

GUIDE TO DISSECTION OF THE TOAD
UGANDA ADVANCED CERTIFICATE OF EDUCATION (P530/3)



Compiled by

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DISSECTION OF THE TOAD/FROG

STARTER ACTIVITY FOR STUDENTS

Complete the following questions as you interact with the specimen

- Observe the dorsal and ventral sides of the frog.
Dorsal side color ----- Ventral side color -----
- Examine the hind legs.
How many toes are present on each foot? -----
Are the toes webbed? -----
- Examine the forelegs.
How many toes are present? -----Are the toes webbed? --

- Use a ruler to measure your frog, measure from the tip of the head to the end of the frog's backbone (do not include the legs in your measurement). Compare the length of your frog to other frogs -----

5. Locate the frog's eyes; the nictitating membrane is a clear membrane that attached to the bottom of the eye. Use tweezers to carefully remove the nictitating membrane. You may also remove the eyeball.

What color is the nictitating membrane? -----
----- What color is the eyeball? -----

6. Just behind the eyes on the frog's head is a circular structure called the tympanic membrane. The tympanic membrane is used for hearing. Measure the diameter (distance across the circle) of the tympanic membrane.
Diameter of tympanic membrane -----

7. Feel the frog's skin. Is it scaly or is it slimey? ----

N.B: you may remove the frog's eyes and bounce the on the floor; they actually do bounce



Anatomy of the toad/frog's mouth

Procedure: Pry the frog's mouth open and use scissors to cut the angles of the frog's jaws open. Cut deeply enough so that the frog's mouth opens wide enough to view the structures inside.

1. ***Locate the tongue.*** Play with the tongue. Does it attach to the front or the back of the mouth? -----
(You may remove the tongue)

Insert a probe into the Eustachian tube. To what structure does the Eustachian tube attach?-----

Summary

Structure	Function	Location
Vomerine Teeth	holding prey	roof of mouth
Eustachian Tubes	equalize pressure	angles of jaw
Tympanic Membrane	hearing	behind the eyes
Esophagus	swallowing food	back of the mouth
Glottis	airway	behind tongue
Tongue	capturing prey	bottom of mouth

DISSECTION OF THE TOAD/FROG

The toad represents the amphibians as part of the organisms studied at the **advanced level biology**. **NOTE: *There are little but significant differences between the toad and the frog***

FROG	TOAD
Smooth skin, moist and slimy skin More aquatic	Rough warty, fairly dry and soft skin More terrestrial

Classification of a common frog	Classification of a common toad
Kingdom : Animalia Phylum: chordata Class: Amphibia Order: Anura Genus: Rana Species: <i>Rana temporaria</i>	Kingdom :Animalia Phylum :chordata Class :Amphibia Order: Anura Genus: Bufo Species: <i>Bufo regularis</i>

NOTE: organisms belonging to the same group of classification; bear common features from which taxonomists base to place it as shown below

Kingdom Animalia	Phylum chordata
Reasons <ul style="list-style-type: none"> ○ Have four limbs which indicate locomotion ○ Has mouth and cloaca which indicate feeding and excretion 	Reasons <ul style="list-style-type: none"> ○ Possession of a vertebral column felt from the back ○ Possession of pentadactyl limbs ○ Having a bilateral symmetry externally
Class Amphibia Reasons <ul style="list-style-type: none"> ○ Moist skin ○ Visible ear drum which indicate presence of sensory organs 	Habitats Frog <ul style="list-style-type: none"> ○ The habitat is aquatic, damp marshes and streams The toad <ul style="list-style-type: none"> ○ The habitat is dumpy terrestrial areas, moist soil

Adaptations of frogs/ toad to their habitats

- Have large protruding dorso-laterally placed eyes to give the animal a wider field of view in its habitat
- Has a characteristic dark brown skin for camouflage and protection against predators
- Body is stream-lined to reduce air resistance during jumping
- Hind limbs are long with webbed digits for leaping long distances
- Possession of poison glands on the back and two glands on the head, providing defense against predation and foreign attack
- Have short and stout front limbs for shock absorption during landing after leap. It also supports the anterior part of the body above ground
- Have very muscular hind limbs for greater generation of the propulsive force during leaping
- Has jointed limbs for flexibility during locomotion
- External ear drum receives sound waves for hearing
- Wide gape for consuming prey of large size

Sex identification of a toad

<i>A male toad/frog exhibits the following external features</i>	<ul style="list-style-type: none">▪ Has a slender body▪ Has a nuptial pad in the hand or on the palm of the first finger▪ Has a light throat▪ Skin underlying the throat is usually white
<i>A female toad exhibits the following external features</i>	<ul style="list-style-type: none">▪ A broader body▪ Has a dark throat/grey

Short notes:

Description of the External features of a toad

The head	Significance
<ul style="list-style-type: none"> ✓ The head is triangular, dorso-ventrally flattened, tapering to the snout. ✓ It is also broad and blatantly rounded ✓ It is triangular with its apex anterior (infront) and base posterior (behind) and joined to the trunk directly ie there is no neck ✓ It is dorso-ventrally flattened and tapers anteriorly ✓ It is anteriorly located on the body 	<ul style="list-style-type: none"> ✓ Shape and position of the head gives the animal a streamlined shape that reduces resistance to its motion in water and on land <p>Note: <i>The head of most common toads is between 0.1-1.50 cm long. This offers a stream lined shape to the head to ease movement in water or swimming or easy burrowing</i></p>

THE EYES	EAR DRUM/TYMPANIC MEMBRANE
<ul style="list-style-type: none"> ✓ Are large and protruding, possessing upper and lower lids. The lower lid is movable (nictitating membrane). It has a large central pupil ✓ The eye is dorso-laterally located. Presence of the eye increases visibility to escape from predators, hunt for food or secure a mate 	<ul style="list-style-type: none"> ✓ It is a pair of circular membranous structures, dorso-laterally placed to transmit sound waves ✓ The tongue is long, elastic, and sticky. It is attached anteriorly to the floor of the buccal cavity.
The mouth	The tongue Adaptation
<ul style="list-style-type: none"> ✓ The mouth is terminal, wide and crescent shaped. When opened, it opens widely (wide gape) this is to consume prey of large size 	<ul style="list-style-type: none"> ✓ Long enough and elastic to trap insects at relatively far distances for food, The ✓ hyoglossus muscles which pass forward to the root of the tongue, into it and up to the tip, flick the tongue over a wide arc when they contract to allow physical gripping of prey. ✓ traps small animals (insects) for food
POISON GLANDS	EXTERNAL NARES
<ul style="list-style-type: none"> ✓ There are two large poison glands located on the dorsal side of the head. ✓ They produce milky substances which offer defense against foreign attack and against predation 	<ul style="list-style-type: none"> ✓ This is a pair of external nares above the mouth. They are anteriorly located. ✓ This is to enable the animal to breathe even when the body is submerged in water.

DESCRIPTION OF THE SKIN OF A TOAD

- It is rough, warty and moist to facilitate exchange of respiratory gases. Body skin is dark brown lined with black pigment spots (melanophores) for camouflage in the natural environment and protection from predators. The vertical side is light whitish to blend with the sky when in water
- The skin is loosely attached on the rest of the body leaving spaces which are fluid filled. This is to facilitate gaseous exchange.
- The skin on the fore and hind limbs are firmly attached this is to hold the skin firmly to hold the skin firmly on the body.

The trunk

- The trunk widens widely laterally and tapers behind the hind limbs ending at the cloaca
- The back has a bend or a hump when the frog is in the sitting posture
- The trunk ends into a cloaca. Cloaca is ventro-posteriorly located this is a common opening for both the gut and the urinogenital systems

The limbs

A toad has a pair of fore and hind limbs. The two pairs of limbs are of unequal sizes.

The fore limbs

- Are short and unwebbed. It is used mainly to support the head and chest and it absorbs the force of fall
- On landing. It is also jointed for flexibility during locomotion.
- The hand terminates into four tapering digits.

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<p>THE HIND LIMBS</p> <ul style="list-style-type: none"> ▪ The hind limbs are much larger, longer and muscular. It is jointed for flexibility during locomotion and its foot end into five tapering digits which are webbed. It consists of four parts and these are ▪ The thigh-in the usual squatting posture it is directed down wards, outward and forward from the thigh joint ▪ The shank –it is directed downwards from the knees ▪ The tarsus is long and directed down wards from heel joint ▪ The foot- this consists of five long slender digits united by webs • The main function of the hind limbs is to provide a propulsive force for both in water and land 	

DIFFERENCES BETWEEN THE FORE AND HIND LIMB

FORE LIMB	HIND LIMB
<p>Its shorter</p> <p>Smaller in size</p> <p>The hand ends into four tapering digits</p> <p>Has toes with unwebbed digits</p> <p>Is L-shaped</p> <p>Is less muscular</p>	<p>Is longer</p> <p>Is larger in size</p> <p>The foot ends into five tapering digits</p> <p>Has toes with webbed digits</p> <p>Is Z- shaped</p> <p>Is more muscular</p>
<p>Similarities</p> <p>Each consists of two pairs</p> <p>The limbs end into tapering digits</p> <p>Both limbs are jointed</p> <p>Both are muscular and powerful</p>	

DRAWINGS OF SOME EXTERNAL FEATURES OF THE TOAD

DRAWING OF THE HIND FOOT

DRAWING OF THE FORE FOOT

Drawing of the tongue attached on the floor
Of the buccal cavity

Drawing of the hind limb of the toad

Drawing of the left thigh muscles of the toad

Drawing of fore limb of the toad

THE BUCCAL CAVITY AND THE PHARYNX

Place a toad (specimen T) on its ventral side, the dorsal side facing upper most; Let the anterior head region to face you directly, Using forceps and a small spatula open the mouth wide. Draw and label all the observable structures in the buccal cavity.

A labeled drawing showing the observable structures in the buccal cavity of specimen T

Teacher's comments

Marking points

- ✓ Title
- ✓ Magnification
- ✓ Neatness
- ✓ Outline
- ✓ Drawing
- ✓ Labeling

THE DIGESTIVE SYSTEM OF THE FROG/TOAD

Digestion in a frog begins in the mouth. Although the frog has teeth, they are basically useless. The frog's tongue however is very important.

Most of the time the tongue is folded back toward the throat. From here the frog is able to flick out the tongue very fast to catch its prey. The tongue is also very sticky.

From the frog's mouth food passes into the stomach by the esophagus. From there the food moves into the small intestine. This is where most of the digestion takes place.

There are large digestive glands, the liver and the pancreas, which are attached by ducts. Liquid wastes from the kidneys go through the ureters to the urinary bladder.

Solid wastes from the large intestine go into the cloaca. Both the liquid and solid wastes leave the body through the cloaca.

Structure in relation to function of different parts of the alimentary canal of the toad

The oesophagus

- It is short and has longitudinal folds, which close it to prevent entry of air into the stomach and yet allow dilation when food is being swallowed
- Cilia of the buccal cavity, pharynx and oesophagus constantly shift the food backward into the stomach. This assists in swallowing and ensures that small food particles are not retained in the anterior regions of the alimentary canal

Stomach

- It is elongated and thick walled
- Internally, it is folded longitudinally, both allow distension and to increase surface area of secretion of gastric juice
- Posteriorly, a slight constriction indicates the position of the pyloric sphincter and the end of the stomach. This controls the exit of food from the stomach

The gall bladder

- Is an avoid sac lying between the main lobes of the liver. Its outlet is the bile duct which runs through the pancreas (ie hepato-pancreatic duct) into the duodenum.
- The gall bladder stores bile secreted by the liver and is secreted into the duodenum to help in emulsification of fats (increasing their surface area for enzyme action)

Short notes:

THE BLOOD VASCULAR SYSTEMS: *The arterial system*

- The heart is the centre of the vascular system, receiving deoxygenated blood from the rest of the body and pumping oxygenated blood to the different parts of the body.
- The **arterial system** consists of **arteries**, i.e. blood vessels that supply oxygen and nutrients to different parts of the body.

The heart and arterial arches

Blood leaves the heart via a common vessel, the **truncus arteriosus**, which divides into two branches one to the right and the other to the left.

Each of the two branches splits into the arterial arches, which, identified from anterior to posterior include:

- **The systemic/aortic arch**-this proceeds laterally then dorsally and curves backwards in a wide arc to join its fellow in mid-dorsal line just anterior to the kidneys
- The carotid arch which supplies blood to the head
- Each systemic arch gives off a small oesophageal artery, an occipital vertebral artery to the back of the head and anterior part of the vertebral column and a large subclavian artery to the front of limbs.
- The united systemic arches from the dorsal aorta and immediately posterior to the junction, the median celiac mesenteric artery proceeds ventrally. It divides into celiac and mesenteric forking into anterior and posterior branches.
- Several small arteries pass from the dorsal aorta to the kidneys and paired genital arteries to the reproductive organs. Finally, the aorta forks into paired iliac arteries which eventually pass into the hind limbs where they are called sciatic arteries
- The pulmo-cutaneous arch which supplies the lung on the respective side of a large area of skin in dorsal and lateral regions of the trunk.
- The arteries branch repeatedly and finally end in minute arterioles, which lead to networks of capillaries from which blood flows into venules and hence to veins which return blood to the heart.

A labeled drawing showing the heart of a toad and the arterial arches with their branches

Teacher's comments

Marking points

- ✓ Title
- ✓ Magnification
- ✓ Neatness
- ✓ Outline
- ✓ Drawing
- ✓ Labeling

Drawing showing blood vessels that supply oxygen and nutrients to the head and fore limbs

Marking points

- ✓ Title
- ✓ Magnification
- ✓ Neatness
- ✓ Outline
- ✓ Drawing
- ✓ Labeling

Short notes:

Blood supply to the rest of the body

- Blood to the rest of the body, below the head, is transported through the **aortic / systemic arch**
- The **arch** first splits to give a **subclavian artery** which contributes as a **brachial artery** to supply the **fore limb**. The other branch joins the flow on the opposite side to form the abdominal/dorsal aorta to the **liver**

Blood supply to the alimentary canal

- Immediately posterior to the junction of the **systemic arches**, the median coeliaco-mesenteric artery proceeds ventrally to supply the alimentary canal and its accessory glands.
- It divides into **coeliac artery** and **mesenteric artery**
- The **celiac artery** gives off **hepatic artery** to *supply the liver and gall bladder* and the **gastric artery** to *supply stomach and pancreas*

Blood supply to the kidneys, genital and hind limbs.

- From the dorsal/abdominal aorta, small branches, renal arteries pass to the kidneys and paired genital arteries pass to the reproductive organs, from the most anterior pair of renal arteries.
- Finally, the aorta forks into paired iliac arteries which eventually pass into the hind limbs where they are called sciatic arteries.

NOTE: *when drawing the arteries for supplying the kidney; it's always important to draw one of the kidneys when folded to expose the renal artery.*

Drawing showing blood supply to the kidneys, genitals and the hind limbs

Teacher's comments:

Marking points

- ✓ Title
- ✓ Magnification
- ✓ Neatness
- ✓ Outline
- ✓ Drawing
- ✓ Labeling

Drawing showing blood vessels that supply blood to the alimentary canal with accessory glands followed from the heart

Teacher's comment/student's notes:

Marking points

- ✓ Title
- ✓ Magnification
- ✓ Neatness
- ✓ Outline
- ✓ Drawing
- ✓ Labeling

THE BLOOD VASCULAR SYSTEMS: *The venous system*

This consists of **veins**, i.e. Blood vessels that return blood from all parts of the body to the heart a.k.a. blood vessels that drain blood from all parts of the body

Blood returns to the heart via three main vessels

- Sinus venosus
- Left anterior vena cava
- Right anterior vena cava

Venous drainage of the head and fore limbs

From the **head and fore limbs**, blood **returns** to the heart via the **anterior vena cava one on the right**, the other on the left.

Each receives **3 large veins** (or tributaries not branches)

- ✓ The **external jugular vein** which receives the **mandibular** and the **lingual vein** (from the floor of the mouth)
- ✓ The **innominate vein**(in the middle) which receives the **sub-scapular vein** from the shoulder region and the **internal jugular vein** from the dorsal region of the head
- ✓ The **subclavian vein** from the **flanks and the back**

Short notes:

Drawing showing the general venous system of the toad

Teacher's comment/student's notes:

Marking points

- ✓ Title
- ✓ Magnification
- ✓ Neatness
- ✓ Outline
- ✓ Drawing
- ✓ Labeling

Drawing showing blood vessels that return blood from the head and fore limbs back to the heart

Teacher's comments/student's notes:

Marking points

- ✓ Title
- ✓ Magnification
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- ✓ Outline
- ✓ Drawing
- ✓ Labeling

Venous drainage of the alimentary canal

- ✓ Blood from the alimentary canal returns to the heart via the **hepatic portal vein**. This joins the **posterior vena cava**, in the substance of the liver via short **hepatic veins** to **sinus venosus** which finally returns the blood to the heart
- ✓ The **hepatic portal vein** is formed by union of the **gastric vein** (from *stomach and pancreas*), intestinal/mesenteric veins, the **splenic** and anterior **abdominal vein**
- ✓ Due to its position, the hepatic portal vein can be identified by following the **anterior part of the anterior abdominal vein up to the liver**.

Drawing showing blood vessels that return blood from the kidneys and alimentary canal to the heart

Marking points

- ✓ Title
- ✓ Magnification
- ✓ Neatness
- ✓ Outline
- ✓ Drawing
- ✓ Labeling

Venous drainage of the hind limbs and kidneys

- ✓ Blood from the hind limbs flows back to the heart via **two routes**. One through an **outer femoral vein** and an **inner sciatic vein**. These join inside the body cavity to form the **renal portal vein** which passes along the outer border of the kidney on the respective.
- ✓ Another is an alternative route for blood for the **femoral vein** which passes inward along the **pelvic vein** which joins its fellow, ventral to **the pelvic girdle to the anterior abdominal vein**. This passes ventrally forward in the midline on the body just beneath the skin to join the **hepatic portal vein** immediately before its entry into the liver.
- ✓ **From the kidney**, blood passes inwards by **renal veins** to join the posterior **venacava** which returns blood direct to **sinus venosus** and eventually back to the heart.

Drawing showing the heart and blood vessels that return blood from the hinds and the kidneys to the heart

Marking points

- ✓ Title
- ✓ Magnification
- ✓ Neatness
- ✓ Outline
- ✓ Drawing
- ✓ Labeling

The urinogenital system

Though there are no external sexual organs, the urinogenital systems of **male** and **female** toads are clearly distinguished internally.

Drawing showing the male urinogenital system of the toad

Teacher's comment/student's notes:

Marking points

- ✓ Title
- ✓ Magnification
- ✓ Neatness
- ✓ Outline
- ✓ Drawing
- ✓ Labeling

Drawing showing the female urinogenital system of the toad

Teacher's comment/student's notes:

Marking points

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- ✓ Labeling

SPINAL NERVES

There are 10 pairs of spinal nerves. The first nine emerge from the **intervertebral** foramina and the 10th pair from small foramina in the **urostyle**

Each mixed nerve gives off 3 branches

- i).a short dorsal branch to the skin and muscles of the back
- ii)a large ventral branch to skin and muscles of the abdomen
- iii)a short **ramus communicans** to the autonomic/sympathetic chain

b) The autonomic sympathetic system

There are 10 pairs of sympathetic ganglia situated at the sides of the aorta posterior and along the systemic arches anteriorly. Each ganglion joined to the corresponding spinal nerve by a **ramus communicans** and respective pairs also joined by transverse connections.

Drawing showing spinal nerves and sympathetic/autonomic nervous system of a toad

Marking points

- ✓ Title
- ✓ Magnification
- ✓ Neatness
- ✓ Outline
- ✓ Drawing
- ✓ Labeling

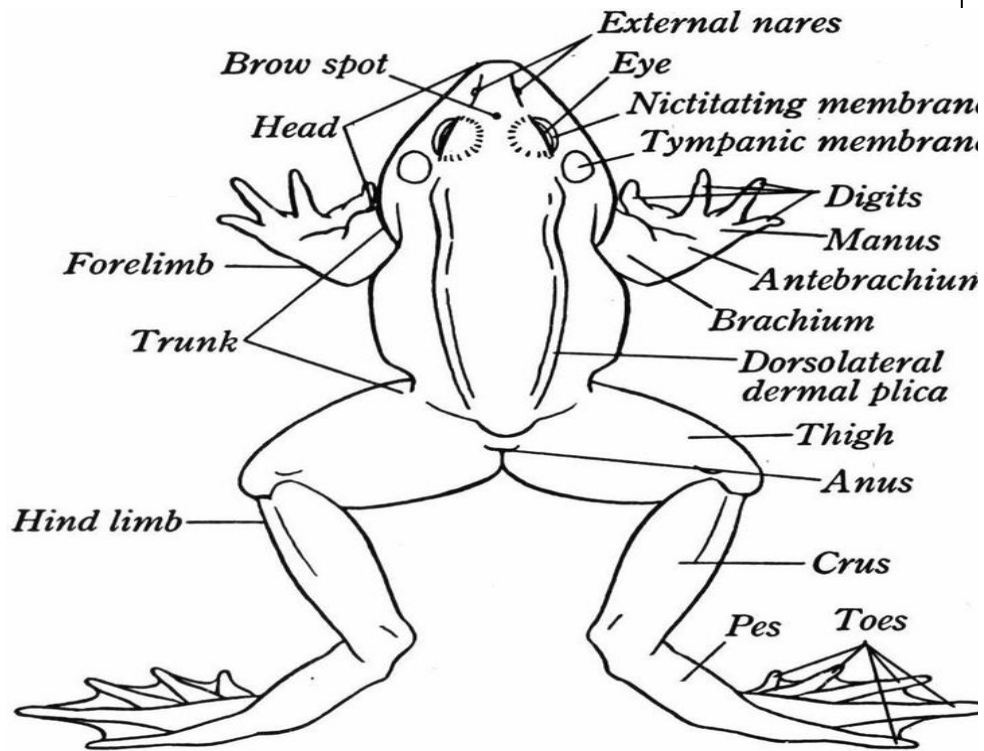


FIG. 384. *Dorsal View of Frog*

This is a preserved specimen, showing head, trunk, limbs, and some of their parts

END

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