
- Solid waste (chemicals, glass, rubber)
- Heavy metals (mercury)
- Volatile substances
- Toxic substances
- Organic waste (microorganisms, carcases)
- Reactive substances
- Radioactive substances



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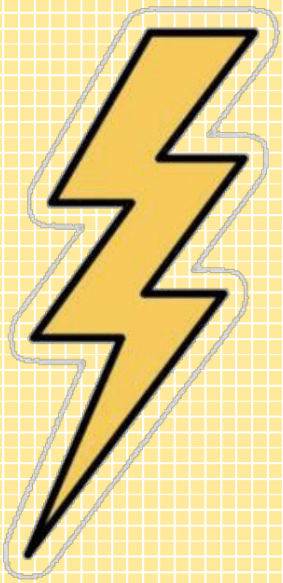
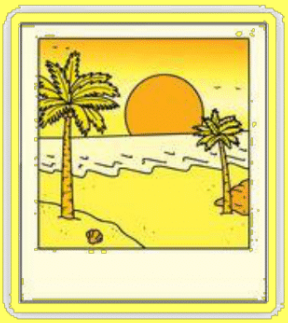


METHODS FOR MANAGING BIOLOGICAL WASTE

BIOLOGICAL WASTE CATEGORIES	EXAMPLE	MANAGEMENT METHOD
Category A (sharp wastes)	Sharp instruments such as syringes, needles, glass, scalpel and other sharp instruments that can cause injuries	Placed into a special bin for sharp material disposal. This bin does not need to be sterilised.
Category B (non-sharp wastes) 	Biological solid waste such as gloves, tissue papers, petri dishes, plastic culture containers and hardened agar	Packed first in autoclave resistant biohazard plastic bags, sterilised in an autoclave for decontamination, and then placed into a biohazard bin . Biohazard plastic bags cannot be thrown into regular waste baskets.
Category C (animal carcases)	Animal carcases, organs and tissues	Wrapped carefully in absorbent material (such as tissue papers), packed carefully into a biohazard plastic bag and frozen.
Category D (liquids)	Broth culture and liquid medium such as blood 	All biological liquid waste must be decontaminated by autoclaving before disposal. Sterilised biological liquid wastes must be 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

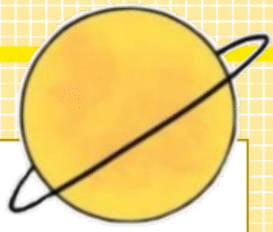
1. Inform your teacher.
2. Declare the spill area as a restricted zone.
3. Sprinkle sulphur to cover the mercury spills.
4. Call the fire and rescue department.

PRACTICES IN A BIOLOGY LABORATORY

CLOTHING ETHICS

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

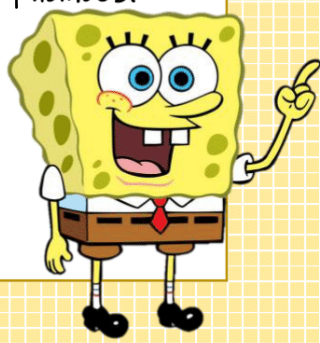
LABORATORY SAFETY RULES



- Do not work alone in the laboratory without supervision.
- Wash your hands after conducting an experiment.
- Do not bring in irrelevant items into the laboratory.
- Clean your workstation using disinfectant.
- Dispose wastes according to the set procedures.
- Do not eat and drink in the laboratory.
- Identify all safety symbols on substances and equipment before use.

SAFETY MEASURES FOR FIRES

- Stop work immediately and switch off all nearby power sources. Unplug appliances.
- Exit the laboratory according to the emergency exit plan.
- Call the fire and rescue department.
- Do not panic and stay calm.
- Do not turn back to collect your belongings.
- Assemble at the assembly point.



HANDLING GLASS AND CHEMICALS

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

HANDLING LIVE SPECIMENS

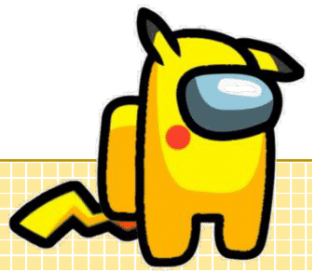
GOOD VIBES

- Use appropriate gloves when handling biological specimens.
- Specimens that are not harmful and have been dissected should be buried or frozen.
- Wash hands with antiseptic detergents before and after experiments.
- All surfaces and workstations should be cleaned with disinfectant before leaving the lab.

EMERGENCY HELP

The following procedures should be followed in the event of an accident:

- Inform your teacher.
- Call the fire and rescue emergency number.
- Remove the victim from the scene.
- Give emergency treatment.
- Make the place of accident as a restricted area.



SCIENTIFIC ATTITUDES AND NOBLE VALUES

Scientific attitudes and noble value practices when carrying out a scientific investigation:

- Having interest and curiosity towards the environment.
- Being honest and accurate in recording and validating data.
- Being diligent and persevering in carrying out a study
- Being responsible about the safety of oneself, others and the environment.
- Appreciating and practising clean and healthy living.
- Appreciate the contributions of science and technology.
- Think critically and analytically.

CHAPTER 1.3

Communicating in Biology

TABLES

- Tables are used to record and present data.
- When you conduct an investigation, the experimental data needs to be recorded in a suitable table
- A table allows you to organise data systematically for easy comparison

GRAPH

- The relationship between the manipulated variable and responding variable can be illustrated in the form of a graph.
- There are several types of graphs such as line graphs, bar charts and histograms.

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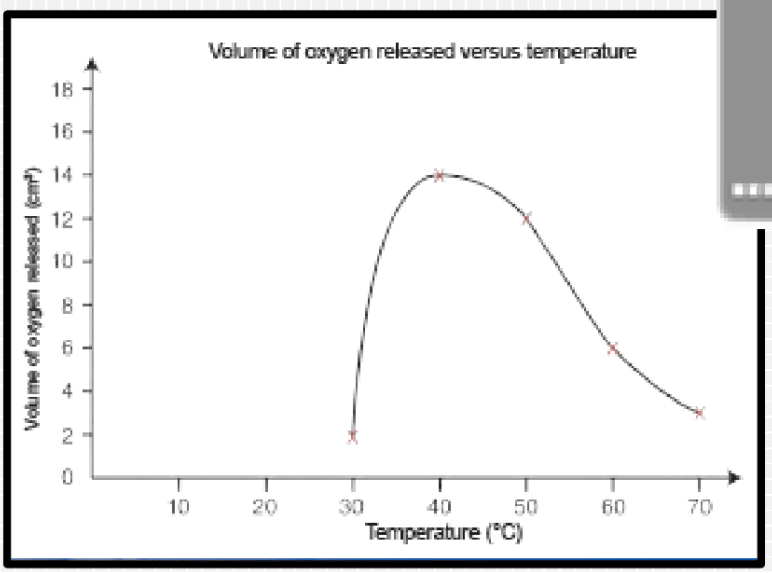
charcoal grey.

GENERAL METHOD OF DRAWING A GRAPH

- The responding variable is represented by the vertical axis (y-axis) and the manipulated variable is represented by the horizontal axis (x-axis).
- The scaling on the axis must be uniform.
- Mark the points with an appropriate symbol such as 'x'.
- Title the graph: "Graph (responding variable) versus (manipulated variable)".

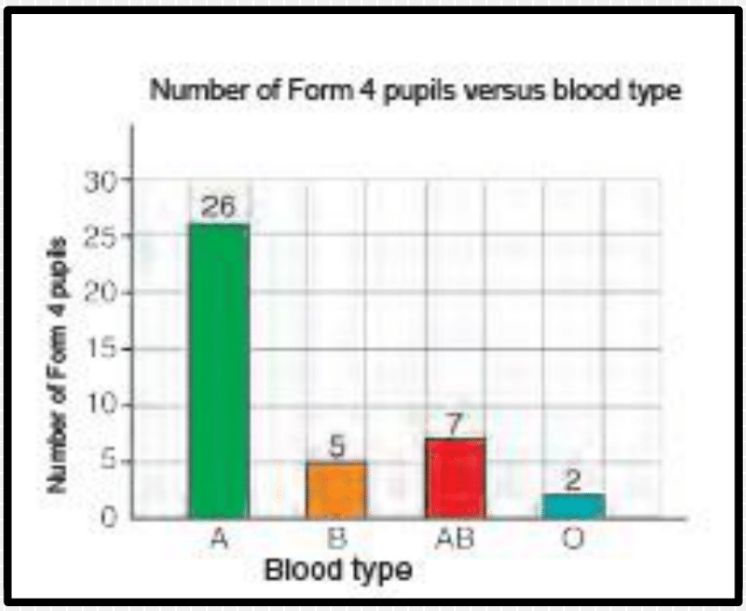


A BAR CHART

presents data using vertical bars that are not attached to each other

METHOD OF DRAWING A BAR CHART

- Draw two axes, the horizontal axis/X to represent the manipulated variable and the vertical axis/Y to represent the responding variable.
- Each width of the bar needs to be uniform.
- The bar height depends on the frequency of the data.
- Bar charts are used to make comparisons between two or more items at a time.



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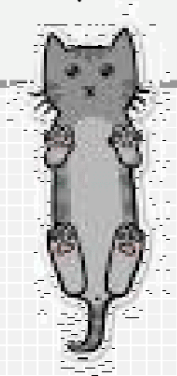
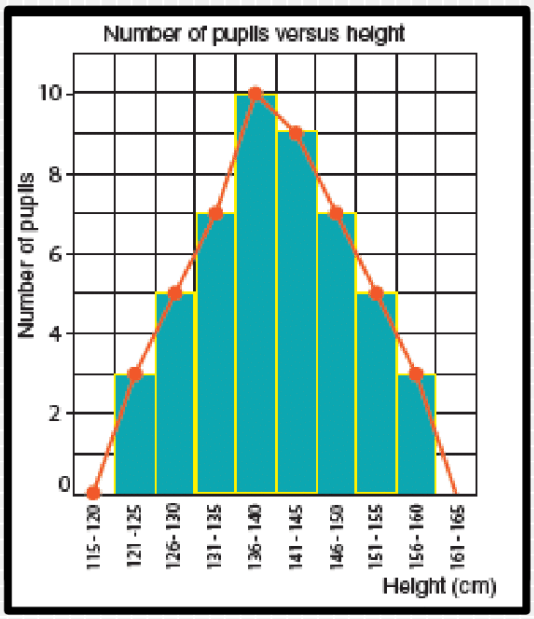
A HISTOGRAM

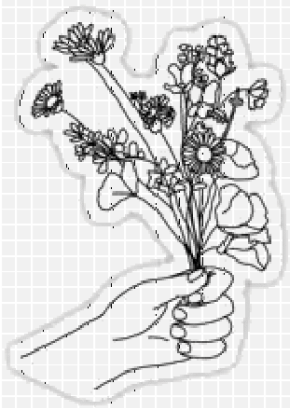
shows the visual distribution of data and the frequency of a value in a data set.



METHOD OF DRAWING A HISTOGRAM

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





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BIOLOGICAL DRAWINGS

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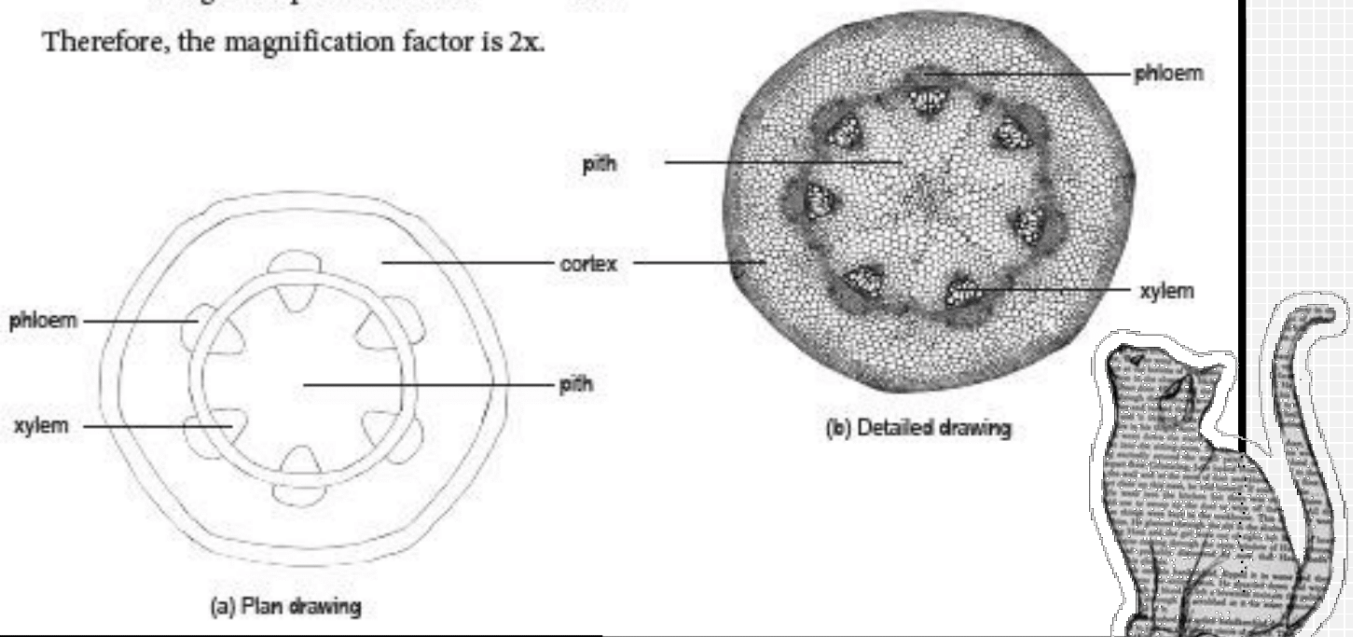
Characteristics of biological drawings

- Large and accurate; use a sharp pencil and not a colour pencil or pen.
- Not shaded artistically.
- Lines drawn must be clear, clean and continuous. Do not use a ruler to draw the outline of a specimen
- Drawings must be labelled. Label lines must point to the correct structure, no arrowheads, must be straight and not cross each other.
- Drawings must have titles.
- Each structure in the drawing must be placed in the correct position, and its size should be proportionate to the rest of the structures.
- A plan drawing is a 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, for example:

$$\frac{\text{Length of drawing in cm}}{\text{Length of specimen in cm}} = \frac{2.4}{1.2} = 2x$$

Therefore, the magnification factor is 2x.



PLANE, SECTION AND DIRECTION

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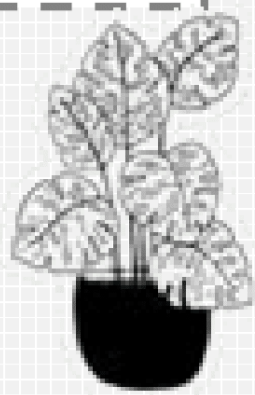
Planes

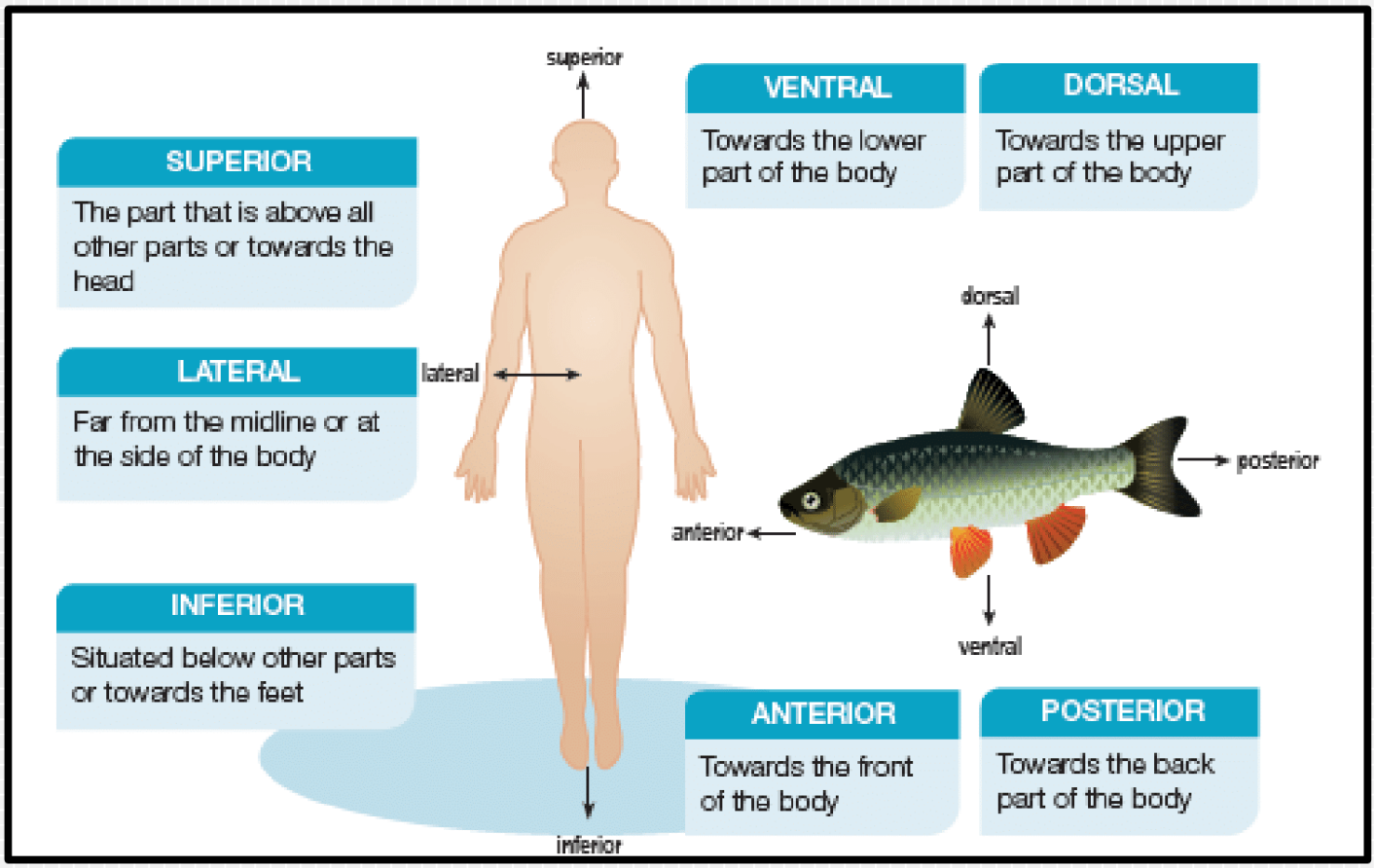
- sagittal plane (divides the body into right and left parts)
- frontal plane (divides the body into frontal and rear parts)
- horizontal plane (divides the body into upper and lower parts)

Section

- Cross section divides the structure into upper and lower portions horizontally
- longitudinal section divides the structure into left and right portions
- Many anatomical drawings of animals and plants need to be labelled with direction. All vertebrates have the same fundamental body plan that is symmetrical
- Direction consists of anterior, ventral, posterior, dorsal, superior, inferior and lateral
- By studying anatomical directions in biology, you can identify the orientation of the vertebrate that is stated



direction



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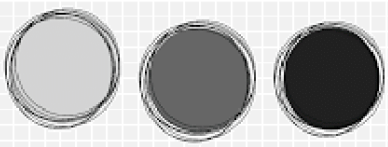

CHAPTER 1.4

Scientific investigation in biology

THE STEPS IN CARRYING OUT A SCIENTIFIC INVESTIGATION

- Identifying problems that can be tested using a scientific investigation
- Forming a hypothesis
- Identifying and controlling variables and data collection method
- Planning and carrying out a scientific investigation
- Collecting data
- Interpreting data and results through scientific reasoning
- Forming a conclusion
- Writing a report