CLASSIFICATION OF THE COMMON TOAD AND COMMON FROG:

TAXONOMIC GROUP	TOAD	FROG
Kingdom:	Animalia	Animalia
Phylum:	Chordata	Chordata
Class:	Amphibia	Amphibia
Order:	Anura	Anura

HABITAT OF THE TOAD: moist ground environment e.g. **(1)** under logs of trees **(2)** underneath stones **(3)** shaded leaf litter **(4)** behind water storage tanks

SUITABILITY / ADAPTABILITY OF THE TOAD FOR THE MOIST LAND HABITAT:
(1) Moist skin dissolves respiratory gases hence quickening their diffusion.
(2) The muscularised hind limbs generate a strong propulsive force for leaping.
(3) The dorso-laterally positioned eyes enable a wide field of vision for food.
(4) Both fore and hind feet possess large, yellowish bumps called **tubercles**, which enable digging burrows in the ground for hiding from predators.
(5) Darker colouration dorsally and lighter colouration ventrally enable camouflage

SUITABILITY / ADAPTABILITY OF THE TOAD FOR LIFE IN WATER:
(1) Closeness of nostrils to the tip of the snout enables breathing when the rest of body is submerged.
(2) The head tapers anteriorly and widens posteriorly to reduce water resistance during locomotion.
(3) Transparent **nictitating** membrane protects the eye ball but without interrupting continuity of vision when under water.
(4) The muscularised hind limbs generate a strong propulsive force for swimming.

Features for sex identification:

MALE TOAD
●Presence of black coloured nuptial pads on the outer faces of the 1st and 2nd fingers
●Under side of throat is light coloured
●Body is slender

FEMALE TOAD
●Body is broad
● Under side of throat is dark coloured

EXTERNAL ANATOMY OF THE TOAD & ADAPTATION / SUITABILITY TO ENVIRONMENT

1. HEAD

Using a ruler, take measurements of the thickness, width and length of the head of the toad

Thickness: may range between 0.5–1.5cm
Width: may range between 1.0 - 3.0cm
Length: may range between 2.0 – 5.0cm

Ratio of thickness to width = 1 : 3 / 1: 2
Ratio of thickness to length = 1 : 4 / 1: 3

a = width
b = thickness
c = length

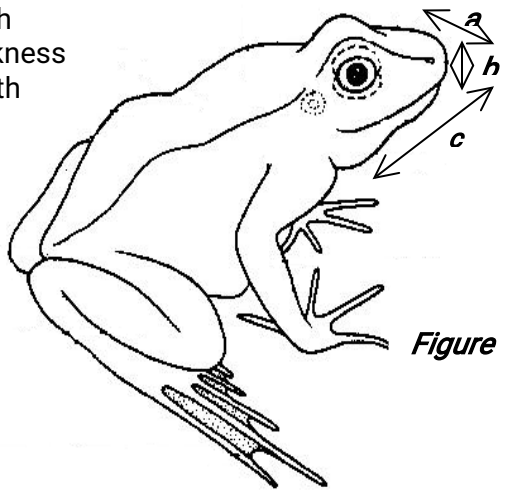


Figure 1

SIGNIFICANCE OF THE PROPORTIONS OF THE HEAD OF TOAD IN RELATION TO ITS MODE OF LIFE:

Offers a streamlined shape which reduces air resistance during locomotion

		Significance
Description of head Structure:	It (**1**) Is dorso-ventrally flattened /compressed **(2)** Tapers to a blunt end anteriorly and broadens posteriorly **(3)** Is directly attached to the trunk extending to the shoulder region.	Offers a streamlined shape to the animal enabling reducing air resistance during locomotion
Location / Position of head:	Attached at the anterior part of trunk directly without a neck.	Reduces air resistance during locomotion

NOTE: *You can also measure the widths of head, mid of trunk and end of trunk, express them in ratio form and notice the streamlined shape of body.*

EYES		**Significance**
Description of eye Structure:	Each of the two **(1)** has large eye balls **(2)** bulges / protrudes out **(3)** has a slightly movable upper eyelid and the lower transparent **nictitating** membrane which can be drawn across the eye ball surface.	**(1)** The protrusion of eyes enables quick detection of movement of objects to catch small organisms for food **(2)Nictitating** membrane protects the eye ball but without interrupting continuity of vision
Location / Position of eyes:	Each of the two eyes lies dorsally but faces laterally opposite to the other on the mid-dorsal line of the head	Enables a wide field of vision for the animal to quickly detect predators or food.

TYMPANIC MEMBRANE / EAR DRUM / TYMPANUM / EAR		**Significance**
Description of Structure:	Each of the two is **(1)** circular-shaped / disc-shaped **(2)** membranous **(3)** flattened **(4)** tightly stretched and resists pushing **(5)** tough	Tightly out stretched to enable vibrating on receiving sound waves
Location / Position:	Each of the two is dorso-laterally positioned posterior to each eye	Dorso-lateral positioning enables detection of airborne sound from many directions

EXTERNAL NOSTRILS / NARES		**Significance**
Description of Structure:	They are **(1)** paired oval-shaped openings **(2)** of small size	They are open to allow passage of respiratory gases
Location / Position:	Each of the two is anteriorly positioned close to the tip of the snout immediately above the mouth	Closeness to the tip of the snout enables early detection of smells / odours of predators before the whole body is exposed

CLOACAL APERTURE		**Significance**
Description of Structure:	It is **(1)** a narrow **(2)** elastic aperture / opening	(**1**) It is elastic to enable materials both of small and large size of size to exit the body **(2)** It is open to allow passage of materials **(3)** It is narrow to regulate egestion.
Location / Position:	It is at the posterior end of the trunk just dorsal to the junction of the hind limbs	Location at the posterior end of the trunk enables the wastes and gametes to be discharged appropriately.

SKIN:		**Significance of skin structure**
Description of nature of skin / Prominent features of the skin	It **(1)** is Very warty **(2)** is moist **(3)** is tough **(4)** is dull coloured dorsally but light coloured ventrally **(5)** is thin **(6)**Shows two protrusions called **parotoid glands**immediately posterior to the eyes but lying dorsally on the head.	**In avoiding predation:** **(1)** The warts and protrusions called **parotoid glands** exude / secrete a viscous, white substance which discourages predation. **(2)** The cryptic colour pattern conceals the toad from predators while in the habitat. **In gaseous exchange:** **(1)** Moistness enables dissolution of respiratory gases hence quickening their diffusion. **(2)** Thinness increases the diffusion rate of respiratory gases and water by osmosis. **(3)** toughness reduces the rate of drying / water evaporation which would interfere with cutaneous gas exchange
Location / Position:	Covers whole body	Enables the whole body to be protected from predators.

DISSECT THE TOAD TO PULL THE SKIN OFF THE BODY WALL.

a) Description of skin attachment to body wall:

Skin is **firmly** attached to body wall at the **limb joints** and **throat region**, while it is **loosely** attached within the **abdominal region**.

Significance of the way in which the skin is attached to the body wall:

(1) Firm attachment holds the skin onto the body of animal hence increasing rate of diffusion of respiratory gases by reducing the diffusion distance.
(2) Loose attachment allows existence of fluid filled space between the body wall and inner surface of skin in which respiratory gases dissolve to quicken their diffusion.

b) Description of the pattern and nature of blood circulation on the inner side of skin

Pattern: There is a dense network of small blood vessels spread all over the inner side of the skin, which on either lateral side of the specimen progressively merge into a large blood vessel which enters at the point of attachment of each fore limb.

Significance:

(1) The dense network increases the surface area for increased diffusion of respiratory gases.
(2) The dense network also increases the flow / draining of blood away from the skin leading to increased gradient diffusion of gases.

Nature: the blood vessels are closely / tightly attached to the inner surface of the skin.
Significance: the closeness of blood vessels to the skin reduces the diffusion distance hence increasing the rate of diffusion of respiratory gases.

STRUCTURE OF THE LIMBS

Drawing of left fore limb of toad

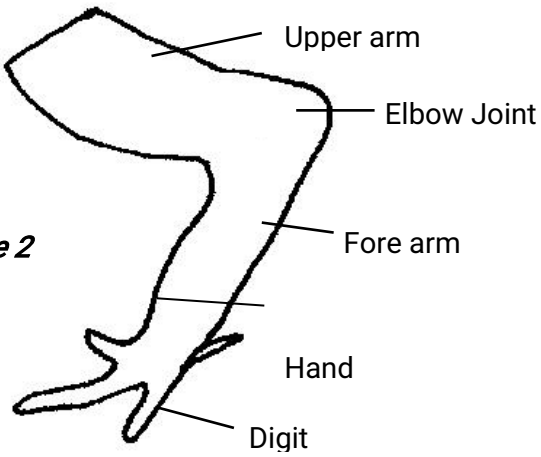


Figure 2

Drawing of left hind limb of toad:

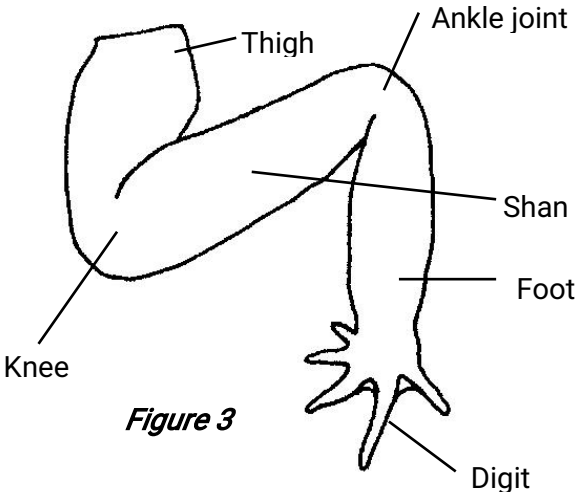


Figure 3

FORE LIMB: structure & significance

●**Is shorter**; about half the length of hind limb, which enables absorbing shock during landing. Ratio of length is 1 fore limb: 2 hind limb. Fore limb length may range between 3.0 - 5.0 cm

●Has **four completely webless digits** which enables digging burrows in the ground for hiding from predators.

●**All the four digits are relatively long**

●**Is less muscular** since it's mainly for absorbing shock during landing

●Has **two main regions** i.e. upper arm and fore arm

HIND LIMB: structure & significance

●**Is longer**; about twice the length of fore limb, which enables effective generation of sufficient propulsive force for leaping. Ratio of length of limbs is 1 fore limb: 2 hind limb. Fore limb length may range between 6.0 - 10.0 cm

●Has **five slightly webbed digits** for gripping the ground to gain stability during leaping

●**One digit is longest, four digits are short**.

●Is **more muscular** for generating sufficient propulsive force for leaping

●Has **three main regions** i.e. thigh, shank and very long foot

Note: The differences between the fore and hind limbs are underlined

MOUTH:

Position: it is terminal at the anterior end of head

Structure / natureof the mouthwhen closed: it is wide and tight-lipped.

Open the mouth by cutting directly back through the angle of the jaw on each side. Extend the cuts posteriorly nearly to the shoulder. Pull the floor of the mouth ventrally to expose the structures of buccal cavity and the pharynx.

STRUCTURES

On the roof of buccal cavity	*On the floor of buccal cavity*
A row of maxillary teeth, two patches of Vomerine teeth, two internal nares / nostrils, two Eustachian tubes, two protrusions that indicate the position of eyeballs	One tongue, One glottis,

DESCRIPTION OF THE BUCCAL CAVITY, ITS STRUCTURES AND THEIR SIGNIFICANCE DURING

FEEDING

Description of Buccal cavity: (1) Has a wide gape **(2)**has several structures attached at the inner surface of the roof and floor**(3)** the roof is moistened by a slippery fluid
Significance: wide gape enables the toad to ingest prey of large size

Description of Tongue structure: it is **(1)** large/massive **(2)** sticky **(3)** forked / bi-lobed at the posterior end **(4)** muscular **(5)** long **(6)** flattened shape **(7)** elastic **Position:** attached anteriorly at the tip of the floor of the buccal cavity.
Significance of the structure and position of the tongue
● It is long and elastic for catching small prey for food at relatively far distance and be retracted into the mouth.
● It is sticky for **grasping** the prey hence reducing chances for prey escape.
● It is attached anteriorly to be flicked out quickly to a prey at relatively far distance
●The flattened shape increases the surface area for trapping prey.

Description of Glottis: it is a short longitudinal slit in the floor of the pharynx.
Function: regulates entry of air into the lungs

Description of Position of eyeballs: oval shaped, pale coloured, protrude in the roof
Significance: the downward protruding exerts a downward pressure which facilitates swallowing because the eye is pushed against the roof of the mouth, forcing the food further back.

Description of Internal nares / nostrils: two small openings in the roof of buccal cavity
Significance: allow entry into and exit of air out of the mouth for gaseous exchange

Description of Maxillary teeth: they are small, pointed, curved inwards, identical and are arranged in one series around the edge of the upper jaw

Description of Vomerine teeth: they are in two patches, protrude out of buccal roof, all are conically-shaped, lying above the eye ball between the internal nares.
Significance: the features of the teeth suit them for firm holding of the prey in the mouth while it is being swallowed whole
(Compare with fig. 3-1, page 20, warren Walker F. Jr, Dissection of the toad 2nd edition, Freeman and company – New York)

Drawing of structures of the buccal cavity and pharynx after pulling the floor of buccal cavity ventrally.

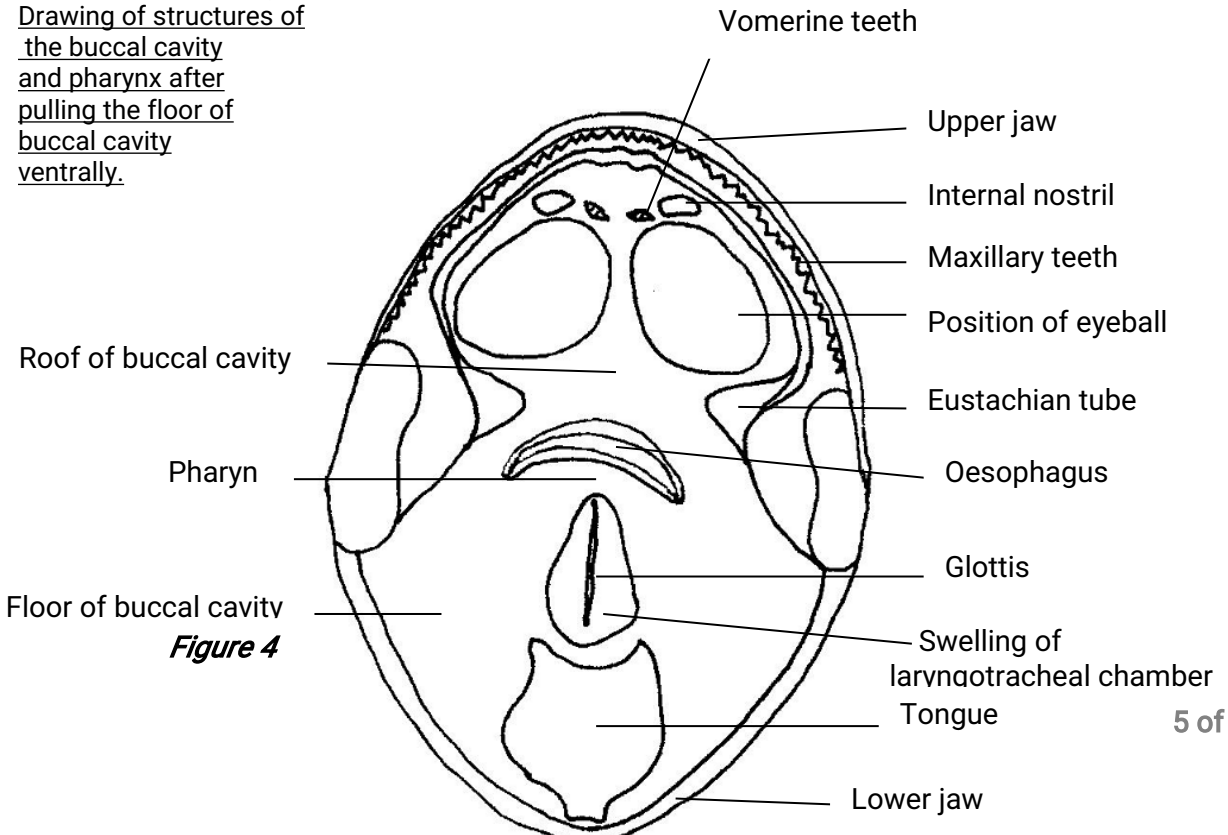


Figure 4

Open the mouth, using a pair of forceps get hold of the tongue, pull and pin it out. Display the structures of the buccal cavity and pharynx by cutting through the left angle of the jaw and displacing the lower jaw to your left. Draw and label the structures displayed.
Compare with fig. 47, pg 108, Rowett HGQ, guide to dissection)

Drawing of structures of the buccal cavity and pharynx after displacing the lower jaw to the right

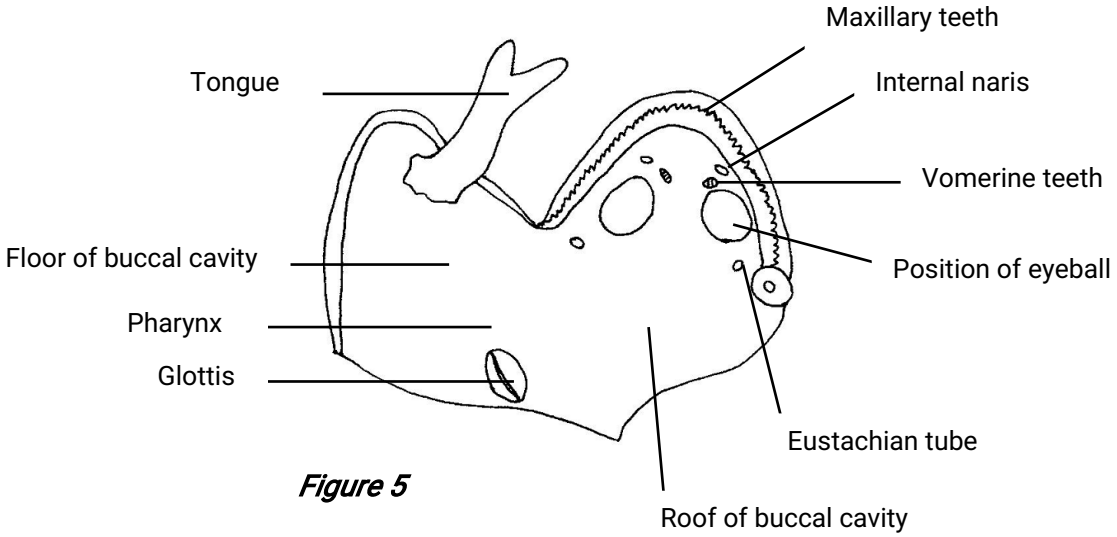


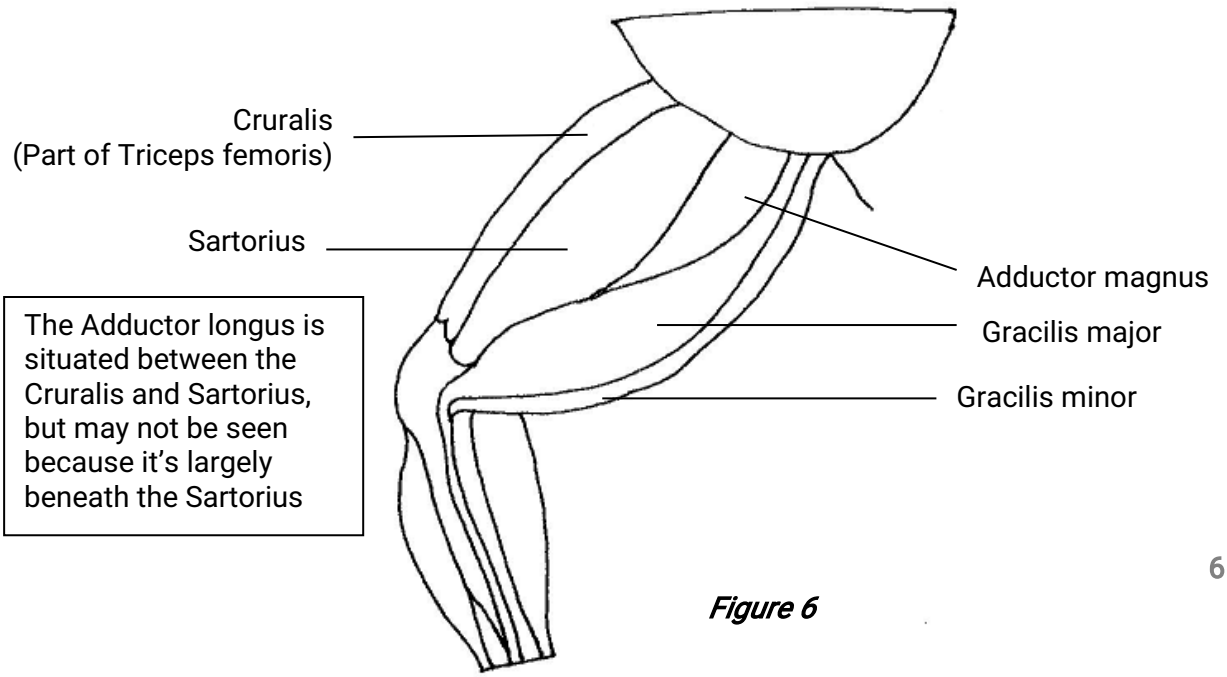
Figure 5

MUSCULATURE OF THE TOAD'S HIND LIMB FOR ELEMENTARY STUDENTS (A-LEVEL)

Adopted from: 1. Warren Walker F. Jr, Dissection of the toad 2nd edition, Freeman and company – NY
2. Bruce D. Wingerd, Frog dissection Manual, figure 3.3 page 15, Johns Hopkins Univ. Press

Dissect the toad with ventral side upper most to display the main superficial muscles of the right thigh.

Drawing of the main ventral superficial muscles of right thigh of the toad



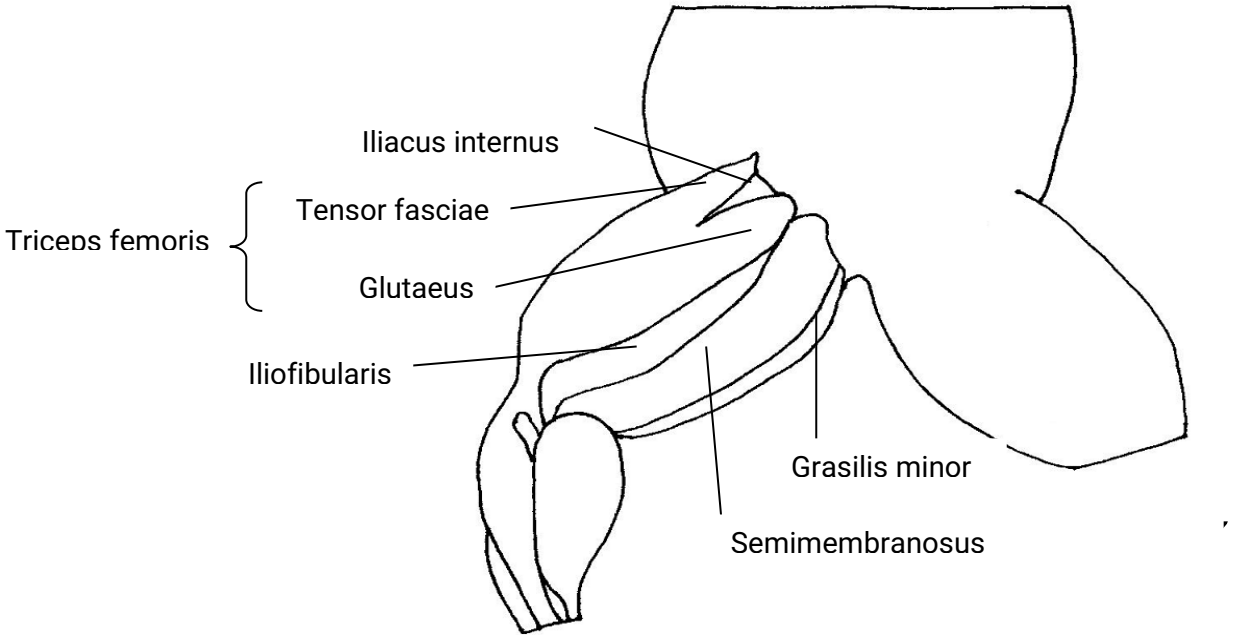
The Adductor longus is situated between the Cruralis and Sartorius, but may not be seen because it's largely beneath the Sartorius

Figure 6

Dissect the left thigh of the toad dorsally to display the main superficial muscles.

Drawing of the main dorsal superficial muscles of left thigh of the toad

(Adopted from Bruce D. Wingerd, Frog dissection Manual, figure 3.2 page 14, Johns Hopkins Univ. Press)



Drawing of the main ventral muscles of the trunk, shoulder and throat of the toad

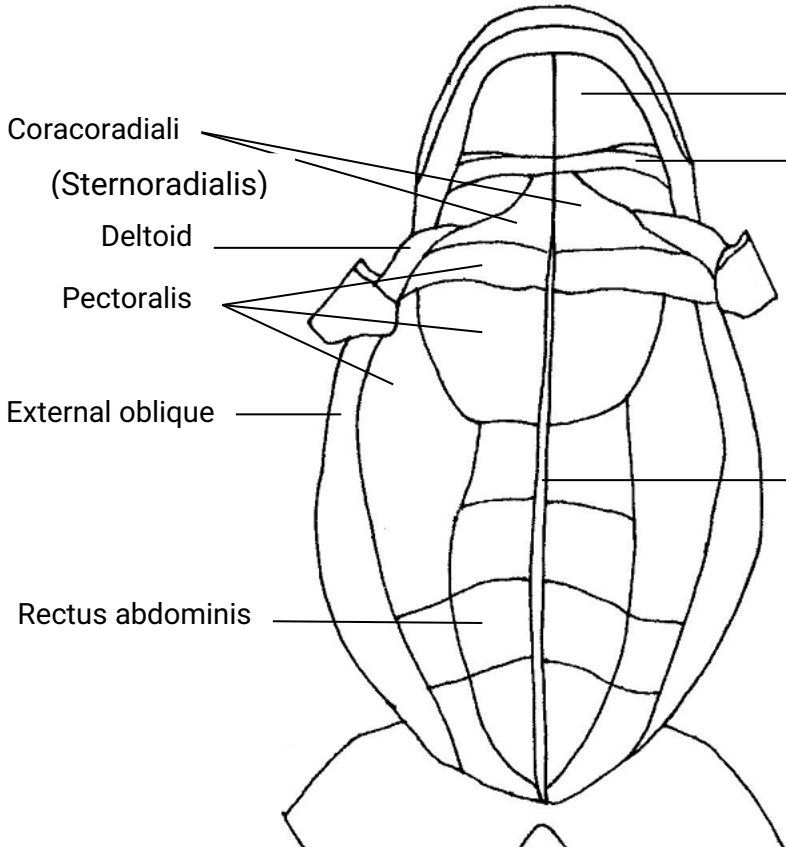


Figure 8

ADAPTATIONS OF THE MAIN VENTRAL SUPERFICIAL MUSCLES OF TOAD / HOW THE MAIN VENTRAL SUPERFICIAL MUSCLES OF TOAD ARE SUITED FOR THEIR FUNCTION

1.Submaxillary / Mylohyoid and Subhyoid muscles: are transversely aligned on the ventral surface of head enabling exerting maximum contractile effect in swallowing of prey and breathing movements of the floor of the mouth.

2. Pectoralis muscle: it is divided into several parts enabling it to produce a strong contractile effect for adducting the arm.

3. External oblique and Rectus abdominis:they are sheet-like enabling support of visceral contents

4. Sartorius: it is long, large and strap-shaped covering a large part of thigh, enabling it to flex the thigh and shank powerfully.

Dissect the animal to display the general visceral structures in situ (undisturbed state).

(Adopted with modification from Rowett HGQ, guide to dissection 2006 reprint fig. 13, pg 77 John Murray)

Drawing of the general visceral structures in situ of the toad

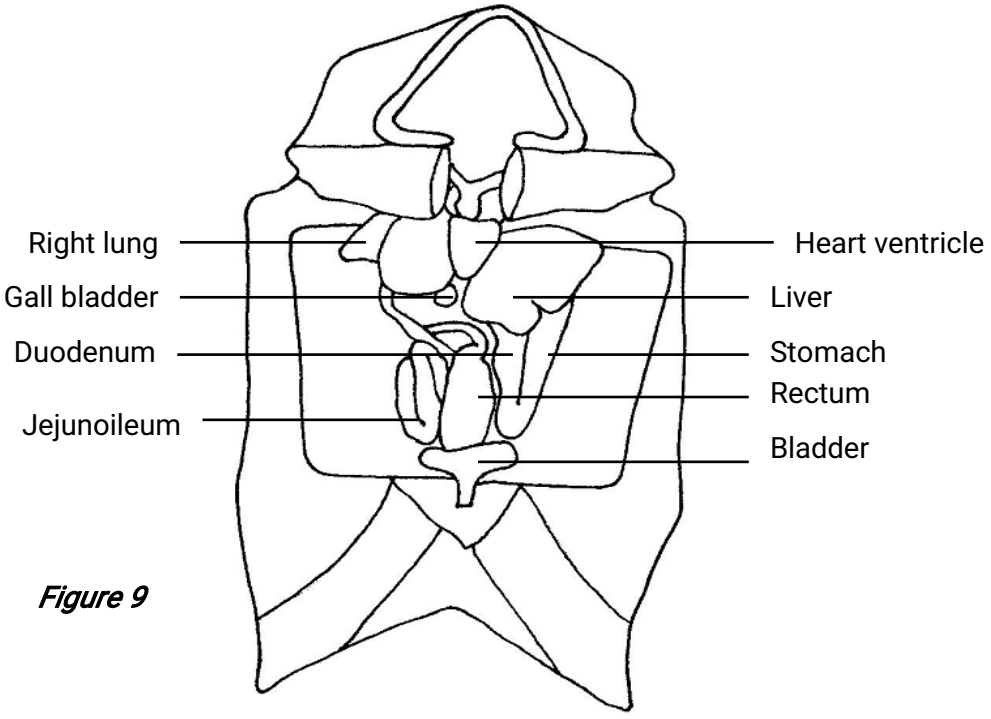


Figure 9

B) (I) IDENTIFY THE ORGANS VISIBLE AND STATE THE ORGAN SYSTEM TO WHICH EACH ORGAN BELONGS.

Organ	Organ system
●Heart	●Circulatory system
●Liver	●Excretory / digestive system
●Stomach	●Digestive system
●Lungs	●Respiratory / Excretory system
●Ileum	●Digestive system

(II) GIVE THE FUNCTIONS OF EACH OF THE ORGAN SYSTEMS IDENTIFIED IN (B) (I) ABOVE TO THE ANIMAL.

●**Circulatory system: (1)** delivery of digested food and oxygen to tissues **(2)** delivery of metabolic wastes from tissues to organs that eliminate them
●**Excretory system:** elimination of metabolic waste substances
●**Digestive system:** breakdown of complex organic substances into substances of smaller molecular mass which are later absorbed into the blood stream
●**Respiratory system:** taking in of air rich in oxygen and expulsion of air rich in carbondioxide

CAREFULLY DISPLACE THE LIVER, ALIMENTARY CANAL AND DISENTANGLE THE BULK OF THE JEJUNOILEUM.

DESCRIBE THE STRUCTURE OF OESOPHAGUS, STOMACH, SMALL INTESTINE, COLON, RECTUM AND BLADDER AND STATE HOW THEY ARE SUITED FOR THEIR FUNCTIONS

Structure	Function	Description	Suitability /adaptation
Oesophagus	It's a passage of ingested prey on its way to the stomach	It's **(1)** tubular (**2)** quite short since animal lacks neck **(3)** muscular **(4)** elastic (**5)** no demarcation between it and stomach externally **(6)** inner lining is smooth	**(1)** tubular to allow food go through **(2)** muscular to enable peristaltic movements that propel food **(3)** elasticity enables both small and large sized food particles to go through**(6)** inner lining is smooth to reduce friction as food passes through
Stomach	Digestion of food	It's **(1)** large **(2)** J-shaped /curved towards right side of body **(3)** longitudinally folded **(4)** muscular **(5)** posterior end /pyloric sphincter is narrow and thickened **(6)** anterior part is wide	**(1)** posterior end /pyloric sphincter is narrow and thickened to keep food inside for chemical and physical digestion to occur **(2)** muscular to enable peristaltic movements that churn food **(3)** large to accommodate food of large size **(4)** longitudinally folded to increase the surface area for digestion.
Small intestine (duodenum & Ileum)	Digestion and absorption of food	**(1)** inner surface is irregularly folded **(2)** duodenum curves anteriorly towards the liver **(3)** it's narrow **(4)** ileum is immensely folded **(5)** it's tubular **(6)** surrounded by many blood capillaries **(7)** thin walled	**(1)** Inner surface is irregularly folded to increase the surface area for absorption of digested food **(2)** ileum is immensely folded to increase the surface area for absorption of digested **(3)** surrounded by many blood capillaries to increase the surface area for absorption of digested food **(4)** thin walled to enable faster diffusion of digested food.
Colon	Absorption of water	It's **(1)** short **(2)** thin walled **(3)** narrow **(4)** tubular **(5)** slightly coiled **(6)** sparsely surrounded by blood capillaries	**It's (1)** thin walled to enable faster diffusion of water **(2)** surrounded by blood capillaries to enable absorption of water
Rectum	Temporary storage of undigested food pending egestion	It's **(1)** short **(2)** thick walled **(3)** wide **(4)** tubular	**(2)** thick wall generates strong contractile effect to expel wastes **(3)** wide to accommodate much undigested food for elimination **(4)** tubular to enable undigested food pass to the exterior of body
Bladder	Temporary	It is (1) membranous (2)	Being thin and highly vascular enables

	storage of water pending elimination	thin (3) highly vascular (4) transparent	reabsorption of water from the bladder during times of drought, using it as a reservoir in such situations.

CONTINUATION FROM FIGURE 9

●Pin out:
(1) The stomach to the left (your right)
(2) The ileum to the right (your left)
(3) The lungs and turn / pull the liver lobes forward and hold them in place with pins **against but not** through the liver lobes. Ensure that the heart is not obscured.
Draw the alimentary canal and associated organs.

DRAWING OF THE ALIMENTARY CANAL AND ASSOCIATED ORGANS, WITH THE STOMACH DISPLACED TO THE LEFT, THE ILEUM TO THE RIGHT AND LIVER LOBES TURNED FORWARD OF THE TOAD *(Modified from Rowett HGQ, guide to dissection fig. 14, pg 78-9 AND warren Walker F. Jr, Dissection of the toad fig. 3-6, pg 24, 2nd edition, Freeman and company – NEW YORK)*

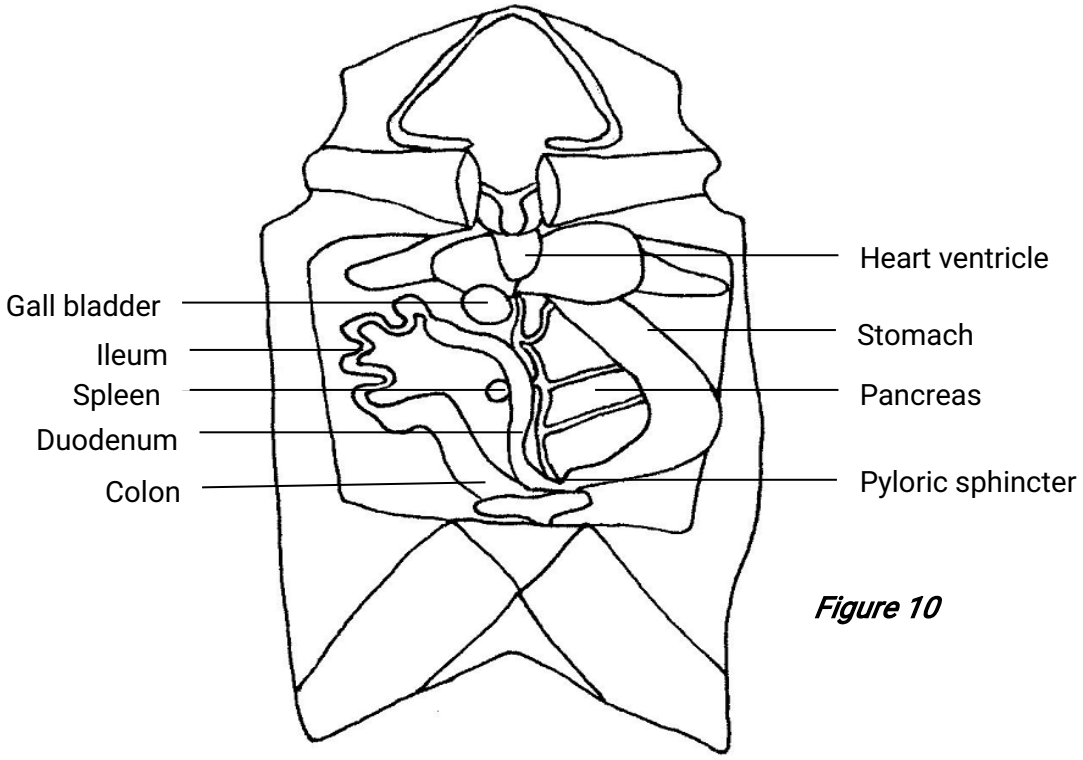


Figure 10

CONTINUATION FROM FIGURE 10

●Turn the heart forward and pin it. Remove any pericardium covering the heart and roots of big vessels. Draw and label the heart, lungs and associated blood vessels.

DRAWING OF THE HEART WHEN TURNED FORWARD, LUNGS AND ASSOCIATED BLOOD VESSELS OF THE TOAD

(Modified from Rowett H.G.Q., guide to dissection fig. 34, pg 97)

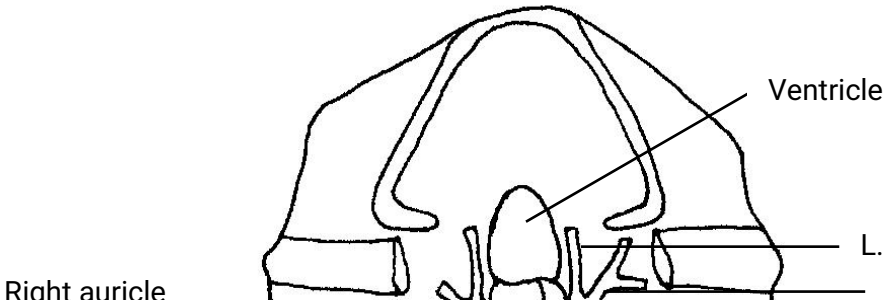


Figure 11

DRAWING OF THE MAJOR VEINS OF THE TOAD

(Blood vessels that drain blood from body parts / carry blood from body to the heart)

(Modified from Rowett H.G.Q., guide to dissection fig. 33, pg 96)

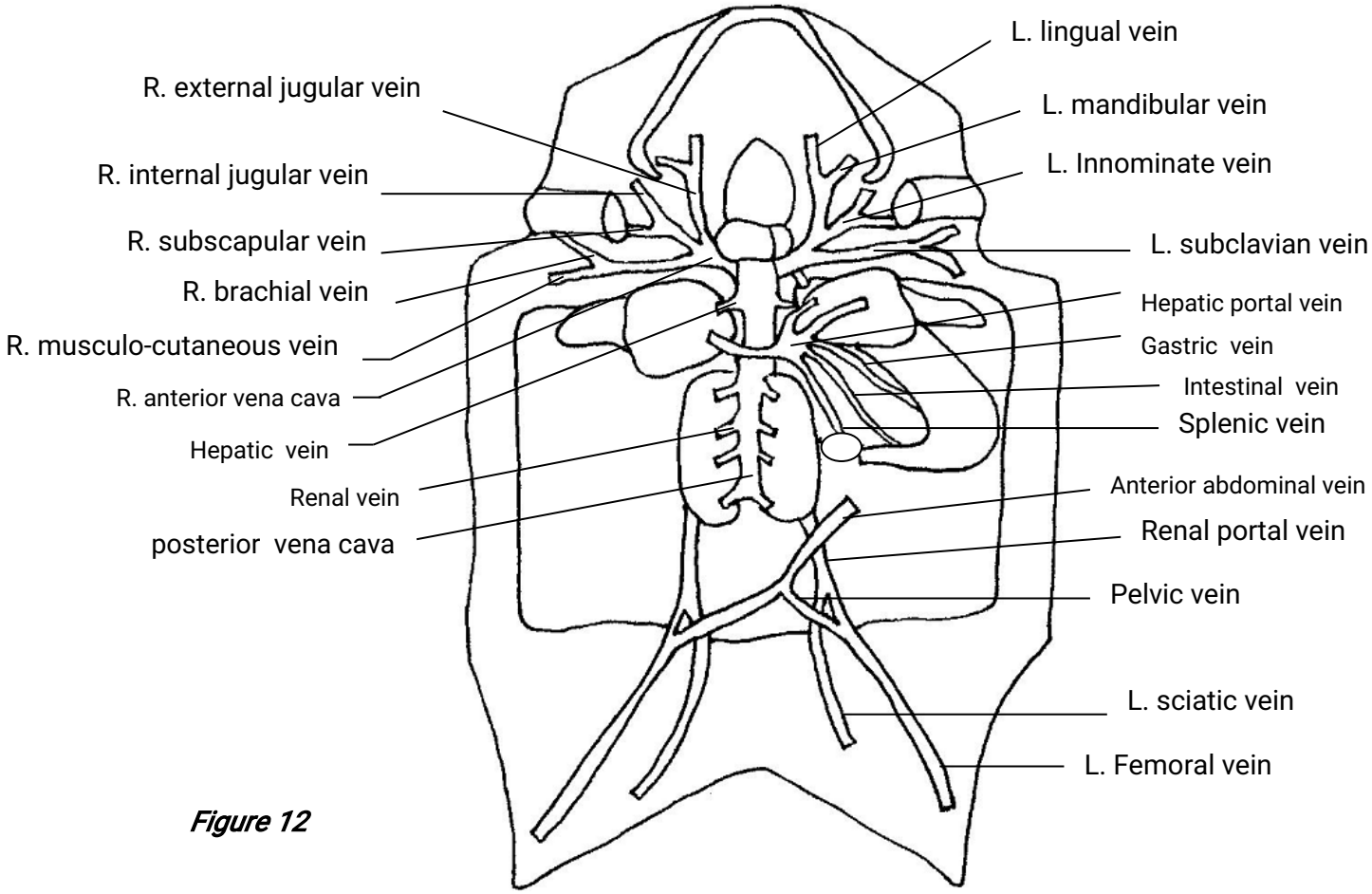


Figure 12

DRAWING OF THE MAJOR ARTERIES OF THE TOAD

(Blood vessels that supply blood to the body parts/carry blood from heart to the body)

(Modified from Rowett H.G.Q., guide to dissection figures 38, 44 and 45)

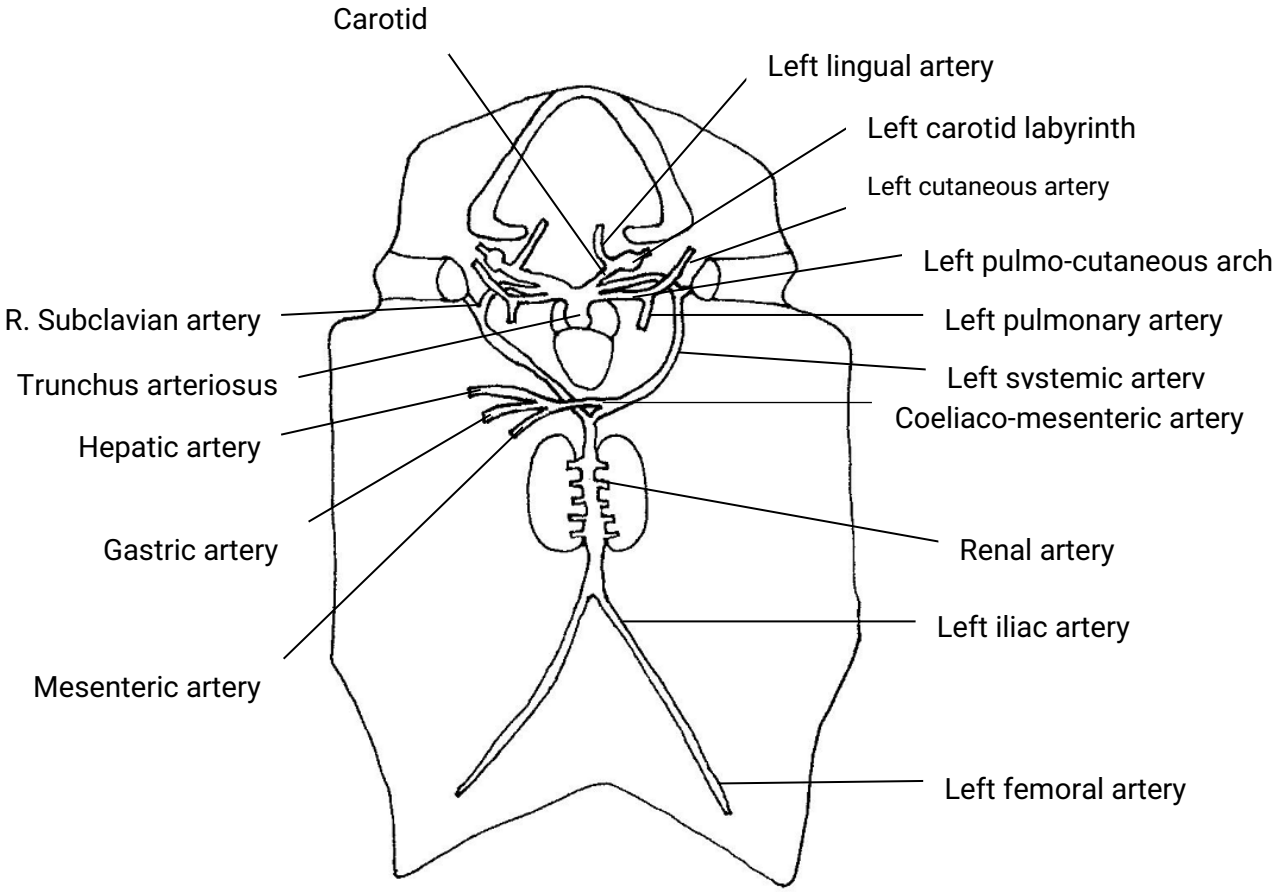


Figure 13

●Dissect the specimen to display the structures lying in the region between the fore and hind limbs.
●Carefully disentangle the bulk of the intestines and displace them to one side of the specimen.

Excluding the structures used for reproduction, draw and label your dissection.
(Modified from Rowett H.G.Q., guide to dissection fig. 15, page 81)

Drawing of structures lying in the region between the fore and hind limbs, excluding the structures used for reproduction, with the intestines displaced to the left of the toad

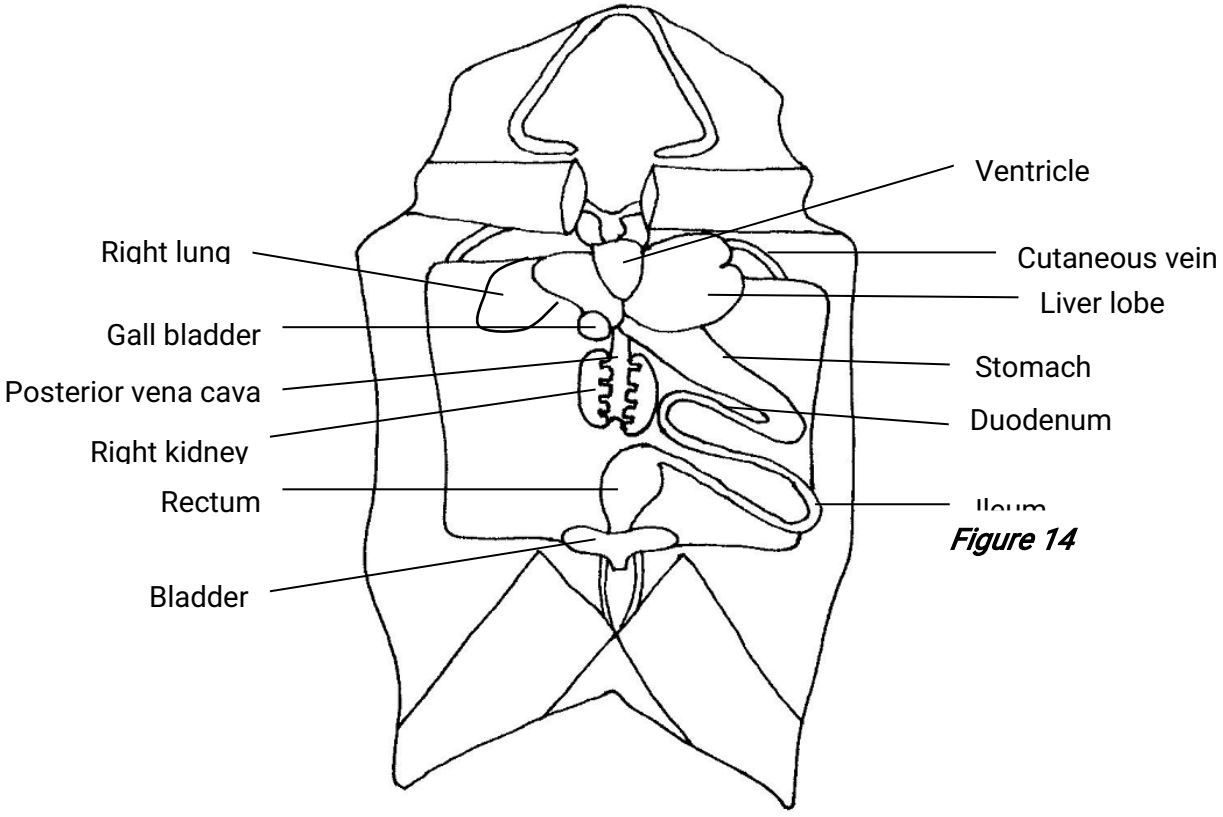
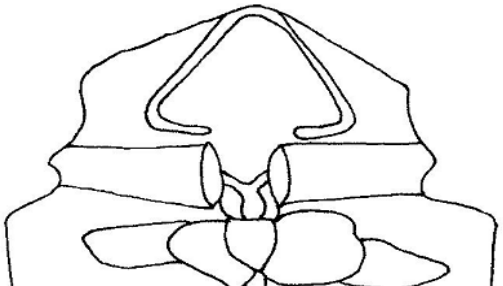


Figure 14

●Dissect the specimen to display the structures that eliminate unwanted / waste materials from the body ***(Modified from Rowett H.G.Q., guide to dissection fig. 18, page 85)***



eliminates carbondioxide
nstruction says "dissect
elimination of unwanted
the skin because it is
may attract a heavy

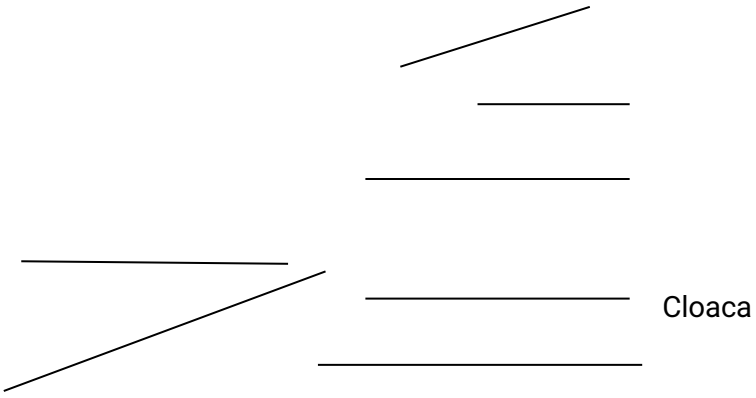


Figure 15

Structure	Waste substance eliminated
Kidney	Urea (nitrogenous waste), excess water
Lungs	Carbondioxide
Skin	Ammonia (nitrogenous waste) and carbondioxide.
Bladder	Excess water
Liver	Bile pigments

DRAWING OF THE MALE URINOGENITAL SYSTEM OF THE TOAD
(Modified from Rowett H.G.Q., guide to dissection fig. 18b, page 85)

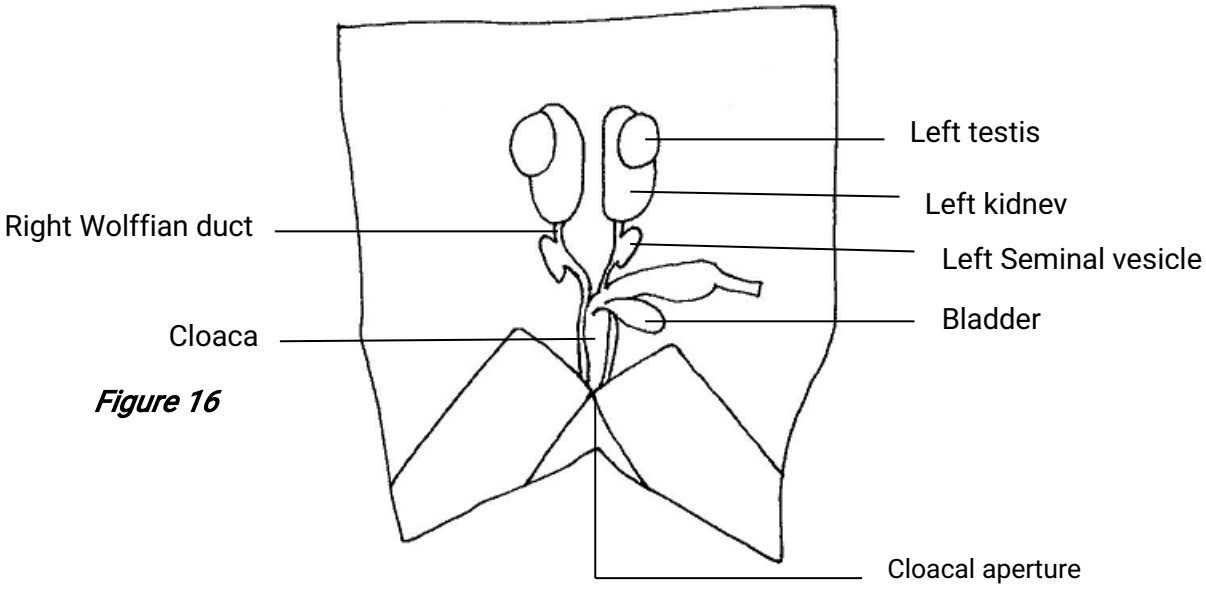


Figure 16

DRAWING OF THE FEMALE URINOGENITAL SYSTEM OF THE TOAD
(Modified from Rowett H.G.Q., guide to dissection fig. 18a, page 84)

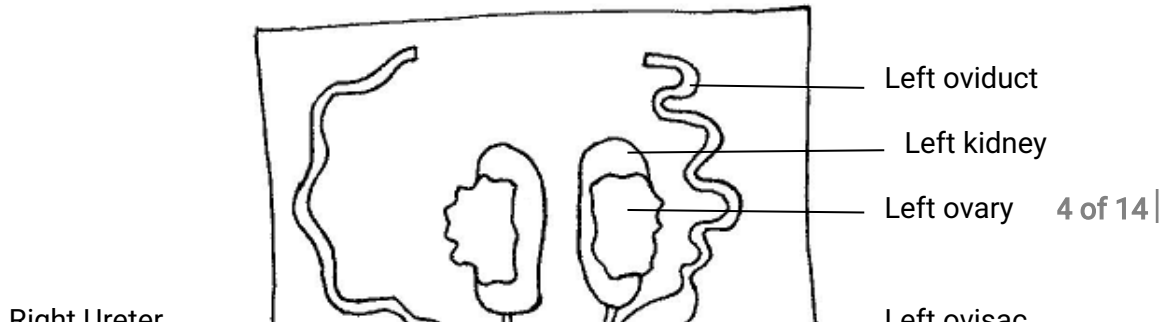


Figure 17

●Dissect to display (i) the blood vessels carrying blood from organs located on the left half of the abdominal cavity back to the heart (ii) structures used for the elimination of unwanted materials from the body. With the heart displaced anteriorly, draw and label the blood vessels and structures displayed on one diagram **(UNEB 2007)**

Drawing of blood vessels carrying blood from organs located on the left half of the abdominal cavity back to the heart and structures used for elimination of unwanted materials from the body with the heart displaced anteriorly in the toad

(Modified from Rowett H.G.Q., guide to dissection fig. 33, pg 96)

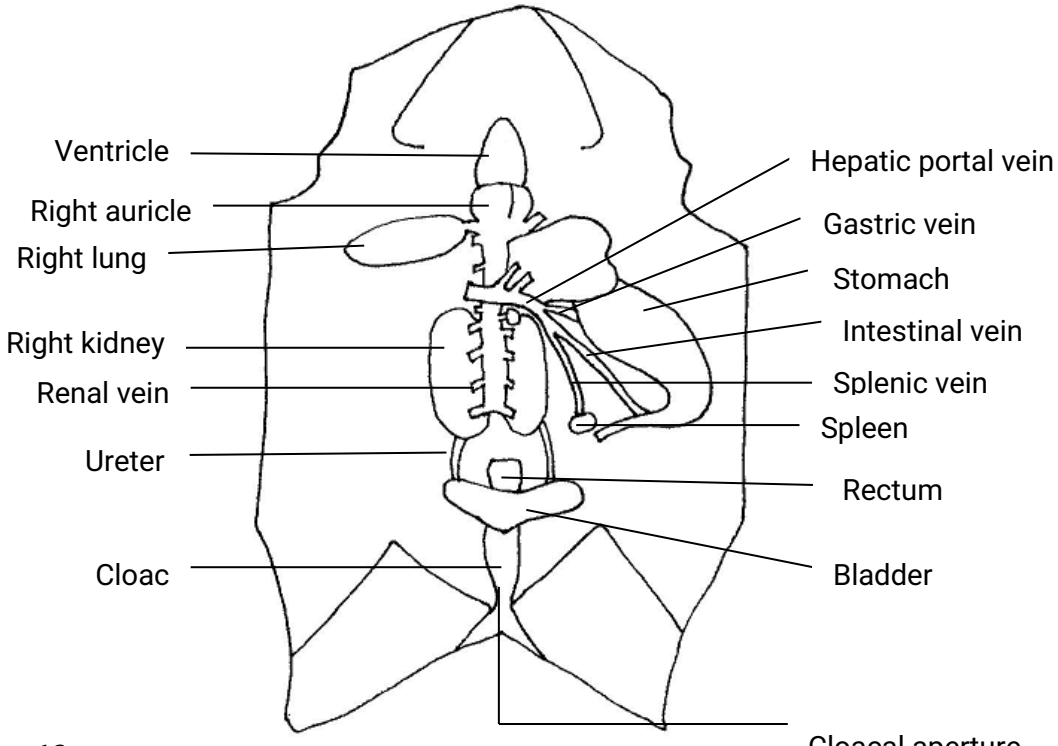


Figure 18

Drawing of the heart and associated blood vessels that drain blood from the fore limbs, head region and skin in the thoracic region on the left side of the toad *(Rowett, fig 33)*

UNEB 2001

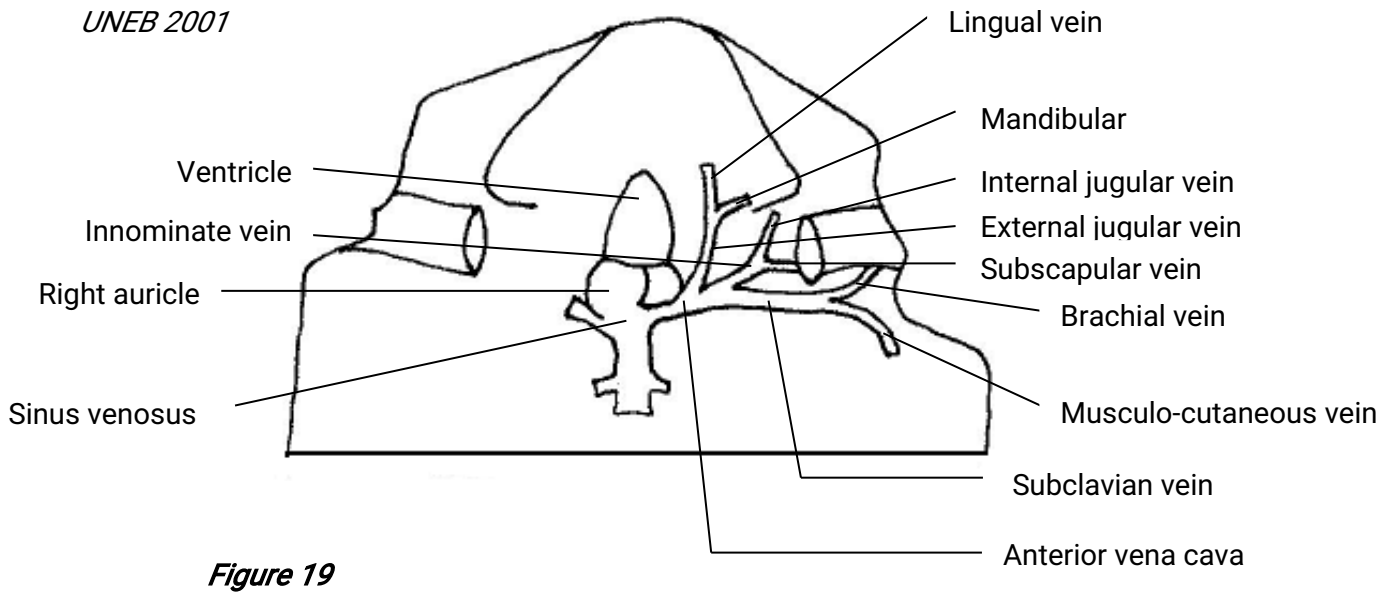


Figure 19

TYPICAL QUESTIONS FOR ANY SERIOUS CANDIDATE TO PRACTICE

Dissect the toad to display the blood vessels that supply nutrients andoxygen to the alimentary canal and the associated organs. Draw and label the heart, spleen and blood vessels. **CLUE:***Modify figure 38, page 101, Rowett H.G.Q., guide to dissection, John Murray)*

Dissect the toad and trace the routes blood flow to the heart from organs found in the left half of the abdominal region. Draw and label without displacing the heart.
By further dissection, display the blood circulation in the left thigh. Draw and label
CLUE:*Modify figure 33, page 96, Rowett H.G.Q., guide to dissection, John Murray)*

Dissect the toad to display **(i)** the blood vessels that drain blood from the alimentary canal and the associated organs back to the heart, with the alimentary canal displaced to your right and the heart turned upwards and pinned through the ventricle **(ii)** the blood vessels that take blood from the heart to the thoracic region of the animal. ***(Avoid vessels that take blood to the head).*** Make one drawing and label your dissection showing (i) and (ii).
CLUE:*Modify figures 33 and 45, pages 96 and 106 respectively, Rowett H.G.Q.)*

(a) Open the abdominal region in the usual way. Cut along the lateral line of the mouth to display the structures in the buccal cavity and pharynx. Draw and label the alimentary canal and the associated structures that facilitate the digestion of food.
CLUE: Consider *appendix IV, page 123, Rowett H.G.Q., guide to dissection)*

(b) Dissect the toad further to display the **(1)** arterial system in the left fore limb / blood vessels that supply blood to the left fore limb **(2)** the venous system in the left hind limb / blood vessels that drain blood from the left hind limb.
CLUE:*Modify figures 33 and 45, pages 96 and 106 respectively, Rowett H.G.Q.)*

Dissect the toad to display the blood vessels which **(1)** carry blood from the **head region** on the left of the specimen back to the heart **(2)** carry blood to the alimentary canal displaced to the right of the specimen and to the kidneys, with the left kidney turned on top of the right. With undisplaced heart, draw and label your dissection

CLUE:*Modify figure 38 page101 and also consider figure 21, page 88, Rowett H.G.Q.)*