

Senior secondary

Biology: Tutorial plans 1–15

Tutor handbook



Forum for African Women
Educationalists in Malawi
(FAWEMA)

*"Supporting Girls and Women to
Acquire Education for
Development"*



The Open
University



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'Keeping Girls in School' Scholarship Programme

Tutor's Folder MSCE Resources: 2014–15

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MSCE B1: Locomotion: Tutorial 1

1. Aims of the tutorial

By the end of this tutorial, Scholars will be able to:

- describe how fish move
- draw and label structures in fish which help them move
- explain how fish are adapted to move.

2. Introduction to the course and outline of the purpose and structure of the tutorials (15 minutes)

Keep in mind the points in the checklist on planning and running a tutorial session.

The first point on the check list should be stressed in this first tutorial. Tell the Scholars that these sessions are an opportunity for them to come with questions or problems arising from their own individual studies since the previous tutorial. You as the Tutor will need to find time to allow for this.

This will be the first biology tutorial that your Scholars will have with you, so you might like to start with a short general introduction to biology as a subject and the biology of this year's course in particular.

Remind them that biology is about living things: plants and animals including humans; how they are made; how they work; and how they interact together.

3. What do we mean by a living thing? Postbox activity (35 minutes)

Ask the Scholars to imagine an insect, a fish, a bird and themselves and to think of three things they all share and that makes each of them a living thing. Ask them to write the each thing on a small piece of paper. They can post their papers in a bag or other suitable container which you have placed centrally in the room. Pull out the papers one by one and read them out aloud. Discuss the ideas on the papers and use them to draw up a list of the characteristics of living organisms on the board or a flipchart sheet.

You can tell them at which stage of the year, i.e. in which unit they will be studying that part of biology.

Movement	in B1; Locomotion
Feeding/nutrition	in B3: The circulatory system and the digestive system
Transferring energy (respiration)	in B2: Respiration
Sensitivity	in B4: Excretion and coordination
Excretion	in B4: Excretion and coordination
Growth	in B5: New generations
Reproduction	in B5: New generations

Large complex organisms like human beings also need a transport system to carry things like food around the body. The circulatory system is studied in B3.

Although not usually listed as one of the seven characteristics, it is important to stress that living organisms do not exist in isolation. They

interact with each other in many different ways. One such way is when one living organism invades the body of another and causes disease. Infectious diseases are studied in B6.

4. Structure and function: group activity (40 minutes)

Ask groups of about four Scholars to discuss their ideas together before they decide what to write in the table.

Remind them that the structure of an organism is about how it is made, what it looks like. The function of an organism (or a part of an organism) is about what its job is, what it does, or how it works.

Ask Scholars to think about the following seven features of the structure of a fish:

- its shape
- its skin
- its muscles and skeleton
- its caudal (tail) fin
- its pectoral and pelvic fins (paired fins)
- its dorsal and anal fins (median fins)
- its swim bladder.

Ask Scholars to use Unit B1 in the Scholar's MSCE Resources Folder to find the functions for each of these parts, and make a table of their findings. An example is shown below.

Structures of a fish	Function of that structure
The muscles and skeleton	The powerful tail muscles contract and relax pulling the tail from side to side. This pushes the tail back against the water so the fish moves forward through the water.

When they have completed their table, they should compare their table with that of another group. As their Tutor, you can be available to help with any major and problematic differences in their tables.

5. Using annotated diagrams in biology (35 minutes)

In biology it is often helpful to describe a living organism or a part of the organism by drawing a diagram of it. If the diagram is also labelled and some notes added to explain the importance of certain key parts, this becomes a very useful way of learning, understanding and remembering.

First ask your Scholars to draw a large, clear diagram of a fish. They can use Figure 2 in Unit B1 as a guide. Then you will ask them to label the structures on the diagram from Activity 2 in the unit.

Finally, ask your Scholars to add a brief note to each part they have labelled to explain its job or function. They could use a different colour pen or pencil to write the functions. This will help them distinguish structures and functions.

The annotated drawings of the Scholars should be displayed on tables, the wall or the floor. Give them about five minutes to walk round and look at other people's work. Ask them to try and decide on one aspect of other people's work that they thought was good and that they would like to

incorporate into their own work in future; e.g. perhaps other people had drawn larger and hence clearer diagrams.

6. Learning some principles of movement in animals by investigating the Scholar's own arm movements (40 minutes)

Ask Scholars to feel their own arms and try to identify the following:

- a. The upper arm bone – the long bone that stretches from the shoulder to the elbow.
- b. The lower arm bone – the long bone (in fact there are two bones side by side, although this is not important at this stage) that stretches from the elbow to the wrist.
- c. The point where the two bones meet, at the elbow in this case. This is called a joint.
- d. The flesh on the top and bottom of each long bone. This is mainly muscle. The muscle is attached at one end to the bone of the upper arm and at the other end to the bone of the lower arm. The muscle can shorten or contract. When this happens the muscle pulls on the bone and makes it move.

Ask the Scholars to bend their arm strongly by making a fist and bending their arms to show their muscles. At the same time they should place the hand of their other arm on the muscle on the top of the upper arm. They should feel it getting firmer. It is actually getting shorter and fatter and pulling on the bone of the lower arm and making it move. The bones are acting as levers.

When they straighten their arm, they will feel this muscle getting softer as it relaxes and stops pulling. They may feel the muscle on the under surface of the upper arm getting firmer. This muscle is contracting to straighten the arm. It is smaller and weaker and not so easy to feel.

Muscles work together in pairs to pull bones in opposite directions. We call them 'antagonistic pairs of muscles'.

Now ask the Scholars to work in small groups and to think about the side to side movements of a swimming fish. Ask them to discuss what bones are involved; where they think the joints are and where they think the muscles will be attached. Ask the Scholars to prepare a short oral presentation to make to the class. This should start with a revision of the description of movement in their own arm. This should be followed by their explanation of how they think the fish moves.

There will only be time for two or three of the groups to give their presentation on this occasion. Make sure that over the months all Scholars get a chance to be involved in oral presentations. These activities help clarify the Scholars' learning. They are also good practice for when they become teachers themselves.

7. Wrap up and set Scholars their self-study tasks for the next fortnight (15 minutes)

Ask Scholars to arrange to spend between half an hour and an hour with a fellow Scholar and take it in turns to test each other on locomotion using the questions at the end of Unit B1.

MSCE B1: Locomotion: Tutorial 2

1. Aims of the tutorial

By the end of this tutorial, Scholars will be able to:

- describe how birds move
- draw and label structures in birds which help them move
- explain how birds are adapted to move.

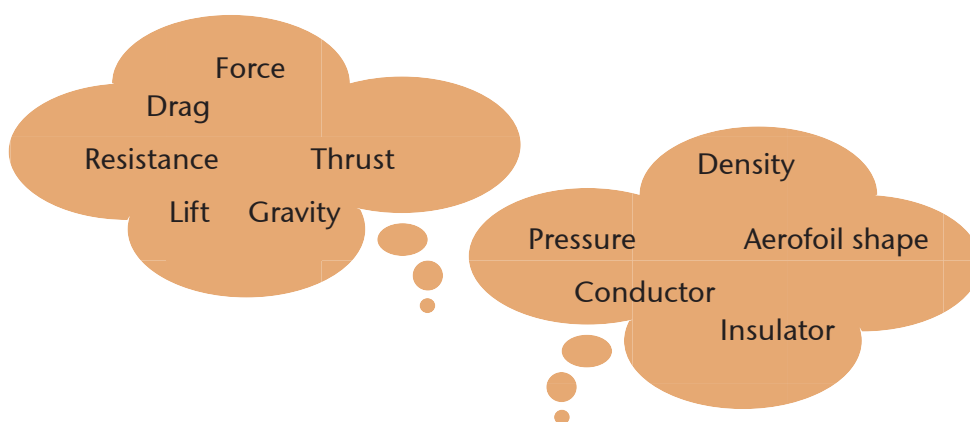
2. Introduction (15 minutes)

Keep in mind the points in the checklist on planning and running a tutorial session.

3. Science and living things: small groups activity (35 minutes)

Explain to your Scholars that when we study biology, we often need to use what we learn in physics and chemistry to fully understand how something works or happens. In studying locomotion in birds in Unit B1 they will have come across several words that they might also find in physics texts such as Unit S2.

The following words appear in Unit B1:



Divide your Scholars into small groups. Half the groups should work on the words from the cloud on the left. The other groups should work on the words from the cloud on the right.

The first task of each group is to go through Unit B1 and underline in pencil each point at which any of their words appear. Second, they should discuss the meaning of each word. Third, they should decide why they need to understand the word in studying locomotion in animals. The group should prepare a short presentation to make to the class.

Choose at least two groups to give presentations to cover both sets of words. Make sure you select different Scholars from those who gave presentations in the previous tutorial. Ask for feedback from the rest of the class on how clear they found each presentation. Also make any relevant comments yourself.

4. Balloon activity on flight in birds (20 minutes)

Ask each Scholar to take a whole page in her note book. In the middle of the page, they should write BIRD FLIGHT in large letters. Around this title, they should draw three large circular shapes. These are the balloons. Label the balloons:

KEY WORDS FACTS I KNOW QUESTIONS I NEED ANSWERING

Scholars should spend the next 15 minutes filling in the balloons according to their label. This activity is for the Scholars (and you) to assess their current knowledge and understanding. They will have a chance to update it later.

5. Whole class session on the two types of flight – flapping and gliding (25 minutes)

Give a short overview presentation yourself of the two types of flight in birds. Involve the Scholars in questions and answers as appropriate. This will reinforce the initial activity of examining some key science words and their relevance to the biology of flight. Key points to cover include:

- There are two types of flight – flapping flight and gliding flight.
- The wings are covered in quill feathers.
- Gravity and drag (air resistance) are the two forces that a bird must overcome to keep up and to move forward during flight.
- Wing and feathers provide an aerofoil shape which results in air pressure differences on the upper and lower wing surface which creates the lift force.
- The streamline shape of the bird as it moves through the air helps to reduce air resistance or drag force.
- In flapping flight the main forward force, the thrust, is provided by the down stroke of the wings.
- In flapping flight lift is provided by both the down stroke and the up stroke of the wings.
- The down stroke and the up stroke are controlled by two different sets of muscles (an antagonistic pair).
- In gliding flight the wings and tail are spread out.
- Gliding flight uses less energy than flapping flight.
- The tail and wing tips control steering.

Give Scholars the opportunity to ask final questions at the end. (No more than one question per Scholar at this stage.)

6. Adaptations of living organisms to their environment and way of life: think, pair, share (40 minutes)

Explain to the Scholars that most biologists believe that all the many and varied living organisms that exist on the earth today have gradually developed over millions of years from simple organisms that first appeared on earth about 3000 million years ago. Over the years different forms of organisms have developed or evolved by a process called natural selection. The different kinds of organisms have evolved because they are

well suited to the different kinds of environment that exist on the earth. Some organisms are suited to living in water, some for living on land. Some are adapted for living in cold places like the Antarctic, or dry places like the Sahara desert, or very hot places like hot springs.

When we study organisms living in a particular environment we find they are especially well suited or adapted to the conditions in that environment. In this activity you will ask the Scholars to think about how different parts of a bird adapt it for efficient flying through the air. Ask Scholars to start the activity by working individually. After 15 minutes, they should work with a partner and share their ideas and agree on a common answer. After a further 15 minutes, each pair should join up with another pair and compare each other's answers.

They should consider the following parts:

- down feathers
- quill feathers
- streamlined shape
- bones
- pectoral muscles
- tail
- wings.

Ask them to present their answer as a table. This is a useful form for summarising and subsequently revising work.

Part of the bird	How it adapts the bird for efficient flight
Tail	Used to control steering
:	
:	

7. Reassessing the balloon activity (30 minutes)

Scholars should look back at their balloons from Section 3. They should make any changes or additions in the light of what they have learned during this tutorial.

If they finish this and there is time available, they could pair up and see if they could help each other with any difficulties they have.

8. Wrap up and set Scholars their self-study tasks for the next fortnight (15 minutes)

Ask Scholars to arrange to spend between half an hour and an hour with a fellow Scholar and take it in turns to test each other on locomotion using the questions at the end of Unit B1.

MSCE B1: Locomotion: Tutorial 3

1. Aims of the tutorial

By the end of this tutorial, Scholars will be able to:

- describe tissue respiration
- distinguish between aerobic and anaerobic respiration
- explain the importance of gaseous exchange in organisms and how it works in humans.

2. Introduction (15 minutes)

Keep in mind the points in the checklist on planning and running a tutorial session.

3. Practical investigation using Scholars' own bodies (35 minutes)

Ask Scholars if they have ever had their pulse taken, taken someone else's pulse, or watched this activity. Discuss when and why this might happen. Show them how to take their pulse and give them a short time to practise.

Now ask the Scholars to work in pairs. One person will count the number of beats of the pulse of the subject, i.e. their partner over a period of 30 seconds. The subject should then run or jump on the spot for 30 seconds. Their partner should take the pulse of the subject again immediately after this. During this second count, the subject should try to notice as many changes as possible that she experiences in her body. Observations should include an increase in rate and depth of breathing.

Collate the results in a table on one side of the board. Next to the table, do a quick brainstorm of things the subjects noticed happening to their bodies during and immediately after the exercise, together with any thoughts about what Scholars think happens in the body during the exercise.

Ask the Scholars: What is the link between pulse rate and leg muscles, and between pulse rate and breathing rate. Give them 5 minutes to think on their own. Then ask them to share their thoughts with a partner. Ideas should then be fed back in a whole class discussion.

You should use this to draw out the following points:

- Energy is needed for the muscles to work during exercise.
- Our energy comes from the food we eat. This has to be digested and then transported from the food tube by the blood stream to the muscles. The most common food molecule used in respiration is the sugar glucose.
- Oxygen is needed for the energy to be released from the food. This comes into the body during breathing and also has to be transported to the muscles, from the lungs, by the blood stream.
- The release of energy from food is called **respiration**. It is also sometimes called tissue respiration, because it happens in every living cell of every tissue. Although it is more obvious that muscle cells need energy, in fact every living cell in the body needs energy for all the different chemical reactions that are continuously happening in each cell. Respiration happens in every living cell of both plants and animals.

- Plants make their glucose during photosynthesis.
- When the energy is released from the glucose during respiration, two waste products are made. These are **carbon dioxide** and water.

The process in which glucose is broken down using oxygen is called aerobic respiration.

It can be summarised by the equation:

glucose + oxygen → carbon dioxide + water + ENERGY

$C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O + ENERGY$

4. Anaerobic respiration: small group activity (30 minutes)

Ask the Scholars to work in small groups. From memory, they should write a paragraph about anaerobic respiration. They must use all of the words below at least once in their paragraph:

aerobic respiration anaerobic respiration break down breathe continue

glucose	hard exercise	actic acid	fatigue,
aches and cramp	muscle cells	normal	not completely
oxygen debt	poisonous	rapidly	repaid

When they have written their paragraph, they can join up with another group and give their presentations to each other.

5. Breathing structures in humans (30 minutes)

Write the following words on the board:

mouth	nose	windpipe or trachea	bronchus	bronchiole
lung	ribs	air sac (alveolus)	intercostal muscles	

Give Scholars 5 to 10 minutes to sketch from memory as best they can one or two diagrams to show these structures. Then ask each Scholar to work with a partner, compare their diagrams and redraw (if necessary) to produce what they agree is a more accurate and better labelled diagram. Each pair should then join up with another pair and exchange diagrams. They should use the diagrams in Unit B2 to mark their fellow Scholars' work. Use a tick for each correct label, correct any wrong labels and draw a circle around any area of the sketch diagram which is incorrect. Each marking pair should decide on one good point about the diagram and write this on the work as a source of encouragement.

6. Breathing mechanism: mind map (30 minutes)

In small groups of about four, ask Scholars to brainstorm key words on 'how we breathe in and out'. Give each group a large sheet of paper and ask them to produce a mind map on this subject. The central word in the map should be BREATHING MECHANISM. There should be three main words coming out from the central word. These will be CONTROL, INHALATION and EXHALATION.

They must make reference to volume, pressure, intercostal muscles, ribs, diaphragm, contract, relax.

Display the mind maps and allow Scholars time to look at them all.

7. Difference between inhaled and exhaled air (25 minutes)

Draw an outline table on the board as below:

Gas Inhaled breath % Exhaled breath % Change

Gas	Inhaled breath %	Exhaled breath %	Change

Write the following randomly ordered bits of information needed to complete the table on the board beneath the table:

carbon dioxide high high nitrogen none oxygen (temperature)
variable variable water vapour 24% decrease 100% increase
0.04 4 16 21 79 79

Ask Scholars to copy out the table. Working in small groups, and from memory, they should agree on how to complete the table.

When they have finished, they can check their work by comparing it with the table in Unit B2.

As the Tutor, do take this opportunity, while the Scholars are all working, to sign off Unit B1 in each of their Scholar's MSCE Resources Folder

8. Wrap up and set Scholars their self-study tasks for the next fortnight (15 minutes)

Ask Scholars to arrange to spend between half an hour and an hour with a fellow Scholar and take it in turns to test each other on respiration using the questions at the end of Unit B2.

MSCE B2: Respiration:

Tutorial 4

1. Aims of the tutorial

By the end of this tutorial, Scholars will be able to:

- explain the importance of gaseous exchange in organisms and how it works in humans, fish and insects
- explain the effects of smoking on the lungs.

2. Introduction (15 minutes)

Keep in mind the points in the checklist on planning and running a tutorial session.

3. Respiratory surfaces and gaseous exchange: brainstorming, mini teaching session and class discussion (35 minutes)

Start with a short brainstorming activity. Write 'Respiratory surfaces and gaseous exchange' on the board and ask Scholars for any words that come to their minds. Write these words on the board as well.

Use the words the Scholars give as a starting point. Remind them of other key points if necessary. Discuss the meaning of the two terms in the title, ensuring that you cover the following points:

- Remind them of the work from last tutorial where they looked at the breathing mechanism in humans. This is how air gets from outside the body to the inside of the lungs (inhalation) inside every tiny air sac in the lungs – and then out again (exhalation).
- From what they know about respiration, it is only the oxygen from the air that needs to be transported from the lungs to every cell of the body.
- Oxygen passes from the air sacs in the lungs into the tiny blood vessels, the capillaries, that branch over the outer surface of the air sacs.
- Carbon dioxide that has been made in all the respiring cells of the body is carried by blood to the capillaries in the lungs. It passes in the opposite direction to oxygen, i.e. carbon dioxide passes from the blood to the air sacs.
- The surface where the oxygen moves in and the carbon dioxide moves out is called the respiratory surface. The respiratory surface in humans is the combined surface of all the air sacs in the lungs and the capillary walls lying next to them.
- The movement of the two gases in opposite directions is called gaseous exchange.

4. Respiratory surface and gas exchange in humans: making posters (30 minutes)

Tell Scholars they are now going to look in more detail at respiratory surfaces and gaseous exchange in humans, fish and insects – starting with humans. Go over the following key points about respiratory surfaces.

An efficient respiratory surface will be:

- Thin, moist and have a large surface area to ensure the maximum amount of gaseous exchange of oxygen and carbon dioxide occurs.
- The gases move by the process of diffusion. The particles of oxygen and carbon dioxide gas are continually moving. [They learn this in science.] There will be a net movement of oxygen particles from one side of the respiratory surface to the other if there is a big difference in concentration of oxygen between the two sides.
- A big concentration difference is ensured in humans by the breathing movements and the circulation of the blood. [The same works for carbon dioxide.]

Ask Scholars to produce a poster about the respiratory surface and gaseous exchange in humans. They can start by drawing a large outline of the human body. They should add the lungs, windpipe and mouth and nose, very simply, in outline only.

They should label the site of the respiratory surface, and add a note to state exactly what it is. They do not need to draw the air sacs in detail. They should ensure that the information in the bulleted list is included on their poster. Display the posters at the end and allow time for everyone to see them all.

5. Respiratory surface and gas exchange in fish: oral presentations (30 minutes)

Scholars should use the key points about respiratory surfaces highlighted in Section 3 and apply them to the respiratory surface of fish. They can use the relevant section in Unit B2 to help them. They can work in pairs on this to produce a short oral presentation. Each pair should then link with another pair. They can give their presentations to each other. This should be followed by a group discussion to ensure they all agree.

6. The respiratory system in insects: a comparison with humans (25 minutes)

Scholars should revise the section on insect respiration in Unit B2.

In groups of four, they should think of the ways in which the respiratory system in insects is the same and the ways in which it is different from the respiratory system in humans. They should record their thoughts in a table.

How the insect respiratory system is the same as the human respiratory system	How the insect respiratory system is different from the human respiratory system

7. Smoking: key points bingo (30 minutes)

Remind Scholars of the four main harmful substances in tobacco smoke: nicotine, tar, carbon monoxide and smoke.

Ask Scholars to work in pairs and to draw a mind map, with the word SMOKING in the middle and the four substances above as the key words around the centre. Give them 10 minutes to write down as many points

they can think of related to the harmful effects of each of these substances.

Read out a list of points from the information in the table in Unit B2. The pairs should cross off those that are on their mind map. The winners are the first to get to get 10 points and at this point they shout out 'Bingo!'

8. Wrap up and set Scholars their self-study tasks for the next fortnight (15 minutes)

Ask each Scholar to prepare four very short (1 to 2 minutes only) presentations. Two should be based on work from Unit B1 and two from work based on Unit B2.

One presentation from each unit should be about any aspect of the unit that the Scholar found interesting, exciting, unexpected or novel.

The other presentation from each unit should be based on an aspect of the unit that the Scholar found challenging and with which they maybe still do not feel completely comfortable. They could include one question which they would really like to know how fellow Scholars and the Tutor would answer.

MSCE B1: Locomotion and B2: Respiration: Tutorial 5

1. Aims of the tutorial

This tutorial reviews the material covered in Tutorials 1 to 4.

2. Introduction (15 minutes)

Keep in mind the points in the checklist on planning and running a tutorial session.

In this tutorial Scholars will give presentations which they have prepared beforehand. Time is allowed for constructive comment and feedback on these. Scholars also build up a bank of potential revision questions on material from Units B1 and B2, using one word answers which you will give them. Make sure you have thought about the words and the possible questions Scholars might come up with before the tutorial.

3. Individual presentations by Scholars (30 minutes)

In this activity – which is also picked up again in Section 5 – Scholars will have the opportunity to give some of their presentations which they prepared for their previous homework.

Give everyone the chance to give two of their presentations – one on something they really enjoyed and one on something they found challenging. Be strict about time allocations, otherwise there will not be time for all Scholars to contribute. After each presentation allow a short time for fellow Scholars to respond with either a positive comment or a helpful suggestion. You may also wish to add comments yourself.

4. Scholars prepare questions for a quiz on locomotion (30 minutes)

Ask the Scholars to prepare a quiz on locomotion, which they could use to help them revise. The quiz will have 20 questions. Each question will have a one-word answer.

Divide the Scholars into four groups. Each group should prepare five questions. The one word answers to each set of questions are:

Group 1	Group 2	Group 3	Group 4
Aerofoil	Down feather	Gliding flight	Scales
Antagonistic (pair of muscles)	Drag	Gravity	Streamlined shape
Barb	Fins	Lift	Swim bladder
Barbule	Flapping flight	Pitching	Thrust
Contract	Gas exchange	Quill or flight feather	Yawing

5. Individual presentations by Scholars (30 minutes)

This is a continuation of the presentations started in Section 3. Allow the Scholars to give their other presentations. Allow a short time for fellow Scholars to respond with either a positive comment or a helpful suggestion. You may also wish to add comments yourself.

6. Scholars prepare questions for a quiz on respiration (30 minutes)

Ask the Scholars to prepare a quiz on respiration, which they could use to help them revise. The quiz will have 28 questions. Each question will have a one-word answer.

Divide the Scholars into four groups. Each group should prepare seven questions.

The one word answers to each set of questions are:

Group 1	Group 2	Group 3	Group 4
Addiction	Bronchus	Lactic acid	Respiratory surface
Aerobic respiration	Carbon monoxide	Muscle fatigue	Ribs
Air sac (in an insect)	Contract (of muscles)	Nicotine	Spiracles
Alveolus	Diaphragm	Oxygen debt	Stroke
Anaerobic respiration	Diffusion	Photosynthesis	Trachea or wind pipe in human
Breathing	Gills	Relaxation	Tracheal system in insects
Bronchiole	Intercostal muscles	Respiration	Tracheoles

7. Using the quizzes produced by Scholars (30 minutes)

Each group will have prepared 12 questions, five on locomotion and seven on respiration. Each group in turn should select one locomotion question and one respiration question to ask the rest of the class. Once all four groups have asked their two questions and all the class have attempted to answer the questions read out by the other groups, each group should give the correct answers to the questions they asked. Scholars can mark their own work.

Spend a short time discussing the questions and answers as a whole class. Were the questions clearly explained? Were they thoughtfully written?

If time allows work through as many as possible of the remaining questions in the same way.

As the Tutor, do take this opportunity, while the Scholars are all working, to sign off Unit B2 in each of their Scholar's MSCE Resources Folder

8. Wrap up and set Scholars their self-study tasks for the next fortnight (15 minutes)

If it is possible, copy all sets of questions and answers produced during the tutorial and provide a set for each student to use for their personal revision.

Alternatively, ensure all students have a full set of the words for each unit and ask them to invent their own questions.

MSCE B3: The Circulatory System: Tutorial 6

This tutorial covers the structures and functions of the circulatory system, including the heart, the blood vessels and the blood; problems of the circulatory system including heart attack and high blood pressure and how to reduce risk of developing them.

Introduction (15 minutes):

Keep in mind the points in the check list on planning and running a tutorial session.

Activity 1: Blood Vessels – Brainstorm and Mind Map. (30 minutes)

Brainstorm key points that are used to describe and distinguish between the characteristics of arteries, veins and capillaries. Write these on the blackboard.

The following points should be noted:– walls thick or thin; walls elastic or not; walls containing a lot or a little of muscle tissue; relative size of lumen; presence of valves or not; pressure of blood in the vessel; carry blood to or from the heart; carry oxygenated or deoxygenated blood (note any exceptions); can substances pass through their walls.

Ask Scholars to work in groups of four to produce a mind map on blood vessels. The central word should be BLOOD VESSELS. Three key words coming out from this should be ARTERY, VEIN and CAPILLARY. The points noted above should appear in the mind map for each type of vessel.

Activity 2: Using a diagram of the circulatory system to trace the pathway of different molecules. (30 minutes)

This activity can be done in pairs. Scholars will need to refer to Figure 1 in Unit B3.

Scholars should use the diagram to trace the pathway and name the blood vessels in the following cases:

1. An oxygen molecule passing from the lungs to the kidney.
2. A glucose molecule passing from the intestines to the brain.
3. An amino acid molecule passing from the intestines to the arm
4. A carbon dioxide molecule produced in a cell of the leg muscle and passing to the outside of the body. (The final part of this will need information from the last Unit B2, Respiration.)

To finish this activity, each Scholar can make up their own question and ask their partner. This time, the person answering could try to answer the question without consulting Figure 1.

Activity 3: The structure and function of the human heart: Fact sheets with deliberate mistakes. (30 minutes)

Give the Scholars 15 minutes to review the information on the structure and function of the heart as outlined in Unit B3. Allow 10 minutes for Scholars to work in pairs, sharing their understanding and discussing any areas of difficulty.

Each pair should now produce a fact sheet on the heart. This should contain three deliberate mistakes.

Finally, work through as many groups as possible, asking them to read out their fact sheets, slowly and clearly. The remaining Scholars should raise their hand as soon as they recognise a deliberate mistake.

Activity 4: Posters of blood cells, outlining their structure and function. (30 minutes)

Scholars can work individually, using the information from Unit B3, to create a poster on blood cells. The poster should include diagrams of each type of cell, together with annotations on important aspects their structure and an outline of their function.

Activity 5: Role play: Advice to a friend on life style tips for a healthy heart. (30 minutes)

In Activity 9 of Unit B3, Scholars were asked to suggest advice on life style tips for a healthy heart. Included in this they were asked to outline how an unhealthy life style can have dangerous results for their heart. Here they are asked to something similar, but they are going to act it out as a short “drama” or role play. They should include the terms listed in Activity 9 in their role play. The Scholar who is receiving the advice could act as “devils advocate” i.e. keep coming up with reasons why they should not lead a healthy life style.

Wrap up and Scholar self-study tasks for the next fortnight. (15 minutes)

Ask Scholars to arrange to spend between half an hour to an hour with a fellow Scholar and take it in turns to test each other on The circulatory system using the questions at the end of Unit B3.

MSCE B3: The Digestive System: Tutorial 7

This tutorial covers the structure and function of the alimentary canal; digestion (physical and chemical) and why it is necessary; the role of enzymes in digestion; the fate of digested food.

Introduction (15 minutes):

Keep in mind the points in the check list on planning and running a tutorial session.

Activity 1: The digestive system – using a semantic map to assess current understanding. (35 minutes)

Ask the Scholars to work individually and to think what they know or think they know about the digestive system at this point in time. You will ask them to make a map a bit like a mind map. They should write THE DIGESTIVE SYSTEM at the centre of the map. The following four categories should be spread around this central term: NAMES OF THE PARTS OF THE ALIMENTARY CANAL; DIGESTION – PHYSICAL AND CHEMICAL; FATE OF PRODUCTS OF DIGESTION; OTHER GENERAL POINTS.

Scholars should then list as many things that they know, or think they know about each of the categories. These should be listed as bullet points. There are no wrong answers. The points indicate what the Scholar knows, or thinks they know. They will have an opportunity to come back to this map at the end of the tutorial in Activity 5.

Activity 2: The structure of the human alimentary canal. (20 minutes)

Write the following 16 names of parts of the human alimentary canal on the board;

Mouth, Tongue, Salivary gland, Gullet or Oesophagus, Stomach, Pancreas, Pancreatic duct, Gall bladder, Bile duct, Duodenum, Ileum, Caecum, Appendix, Colon, Rectum, Anus.

Working first individually, ask Scholars to sketch, from memory, as much as possible of the alimentary canal. They should then join up with a partner and compare diagrams and alter as they think fit. Finally, they should compare their outline diagrams with the diagram in Figure 7 of Unit B3. Any necessary changes should be made.

They should then close their units and working in pairs, they should label their diagrams, using the words on the blackboard. When they have completed as much as they can, they should check their labels against those in Figure 7 of Unit B3.

Activity 3: Presentations on digestive enzymes. (40 minutes)

Ask the Scholars to spend 10-15 minutes individually reading through the section on enzymes in Unit B3. Divide the class into groups of four. Each group will be asked to produce a short presentation on the digestion of either carbohydrates, proteins or fats. Share out the tasks between the groups. Remind the group working on fats, not to forget the role of bile.

Ask selected groups to give their presentations. Ensure all food types are covered at least once. Remember to make sure that you allow all students to have the opportunity to give presentations during your series of tutorials with them.

Activity 4: Writing a story of the digestion of a meal of fish and cassava.* (30 minutes)

Ask Scholars to imagine they have eaten a meal of fish and cassava. They should write a story describing what happens to all the parts of the meal as they pass through the body.

The following words should be included in the story: INGESTION, PHYSICAL DIGESTION, CHEMICAL DIGESTION, ABSORPTION, ASSIMILATION, PERISTALSIS, BILE, FAECES., ENZYMES (AS APPROPRIATE)

Activity 5: Looking back and reassessing the semantic maps on the digestive system. (25 minutes)

Scholars should go back to their semantic map, produce in Activity 1. They should check the points they wrote and make any adjustments necessary.

Working with a partner, Scholars can then exchange maps and read through their partner's thoughts. If possible, Scholars should make suggestions which they feel might be helpful to their partners learning and understanding. They should praise any points they think were expressed in an accurate and helpful manner.

As the Tutor, do take this opportunity, while the Scholars are all working, to sign off Unit B3 in each of their Scholar's MSCE Resources Folder.

Wrap up and Scholar self-study tasks for the next fortnight. (15 minutes)

Ask Scholars to arrange to spend between half an hour to an hour with a fellow Scholar and take it in turns to test each other on the digestive system using the questions at the end of Unit B3.

*Tutors may wish to change this meal to something more suitable for their Scholars

MSCE B4: Excretion: Tutorial 8

This tutorial covers excretion, homeostasis and osmoregulation as applied to humans; the structure and function of the kidney; kidney dialysis machines and how they work.

Introduction (15 minutes):

Keep in mind the points in the check list on planning and running a tutorial session.

Activity 1: The structure of the human excretory system. (30 minutes)

Write the following 9 names of parts of the human excretory system on the board;

Kidney, Ureter, Bladder, Urethra, Renal artery, Renal vein, Aorta, Vena cava, Diaphragm.

Working first individually, ask Scholars to sketch an outline of the human body. Then from memory, they should draw in as much as possible of the excretory system. They should then join up with a partner and compare diagrams and alter as they think fit. Finally, they should compare their outline diagrams with the diagram in Figure 1 of Unit B4. Any necessary changes should be made.

They should then close their units and working in pairs, they should label their diagrams, using the words on the blackboard. When they have completed as much as they can, they should check their labels against those in Figure 1 of Unit B4.

Finally, they should annotate their diagrams with a sentence to explain the function of each of the labelled structures.

Activity 2: Annotating a diagram of a kidney tubule to explain its function. (30 minutes)

Scholars should first spend 5 minutes reminding themselves of the structure of one of the kidney tubules, or nephrons, which make up each kidney, by studying Figure 3 in Unit B4 and reading the four paragraphs below the diagram.

Then working in pairs, they should copy the outline of the simplified diagram of the kidney tubule in Figure 4. No labels or arrow should be copied.

They should then close their units and they should write three short paragraphs explaining what happens: (1) at the capsule end, (2) along the length of the tubule and (c) at the end of the tubule. They can add any other labels if they wish to the diagram. The words below should be incorporated into their paragraphs.

GLOMERULUS (BUNCH OF BLOOD CAPILLARIES), ULTRA-FILTRATION, RENAL OR BOWMAN'S CAPSULE, GLOMERULAR FILTRATE, BLOOD CELLS, SELECTIVE RE-ABSORPTION, OSMOSIS, ACTIVE TRANSPORT, GLUCOSE, UREA, AMINO ACIDS, SALTS, WATER, URINE.

Each pair of Scholars should then join up with another pair and they should read each other's work. Scholars should make any suggestions which they feel might improve their fellow Scholar's work and might be helpful to their learning and understanding.

Finally Scholars should look at Figure 4 in Unit B4 and make any additions or alterations they feel appropriate.

Activity 3: Oral presentations on osmoregulation in humans. (30 minutes)

Ask your Scholars to work in groups of four to prepare a short oral presentation to explain the events or changes that will happen (a) in the blood; (b) in the hypothalamus; (c) in the pituitary gland; and (d) in the kidney tubules, in the following two situations:

- i. After you have just drunk a great deal of water.
- ii. On a hot day when you have not had anything to drink for a long time.

Scholars can use the section on osmoregulation in Unit B4 to help prepare their presentations.

Ask selected groups to give their presentation to the whole class. Remember to make sure that you allow all students to have the opportunity to give presentations during your series of tutorials with them.

Activity 4: Post box – Creating factual statements on key processes – excretion, osmoregulation and homeostasis. (30 minutes)

Scholars can either do mini brainstorming on the processes – excretion, osmoregulation and homeostasis – or they could search their B4 unit for key facts. They should choose three factual statements about each process and one question about the process which they do not quite understand. They should write these on separate small pieces of paper. The statements/questions for each process should be collected separately in three bags or containers.

Ask different individual Scholars to withdraw from 2-4 statements (according to the size of your class) and read them out. When all the statements/questions for one process have been read out, make any comments yourself about any important points you feel are missing. For the questions, ask the class if they can help with answers first. Add your own points as well if necessary. Do the same for the other processes.

Activity 5: Poster of kidney dialysis machine. (30 minutes)

Scholars should spend 10-15 minutes reading through the information about the kidney dialysis machine. They should then make a poster, including a diagram showing its structure, together with annotations explaining how it works.

Wrap up and Scholar self-study tasks for the next fortnight. (15 minutes)

Ask scholars to arrange to spend between half an hour to an hour with a fellow scholar and take it in turns to test each other on Excretion using the questions at the end of Unit B4.

MSCE B4: Coordination: Tutorial 9

This tutorial covers coordination and its importance; the main structures and functions of the human nervous system, including neurons; reflex actions; the effects of different types of drugs on brain activity.

Introduction (15 minutes):

Keep in mind the points in the check list on planning and running a tutorial session.

Activity 1: What is coordination and why is it important? (30 minutes)

Scholars should work in small groups and using Unit B4, they should assemble ideas to answer this question. They could do a brain storm to start them off. They should produce a short presentation, to last 2-3 minutes, to answer the above question. They should include some particular examples of why coordination is important, not just general statements.

As many groups as possible should have the opportunity to give their presentations. You can give a final summing up, praising the work. Add or emphasise any points that you feel have not been sufficiently drawn out.

Activity 2: Mini oral presentations – Deliberate mistakes in facts about the brain. (30 minutes)

Ask Scholars to work in small groups to prepare a fact sheet about the brain. The fact sheet should contain between eight and ten facts. Two of the facts should be deliberately incorrect.

Finally, work through as many groups as possible, asking them to read out their fact sheets, slowly and clearly. The remaining scholars should raise their hand as soon as they recognise a deliberate mistake.

Activity 3: Practical investigation of the knee jerk reflex, followed by a biological explanation of how it happens. (35 minutes)

Demonstrate the knee jerk reflex to the Scholars.

Ask them to work in small groups. First they should practice the reflex on each other.

Ask them to produce a diagram to explain how the reflex action happens. They should include the terms below, explaining how each is involved in the action.

Stimulus, receptor, sensory neuron, impulse, relay neuron, motor neuron and effector organ, response.

Activity 4: Think, pair, share – Structure and function of sensory and motor neurons. (30 minutes)

Scholars should attempt to sketch a diagram of a sensory and a motor neuron, with as many labels as possible. They should then pair up with a fellow Scholar and compare sketches. They can make any appropriate revisions to their diagrams. They should discuss the function of each type of neuron and agree on a short annotation to add to their diagrams to explain the function of the two cells. Finally they can refer to their Unit B4 to check the accuracy of their work.

Activity 5: Key word splat activity on drugs. (30 minutes)

Write the following four words on the board, in large letters and well spaced out.

PAINKILLER STIMULANT SEDATIVE HALLUCINOGEN

Divide the class into two groups. Invite a representative from each group to the front to stand by the board. Scholars must not use their notes for this activity. Read out either a definition of one of the four drug types or the name of an example of a drug belonging to one of the four types.

The first Scholar to “splat” i.e. point with her hand to the correct key word wins a point for her team. The Scholar who did not guess successfully returns to her team and is replaced with another Scholar from that team. If you finish reading out all the definitions and drug names, ask a Scholar to take your place in reading out definitions and names and repeat the process. Round off the activity by discussing with Scholars the four main reasons why drugs can be dangerous, as summarised in Unit B4.

Wrap up and Scholar self-study tasks for the next fortnight. (15 minutes)

Ask each Scholar to prepare four very short (1-2 minutes only) presentations. Two should be based on work from Unit B3 and two from work based on Unit B4.

One presentation from each unit should be about any aspect of the unit that the Scholar found interesting, exciting, unexpected or novel.

The other presentation from each unit should be based on an aspect of the unit that the Scholar found challenging and with which they maybe still do not feel completely comfortable. They could include one question which they would really like to know how fellow Scholars and the tutor would answer.

Review of Circulation, digestion, excretion and coordination: Tutorial 10

This tutorial reviews material covered in tutorials 6-9.

Introduction (15 minutes):

Keep in mind the points in the check list on planning and running a tutorial session.

In this tutorial Scholars will give presentation which they have prepared beforehand. Time is allowed for constructive comment and feedback on these. Scholars also build up a bank of potential revision questions on material from Units B3 and B4, using one word answers which you will give them. Make sure you have thought about the words and the possible questions Scholars might come up with before the tutorial.

Activity 1: Individual presentations by Scholars. (30 minutes)

In this activity – which is also picked up again in Activity 3 – Scholars will have the opportunity to give some of their presentations which they prepared for their previous homework.

Give everyone the chance to give two of their presentations – one on something they really enjoyed and one on something they found challenging. Be strict about time allocations, otherwise there will not be time for all Scholars to contribute. After each presentation allow a short time for fellow Scholars to respond with either a positive comment or a helpful suggestion. You may also wish to add comments yourself.

Activity 2: Scholars prepare questions for a quiz on circulation and digestion. (30 minutes)

Ask the Scholars to prepare a quiz on Circulation and digestion, which they could use to help them revise. The quiz will have twenty four questions. Each question will have a one word answer.

Divide the Scholars into four groups. Each group should prepare six questions.

The one word answers to each set of questions are:

Group 1

Alimentary canal
Amino acid
Amylase
Aorta
Artery
Atrium (pl atria)

Group 2

Capillary
Chemical digestion
Enzyme
Fibrin
Haemoglobin
Heart attack

Group 3

Hormone
Ingestion
Lipase
Peristalsis
Phagocytosis
Physical digestion

Group 4

Plasma
Platelets
Protease
Vein
Vena cava
Ventricle

Activity 3: Individual presentation by Scholars. (30 minutes)

This is a continuation of the presentations started in Activity 1

Activity 4: Scholars prepare questions for a quiz on Excretion and coordination. (30 minutes)

Ask the Scholars to prepare a quiz on Excretion and Coordination, which they could use to help them revise. The quiz will have twenty five questions. Each question will have a one word answer.

Divide the Scholars into five groups. Each group should prepare five questions.

The one word answers to each set of questions are:

Group 1

Active transport
ADH (Anti diuretic hormone)
Coordination
Effector
Excretion

Group 2

Homeostasis
Impulse (nerve impulse)
Medulla oblongata
Meninges
Motor neuron

Group 3

Nephron
Neuro-transmitter
Osmo-regulation
Osmosis
Receptor

Group 4

Reflex arc
Reflex action
Response
Selective re-absorption
Sensory neuron

Group 5

Stimulus

Synapse

Ultra-filtration

Urea

Urine

**Activity 5: Using the quizzes produced by Scholars.
(30 minutes)**

Trial run of the two quizzes. Each group should start by reading out one question from each of their sets of questions. Individuals in the other groups should write down the answers.

After the first eight questions have been read out and Scholars had a chance to attempt to answer them, the set answers should be read out. Scholars can mark their own work.

Spend a short time discussing the questions and answers as a whole class. Were the questions clearly explained? Were they thoughtfully written? If time allows work through as many as possible of the remaining questions in the same way.

**Wrap up and Scholar self-study tasks for the next fortnight.
(15 minutes)**

If it is possible, copy all sets of questions and answers produced during the tutorial and provide a set for each student to use for their personal revision.

Alternatively, ensure all students have a full set of the words for each unit and ask them to invent their own questions.

As the Tutor, do take this opportunity, while the Scholars are all working, to sign off Unit B4 in each of their Scholar's MSCE Resources Folder.

MSCE B5: New Generations

Part 1 of 2: Tutorial 11

This tutorial covers learning outcomes 3,4,5,6 & 7 of B5. *Structure and function of human male and female reproductive systems; Fertilisation and implantation; Structure and function of placenta; Human menstrual cycle; Contraception.*

Introduction (15 minutes):

Keep in mind the points in the check list on planning and running a tutorial session.

This tutorial concentrates on how human bodies are adapted for having babies and how this actually happens. The activities in this tutorial centre largely around diagrams and their labels; and key words and their meaning.

As an introductory 5 minute opening activity into this topic, Scholars could be asked to share information about friends or relations who have recently had babies or who are about to have babies.

Activity 1: Think, pair, share. (35 minutes)

Menstruation and the female reproductive system

Begin the topic by considering **menstruation**, which starts in girls at puberty. All Scholars should be familiar with this. In this activity Scholars develop their understanding of the **female reproductive structures** and start thinking about the functions of some of the parts.

Divide the Scholars into small groups and ask them to consider the following:-

Imagine they have to explain to a younger sister what will happen when she starts having periods. What sort of things would they say regarding?

- What will she notice herself and how will she need to deal with this?
- What parts of the inside of her body are involved and what happens inside? Ask them to use the following words in their explanation:- egg (ovum), ovary, uterus, vagina. They should sketch a simple diagram to show where these parts are in her body. (They can use the diagrams in the unit to help). They should label their sketch.

Ask an individual from one or two of the groups to report on what the group decided they would say to a younger sister to explain menstruation.

Activity 2: Think, pair, share. (35 minutes)

The male reproductive system and how a baby is started

To understand **how a baby is started**, Scholars need to know the basic structures of the female and **male reproductive systems**. They must also understand that sexual intercourse must happen so that an egg and sperm can join together, in a process called fertilisation, to make a cell called a zygote.

Again, divide the Scholars into small groups and ask them to do the following:-

- a. Sketch an outline of the male body
- b. Discuss what they know about the following words – sperm, penis, testis, semen.
- c. Agree among themselves where on their diagram, each word would best be written.
- d. They can then look in their units at the section on the male reproductive system and check how accurate they were.

While students are working in groups, prepare the front board for the conclusion to this activity.

On one side of the board/flip chart sheet list the following four things:- Sexual intercourse; ejaculation; fertilisation; zygote. Three of these are actions. One is a “thing” or object. All are essential before a baby can start to develop.

On the opposite side of the board, or on another flip chart sheet, write the following four statements:- A sperm cell joins with or fuses with an egg cell. Contractions of the sperm ducts which cause semen to be forced out of the end of the penis. The cell made when the sperm and egg join together. The penis of the man is placed inside the vagina of the woman.

Now ask the groups to present their sketches to the whole class, together with their understanding of the four key words:- sperm, penis, testis, semen.

Finally ask Scholars to read the two lists you have written at the front. Ask for volunteers to draw a line connecting each term on the left to an explanation from the statements on the right. Ensure everyone agrees with the result.

Activity 3: A baby develops: Whole class activity, labelling and explaining diagrams. (25 minutes)

Ask the Scholars to spend 5 minutes studying Figures 4 and 5a, together with the statements in Activity 3 in their B5 unit.

Ask one Scholar to draw an outline sketch based on Figure 4 on one side of the board/one flip chart sheet. Ask another scholar to draw an outline sketch of Figure 5a on the other side of the board or a second flip chart sheet.

Ensure Scholars understand the connection between the two diagrams. Ask for volunteers to come out to add the following labels to structures in the diagrams (both if applicable):- ovary, oviduct, uterus or womb, egg, sperm, uterus wall, placenta, foetus, amniotic cavity, cervix. The following labels should also be added, but in capital letters to indicate they are processes as opposed to structures:- ovulation, fertilisation, implantation.

Ask for volunteers to come to the front and use the diagrams to explain (a) ovulation, fertilisation and implantation; (b) how the structures in Figure 5a are important for the developing baby.

Activity 4: Contraception. (25 minutes)**Group sketching and labelling of diagrams. Peer assessment of work**

Ask each Scholar to sketch two diagrams – one of the female reproductive system and one of the male reproductive system. Discuss the meaning of the term contraception. Collect ideas from the class of the different contraceptive or birth control methods they know. List these on the board. Using symbols ask the Scholars to mark on their diagrams the main site of action for each of the contraceptive methods listed and to label them.

They should swap diagrams with a partner and assess their partner's work. Tick each point of agreement. Put a cross if they are sure a point is wrong. Put a question mark if they are not sure. Each diagram should then be passed to a third person and the assessment completed. Finally diagrams should be returned to the original owner and the markings noted.

Take questions from the class over any continuing discrepancies and discuss. This section is covered in Unit B5, Activity 7 and the preceding section of text.

Activity 5: Whole group activity Mind Map. (30 minutes)

1. Scholars should use the key words covered in this tutorial and create their own mind map.

If the group of Scholars show a range of stages of development of their knowledge and understanding, the above might be sufficient work for some.

2. Optional extension work should be set as appropriate to individual Scholars. For example, they should ensure they understand the meanings of the words below and add these in the appropriate places to their mind map:

Hormone, corpus luteum, oestrogen, progesterone, LH, FSH, oviduct (fallopian tube), cervix, cilia, menopause, ovulation, pituitary gland, puberty, scrotal sac, urethra.

MSCE B5: New Generations

Part 2 of 2: Tutorial 12

This tutorial covers learning outcomes 1,2,8 & 9 of B5. *Chromosomes, DNA and genes; How genes control characteristics; Division of nucleus and chromosomes; Inheritance.*

Introduction (15 minutes):

Keep in mind the points in the check list on planning and running a tutorial session.

The last tutorial looked at how a new baby comes into existence. Here we look at what determines what the baby will be like. This tutorial concentrates on genes, chromosomes, genetics and inheritance.

Model making is used to develop understanding of microscopic structures. You could either collect and bring to the tutorial – string or thread, coloured felt tip pens and cardboard from old food packaging (for Activities 1 & 2); or you could arrange to take the Scholars outside briefly to collect.

Observation of characteristics of the Scholars themselves together with worked examples are used to look at how characteristics are inherited.

Check whether Scholars had any problems with the mind maps from the last tutorial.

Activity 1: In small groups, make models of a cell, nucleus, chromosomes and genes. (30 minutes)

Divide Scholars into small groups and ask them to discuss the meanings of the following words:–

cell, nucleus, chromosome and gene. 10 mins

Provide each group with – string or thread, coloured felt tip pens and cardboard from old food packaging. Ask them to plan and make a model to illustrate the group's understanding of the words above.

Alternatively, start this section of work by giving the Scholars 5 minutes to go outside and collect a selection of object such as twigs, stones, sand, long grass, fruits and seeds, which they could use to make their model. 20 mins

Present the models to the class. Explain any ways in which they feel their models do not correctly mimic the actual thing and say why. 10 mins

Activity 2: In small groups make models of mitosis and meiosis. (30 minutes)

Remind students that cells have two ways of dividing – by mitosis and by meiosis.

Divide Scholars into small groups. Ask each group to make models to show how a very simple cell, with just one pair of chromosomes in its nucleus divides, first by mitosis and then by meiosis. They can lay out models of the main stages on a board or a table or the floor. Start half the groups off with making models of mitosis and half with making models of meiosis. They can refer to Figure 10 in Unit B5 to help them. Cell outlines can be drawn on card. Chromosomes could be made from card or modelled using twigs.

Once all groups have completed models for at least one of the two processes, stop the class and go around the room together looking at the models. Each group should present their models to the class. They should also explain any ways in which they feel their models do not correctly mimic the actual thing and say why.

Working together as a whole class, draw up a list the similarities and differences between the two types of division. Explain the importance of these similarities and differences to the lives of living organisms. This can be summarised as a table on the board or flip chart sheet.

Activity 3: Introduction to human inheritance by brain storming, discussion and simple practical experiment/observation. (30 minutes)

Get the whole class to brainstorm examples of characteristics of human beings for two minutes. Write the results on the board or flip chart sheet. Now decide which of these are inherited from our parents/due to our genes and which can be changed by our environment, and which could be affected by both genes and environment. Indicate this by symbols or colour on the brain storm map.

Do another short brain storm, on a separate sheet/side of the board to gather ideas from Scholars about what they know and understand about genetic inheritance.

Important ideas to build up include: inherited characters are controlled by pairs of genes. Most characters are controlled by several pairs of genes. Some are controlled by just a single pair and therefore useful in helping us understand the basic ideas of genetics. One of each pair of genes comes from your mother and one from your father.

Working in pairs, each Scholar should decide whether they are able to roll their tongue or not and if they have free or attached ear lobes. Use Figure 11 in Unit B5 for guidance. (NB There is now discrepancy as to whether these characteristics are controlled by a single gene, but for this activity we will assume they are.)

Discuss the terms genotype/phenotype; heterozygous/homozygous; dominant/recessive, in relation to these two characteristics. [Genes for tongue rolling ability and free ear lobes are both dominant.]

Discuss use of letters to represent genes. Work out the possible genotypes of each Scholar with regard to the 2 characteristics considered here. [E.g. TT, Tt, tt and EE, Ee, ee.]

Activity 4: Investigating a genetic problem. (30 minutes)

Introduce the following problem to the scholars.

Maria had three pet guinea pigs – one white male and two black females. The male had several litters with each female. The babies in the litters of one female were all black. The babies in the litters of the other female contained both black and white babies.

If we assume that colour is controlled by a single pair of genes, how could we explain these findings?

Give Scholars a little time to think about the problem themselves first. Then let them ask question of you and of their fellow Scholars. You could use the C3B4ME technique, i.e. they must ask three fellow Scholars for help before they approach you.

The following five points may be useful things to remind or tell scholars and get them to think about when tackling genetics problems.

1. *We use letters to represent genes.*
2. *We use capital letters for dominant genes and lower case for recessive genes.*
3. *Characters which occur most frequently are most likely to be dominant.*
4. *Individuals showing characteristics controlled by recessive genes must be homozygous for the recessive gene, in order for the character to show.*
5. *Individuals showing characteristics controlled by dominant genes could be either homozygous or heterozygous. You need to see the results of breeding experiments to decide which they are.*

Try to help the Scholars through the problem to reach the solution that black colour must be dominant to white colour. One of the black females must have been homozygous and one must have been heterozygous. Only the latter could have had white babies with the white father.

Activity 5: Make glossary of genetic terms. (30 minutes)

Divide the Scholars into small groups. Write a list of key genetics terms on the board – see below. Ask each group to write a definition for each term. When complete, each group should pass their definitions to another group to check there is agreement.

Terms – mitosis, meiosis, gene, chromosome, nucleus, dominant, recessive, heterozygous, homozygous, genotype, phenotype, inheritance, genetics, haploid, diploid, spindle, equator.

Finish with a whole class discussion of any areas of disagreement.

As the Tutor, do take this opportunity, while the Scholars are all working, to sign off Unit B5 in each of their Scholar's MSCE Resources Folder

Wrap up and Scholar self-study tasks for the next fortnight. (15 minutes)

1. Learn glossary words.
2. Try to solve this genetics problem.

Test 1. A fruit grower crosses a white fruited plant with a yellow fruited plant. This produces twenty new plants. Eleven have white fruit, nine have yellow fruit.

Test 2. He self-fertilises the white fruited offspring and gets a mixture of white fruited and yellow fruited offspring.

Test 3. He self-fertilises the yellow fruited offspring and all the offspring are yellow.

Assume that fruit colour is determined by a single pair of genes. Which gene is dominant? – show by diagrams what is the genotype of the parents and all types of offspring.

For each of the three tests above, write the genotypes of the parents and all types of offspring. Use letters for the genes and provide a key. For each individual, write whether it is homozygous or heterozygous.

MSCE B6: Drugs and Disease

Part 1 of 2: Tutorial 13

This tutorial covers learning outcomes 1-5 of B6. *Infectious diseases and the types of microbe that cause them; Signs and symptoms of selected diseases; How infectious diseases are spread and how they can be controlled.*

Introduction (15 minutes):

Keep in mind the points in the check list on planning and running a tutorial session.

Go over the answer to the genetics problem set for homework.

In this tutorial you will start by highlighting the main infectious diseases Scholars need to know about and relate them to particular parts of the body in a visual manner, by getting scholars to sketch a body outline together with the main organs. The second activity deal with means of transmission, control and treatment. Vector borne diseases are discussed in Activity 3 and diseases of the nervous system covered in Activity 4.

Activity 1: Small group work – sketching body, labeling parts and sites where pathogens act. (45 minutes)

In groups, draw a large outline of the human body on a sheet of paper. Sketch in the positions of the following:– nasal passage, mouth, throat, oesophagus, stomach, intestines, windpipe (trachea), bronchi, lungs, lymph glands under arms and in groin, kidney, brain, vagina and penis (divide the bottom part of the sketch into a right and left half to accommodate the latter two organs).

Label the following parts of the diagram:– inside mouth, upper throat, throat, windpipe, lungs, lining of intestines, skin, lymph glands, kidneys, brain, vagina, head of penis.

Read through the following list of pathogens:– cold virus, flu virus, measles virus, pneumonia bacteria, TB bacteria, cholera bacteria, typhoid bacteria, chicken pox virus, ringworm fungus, athlete’s foot fungus, thrush fungus. Write the name of each pathogen next to any of the body parts that you labelled on your diagram which it can affect.

Report back – each group discusses a part of their diagram. Divide the reporting back so all groups have a chance to contribute, Extend the class discussion to cover the main symptoms of diseases.

Activity 2: Brain storming and small group work. Spread and control of infectious diseases. (30 minutes)

Ask Scholars how they themselves or their siblings have contracted infectious diseases such as colds, flu, chicken pox. Lead on from this to brain storm with the whole class the main ways in which any infectious disease can be spread. Write the main ways diseases can be spread on the board/flip chart sheet. (See Unit B6, Activity 3 together with its answer and the preceding section of text).

Ask Scholars to work in small groups and to decide which diseases are spread in each of the main ways listed on the board. They should then decide how this knowledge can be used to reduce spread of each disease. Finally they should discuss whether they know of any drugs, vaccines or other treatments that are available for each disease. They can record thoughts in a table on a flip chart sheet, e.g. see below. (See Unit B6, Activities 3 & 4 and their answers).

Method of spread	Disease	How to reduce spread	Drugs, vaccines or other treatments
Droplets in air	Flu	Hand over mouth and nose when sneezing.	Rest and drink plenty of liquids.
Etc.			

Report back to whole class – share reporting between groups.

Activity 3: Brain storming and producing class mind map on vector borne diseases. (30 minutes)

Remind Scholars that some diseases are caused by pathogens that are transmitted to human by other animals, which we call vectors. Diseases transmitted in this way include malaria, sleeping sickness and elephantiasis. As a whole class activity, brain storm what scholars know about these diseases. Build up a whole class mind map. Add notes on:– the name of pathogen and the vector ; how the vector transmits the pathogen; symptoms of the disease and parts of body affected; control of the disease by control of vector; other ways of controlling and/or treating the disease. (See Unit B6, section entitled Infectious diseases caused by protozoa and nematode worms – including their control and treatment.)

Activity 4: Small group sketching, exchange of group efforts, small group reassessment of own efforts, followed by discussion of key terms. Whole class summing up. (45 minutes)

- A. In small groups and from memory, Scholars should produce a sketch diagram of a nerve cell. If possible they should sketch the three types of nerve cell. They should add as many labels as possible. They should then exchange their work with that from another group. They should tick all labels they agree with and think are correct; write a ? for any parts or labels which they think are not correct. Work should be returned to the original group. Any revisions may now be made to the original sketch.
- B. Each group should agree on one or two sentences to explain the following terms, say where in the body each is found and why each is important:–
 motor neuron, muscle, cerebrospinal fluid, meninges.

- C. Working now as a whole class, ask one Scholar to draw a motor neuron on the board or flip chart. Ask other Scholars to explain each of the terms:– motor neuron, muscle, cerebrospinal fluid, meninges.
- D. Finally, using their understanding of the terms above, Scholars should be asked to explain how each of the following pathogens causes disease in humans:–polio virus, tetanus bacteria, meningitis bacteria (virus), leprosy bacteria. This could be done as a whole class collaborative activity.

Wrap up and Scholar self-study tasks for the next fortnight (15 minutes)

- 1. List key words covered in this tutorial and write their own explanation of each word.
- 2. Ask Scholars to arrange to spend between half an hour to an hour with a fellow Scholar and take it in turns to test each other on reproduction and genetics using the questions at the end of Unit B5.

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Part 2 of 2: Tutorial 14

This tutorial covers learning outcomes 6-8 of B6. *Ways in which your own body protects you against disease, including the lymphatic system; Natural and artificial immunity; How HIV weakens the immune system.*

Introduction (15 minutes):

Keep in mind the points in the check list on planning and running a tutorial session.

In this tutorial you will guide the Scholars through from the first line of defence of the body against invading pathogens, such as the skin, to more specialised mechanisms, including the role of the lymphatic system, specialised cells – lymphocytes and phagocytes – and the role of antibodies in natural immunity and in vaccinations.

For Activity 2 you will need to prepare a written sheet for each group with the six questions, with the three possible answers for each question. These can be collected in at the end of the session and reused. If copying facilities are limited, you could write out each of the six questions on a separate sheet, so each group just considers one question. In the reporting back session, the groups will need to carefully explain their question as well as discussing the answer they selected.

You will need to prepare cards for Activity 3 before the tutorial.

There is a considerable amount of “reporting back” by groups throughout this tutorial. Make sure that each group has the chance of being the first and main group to report on their findings for at least one of the activities.

Activity 1: Small group discussion. (30 minutes)

The following act as a first line of defence by our bodies against invading pathogens.

- 1. Skin**
- 2. Lining of nose, mouth and air passages**
- 3. Stomach lining**
- 4. Tears and ear wax**

Ask your students to work in small groups and to discuss how the four things above can help protect the body from invading pathogens.

Report back to the whole class

Activity 2: Small group selection of best fit answers to questions on the lymphatic system. (45 minutes)

This activity draws the Scholar's attention to the existence of the lymphatic system and its role in defence against disease.

Divide Scholars into groups. Ask them to consider the six questions below. Each question is provided with three possible answers. The group is asked to decide which is the best answer for each of the six questions.

In the reporting back session, groups should explain why they selected the answer they did. They should say what was wrong with the other answers.

Question 1. Which sentence best describes the lymphatic system?

- A. A network of tubes throughout the body that drains fluid from tissues and returns it to the bloodstream.
- B. A collection of special cells and chemicals that fight infection from foreign organisms like viruses and bacteria.
- C. A series of glands that secrete chemicals called hormones into the blood, which help to regulate a range of body processes.

Question 2. What are the main roles of the lymphatic system?

- A. Managing fluid levels in the body, making hormones that regulate metabolism, and filtering out bacteria.
- B. Managing fluid levels in the body, maintaining the body's sense of balance, and housing types of white blood cells.
- C. Managing fluid levels in the body, filtering out bacteria, and housing types of white blood cells.

Question 3. How is the lymph pumped around the body?

- A. By a special organ (the lymphocardial node), located in the abdomen, that acts like a little pump.
- B. The contraction of skeletal muscles close to the lymph vessels pushes the lymph along.
- C. By muscular movements and contractions of the larger lymph vessels.

Question 4. What stops lymph from travelling backwards through the lymphatic vessels?

- A. Nothing, because the lymphatic system works most efficiently when the lymph is allowed to travel in whichever direction it needs to go.
- B. Many of the vessels contain one-way valves, which are forced shut by back-pressure.
- C. The lymph is contained and pumped at high pressure inside the lymphatic vessels, making any backwards movement impossible

Question 5. What are lymph nodes?

- A. Collections of swellings in lymph vessels that are found at various locations around the body, especially in the neck, arm pits and groin areas.
- B. Abnormal scar tissue that prevents the free movement of lymph through the vessels.
- C. Special clusters of nerve cells that allow the lymphatic system to communicate directly with the brain.

Question 6. What happens to any excess fluid that the lymphatic system removes from tissues?

- A. Fluid that the body needs is returned to the bloodstream, but excess fluid is piped directly to the bladder for excretion.
- B. Fluid that the body needs is returned to the bloodstream, but excess fluid is directed to the mouth to aid in saliva production.
- C. All collected fluids are returned to the bloodstream.

Activity 3: Circus of activities to reinforce understanding of the terms:-

Phagocytes Lymphocytes Antibodies Antigens Vaccinations (45 minutes)

Before the tutorial, copy out the information below for each of the three stations onto three separate cards. If you have a very large group of Scholars, you could make duplicate cards for each station.

Spread the three cards around the room. Divide the class into three groups. Start each group at one of the three stations. After 5-8 minutes, ask the groups to move around to a new station. Ensure the groups move in the same direction, so that all groups cover all stations.

When all groups have completed all stations, hold a report back session with the whole class to ensure all individuals are clear about the work covered.

Station 1

The sentences below describe how **phagocytes** destroy pathogens.

Copy out and complete the sentences, using words from the box.

Digesting, capillaries, surround, vacuole

- 1 Phagocytes are able to squeeze through the walls of small blood vessels called.....
- 2 They move towards pathogens and begin to.....them.
- 3 The phagocytes surround the pathogen until it is completely inside a special structure called a.....
- 4 The phagocyte then destroys the pathogen by..... it.

Station 2

Read these three paragraphs

Bacteria and viruses have chemicals called **antigens** on their outer surface which help to identify them. Each different bacteria or virus has different antigens. **Lymphocytes** recognise invading cells by detecting their antigens which are not recognised as a natural part of the body.

The lymphocytes make chemicals called **antibodies**. These antibodies attach onto the antigens on the surface of the pathogens to label them, so that the pathogens can be destroyed.

If you get a new infection which you have never had before, it takes time to develop new antibodies to mark them. During this time, the bacteria can grow, causing illness or even death.

After you have had an infection once, the lymphocytes 'remember' the type of antibody needed, so they can respond much more quickly if you get infected again. So, once you have had an illness, you have more resistance in the future.

Now do this

Lymphocytes recognise, make and remember. Expand on these three things that lymphocytes can do to explain why they are so important in protecting us against infectious diseases.

Station 3**Read this paragraph**

Vaccines, which provide immunity to an infection, are made using weakened or dead cells of the pathogen which causes the illness. The body uses these to 'learn' how to make the right **antibodies**, ready for any future infection. It is as if you had already had the illness once, so you do not get it again. When you are given a vaccine, as an injection or orally, we say you are being **vaccinated** or having a **vaccination**.

Now do this

Use information from this paragraph, together with your own background knowledge to write a sentence to explain the meaning of each of the underlined words.

Activity 4: The human immunodeficiency virus or HIV Role play activity. (30 minutes)

Scholars could be asked to improvise a short drama or role play in which they explain to a younger sibling why HIV is such a dangerous virus and how, once contracted, it has such a devastating effect on the life of the patient. Volunteers could be asked to present their role plays to the whole class.

The following key points could be highlighted by writing them on the board or flip chart sheet after the role plays.

1. The human immunodeficiency virus or HIV is so damaging because it attacks the body's immune system. In other words, it attacks the very system which our bodies have developed to protect us from disease.
2. The virus causes the number of lymphocytes and phagocytes to become less. This means they are not available to protect the body against any invading pathogens. People with HIV keep getting diseases that normal people quickly fight off. Very often they die from pneumonia.
3. There is no cure or vaccine for HIV. Antiretroviral drugs can delay death, but they are expensive and not always available.
4. HIV is transmitted by:– (a) sexual contact; (b) contact with infected body fluids or tissues (e.g. reusing syringe needles); (c) infected mothers pass the virus to their babies in the womb.

Wrap up and Scholar self-study tasks for the next fortnight (15 minutes)

1. Ask Scholars to arrange to spend between half an hour to an hour with a fellow Scholar and take it in turns to test each other on drugs and disease using the questions at the end of Unit B6.
2. Ask each Scholar to prepare four very short (1-2 minutes only) presentations. Two should be based on work from Unit B5 and two from work based on Unit B6.

One presentation from each unit should be about any aspect of the unit that the Scholar found interesting, exciting, unexpected or novel. The other presentation from each unit should be based on an aspect of the unit that the Scholar found challenging and with which they maybe still do not feel completely comfortable. They could include one question which they would really like to know how fellow Scholars and the tutor would answer.

3. Extension, if time. List key words covered in this tutorial and write their own explanation of each word.

Recap of Units B5 and B6: Tutorial 15

This tutorial covers learning outcomes from both B5 and B6. It is a review of work covered in tutorials 11-14. It acts as an illustration of a strategy that is important in revising and remembering course materials as well as further developing understanding.

Introduction (15 minutes):

Keep in mind the points in the check list on planning and running a tutorial session.

In this tutorial Scholars will give presentation which they have prepared beforehand. Time is allowed for constructive comment and feedback on these. Scholars also build up a bank of potential revision questions on material from Units B5 and B6, using one word answers which you will give them. Make sure you have thought about the words and the possible questions Scholars might come up with before the tutorial.

Activity 1: Individual presentations by Scholars. (30 minutes)

In this activity – which is also picked up again in Activity 3 – Scholars will have the opportunity to give some of their presentations which they prepared for their previous homework.

Give everyone the chance to give two of their presentations – one on something they really enjoyed and one on something they found challenging. Be strict about time allocations, otherwise there will not be time for all Scholars to contribute. After each presentation allow a short time for fellow Scholars to respond with either a positive comment or a helpful suggestion. You may also wish to add comments yourself.

Activity 2: Scholars prepare questions for a quiz on reproduction and genetics. (30 minutes)

Ask the Scholars to prepare a New Generations quiz, on reproduction and genetics, which they could use to help them revise. The quiz will have twenty four questions. Each question will have a one word answer.

Divide the Scholars into four groups. Each group should prepare six questions.

The one word answers to each set of questions are:–

Group 1

Chromosome
DNA (deoxyribonucleic acid)
dominant
embryo
fertilisation
gamete

Group 2

gene
heterozygous
homozygous

hormone
meiosis
menstrual cycle

Group 3

mitosis
ovary
ovum (pl ova)
placenta
recessive
semen

Group 4

sperm
testis (pl. testes)
umbilical cord
uterus or womb
water sac or amnion
zygote.

Activity 3: Individual presentation by Scholars. (30 minutes)

This is a continuation of the presentations started in activity 1.

Activity 4: Scholars prepare questions for a quiz on drugs and disease. (30 minutes)

Ask the Scholars to prepare a quiz on Drugs and Disease, which they could use to help them revise. The quiz will have twenty questions. Each question will have a one word answer.

Divide the Scholars into four groups. Each group should prepare five questions.

The one word answers to each set of questions are:–

Group 1

Antibody
Antigen
Cerebrospinal fluid
Contagious
Immune system

Group 2

Immunity
Infectious disease
Lymph
Lymphatic system
Lymph node

Group 3

Lymphocyte
Macrophage
Meninges
Microbe
Motor neuron

Group 4

Natural immunity

Pathogen

Phagocyte/phagocytic cell/phagocytosis

Vaccine

Vector

Activity 5: Using the quizzes produced by Scholars. (30 minutes)

Trial run of the two quizzes. Each group should start by reading out one question from each of their sets of questions. Individuals in the other groups should write down the answers.

After the first eight questions have been read out and scholars had a chance to attempt to answer them, the set answers should be read out. Scholars can mark their own work.

Spend a short time discussing the questions and answers as a whole class. Were the questions clearly explained? Were they thoughtfully written?

If time allows work through as many as possible of the remaining questions in the same way.

As the Tutor, do take this opportunity, while the Scholars are all working, to sign off Unit B5 and B6 in each of their Scholar's MSCE Resources Folder.

Wrap up and Scholar self-study tasks for the next fortnight. (15 minutes)

If it is possible, copy all sets of questions and answers produced during the tutorial and provide a set for each student to use for their personal revision.

Alternatively, ensure all students have a full set of the words for each unit and ask them to invent their own questions.



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