



Educan

A comprehensive guide to excelling in

O-Level Biology

A NEW COMPETENCE BASED
BIOLOGY
STUDENTS' BOOK 3

BAGGOOLE DANIEL

A NEW COMPETENCE BASED BIOLOGY

A Comprehensive Guide to Excelling In Ordinary Level Biology

STUDENTS' BOOK 3

A PERSPECTIVE OF THE COMPETENCE BASED CURRICULUM

(A must-read handbook for young visionary Biologists)

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Courtesy of;



A handwritten signature in black ink, appearing to read "Bagoole Daniel", with a small flourish at the end.

Bagoole Daniel

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It is therefore wise to prevent these cases from happening by proper care of our kidneys and the urinary tract system.

The best way to prevent urinary tract infections and kidney diseases is to keep the kidneys and the entire urinary system healthy. This can be done through proper diet and nutrition. Some methods that keep the urinary system and kidneys functioning normally include:

(i) Drinking a lot of water, at least 6 glasses of water a day to flush out toxins in the body. Urinating frequently is not always a bad thing, especially when you drink much water daily. It is one of the ways through which the body gets rid of toxic substances like urea. People that take longer time without urinating usually accumulate more toxins in their body.

(ii) Exercising regularly to keep fit. Maintain a healthy weight according to your age to avoid putting excess strain on all bodily systems.



Exercising through running

(iii) Avoid taking too many drugs especially pain killers. Stick to prescriptive drugs from a qualified medical officer.

(iv) Visit a doctor (**urologist**) regularly to check the health of the urinary system.

(v) Eat healthy by avoiding junk food. Eat more fresh fruits and green vegetables. Choose foods low in sodium, sugar and fats but high in fiber content.

(vi) Be informed about the causes and prevention methods of kidney diseases and urinary tract infection causes.

(vii) Avoid smoking and alcohol intake. Too much alcohol tends to overwork your kidneys in an effort to remove it from blood; which may result to kidney malfunctioning and failure.

NOTE

It is good practice to empty your bladder in toilets, latrines or urinals. Urinating in public places like bus stops, by the roadside, in water bodies or on walls is extremely unhygienic. In addition to polluting the environment, the urine may also contain disease-causing micro-organisms that can contaminate drinking water and vegetables.

- Secretion of tears when an onion is cut, near the eyes.
- Swallowing
- Change of the size of the pupil when in different light intensities.

ACTIVITY 7.1

Aim: To demonstrate the knee-jerk reflex.

Procedure:

1. Let a student sit on a high / raised table so that the legs are dangling freely. (When the feet are not resting on anything)
2. Using the edge of a ruler, tap the knee tendon firmly.
3. Observe the jerking of the forward of the leg with each tap.

Explain the path of the nerve impulse transmission involved. Illustrate your explanation with a simple diagram.

Test yourself



1. Outline the importance of reflex actions to our survival as human beings.
2. State the five components of a reflex arc, and state the significance of each.
3. Construct a meaningful sentence containing all the following words: **synapse, grey, arc, relay, motor, sensory, effectors, transmitter**

VOLUNTARY AND INVOLUNTARY RESPONSES

When an action is produced with the involvement of thoughts, they are called **voluntary responses**. It involves actions like walking, eating, jumping and running. These actions are produced consciously. Both spinal cord and brain are involved and these coordinate with the peripheral nervous system to generate necessary movements.

Actions which take place without consciousness or willingness of an individual are called the **involuntary responses**. Digestion, heart beating, sneezing, are a few examples of involuntary actions.

Both involuntary and voluntary actions are controlled by the same parts of the brain. Hind brain and midbrain control involuntary actions like salivation, vomiting etc. all the body's voluntary actions are controlled by the motor cortex in the frontal lobe of the cerebrum.

The table below gives a comparison between the two types of responses / actions

Voluntary responses	Differences	Involuntary responses
Occurs with awareness	Type of response	Occurs without awareness (automatic)
Cerebrum	Part of the brain controlling the action	Medulla oblongata
Receptor - → spinal cord - → cerebrum spinal cord - → effectors	Nervous pathway	Receptor - → spinal cord - → medulla oblongata - → spinal cord - → effectors
Slower	Speed	Faster
Speaking, hearing, writing	Example of actions	Heartbeat, peristalsis, knee jerk



2. Support the casualty's shoulders with a cushion so that the head falls back. Lay the casualty on their back, place a folded jacket / cushion / towel under the shoulders.

This allows the head to fall or drop back so that the tongue does not block the air ways to the trachea. Call for help again.

3. Hold the nose between your thumb and fingers so that no air can escape and gently blow directly into the casualty's mouth as illustrated here on the right. Watch as the chest rises, this will show you that air is getting into the lungs. *Call for help again.*



4. Take your mouth away and release your fingers from the nose. This allows air to escape and the chest lowers, because expiration is a passive process. *Call for help again.*

5. Repeat steps 3 and 4 at about 5 – second intervals until the casualty begins to breathe on their own. Call for help again.

6. Keep the casualty in a warm blanket and turn them on their ventral side with the back upwards. Call for help again.



Sometimes a person not only stops breathing, their heart stops beating as well. There is a method of pressing on the chest that you can apply in case this happens, so you can keep blood moving around the body as well. It is called **cardiopulmonary resuscitation**.

Push down 30 times. Continue with two breaths the 30 pushes until medical help arrives.

RATE AND DEPTH OF BREATHING

The average breathing rate for an adult human at rest is about **14 breaths per minutes**. This supplies the oxygen needed for all the normal activities of the cells, but it does not us up all the capacity of the lungs. When a person is breathing normally at rest, like when you are seated in the class room attending a lesson, you take in and out about **500cm³** of air each time you breathe. This is called the **tidal volume** and it is only about 15% of the possible maximum. If more oxygen is needed for any reason, there are two ways of getting more air into the body; you may breathe more quickly (breathing rate) or more deeply (depth of breathing), taking in more air into the lungs. Usually, we do a combination of the two.

What are the factors that affect the breathing rate?

Any condition that increases oxygen requirement, and so raises the carbon dioxide production of the body will tend to increase the breathing rate. The main factors include;

- Exercise
- Drugs
- Anxiety
- Environmental factors

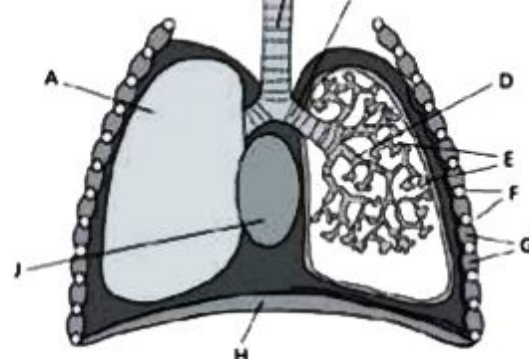
(ii) Describe why these rings are necessary.

b) (i) Give the letters of two structures that move causing air to be taken into the lungs.

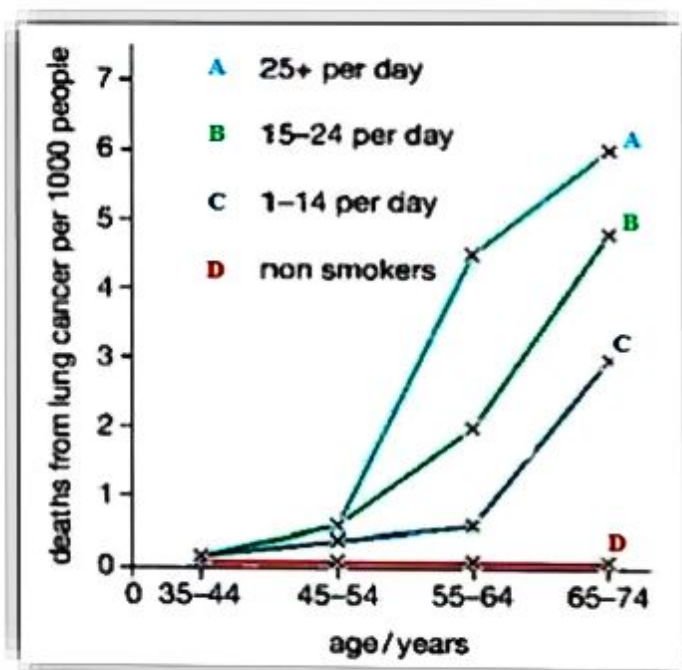
ii) For each structure named in (b) (i), describe how contraction of muscles results in air being inhaled.

(c) (i) Give the letter of the surface in the lungs where gas exchange takes place.

(ii) Describe two ways that this structure is adapted for gas exchange.



6. A long – term investigation was carried out into the link between smoking and lung cancer in Kamwokya ghetto town, found in the outskirts of Kampala city. The records of people dying from lung cancer after smoking different number of cigarettes were obtained and plotted against different age brackets. Study the graph carefully and answer the questions that follow;



- (a) Write a paragraph to explain what the researchers found out from the investigation.
- (b) How many deaths from lung cancer would be expected for subjects aged 55 who smoked 25 cigarettes a day up until their death?
- (c) How many deaths from lung cancer would be expected for subjects aged 25 smoking 10 cigarettes a day?
- (d) Explain how a person who doesn't smoke tobacco cigarettes but lives with smokers can be affected in a long run.

- (d) Design and make a hard-hitting leaflet explaining the link between smoking and lung cancer. It should be aimed at encouraging an adult smoker to give up the habit. You can use suitable computer software to produce your design. Include some smoking statistics, perhaps from internet search. However, don't use too many lest they may put the target person off reading the leaflet.

Activity of integration 1

Barigye and his young sister Kichoncho were playing by the river side in the water, some 100meters away from where they had camped with their parents. As they played in the water, Kichoncho accidentally swallowed much water, and drowned.



With too much fear, Barigye quickly pulled her out of the water and put her on the ground, but realised she had stopped breathing. Barigye is afraid and doesn't know which first aid to give to her sister.

Task

Using the information above, design a first aid plan for Kichoncho.



When alcohol is consumed, it is absorbed into the blood very quickly since it is a small molecule that does not need to be digested. It is also soluble in cell membranes, so it is absorbed very quickly through the wall of the stomach and small intestine. The presence of food in the stomach slows down its absorption. Alcohol gets distributed throughout the body in the blood.

Some is lost through the lungs and the kidneys. It is absorbed by liver cells and broken down by enzymes so that its concentration in the blood decreases gradually.

This breakdown happens more quickly in men than in women because men have more of these enzymes and they tend to be more active. They also have more water and less fat in their bodies than women, which tends to cause the concentration of alcohol in the blood decreases more quickly.

ADDICTION

Some people become dependent upon alcohol and are sometimes referred to as alcoholics. They develop a tolerance as more enzymes that metabolise alcohol are made in the liver. They therefore need to take greater quantities of alcohol to get the same effect. They feel tense and irritable and find it hard to cope with everyday problems without a drink. Alcoholics cause their families pain and misery. They can become aggressive after drinking and spend a lot of money on buying alcohol.

SOCIAL PROBLEMS

The misuse of alcohol is a factor in crime, family disputes. Marital breakdown, child neglect and abuse, absenteeism from work, vandalism, assault and violent crime including murder.

Alcohol and many other drugs are involved in many road accidents. Alcohol has adverse effects on people's concentration, while at the same time making them feel more confident. In Uganda, it is

against the law to drink alcohol and then drive a vehicle or operate any machine, and when found guilty, can attract severe penalties including imprisonment.

Long term effects of alcohol

Drinking large quantities of alcohol over a number of years can have serious effects on health. It can lead to stomach ulcers, heart disease and brain damage. The liver is the part of the body that breaks down alcohol and other toxins. Drinking large quantities of alcohol interferes with the metabolism in the liver so that fat is stored and builds up. This condition is known as **fatty liver**. If this continues, the liver tissue is damaged and replaced by fibrous scar tissue.

If heavy drinking continues, then the liver becomes full of nodules.

This is the condition known as **cirrhosis**.



The liver becomes less able to carry out its job of removing the toxins from blood. This condition is not reversible and is fatal unless the person stops drinking. Long-term alcohol consumption also leads to brain damage, with changes in personality and behaviour.

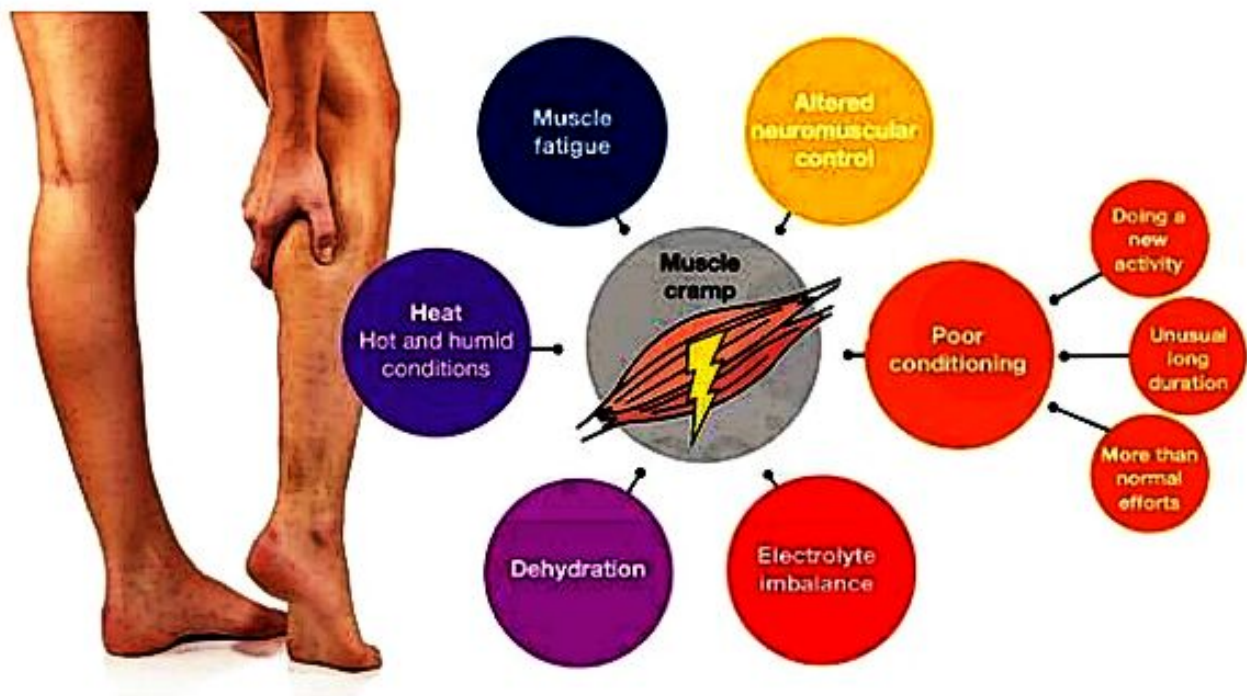
A concentration of 500 mg of alcohol in 100 cm³ of blood results in unconsciousness. More than this will

MUSCLE CRAMPS (MUSCLE SPASMS)

Muscle cramping during exercise is a common problem among athletes that involves sudden, involuntary and painful muscle contraction during or after exercise. The occurrence of cramps is quite unpredictable, and the causes are not well understood, though there are two hypotheses.

Many athletes have experienced muscle cramping during or after exercise, at some point in their sporting career. It is difficult to assess how many athletes suffer from muscle cramps, as some athletes may experience cramps only occasionally, whilst cramping may be a recurring problem for others. There are also different types of cramps, from small cramps in small muscles that resolve quickly to large whole-body cramps that cause pain for hours or even days

Causes of muscle cramps



The exact cause of leg cramps is not well understood, but there are some risk factors that are thought to contribute:

- **Age:** Leg cramps are more common in young (adolescent age) and older (over 65) patients.
- **Muscle fatigue:** Overexertion due to heavy exercising or being active in an unusual way may be to blame.
- **Dehydration:** This includes electrolyte imbalances (potassium, magnesium, sodium, and calcium in particular.)
- **Being overweight**
- **Early pregnancy:** This could be linked to calcium changes or muscle fatigue from carrying extra weight.
- **Medication use:** Some medications can cause muscle spasms as a side effect, including statin drugs and corticosteroids like prednisone.

Unit
11

DEVELOPMENT IN PLANTS AND ANIMALS



Chapter Learning Outcomes;

By the end of this chapter, you should be able to:



- Understand the need for differentiation of cells as multicellular plants and animals grow.
- Understand the process of secondary growth of stems in dicotyledonous plants.
- Know stages of development in an insect.
- Know the meaning of the term metamorphosis, and compare complete and incomplete metamorphosis.
- Understand the lifecycle of a housefly, cockroach, mosquito, bee and butterfly.
- Recognise and compare the main characteristics of stages of human development from birth to adulthood, including the developmental stages of a child (Physical, behavioural and cognitive)
- Understand the physical, physiological, psychological (emotional) and behavioural changes associated with adolescence and puberty and the associated myths.
- Understand and be able to cope with changes related to secondary sexual characteristics at puberty.
- Understand various features related to the process of aging.

Competency: *You should be able to understand that organisms develop specialized cells, tissues, and organs as they grow leading to changes in structure and function.*

INTRODUCTION



Did you know that you are a walking, talking, thinking, learning collection of over 30 trillion cells! But you weren't all that large and complex. In fact, you (like every other human on the planet) started out as a single cell – a zygote, or the product of fertilization. So, how did your amazing, complex body form?

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