Scientific classification of the rat

Taxonomic group	External observable / diagnostic features
Kingdom: Animalia	Possession of (1) a pair of eyes, (2) locomotory structures (3) Mouth
Phylum: Chordata	Presence of post anal tail
Class: Mammalia	Presence of (1) a pair of pinnae (external earlobes), (2) nipples, (3) fur (4) heterodont teeth
Order: Rodentia	Possession of a pair of elongated chisel-shaped incisor teeth at the front of each jaw
Family: Muridae	Possession of (1) tail scaled tail (2) pointed snouts with long whiskers
Genus: Rattus ***Species***: (1) *Rattus norvegicus* - brown rat (2) *Rattus rattus* black rat.	

Habitat: underground tunnels / burrows, dark burrows in houses

Evolutionary significance of dissecting a rat

Being a vertebrate, many aspects of a rat's structural organisation are common with man, hence studying the rat relates to studying a human, which clearly is evidence of common ancestry. Therefore, for every structure observed in the rat, there is an equivalent structure in the body of humans.

Key aspects of dissection

1. For every structure seen, the following should be determined:
- The organ system to which each structure belongs
- How each structure is connected with other components
- The general function of the structure
- The specific function of the structure (if applicable)

2. The person dissecting works like a **surgeon**, not like a **butcher**! To **dissect** does not mean **"cut up"**; instead it means **"expose to view"**. Care must be taken when dissecting to avoid destroying parts of the specimen.

External and Internal Anatomy - major structures to identify

External anatomy
- □ Cranial & cervical regions
- □ Pectoral & thoracic regions
- □ Abdominal & Pelvic regions
- □ Vibrissa (whiskers) & Teeth
- □ Eyes
- □ Teats (nipples), Tail & anus
- □ Urinary aperture & vaginal orifice (Female)
- □ Scrotal sacs & prepuce (male)

Digestive System
- □ Liver
- □ Esophagus
- □ Stomach
- □ Small intestine
- □ Large intestine
- □ Mesentery

Superficial muscles
- □ Biceps brachii (arm)
- □ Triceps brachii
- □ Biceps femoris (leg)
- □ External oblique (chest/abdominal)
- □ Pectoralis Major/Minor

Thoracic Cavity
- □ Heart
- □ Lungs
- □ Diaphragm
- □ Trachea

Circulatory System
- □ Vena Cava
- □ Renal Artery
- □ Right/left external jugular
- □ Aortic Arch
- □ Right/left subclavian
- □ Right/ Left femoral
- □ Right & left atrium
- □ Right & left ventricles

Excretory and Reproductive (urogenital) System
- □ Kidneys
- □ Ureters
- □ Adrenal gland
- □ Ovaries (female only)
- □ Testes (male only)

EXTERNAL ANATOMY OF THE RAT

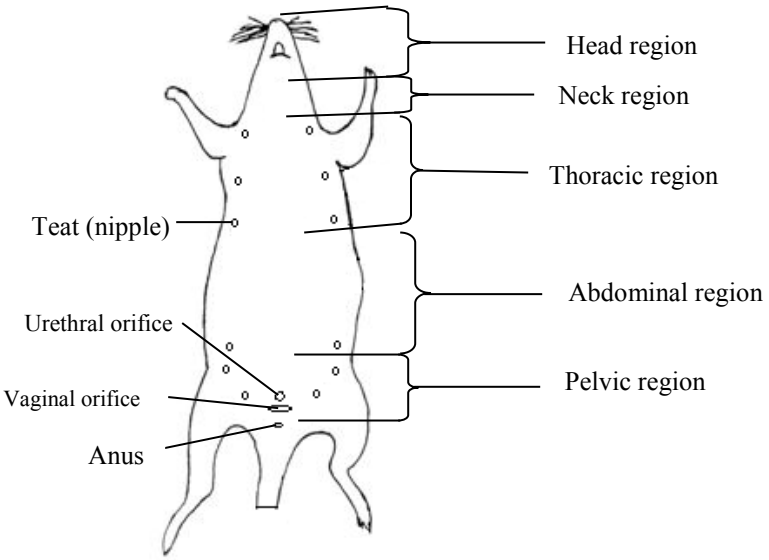
The body is divided into four easily identifiable areas:

1. *Cranial region*–head; **2. Cervical region**–neck; **3. *Trunk (****Thoracic region*-chest area; *Abdominal region*–belly; *Pelvic region*-area where the back legs attach on body trunk); **4. *Tail***–caudal. Limbs are attached on the trunk.

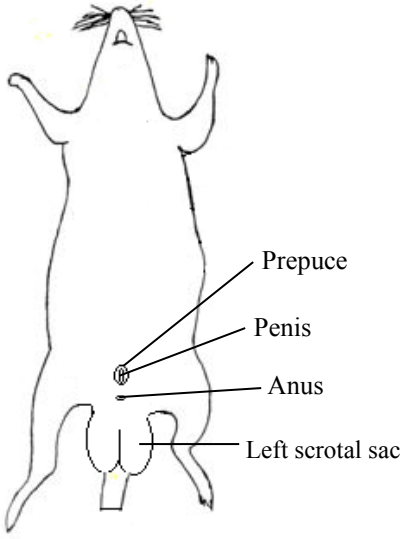
Note: *When pressed, the ventral surface of the* ***thorax*** *feels firmer than the* ***abdomen,*** *which is softer*

Main body regions (anatomical regions)

Drawing of features at the ventral surface in different anatomical regions of female rat



Drawing of features at the ventral surface of male rat



Part	Description	Significance
SKIN	***Location***: covers entire body	It offers protection all over the body against mechanical injuries, entry of parasites and heat loss
	Structure: (1) thick (2) covered with fur	(1) Thick to protect underlying tissues against mechanical injuries, entry of parasites. (2) Presence of fur reduces heat loss

Description of hair distribution on the skin

Some parts have sparse fur, some have dense fur while some parts lack hair (are hairless)

Sparsely furred parts	***Densely furred parts***	***Parts without hair***
Pinnae, upper surface of feet, anal region, tail, mystacial pads, scrotal sac and prepuce (in males), nipples and clitoris (in females). ***Significance of sparse furring:*** enables loss of excessive heat during hot weather	The dorsal and ventral surfaces of the trunk ***Significance of dense furring:*** (1) for insulation against heat loss (2) protects the skin against mechanical damage.	Lower surface of feet. ***Significance of hairless soles:*** Enables gripping the surfaces during locomotion

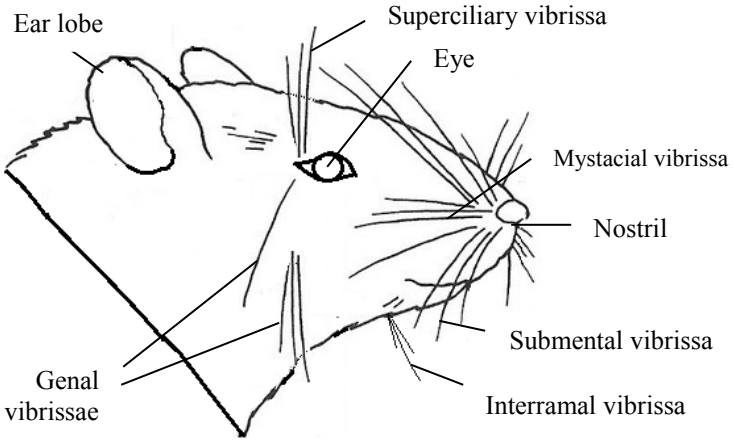
Description of nature of hair: Some of the hair is long and stiff, short, moderately long

Parts with Long, stiff hair	***Parts with Short hair***	***Parts with hair of Medium size***
Mystacial pads, dorsal to the eyes. ***Significance of vibrissae being long and stiff*** Enables tactile sensing of burrow walls in the dark	Pinnae, upper surface of feet, anal region, tail, scrotal sac and prepuce (in males), nipples and clitoris (in females). ***Significance of hair being short*** To allow much heat loss when the body heats up.	The dorsal and ventral surfaces of the trunk

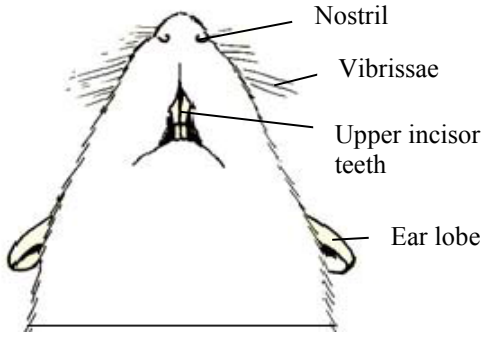
THE HEAD

***Shape and significance**:* Tapers anteriorly and broad at the base for reducing air resistance during locomotion

Drawing of lateral view of the head of rat showing features of sensitivity



Drawing of ventral view of the head of rat



VIBRISSA (WHISKER) - *Plural*: VIBRISSAE

Structure: each is long, stiff, and thin.

***Location*:** grow around the mouth and on the face, some pointing dorsally, others laterally, posteriorly, ventrally.

***Function*:** Sensitive to touch, which allows the animal to judge the size of an opening that it is about to pass through

Groups of vibrissae

(1) Superciliary or Supraorbital - above the eye ***(2) Mystacial*** - where a moustache would be ***(3) Genal*** - on the cheek, far left ***(4) Submental*** - beneath the chin ***(5) Interramal*** - between the mandibles of the lower jaw.

LIPS

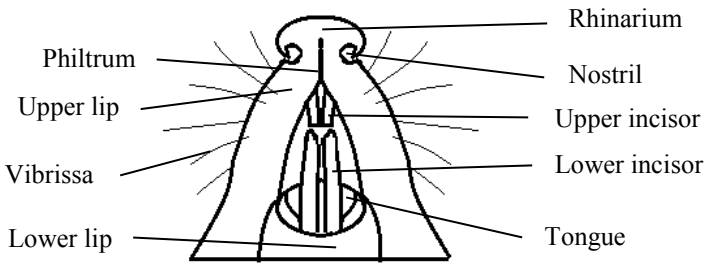
Description of lips of a rat

1. Upper lip: split into two medially, by a cleft called **philtrum**, which extends to the nostrils. Upper lip has vibrissae.

2. Rhinarium: area between the nostrils. Rhinarium is moist, hairless, shinny

3. Lower lip: not divided, hairy

Drawing of lips and other structures observed from ventral view of rat head



ADAPTATION OF UPPER LIP

1. Has a cleft called **philtrum** that exposes incisor teeth to gnaw food

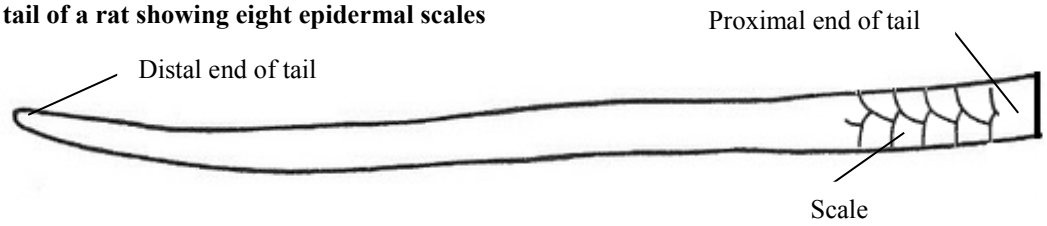
2. Many **vibrissae** for sensing tunnel diameter

3. Lower edge is **flap**-like to hold food in diastema during feeding

DESCRIPTION OF PINNAE (EAR LOBES)	SIGNIFICANCE
Position**:* dorso-lateral on the head ***Structure**:* **(1)** each is erect **(2)** It is a flexible flap. **(3)** Sparsely furred **(4)** Broad and rounded at the top, narrows at base **(5)** ***Blood vessels form a pattern from dorsal view: There is one main blood vessel originating from the base upwards and forms several branches, each of which branches dichotomously close to the tip of the pinna. There is also a smaller capillary close to the edge of the pinna.	●Dorso lateral to receive sound waves from all directions ●Staying erect maintains a posture that enables reception of sound waves and direct into external auditory meatus. ●Flexibility enables turning to the direction of sound waves. ● Scanty hair allows loss of excess heat in hot weather ● Conical shape increases surface area for reception of sound ●The branching pattern of blood vessels enables a rich nutrient supply to pinna tissue. It also enables loss of much heat during overheating.

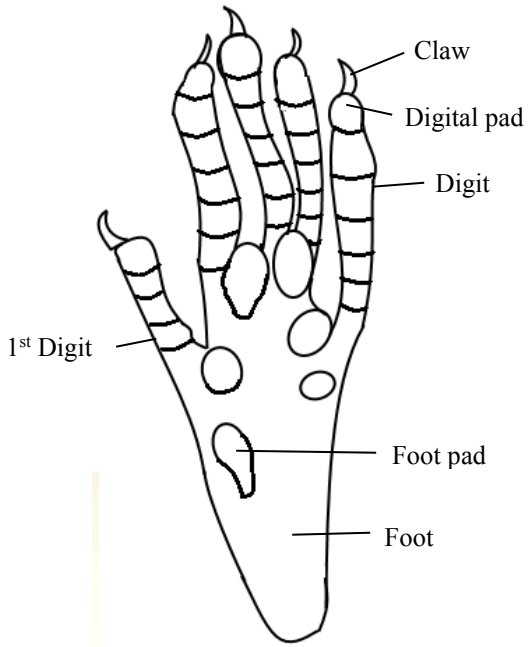
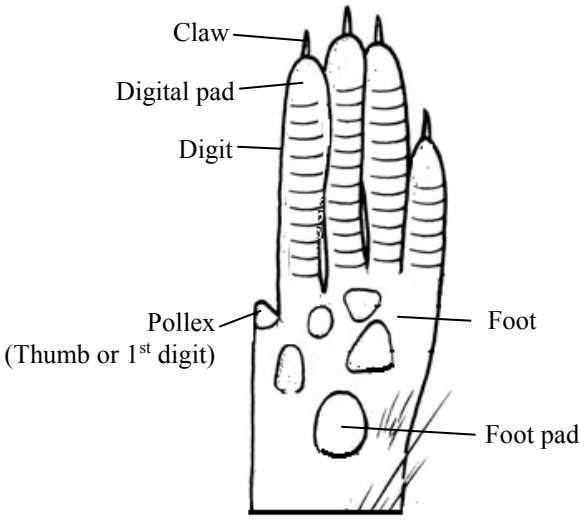
EYES: ***Position****:* dorso-lateral on the head ***Structure****:* Are paired, have large pupil, are covered by upper and lower eyelids, and a semitransparent, movable nictitating membrane in the inside anterior corner.	● Dorso-lateral position enables seeing food and predators in the habitat from a wide area. ● The nictitating membrane when drawn across the eyeball removes foreign particles.
NOSTRILS / NARES: ***Position****:* ventral surface at the tip of the snout, but face laterally ***Structure****:* Narrow, comma-shaped paired openings	● Being at the most anterior enables detection of smells even when the trunk is concealed from predators in burrows. ● Narrowness enables minimise entry of chemicals ● Being open allows entry of chemical substances
TAIL: ***Position***: At terminal end of trunk, dorsal to anus ***Structure:*** **(1)** Elongated, up to a ratio of about 1 trunk: 1 tail **(2)** Solid, when pressed between fingers **(3)** Tapers posteriorly **(4)** Has rows of overlapping epidermal scales all over, which face backwards / posteriorly. **(6)** Hairless, but **three**, **short bristles** project from under the **edge** of each **scale**. **(7)** Surface covered with orange-yellow, waxy grease	● Great length and solidness enable providing body support during climbing of trees / walls. ●Great length also enables chasing away parasites from all over the body. ● Solidness enables tail to hit at and scare away predators. ● Tapering anteriorly reduces air resistance during locomotion ● Overlapping epidermal scales reduce water evaporation ●Hairless / short bristles enable much heat loss to avoid overheating of the body. ●Waxy grease reduces evaporation of water from the tail.

Drawing of tail of a rat showing eight epidermal scales

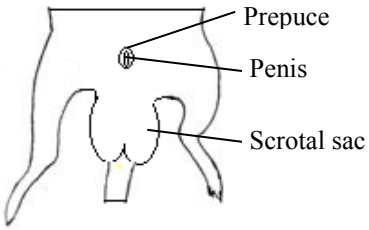
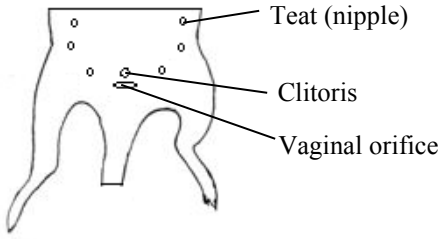


LIMBS

FORE LIMB	HIND LIMB
Whole limb**:** Short, relatively muscular, upper parts are covered with thick fur. ***Foot*****:** short with **five digits** of variable length i.e. thumb (1st digit) is much reduced, claws on digits are sharp, curved, hard, pointed, except claw on thumb which is flattened, not sharp in **mature rat**. ***Upper (dorsal) surface of foot***: sparsely furred, ***Ventral (lower) surface***: hairless, with **foot pads** ***Foot pads and digital pads:*** swollen, horny thickenings on medial surface ***Digital pads:*** located at the tips and bases of digits. ***Foot pads:*** located on the sole of the foot, **six** in total ***FUNCTION OF FORE LIMB*** ●Holding and grasping walls, support materials. ***ADAPTATION OF FORE LIMB*** ●Sharp claws prick and scare away predators. ●Ventral surface has dermal ridges, foot pads, digital pads to grip surfaces to avoid sliding. ●Long digits ensure firm grip of surfaces	***Whole limb*****:** Relatively long, highly muscular, upper parts are covered with thick fur. ***Foot*****:** long, has **five digits** of variable length, claws on digits are sharp, curved, hard, pointed claws. ***Upper (dorsal) surface of foot***: sparsely furred ***Ventral (lower) surface of foot***: hairless, has foot pads, digital pads and dermal ridges on digits. ***Foot pads and digital pads:*** swollen, horny thickenings on medial surface ***Digital pads:*** located at the tips and bases of digits. ***Foot pads:*** located on the sole of the foot, **six** in total ***FUNCTION OF HIND LIMB*** ●Running, climbing, jumping and support ***ADAPTATION OF FORE LIMB*** ●Highly muscular to generate strong propulsive force ●Long to provide great thrust when jumping ●Ventral surface of foot is hairless to minimise noise during locomotion ●Ventral surface has dermal ridges, foot pads, digital pads to grip the ground when running to avoid sliding.

Drawing of left hind foot of a rat	Drawing of left fore foot of a rat
	

FEATURES FOR SEX IDENTIFICATION

Male rat	Female rat
1. *Scrotum*: Double pouch, two scrotal sacs, oval-shaped, large, scantly furred. ***Location:*** Posterior and lateral to urogenital aperture. **2. *Prepuce*:** cylindrical, sparsely furred, covered with short hair, bulging ***Structure in relation to function*** **Scrotal sac:** (i) Large for accommodating large testes to manufacture much sperm (ii) scantly furred to allow much heat loss 	**1. Teats / nipples / mammary papilla:** ***Location***: Twelve (6 pairs); ventrally positioned - six (3 pairs) are located in thoracic region, two (one pair) in the abdomen, four (2 pairs) in the groin / pelvic region. ***Structure*:** each nipple is pointed, cylindrical, hairless, short, smooth. **2. Vaginal orifice:** ***Location:*** anterior to the anus ***Structure****:* open, depression, oval-shaped, moist ***Structure in relation to function*** **Vaginal orifice:** (i) Open to enable entry of penis during copulation (ii) Moist to enable entry of penis without much resistance. 

ANUS

Location in females: Most posterior aperture, at the base of the tail, seen by lifting the tail.
Location in males: Most posterior aperture, hidden by overhanging scrotum, seen by lifting the tail.
Function of anus: It discharges the rat's solid wastes.
Adaptation: it is an aperture, to allow discharging faeces.

BUCCAL CAVITY (ORAL CAVITY)

Procedure: Use larger pair of scissors to cut at both angles separating upper and lower jaws, depress the lower jaw

Observable structures at the **roof of buccal cavity**	***Observable structures*** at the **floor of buccal cavity**
Upper incisor teeth: two, moderately long, curved, sharp top	**Lower incisor teeth:** two, very long, curved, sharp
Upper molar teeth: ridged, large surface area, 2 rows	**Lower molar teeth:** ridged, large surface area, 2 rows
Anterior palate: hard (bony), ridged, white coloured	**Tongue:** muscular, tapers anteriorly
Posterior palate: soft, smooth, moist, red coloured	**Epiglottis**: moist

TEETH OF RATS

Dentition: **Heterodont** i.e. shapes of teeth differ greatly

The dental formula for the rat

$$\mathbf{I}\ \frac{1}{1}\ \mathbf{C}\ \frac{0}{0}\ \mathbf{P}\ \frac{0}{0}\ \mathbf{M}\ \frac{3}{3}\ \times 2 = 16$$

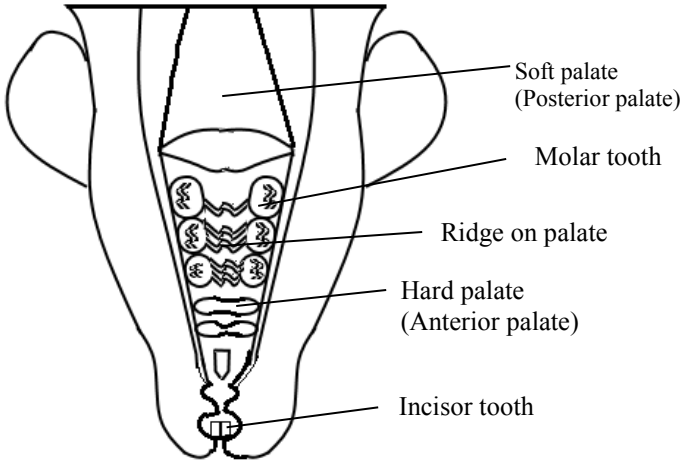
Description of rat's dental formula

- Dental formula shows half the number of teeth in each jaw
- ***Upper row:*** upper jaw, molars are in two rows; left 3, right also 3
- ***Lower row:*** lower jaw, molars are in two rows; left 3, right also 3
- ***Each jaw has:*** 2 incisors, 0 canine, 0 premolar and 6 molars.
- ***Total number of teeth:*** 16
- A gap called the **diastema** separates incisors from molars.

Adaptations of buccal cavity structures

- ***Incisors:*** hard, top sharp to gnaw hard food substances
- ***Molars:*** ridged with a large surface area to grind food.
- ***Anterior palate:*** ridged for increased friction during chewing to prevent food from falling out of the mouth
- ***Posterior palate:*** smooth to reduce friction when swallowing
- ***Tongue:*** muscular to turn food in the mouth during chewing
- ***Diastema:*** separates chewing from gnawing for proper physical digestion to occur

Drawing of roof of buccal cavity, ventral side uppermost



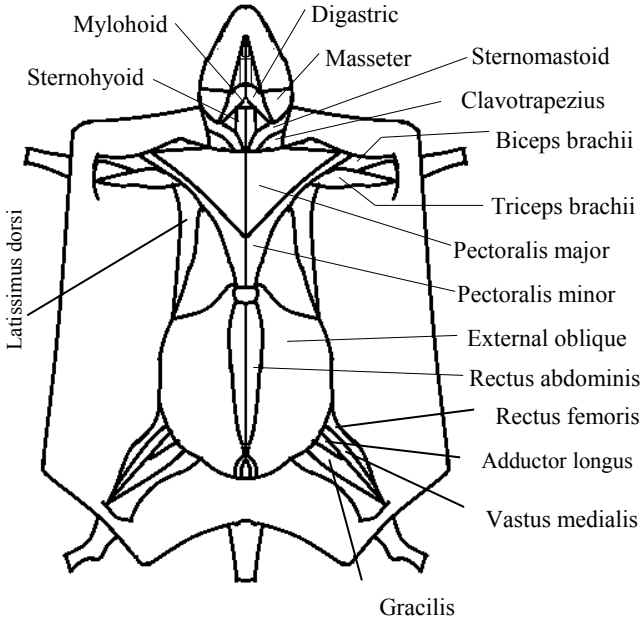
INTERNAL ANATOMY

GLOSSARY OF TERMS

Right and ***Left*** - refer to the specimen's right and left
Viscera - internal organs
Internal organs: organs seen after opening body wall
Inner structures: seen after lifting body flaps e.g. teeth
Superficial: on or near the surface
Deep: some distance below the surface
Dorsal: toward the back
Ventral: toward the belly
Lateral: toward the sides
Median: near the middle
Anterior: toward the head
Posterior: toward the hind end (tail)
Sagittal: mid-line which bisects left from right sides
Proximal: towards the center of the body
Distal: farther away from the body
Caudal: toward the tail end
Pectoral: relating to the chest and shoulder region
Pelvic: relating to the hip region
Dermal - relating to the skin
Longitudinal - lengthwise
Abdominal cavity - area below (posterior to) diaphragm
Thoracic cavity - area above (anterior to) the diaphragm
Transverse: separation between anterior and posterior
Horizontal: separating line between dorsal and ventral

MUSCULAR SYSTEM

Superficial muscles of the ventral surface of the rat

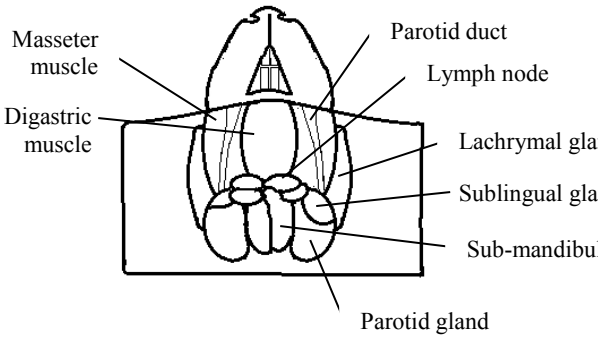


Region	Muscles and their functions
Head and Throat	***Masseter*:** mastication (chewing) ***Digastric*:** opens the mouth. ***Mylohyoid*:** raises floor of mouth. ***Sternohyoid*:** pulls the hyoid towards the sternum. ***Sternomastoid*:** rotates the head
Chest and Fore leg	***Pectoralis major:*** pulls arm towards the chest. -It is large, triangular covers the upper thorax ***Pectoralis minor:*** pulls arm towards the chest -It is partly covered by Pectoralis Major. ***Biceps brachii:*** flexes (bends) lower arm -It is large, located on inside of the upper arm. ***Epitrochlearis:*** extends lower arm -It is a flat, thin, at medial surface of upper arm. ***Triceps brachii:*** extends the lower arm -Has three heads. -Runs between the scapula and humerus and ulna.
Shoulder and Lateral of fore leg	***Clavotrapezius:*** pulls the clavicle forward. ***Latissimus dorsi***: pulls the arm downward.
Abdominal Muscles	***External oblique*:** compresses and holds internal organs of abdomen in place ***Rectus Abdominis*:** compresses and holds the internal organs of abdomen in place

Hip and Medial Muscles of Hind Leg
***Gracilis*:** pulls the thigh inward.
***Rectus femoris*:** extends the lower hind leg.
***Vastus medialis*:** extends the lower hind leg.
***Adductor longus*:** pulls the thigh towards the body.

SUPERFICIAL STRUCTURES IN THE THROAT OF A RAT

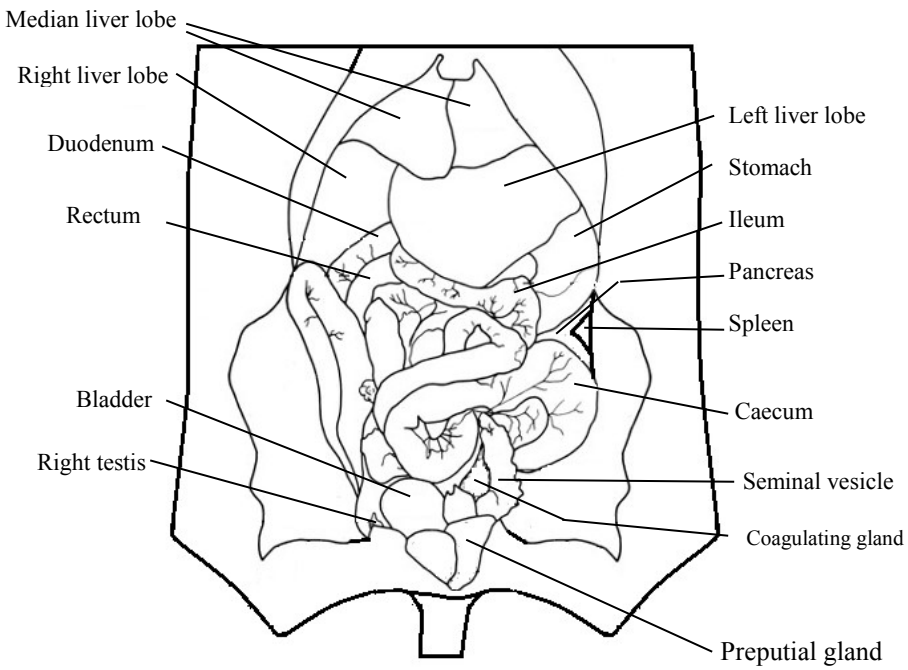
These are muscles and various glands that belong to different organ systems



	Structures and their organ systems
Digestive system	***Parotid gland:*** it is the **major salivary gland** which **s**ecretes saliva that contains starch digesting enzymes. ***Parotid duct*:** empties saliva from the Parotid gland into the oral cavity. ***Sub-mandibular (Sub-maxillary) gland*:** a salivary gland that secretes a thick mucus. ***Sublingual gland*:** a small salivary gland that empties into the oral cavity behind the lower incisors.
Immune system	***Lymph nodes*:** filter foreign particles from immune system and also make leucocytes. ***Lacrimal gland*:** secretes lacrimal fluid (tears) to lubricate and protect the eye. Tears contain water, proteins (albumin), lysozyme enzyme, mucins, salts, lipids, etc.

MAMMARY GLANDS DRAWING

ABDOMINAL VISCERA AND THE DIGESTIVE SYSTEM



- **Abdominal viscera:** structures observed on opening up the abdominal wall.
- **Digestive system** consists of alimentary canal and accessory structures

- ***Alimentary canal:*** a tube in which food passes, and includes these parts: mouth, throat, oesophagus, stomach , small intestines , large intestines, rectum and anus.

- ***Accessory structures*:** the organs, glands, and tissues whose activities enable digestion, e.g. by secreting fluids with enzymes but undigested food does not pass through them. They include: salivary glands, liver, gallbladder and pancreas.

Part	Description of structure	Function
Parietal Peritoneum	- very thin, shiny membrane, lines the inside of abdominal wall.	Protection of viscera
Visceral Peritoneum	- very thin, shiny membrane, covers the internal organs of the abdominal cavity.	Protection of viscera
Mesenteries	- folds of the visceral peritoneum that attach the small intestine and colon to the posterior abdominal wall.	Keeps organs in place
Liver	- Large, dark brown organ, lobed, occupies much of the anterior portion of the cavity, suspended just under the diaphragm. **The four lobes:** **(i) *median or cystic lobe*** – top most, has central cleft **(ii) *left lateral lobe*** – large, partially covers the stomach **(iii) *right lateral lobe*** - partially divided into anterior and posterior lobules, hidden from view by the median lobe **(iii) *caudate lobe*** – small, folds around the esophagus and the stomach, seen most easily when stomach is raised	Manufactures bile, Regulates food in blood e.g. glucose. Remove toxins, Stores ions and vitamins
Gall Bladder	- the rat does not have a gall bladder.	
Stomach	- curved, bag-like organ, lies below the diaphragm.	Physical digestion by churning food Chemical digestion by secreting digestive enzymes e.g. pepsin
Esophagus	- Muscular tube, passes through the diaphragm, empties food into stomach.	
Small Intestine	- composed of three major parts. The stomach empties its contents into the first section of the intestine called the **Duodemum.** The **Ileum** is the terminal section of the small intestine that connects with the cecum. The middle section	

	(between the duodenum and ileum) is the **Jejunum.** The small intestine is where most digestion and ingestion occurs.	
Large Intestine (Colon)	**-** is shorter and wider than the small intestine. The ileum of the small intestine empties into the first section of the colon, the **Cecum.** The **Vermiform Appendix** is a blind-ended sac attached to the cecum. The appendix functions as a lymphatic organ in immunity and often becomes infected in humans. **Rectum -** the terminal portion of the colon leading to the anus.	
Spleen	**-** is located to the left of the stomach at the end of the pancreas. It functions in immunity.	Protection
Pancreas	**-** has a glandular lobular appearance and is attached to the duodenum. It has both a digestive function (it secretes enzymes) and a hormonal function.	

PRACTICE QUESTIONS ON ANATOMY OF THE RAT

1.You are provided with a freshly killed rat.

(a)(i) Observe the head carefully and describe five ways its external structural features adapt the animal to live in its habitat. (5marks)

(ii) Draw and label the head as you observe it in its lateral and ventral views. Ventral view (03marks), Lateral view (03marks)

(ii) Open the buccal cavity and count the number of teeth. Write the dental formula.(02marks)

(b)(i) Dissect the animal to display the superficial structures in the neck. Draw and label. (10marks)

(ii) Proceed to dissect and display internal structures posterior to the diaphragm. Observe them in the undisturbed state. Draw and label. (12marks)

(c) By further dissection, display the structures used for reproduction, and blood vessels supplying blood to them. Draw and label. (10marks)

2. You are provided with a freshly killed rat.

(a) Examine the trunk and limbs and suggest five ways the animal is adapted to cope up with the challenges in its habitat (05marks)

(b)(i) State the sex of the animal and suggest two reasons for your answer. (1½ marks)

(ii) Draw and label the external structures you used to establish the sex of your specimen. (03marks)

(iii) Describe the external structures you would use to identify the mammal of the opposite sex.(06marks)

(c) Proceed to dissect and display reproductive structures and blood vessels draining blood from them back to the heart. (10marks)

(d) By further dissection:

(i) Open up the thoracic cavity and display the structures in the undisturbed state in this part of the body.

(ii)Displace the liver lobes anteriorly and the stomach to your left. Draw and label the structures in the thoracic cavity and those originally obscured by the stomach on the same drawing. (22marks)

3. (a)You are provided with a freshly killed rat. Examine the animal carefully and describe:

(i) Structure and distribution of fur. (06marks)

(ii) The structural features of the tail. (03marks)

(iii) Outline the significance of your observations in (a) (i) and (ii) to the survival of the animal. (05marks)

(b) Dissect the abdominal region, and display the internal structures in this part of the body. Deflect liver lobes anteriorly, displace duodenum to the right and the rest of the intestine (ileum) to the left. Re-arrange the structures so that the structures within the mesentery can be seen clearly. Cut and remove stomach and spleen. Draw and label. (20marks)

4. You are provided with a freshly killed rat.
(a) Dissect the region posterior to the diaphragm to display the digestive system.
(i) Describe the structure of the liver and its point of attachment. (03marks)
(ii) Displace the liver lobes anteriorly, the duodenum to your left and re-arrange the rest of the gut to display the blood vessels draining the digestive system. Draw and label. (20marks)
(b) (i) By further dissection, display the blood vessels draining blood from the urino-genital system. Draw and label. (18marks)
(ii) Briefly describe the procedure you performed to display the system in b(i) above. (03marks)

5.You are provided with a mature mammal labelled specimen R.
Measure the length of the whole body, the tail and the rest of the body.
(i) Record your results as follows: Whole body… Tail…Rest of the body (without tail) …… (03marks)
(ii) Calculate the ratios: Tail to whole body and tail to rest of the body. (2marks)
(iii)What is the biological significance of these ratios. (02marks)
(b) Dissect the abdominal region. Displace the liver lobes anteriorly and the alimentary canal to the right. Search for the blood vessels supplying the digestive system. Draw and label. (20marks)
(c) By further dissection, open up the chest cavity. Carefully remove the thymus gland, ligature main blood vessels associated with the heart. Cut through these and blood vessels, remove the heart. Search for the respiratory tract and organs for gaseous exchange. Draw and label. (18marks)

(5) (a) Dissect a freshly killed rat provided, to expose structures anterior to the diaphragm. Remove the thymus gland, displace the heart to your left. Trace for blood vessels located in the thoracic region, draw and label (15 marks)
(b) Dissect specimen M provided to expose blood vessels draining the structures posterior to the diaphragm, when the gut has been cut out. Draw but label only structures on the right. Label. (22 marks)

6(a) Dissect the abdominal region to display the stomach. Then shift the stomach to your left and tear off any unnecessary tissues to clearly display the nerves, blood vessels, glands and organs originally concealed by the stomach. Draw and label this portion of your dissection. (12 marks)
(b) Continue to dissect to display the blood vessels that supply blood to the digestive system.(23 marks)

7. You are provided with specimen R which is freshly killed, Dissect the specimen to display the alimentary canal, cut the mesentery to let the organs free and deflect the parts of the displaceable parts of the alimentary canal to the left of the specimen. Search for the blood vessels supplying the alimentary canal. Draw and label your dissection. (15 Marks)

8. (a) Explain five ways the animal uses the structural features of the head to cope up with the challenges in its habitat. (5 marks)
(b) Lay the animal in the usual way, dissect and remove the skin from the ventral side of the animal. Search for the superficial structures. Draw and label (12 marks)
(c) By further dissection, Display the mesentery within the bulk of the intestines; trace the lymph nodes in the region of your dissection. Draw and label the junction between ileum, caecum, appendix and colon including structures in the mesentery. (15marks)

9. You are provided with specimen B which is freshly killed. Lay the animal with the ventral side upper most and dissect the specimen to expose the structures in the thoracic region, the heart and the great blood vessels draining the forelimbs. Pin the heart to the right of the animal. Draw and label fully. (15 marks)
(a) You are provided with specimen B which is freshly killed.
(i)Pin the animal on a dissecting board and proceed to dissect and open up the abdominal cavity. Pin aside the abdominal wall and examine carefully the contents of the abdominal cavity in the undisturbed state. Name five organs visible and state the organ system to which each organ belongs.
(ii) Draw and label the structures observed in your dissection (10 marks)

10 (a) You are provided with specimen R which is freshly killed. Examine it carefully and answer the following questions.
(i) Describe the features of the ears (3 marks)
(ii) Explain 3 ways the ears are suited for their function. (3 marks)

(b) Proceed to dissect and expose the heart and structures with in the thoracic cavity. Remove the thymus gland, displace the left lung to one side .Draw and label. (15 marks)

11. You are provided with a freshly killed animal T.
(i) Dissect the specimen to clearly display the structures lying anterior to the diaphragm and posterior to the neck. Without displacing any organs. Draw and label fully (12 marks).
(ii) Now proceed to dissect and display the blood vessels returning blood from the left hind limb and the left kidney back to the heart. Draw and label fully. (10 marks)

(12) (a) Observe the foot of the fore and hind limbs from ventral view. Draw and label. (10 marks)
(b) Outline the differences between the hind and fore feet (5 marks)
(c) Place the animal on the dissecting board in the usual way. Dissect to display the liver, kidney, adrenal glands and the small intestines. Draw and label the above organs and the blood vessels draining them.
(16 marks)