III THE RAT

As type specimen for mammalian dissection rat, guinea-pig and rabbit are all equally suitable, but as the rat is now most frequently used, the complete procedure for it only is included in this volume. This procedure is applicable to the guinea-pig though it differs from the rat in a number of minor details (cf. mouse), e.g. in the shape of the seminal vesicles, absence of coagulating glands and larger caecum. The rabbit, however, differs from the rat sufficiently to make alternative instructions necessary in places. These are given in an appendix.

The dissection of the rat falls into three sections, (*a*) the contents of the abdomen, (*b*) the contents of the thorax and the neck, (*c*) the brain. For the first two of these sections the rat should be attached ventral side uppermost to a wooden dissecting board. Large wooden- or brass-handled pins are used for this purpose, but a supply of ordinary pins will be found useful for holding the various structures in place during the display.

With the exception of the brain, dissection is best performed on a freshly-killed specimen. Especially is this so for display of the alimentary canal and the diaphragm.

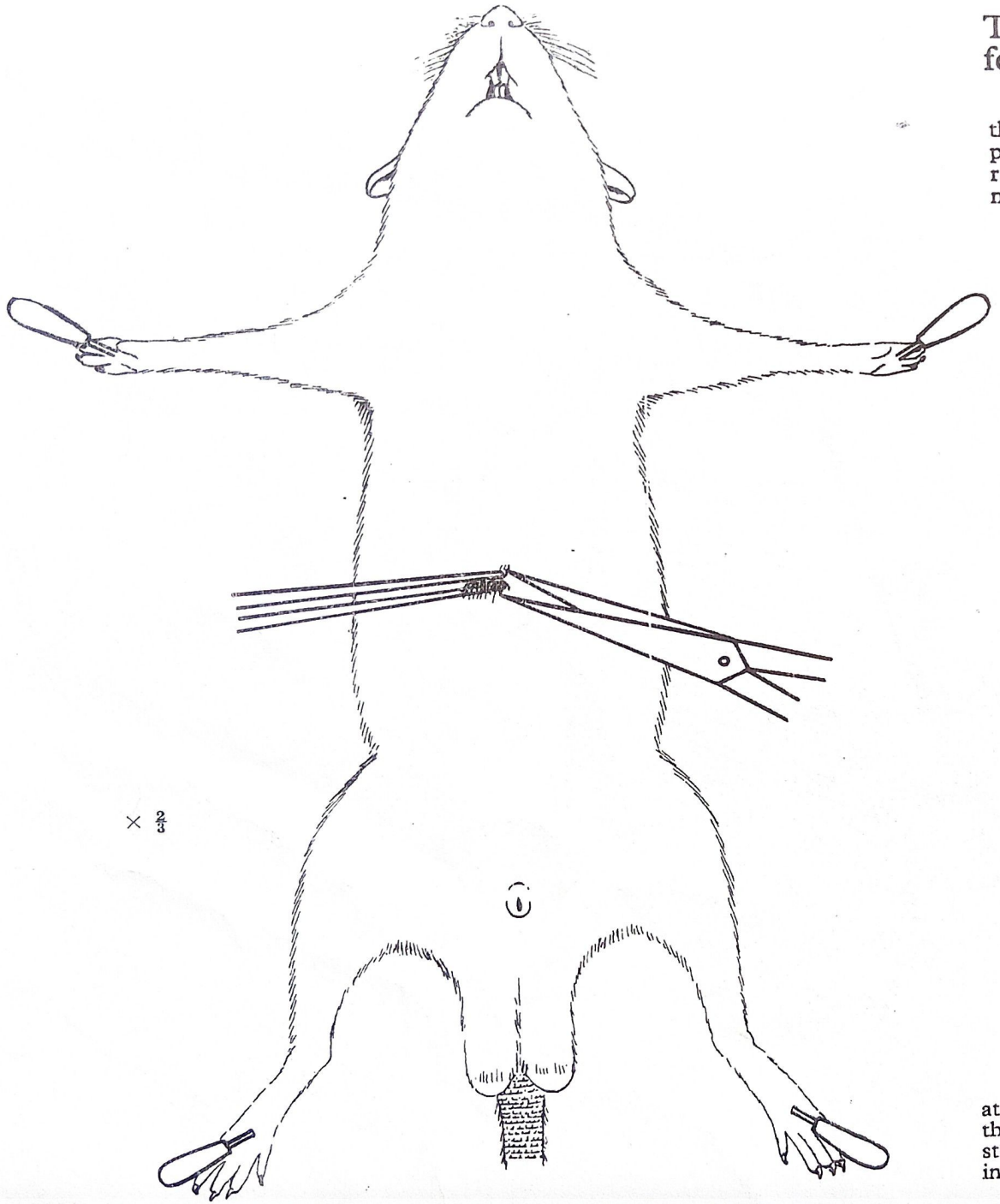
Before the brain is dissected the nervous tissue MUST be hardened with preservative. To hasten the penetration of the brain by the formalin a small section of the roof of the skull may be removed, see Figs. 43–46.

N.B.—When dissecting a freshly-killed rat there is always much capillary bleeding. The blood should be kept mopped up with a cloth so that the structures retain their own shade of colour and do not become uniformly reddened and thus more difficult to identify. Owing to great variability in the amount of fat and in the position of some of the blood-vessels it is impossible to show the same degree of exactitude as in the drawings of the frog and dogfish. Wherever it occurs 'masking' fat should be removed with BLUNT forceps.

The standard scale as seen in Fig. 1 is about two-thirds the size of an average rat.

ORDER OF DISSECTION OF RAT

	figs.	*pages*
General directions in preparation for dissection of the abdomen, thorax or neck	1–3	*127–129*
Section I—The Abdomen		
(*a*) *Opening up the abdominal cavity*	4a & 4b	*130–131*
(*b*) *The alimentary canal*	5–9	*132–137*
(*c*) *The solar plexus*	10–12	*138–140*
(*d*) *Removal of the alimentary canal*	12	*140*
(*e*) *The male urinogenital system*	13–16	*141–143*
(*f*) *The female urinogenital system*	17 & 18	*144–145*
(*g*) *The blood-vessels of the abdomen*	19a & 19b	*146–147*
The Diaphragm	20–22	*148*
Section II—The Thorax and Neck		
(*a*) *Opening up the thoracic cavity*	23–26	*149–150*
(*b*) *The heart and great blood-vessels*	27 & 28	*151*
(*c*) *The blood-vessels and nerves of the neck*	29–34	*152–156*
(*d*) *Examination of the heart and lungs isolated*	35–42	*157–160*
Section III—The Brain	43–57	*161–168*
APPENDIX. The Rabbit		
1 The Alimentary Canal	A1–4	*169–171*
	A6–8	*173–174*
2 The Solar Plexus	A5	*172*
3 The Urinogenital System	A9–10	*175–177*
4 The Abdominal Blood-vessels	A11–12	*178–179*
5 The Diaphragm		*180*
6 The Neck and Thorax	A13–16	*180–183*
7 The Lungs and Heart	A17–25	*184–186*
8 The Brain	A26–39	*187–193*
Notes on the Mouse		*194*



× ⅔

THE RAT—General Directions in Preparation for Dissection of the Abdomen, Thorax or Neck

If the dissection is to be completed on a freshly-killed specimen, the skin need only be laid back as shown in Figs. 1–3. Even if preservative is to be used it is not essential to remove the skin of the rat, though it is desirable to do so in the case of the more furry mammals—see inset to Fig. 3.

Fig. 1

Lay the rat ventral side uppermost on a dissecting board and attach it in spread-eagle position by means of strong dissecting pins through the fore- and hind-feet. Place each pin at an angle to the strain put on it. Lift the skin in the mid-ventral line and cut as indicated.

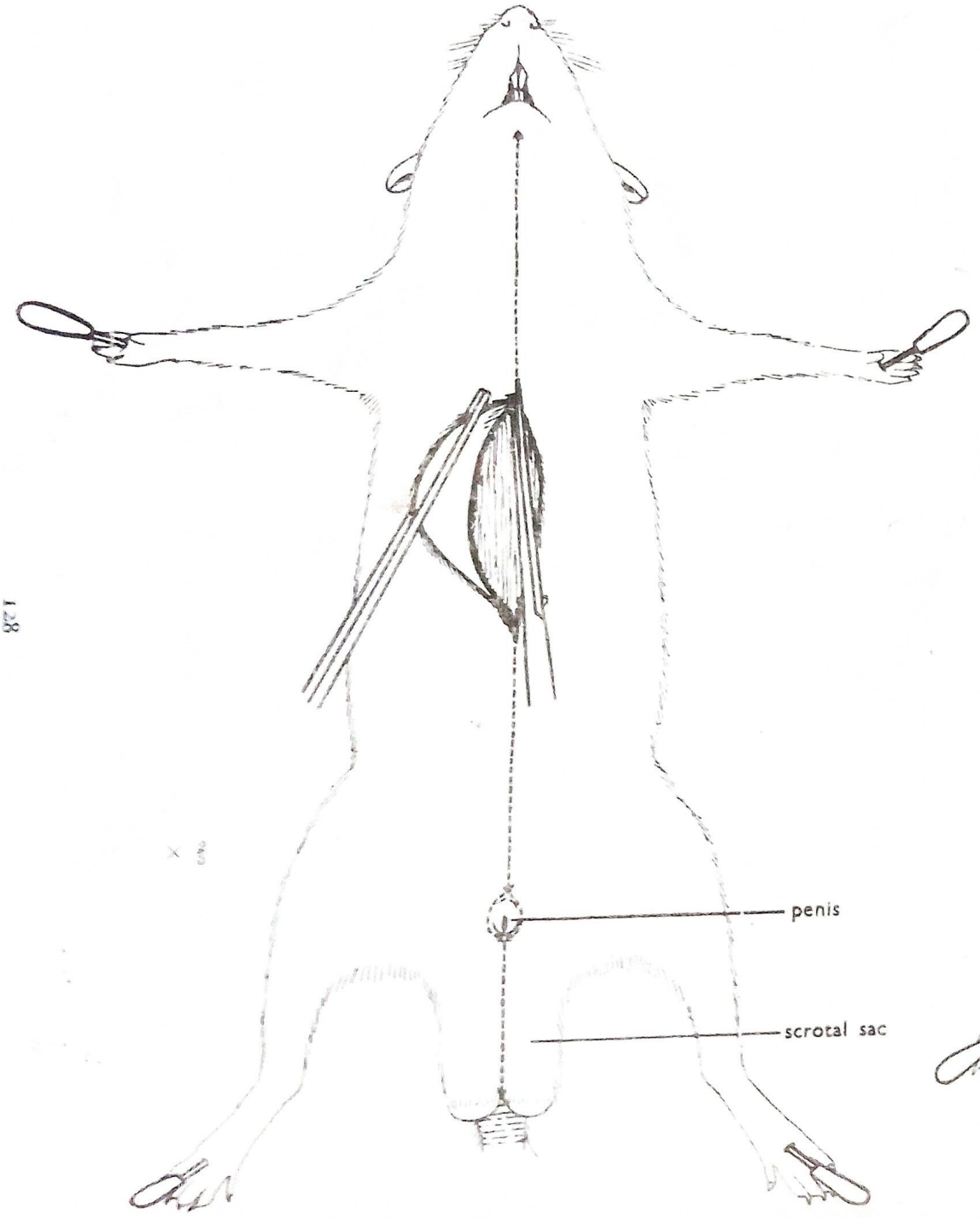


Fig. 2a. Male

Slit the skin along the mid-ventral line.

N.B. Keep the scissors as horizontal as possible to avoid cutting the body-wall under the skin.

Continue the cut forwards to the level of the lower lip and backwards around the penis and between the scrotal sacs.

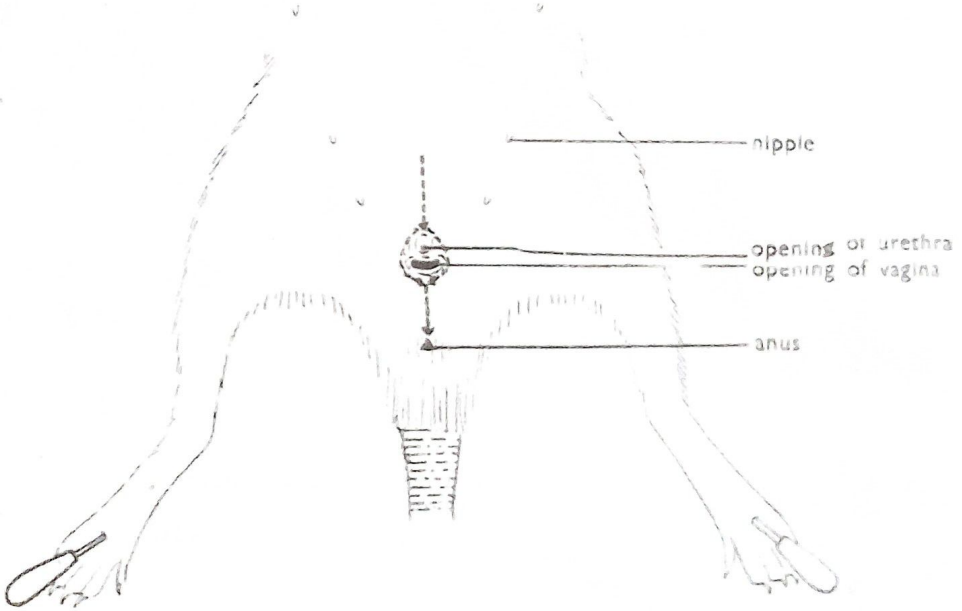
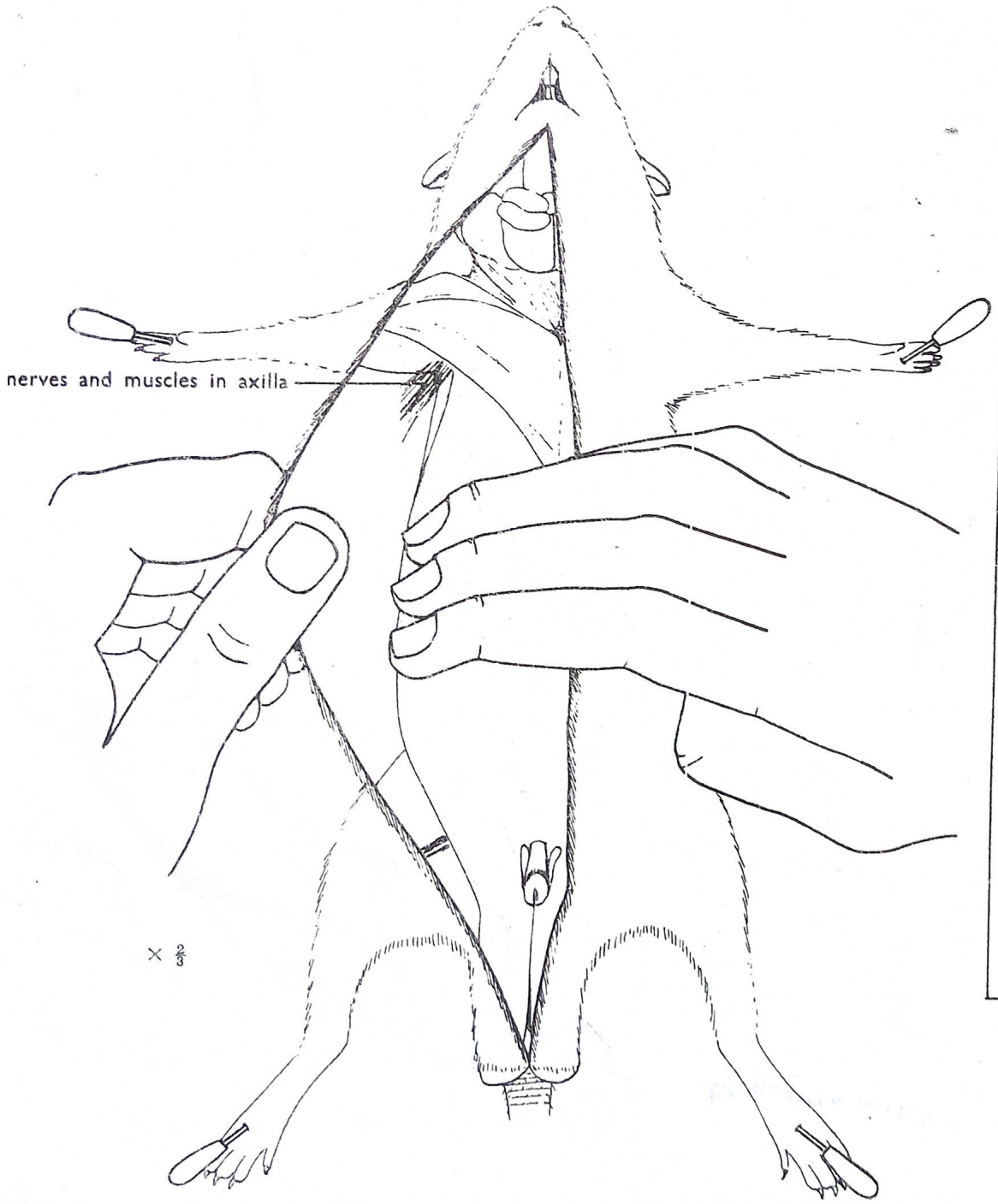
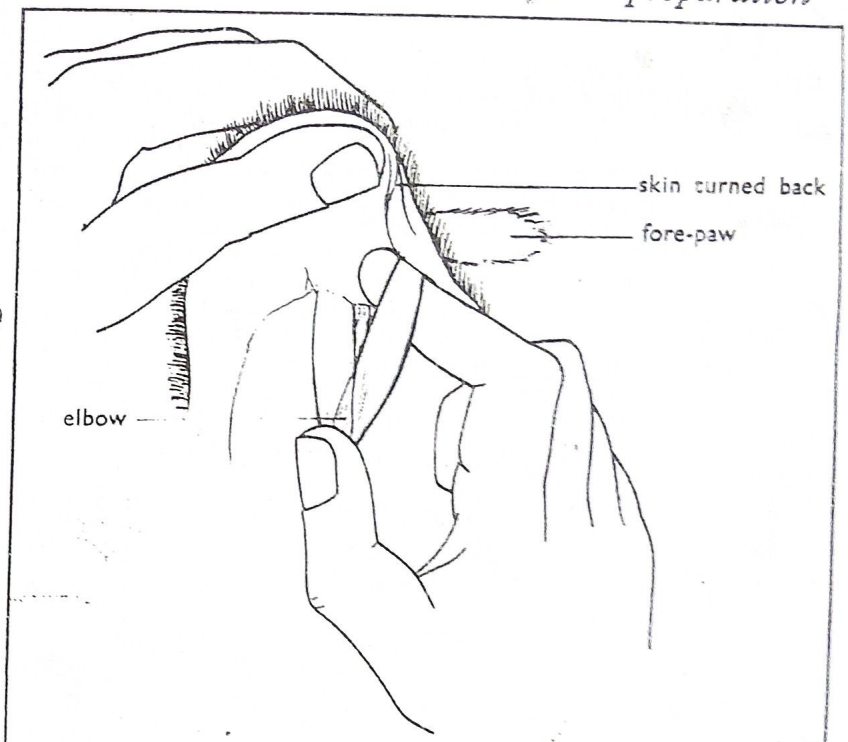


Fig. 2b. Female

Cut the skin as described for the male, but continue the cut backwards as far as the anus, passing on either side of the urinary and genital apertures.





INSET TO FIG. 3

If the skin is to be removed completely proceed as follows.

Remove the skin from the fore-limbs by turning it inside out and pulling on the elbow as shown. Pull the skin off as far down the paw as will come easily. Cut or tear it away, leaving only a little fur on the paw itself.

Repeat the process on the hind limbs.

Cut away the tail at its base.

Cut off the pinnae.

Remove as much of the fur from the head as will come easily by the same process of turning the skin inside out.

N.B. When skinning the neck be careful not to rupture the jugular veins.

Fig. 3

Pull aside the skin, loosening it from the body-wall by using the fingers as shown.

N.B. Be careful not to tear the nerves and muscles in the axillary region.

(*a*) OPENING UP THE ABDOMINAL CAVITY

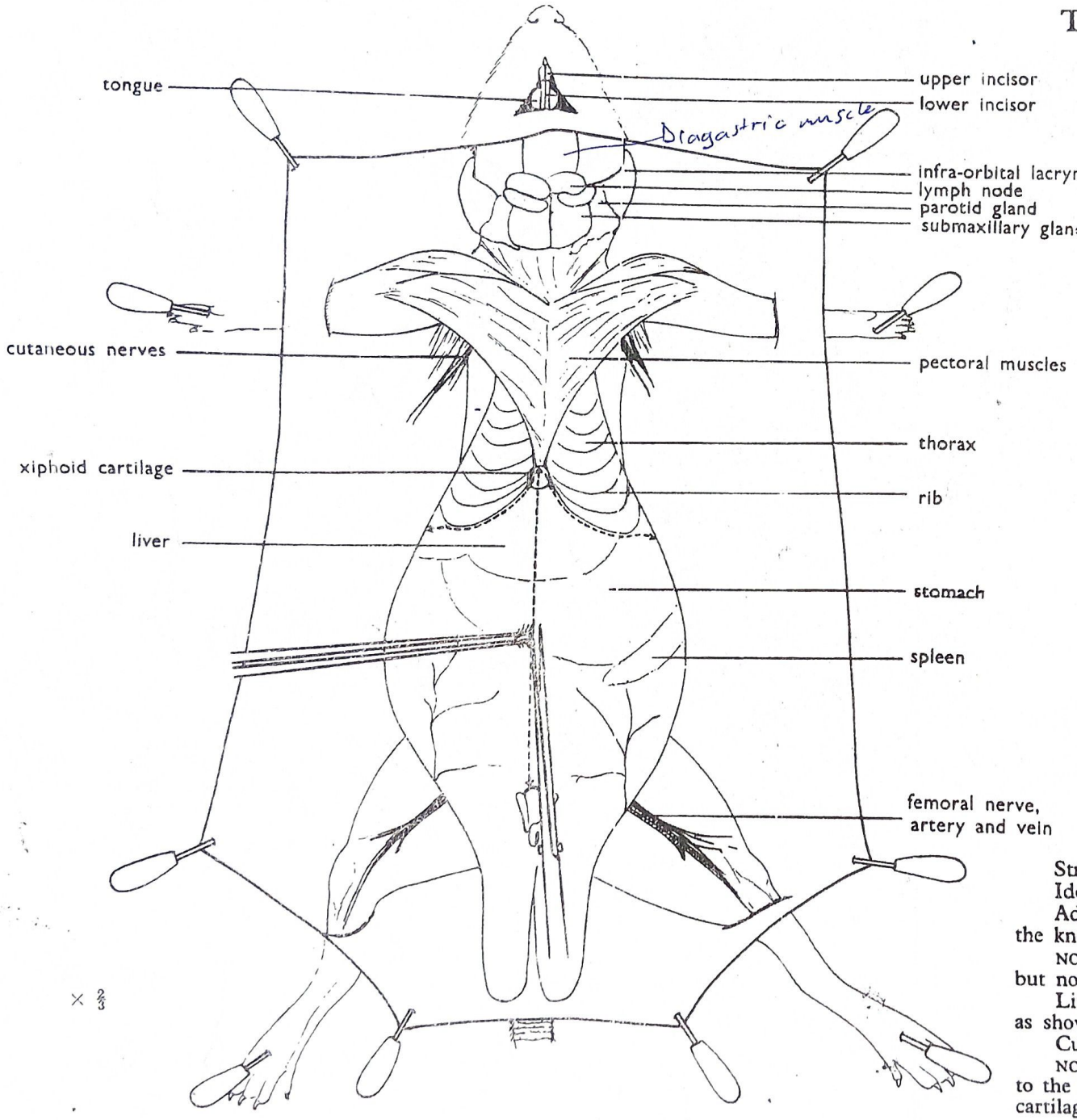


Fig. 4a. Male

Stretch the skin and pin it back as shown.

Identify the parts labelled.

Adjust the positions of the pins through the legs so that the knees are fully extended.

NOTE. In the diagram this has been done on the right but not the left side to show the difference.

Lift the abdominal wall with forceps and make an incision as shown.

Cut as indicated by the dotted lines.

NOTE. The muscles of the abdominal wall are attached to the xiphisternum. They can be lifted clear of the xiphoid cartilage, which is therefore not cut.

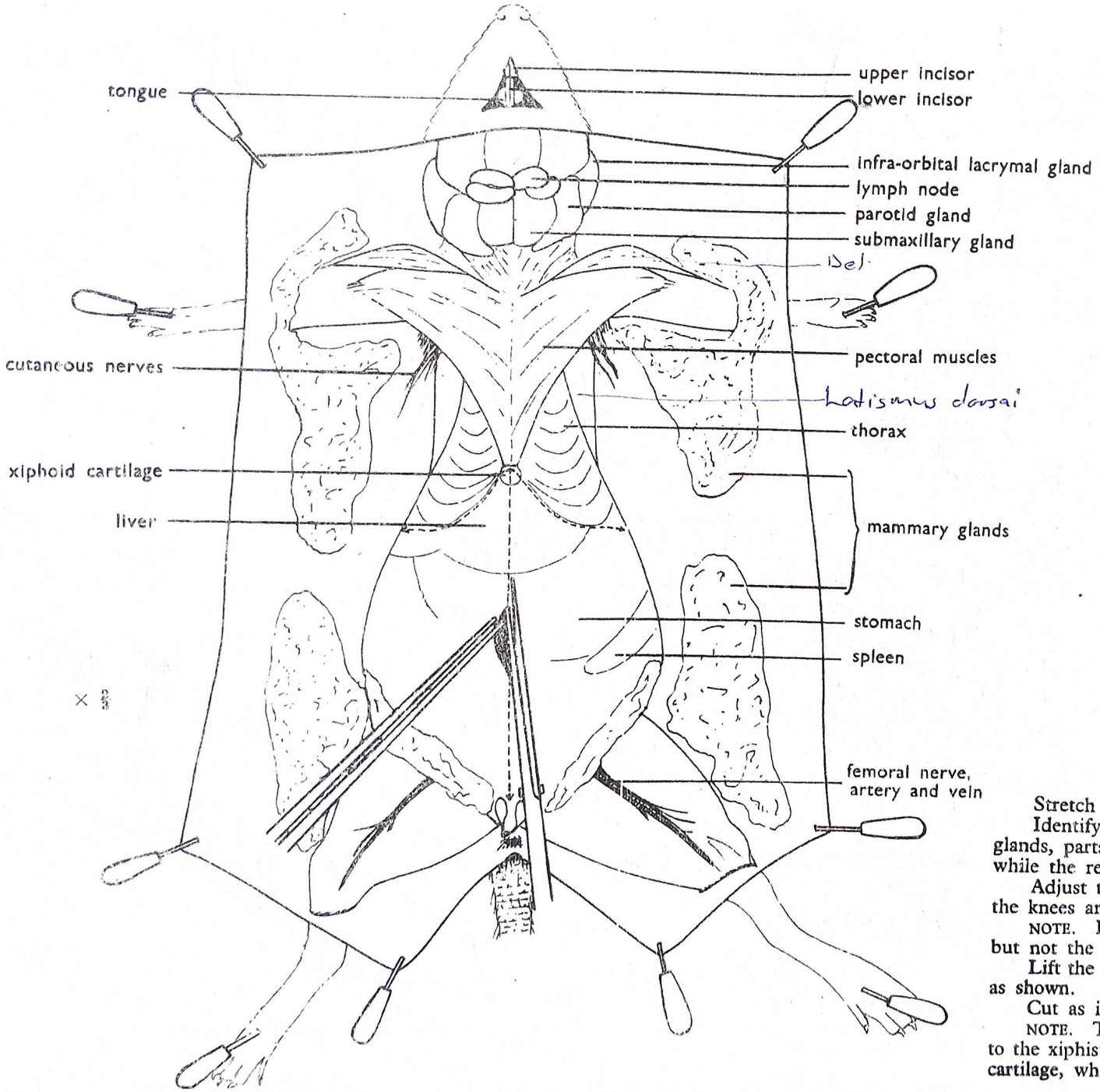


Fig. 4b. Female

Stretch the skin and pin it out as shown.

Identify the parts labelled, noticing especially the mammary glands, parts of which usually remain in the inguinal region while the rest comes away with the skin.

Adjust the positions of the pins through the legs so that the knees are fully extended.

NOTE. In the diagram this has been done on the right but not the left side to show the difference.

Lift the abdominal wall with forceps and make an incision as shown.

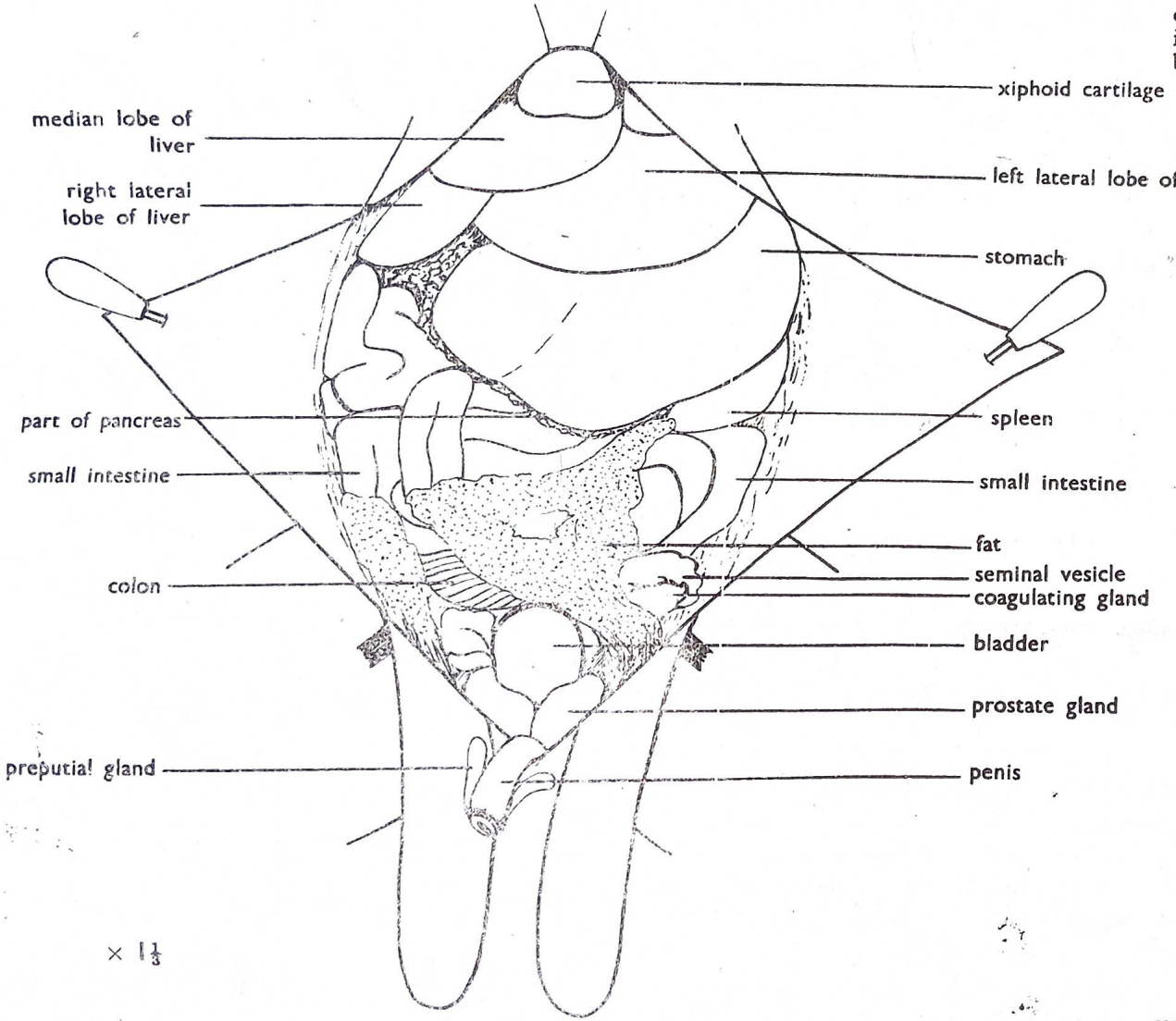
Cut as indicated by the dotted lines.

NOTE. The muscles of the abdominal wall are attached to the xiphisternum. They can be lifted clear of the xiphoid cartilage, which is therefore not cut.

(*b*) THE ALIMENTARY CANAL

A male rat is shown throughout this section with the exception of Fig. 5*b*, but the procedure is identical in the female.

With care, the abdominal parts of the alimentary canal can be displayed without further use of instruments. All that is necessary is the rearrangement of the parts so that they can be seen clearly.



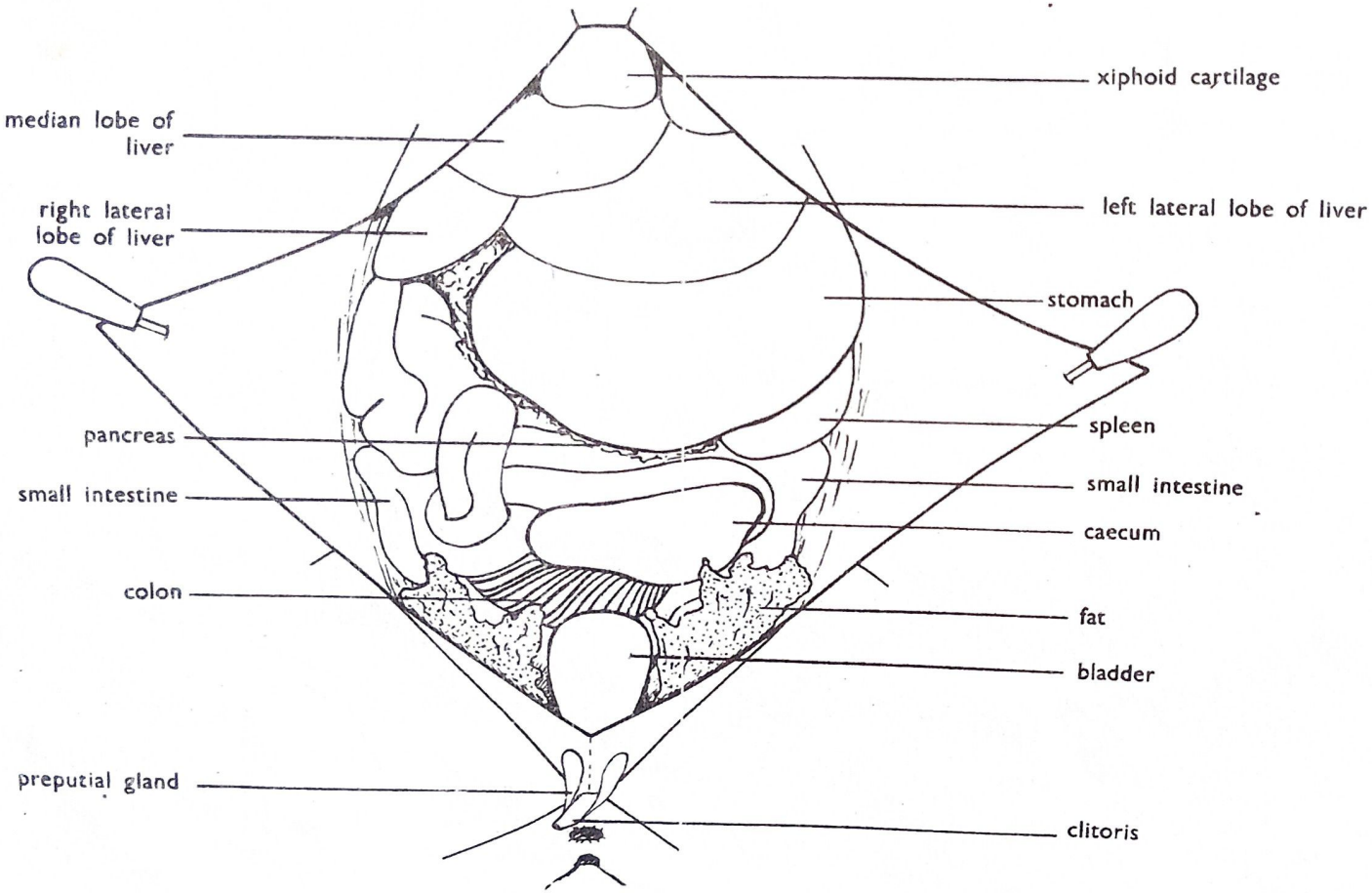
× 1⅓

Fig. 5a. Male

Pin aside the abdominal wall.

Examine the contents of the abdominal cavity in the undisturbed condition.

DRAW

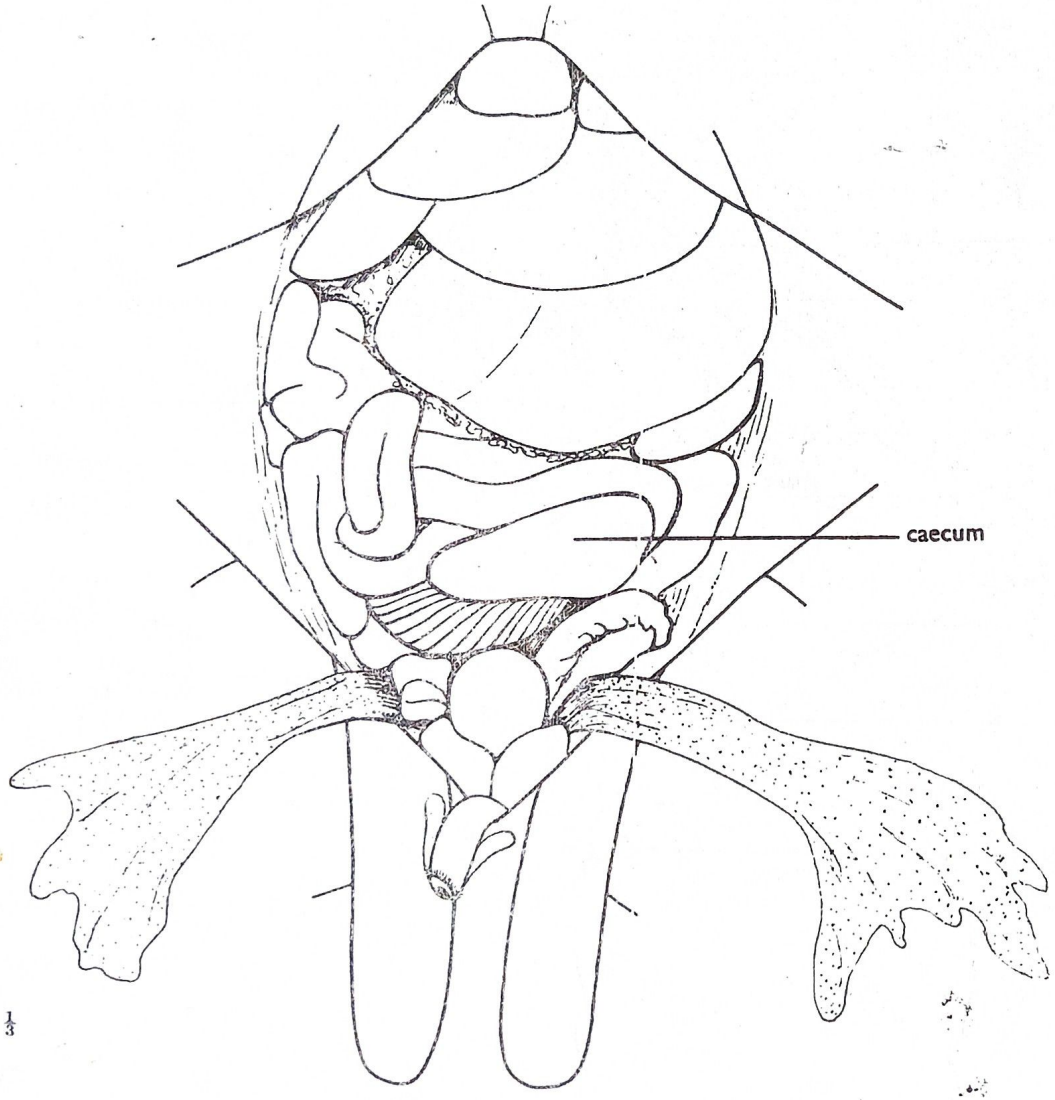


× 1⅓

Fig. 5b. Female

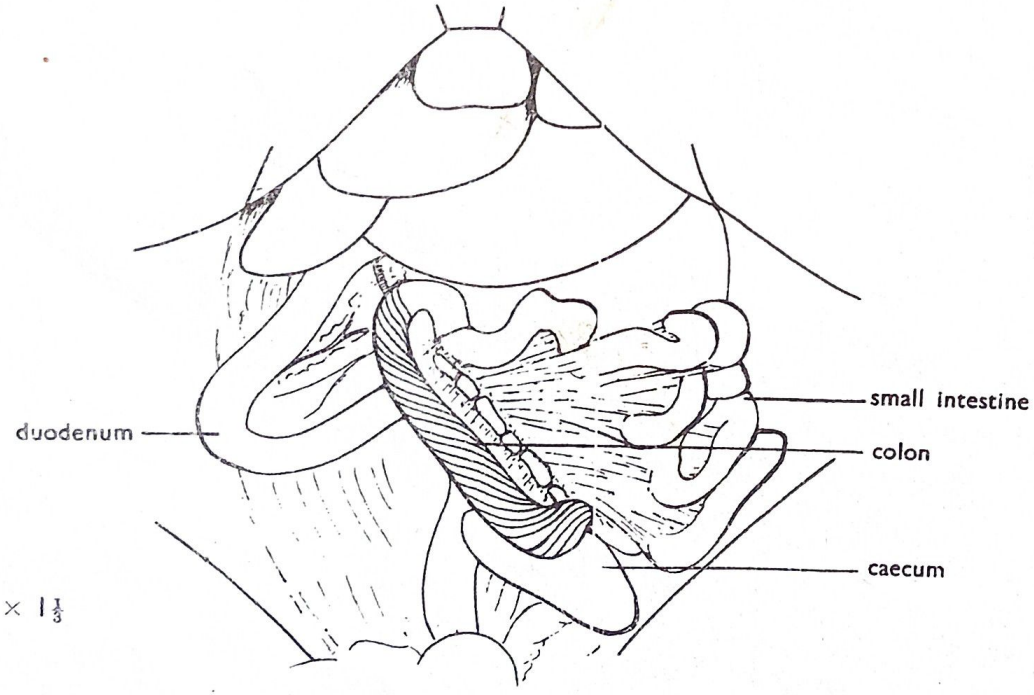
Pin aside the abdominal wall.
Examine the contents of the abdominal cavity in the undisturbed condition.

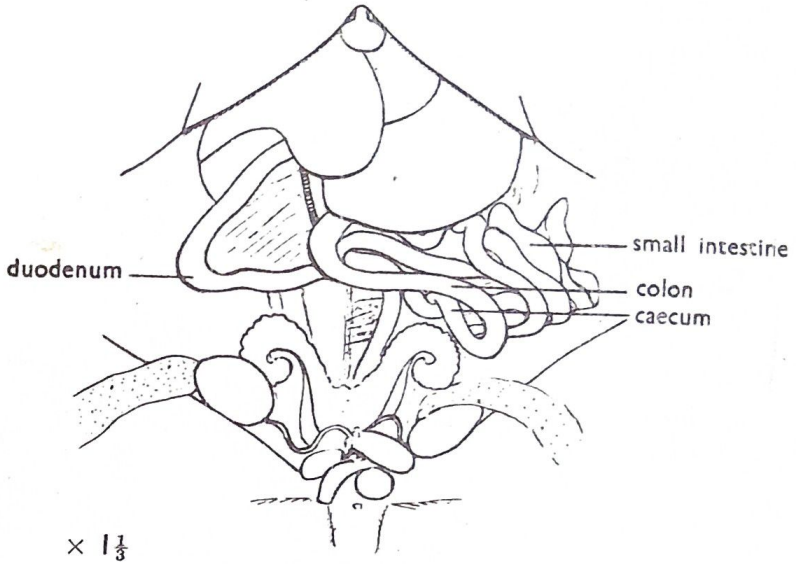
DRAW



× 1⅓

Fig. 6
Lay aside the fat bodies.



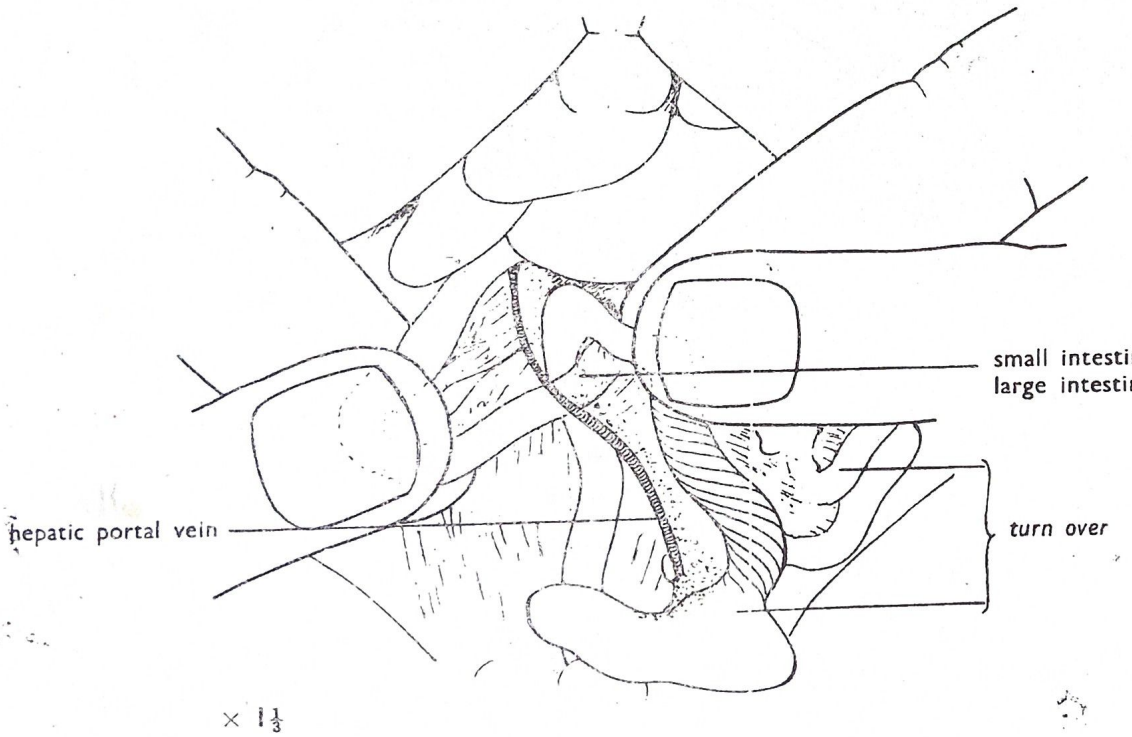


INSET—THE MOUSE

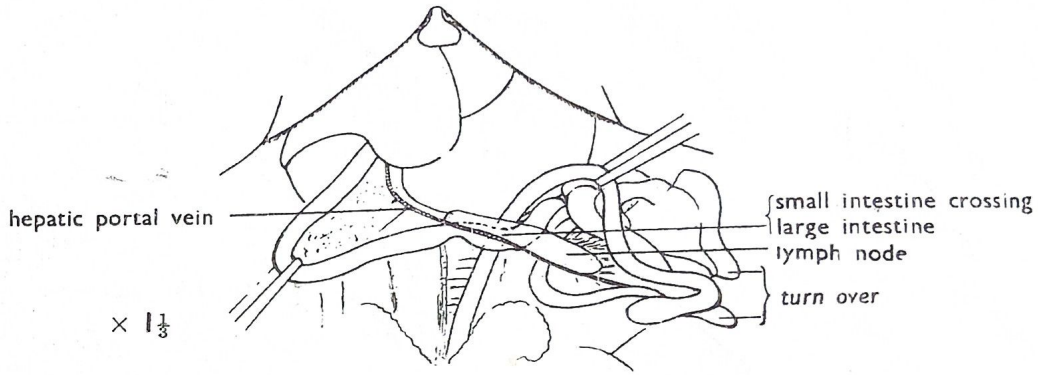
Fig. 7

Move the bulk of the intestines to YOUR right. Find the duodenum and colon.

NOTE. There is some adhesion of their mesenteries.



× 1⅓



× 1⅓

INSET—THE MOUSE

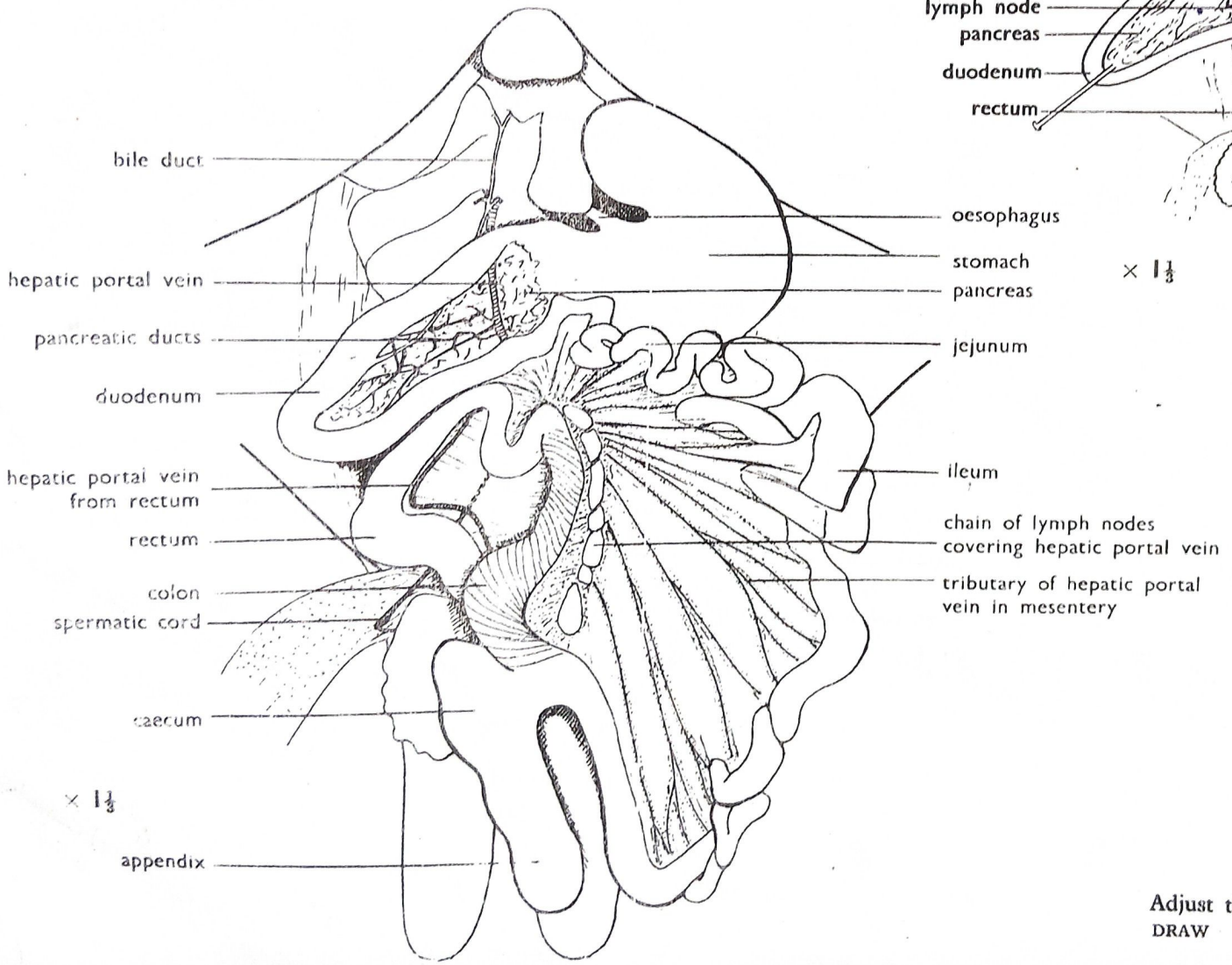
Fig. 8

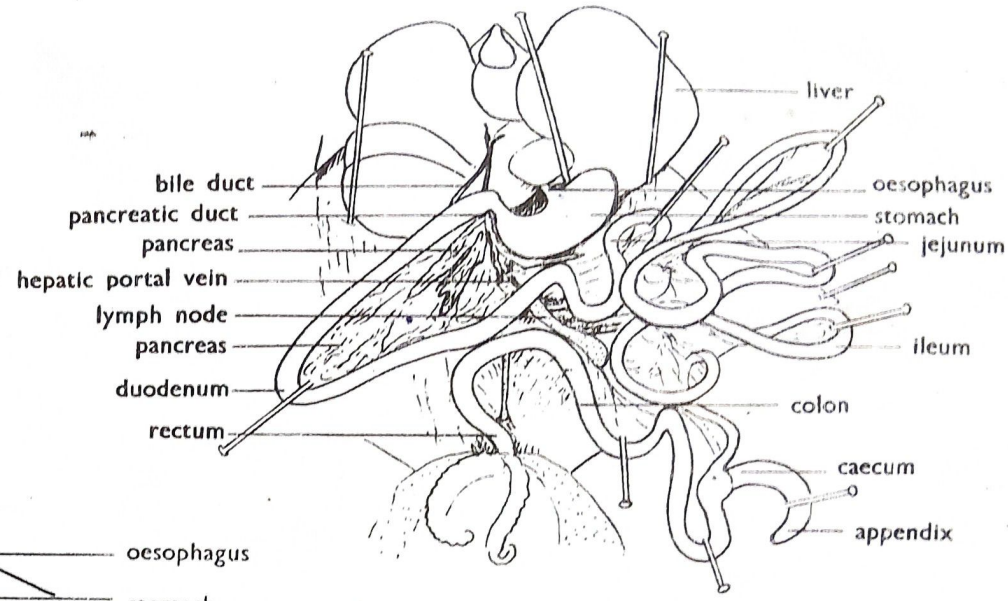
Grip the duodenum and colon and carefully pull them apart, thus exposing the hepatic portal vein.

N.B. BE CAREFUL NOT TO TEAR THE MESENTERIES.

Notice the way in which the small and large intestines are twisted over one another.

Turn the bulk of the intestines over to undo this twist.





× 1⅓ *INSET—THE MOUSE*

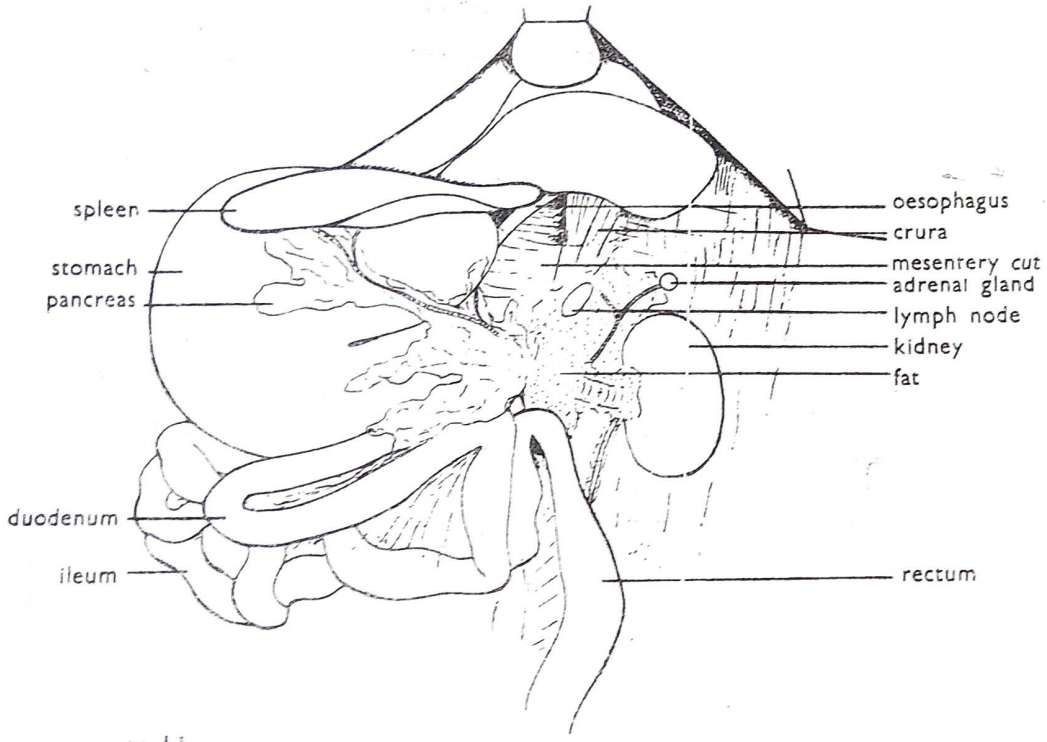
Fig. 9

Adjust the positions of the structures as shown.

DRAW

(*c*) THE SOLAR PLEXUS

The dissection of the solar plexus is often omitted by elementary students, but is not difficult if sufficient care be taken. It is very important to AVOID CAPILLARY BLEEDING as far as possible and to mop up any that may occur.



× 1½

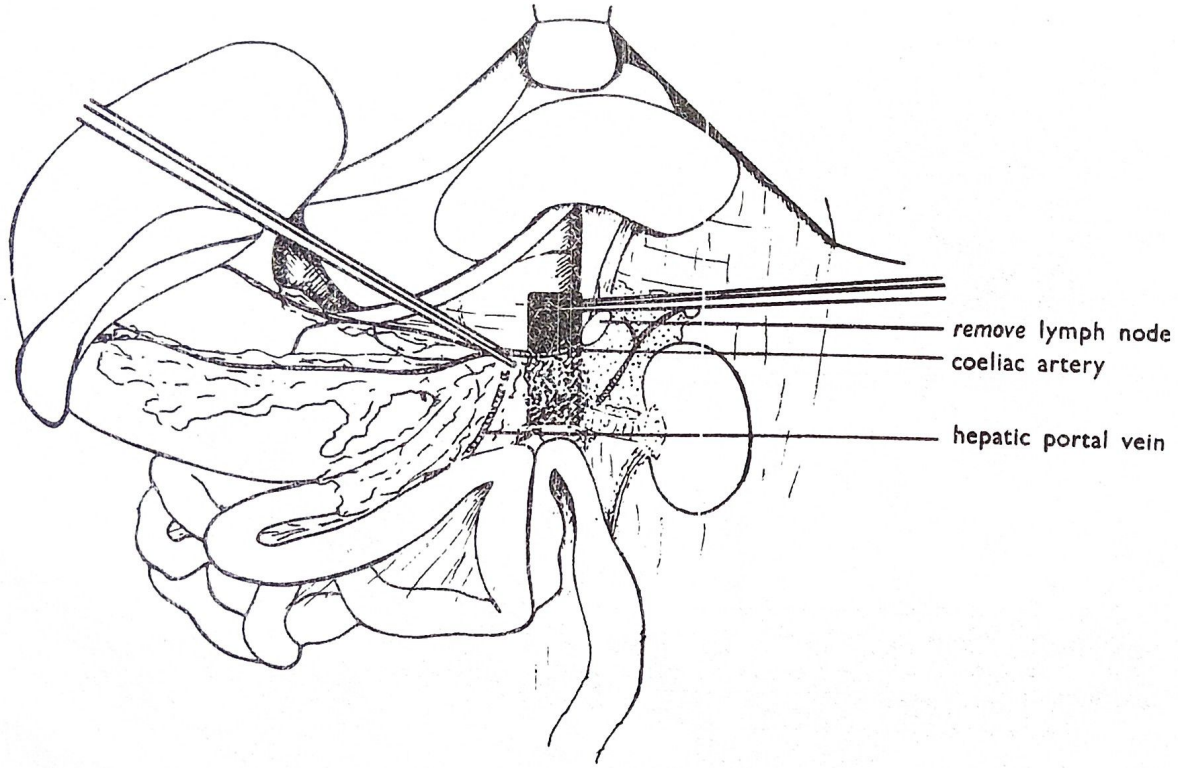
Fig. 10

Lay the stomach and intestines over to the RIGHT SIDE OF THE RAT as shown.

Identify the structures indicated.

NOTE. The amount of fat, and consequently the amount of masking, is very variable.

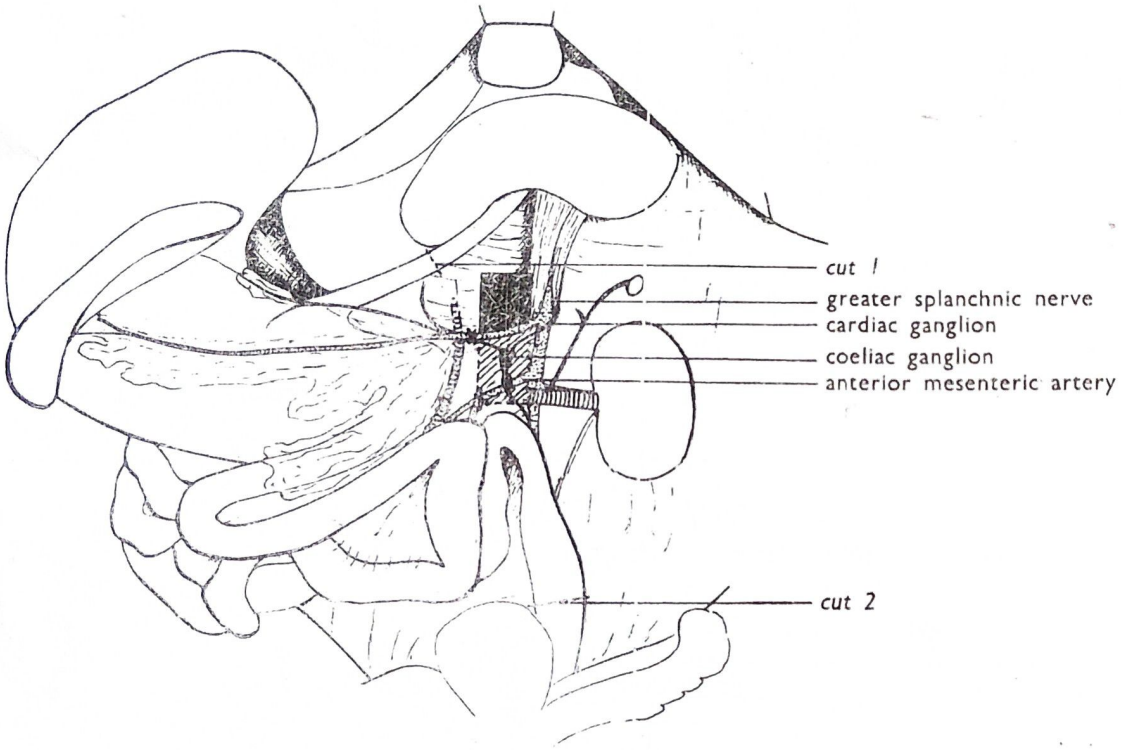
Cut or tear the mesentery holding the stomach, being careful not to damage any blood-vessels.



× 1⅓

Fig. 11

Adjust the position of the stomach as shown.
Identify and lift up the coeliac artery.
Insert a small piece of black paper behind the artery and the region immediately posterior to it.
Remove the lymph node with forceps.
With blunt forceps gently pluck away the fat from the area overlying the black paper.
N.B. Watch for the structures shown in Fig. 12.



× 1⅓

Fig. 12

Observe and DRAW the solar plexus.

(*d*) REMOVAL OF THE ALIMENTARY CANAL

The alimentary canal must be removed before any dissection of the urinogenital system and abdominal blood-vessels.

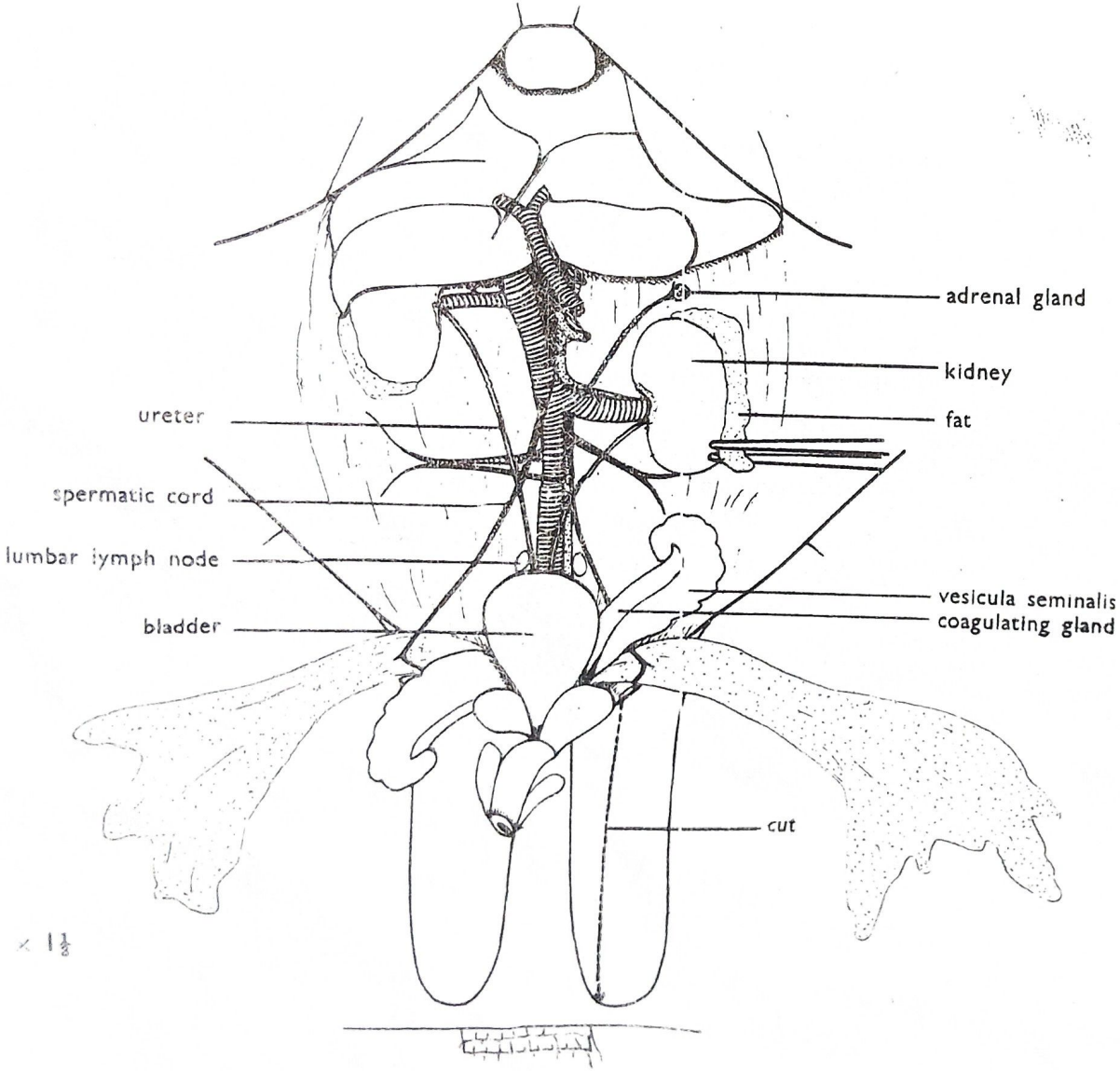
Ligature the coeliac and anterior mesenteric arteries and the hepatic portal vein in the positions indicated by X. Cut each vessel distal to the ligature.

Cut the oesophagus—cut 1.

Cut the rectum—cut 2.

NOTE. The posterior mesenteric artery will be destroyed if the rectum is cut too near the pelvis.

Gently tear the mesentery to remove the alimentary canal.



THE RAT—*The abdomen*

(*e*) THE MALE URINOGENITAL SYSTEM

Before dissecting this system the alimentary canal must be removed as shown in Fig. 12.

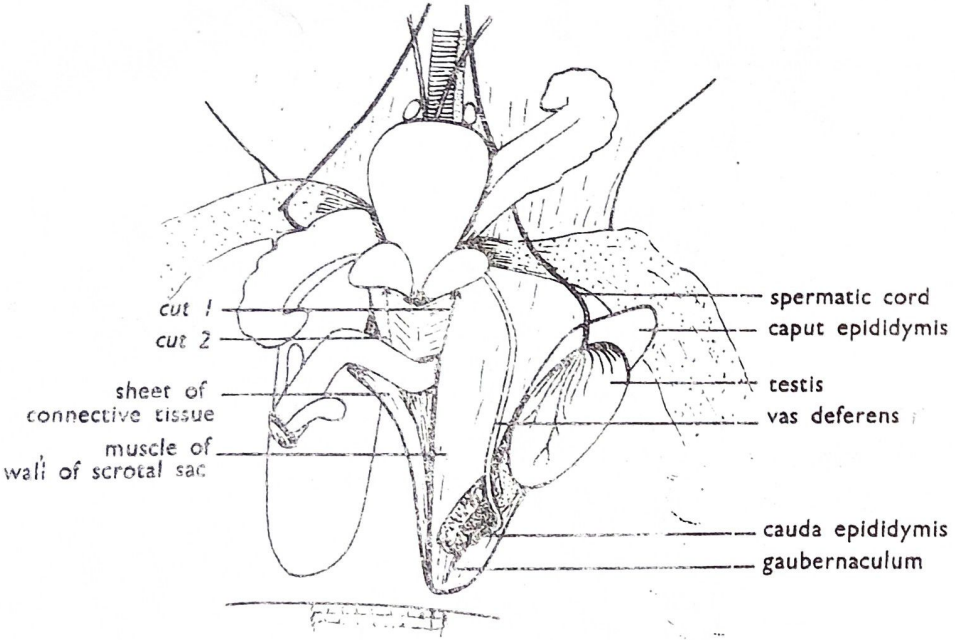
There is considerable variation in the amount and fat and also in the finer details of the distribution of blood-vessels which, though they are shown in the following diagrams, need not be cleared till later.

Fig. 13

Remove the fat from the kidneys, using blunt forceps as shown.

Similarly clear the ureters.

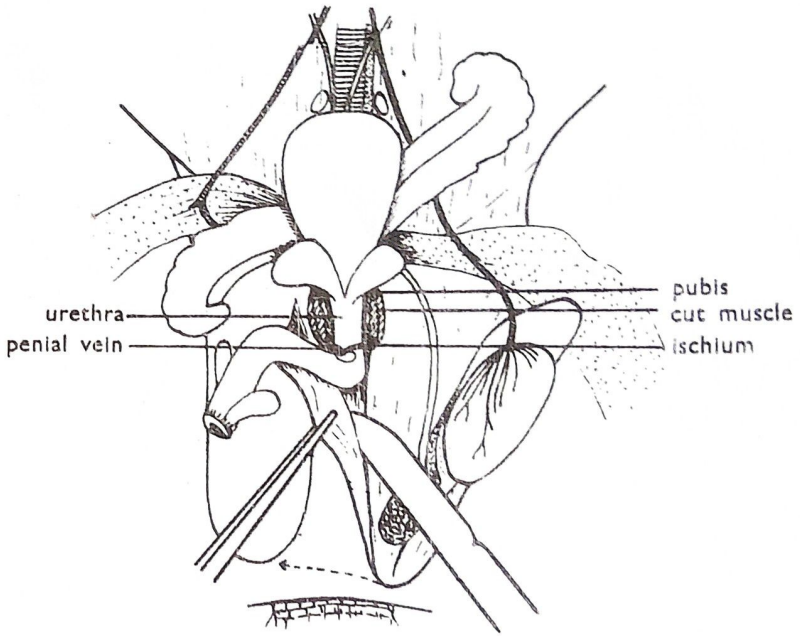
Cut through the ventral wall of the scrotal sac along the line indicated.



× 1⅓

Fig. 14

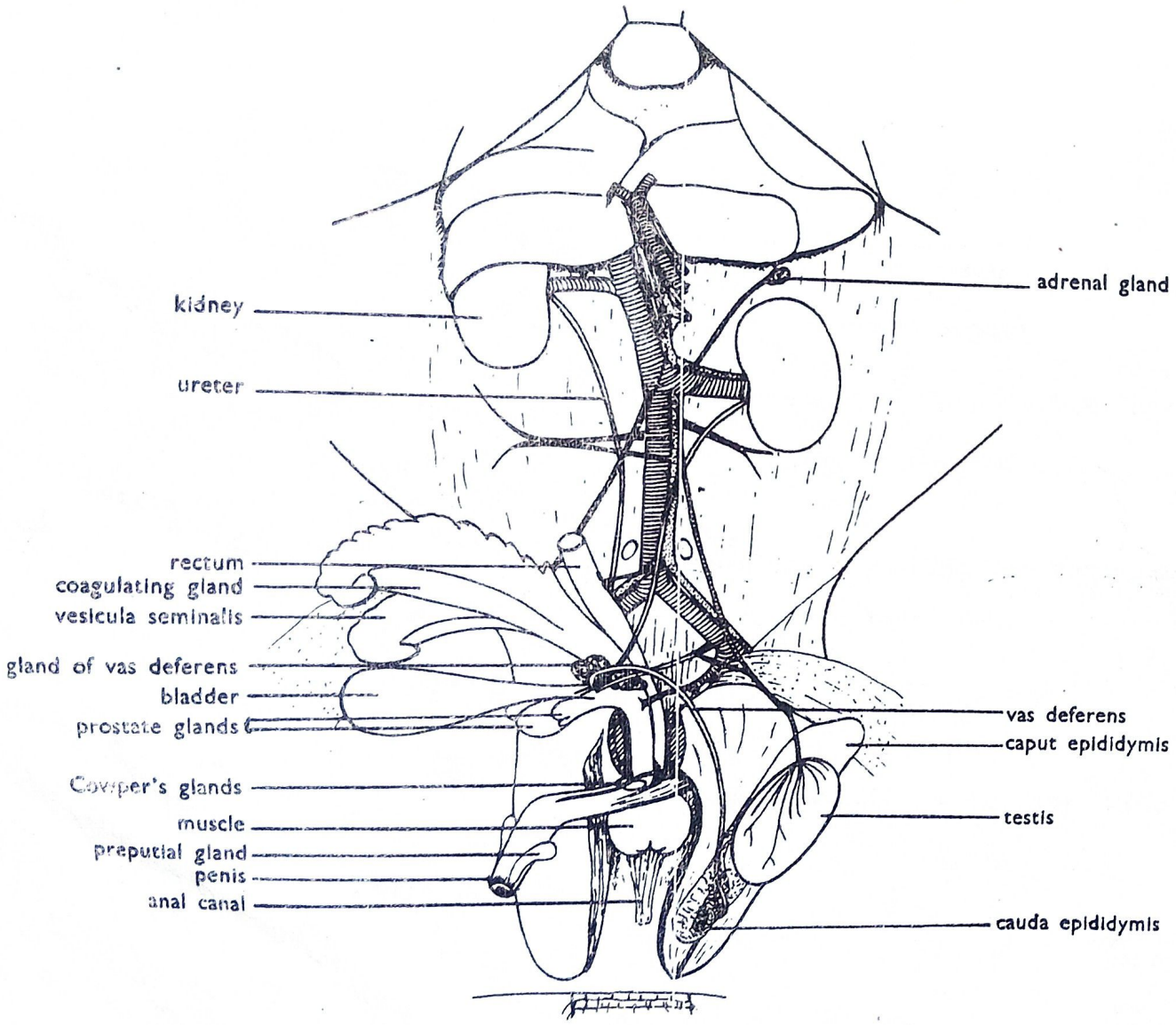
Open the scrotal sac and display the contents as shown.
Cut through the pelvic girdle—cuts 1 and 2.
N.B. Keep the points of the scissors well up.



× 1⅓

Fig. 15

Remove the connective tissue from the region between the scrotal sacs sufficiently to expose the anal canal and the muscles around the end of the rectum—see Fig. 16.



× 1⅓

Fig. 16

Lay the bladder to one side.

Lay the seminal vesicles, coagulating glands and prostate glands over to the SAME side.

With a needle or fine forceps carefully loosen the structures from one another till they can be displayed as shown.

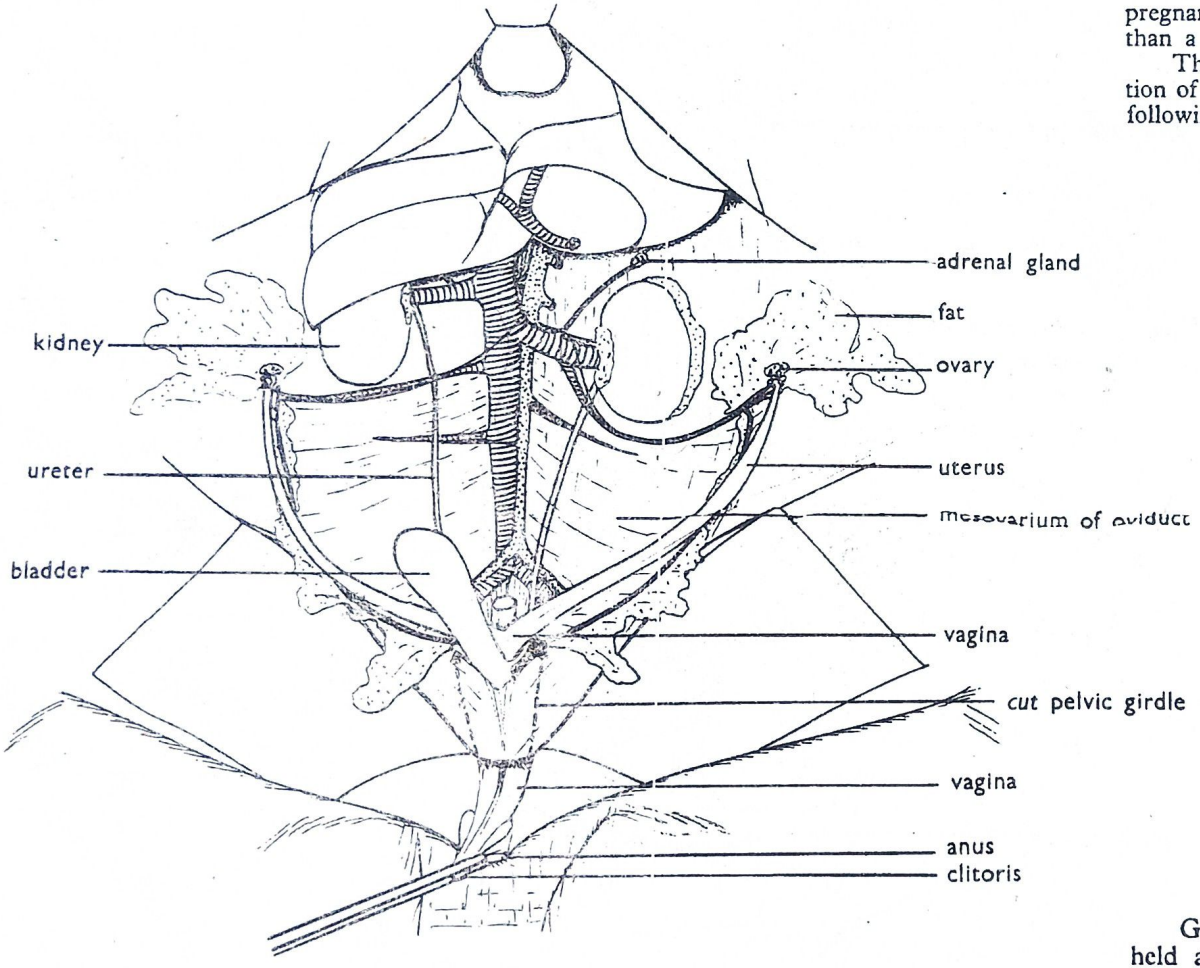
DRAW

(*f*) THE FEMALE URINOGENITAL SYSTEM

Before dissecting this system the alimentary canal must be removed as shown in Fig. 12.

There is considerable variation in the amount of fat. A pregnant female as shown in Fig. 18 generally has less fat than a non-pregnant one.

There is also variation in the finer details of the distribution of the blood-vessels which, though they are shown in the following diagrams, need not be cleared till later.



× 1⅓

Fig. 17

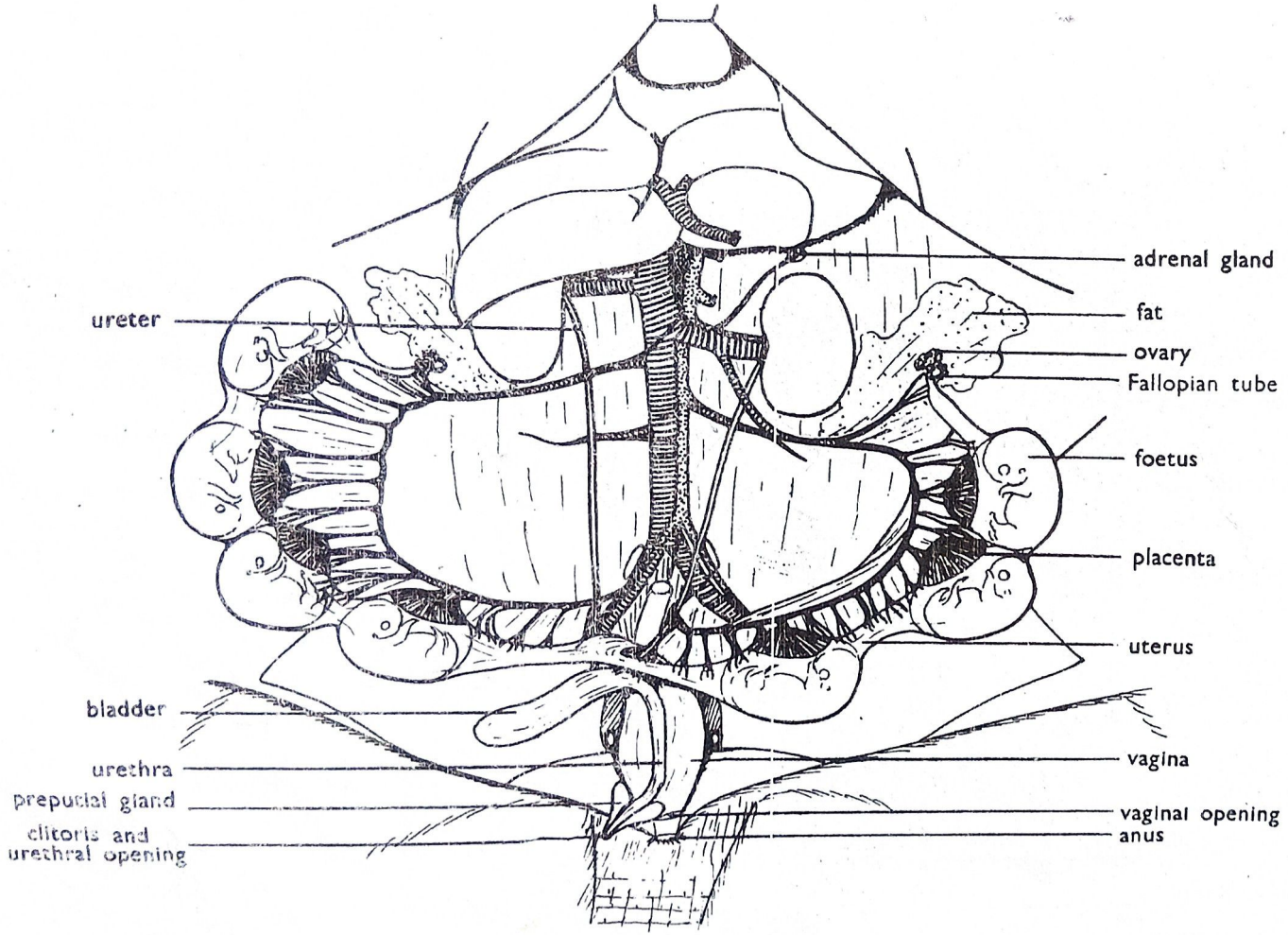
Grip the clitoris and pull it gently so that the urethra is held away from the pelvis. Cut through the pelvic girdle along the lines indicated. Remove the ventral part of the girdle.

Lift the oviducts and remove the mesovarium from them sufficiently to expose the ureters but DO NOT CUT ANY OF THE BLOOD-VESSELS.

If necessary, remove fat from the kidneys and ureters.

Leave the fat around the ovaries and attached to the oviducts, but displace it so that these structures may be observed.

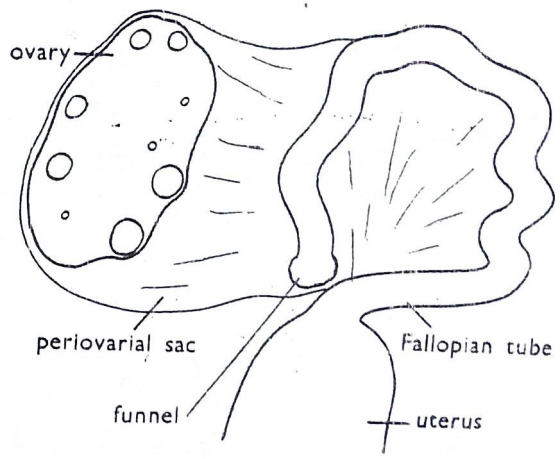
REMEMBER ME!



× 1½

Fig. 18

Push back the cut edges of the pelvic girdle.
Display the uterus of a pregnant female as shown above.
NOTE. In a non-pregnant female the uterus is best left as shown in Fig. 17.
DRAW



c. × 13

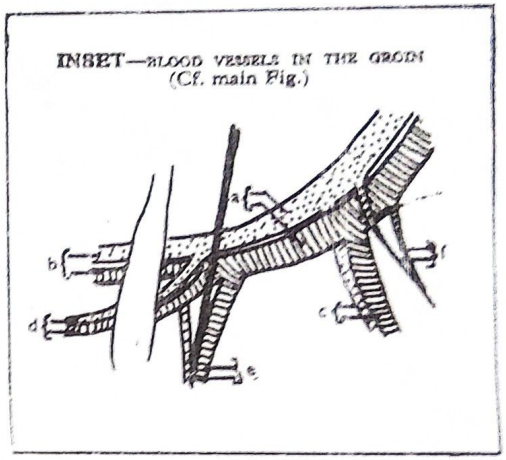
THE FALLOPIAN TUBE

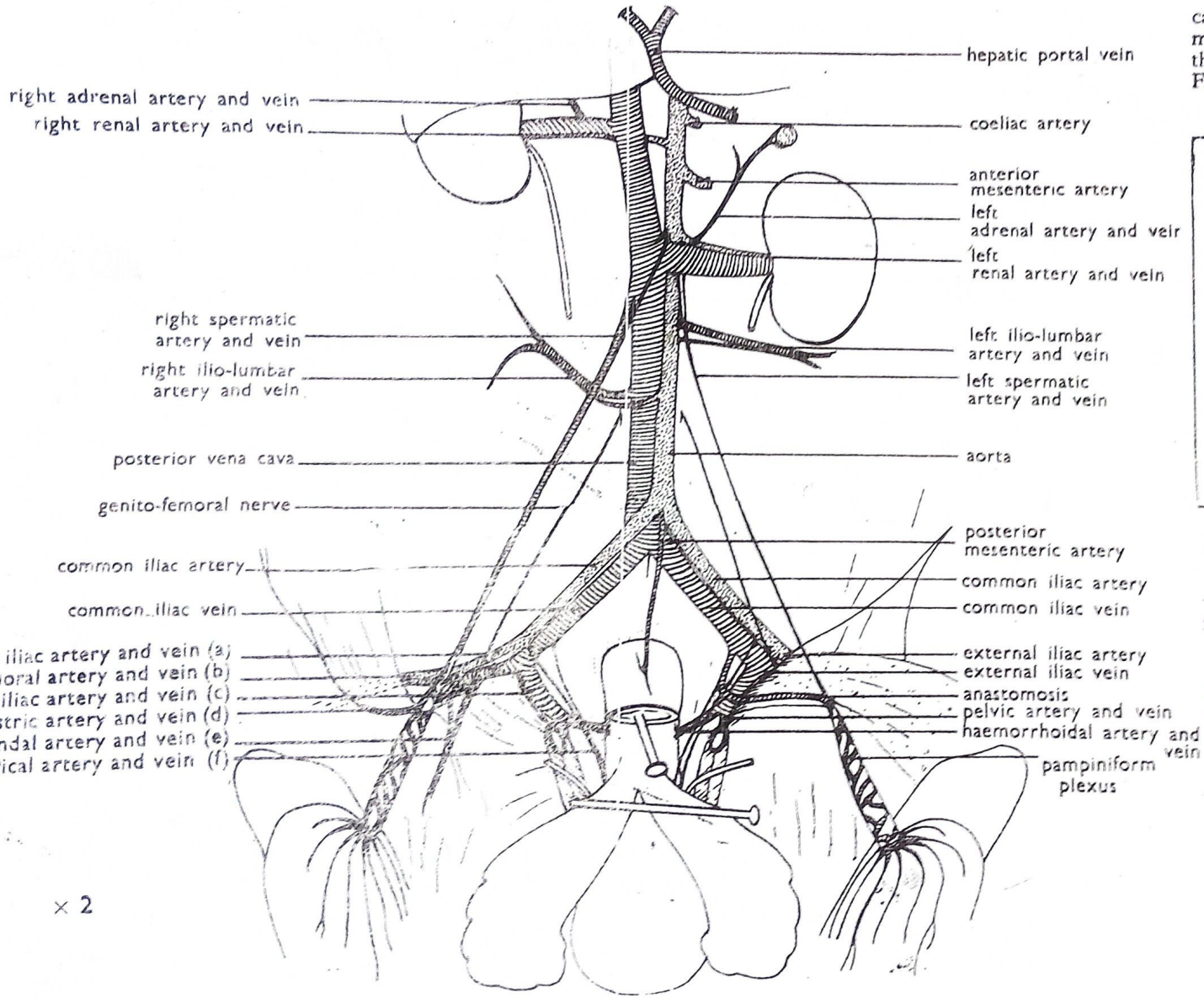
The ovary is enclosed within a thin-walled ovarian sac. The Fallopian tube is very small and much coiled. Its opening from the ovarian sac cannot be seen with the naked eye. It should be examined with the aid of a microscope AFTER completion of the examination of the blood-vessels—see Fig. 19*b*.

Cut the uterus about half an inch from the Fallopian tube and take out both tube and ovary together. Mount them on a slide, straightening out the coils of the tube as much as possible. Observe and DRAW

(*g*) THE BLOOD-VESSELS OF THE ABDOMEN

Before the blood-vessels of the abdomen can be fully displayed the alimentary canal must be removed as shown in Fig. 12 and the pelvic girdle should be cut as shown in Fig. 14 (male) or Fig. 17 (female).





× 2

Fig. 19a. Male

Cut the ureters.

Pin the bladder, seminal vesicles and rectum out of the way as shown.

Remove the RIGHT fat body.

The blood-vessels can be traced through the RIGHT groin by easing away the muscle and connective tissue with forceps. Trim with scissors if necessary.

Clear away the remains of the mesentery and fat to display the aorta and posterior vena cava fully.

NOTES. (1) There is a large anastomosis between the pampiniform plexus and the vesical vein on the LEFT side only.

(2) The positions where the ilio-lumbar and spermatic arteries leave the aorta and the corresponding veins meet the posterior vena cava vary. A common condition in which the left spermatic vessels are branches of the left renal vessels is shown.

DRAW

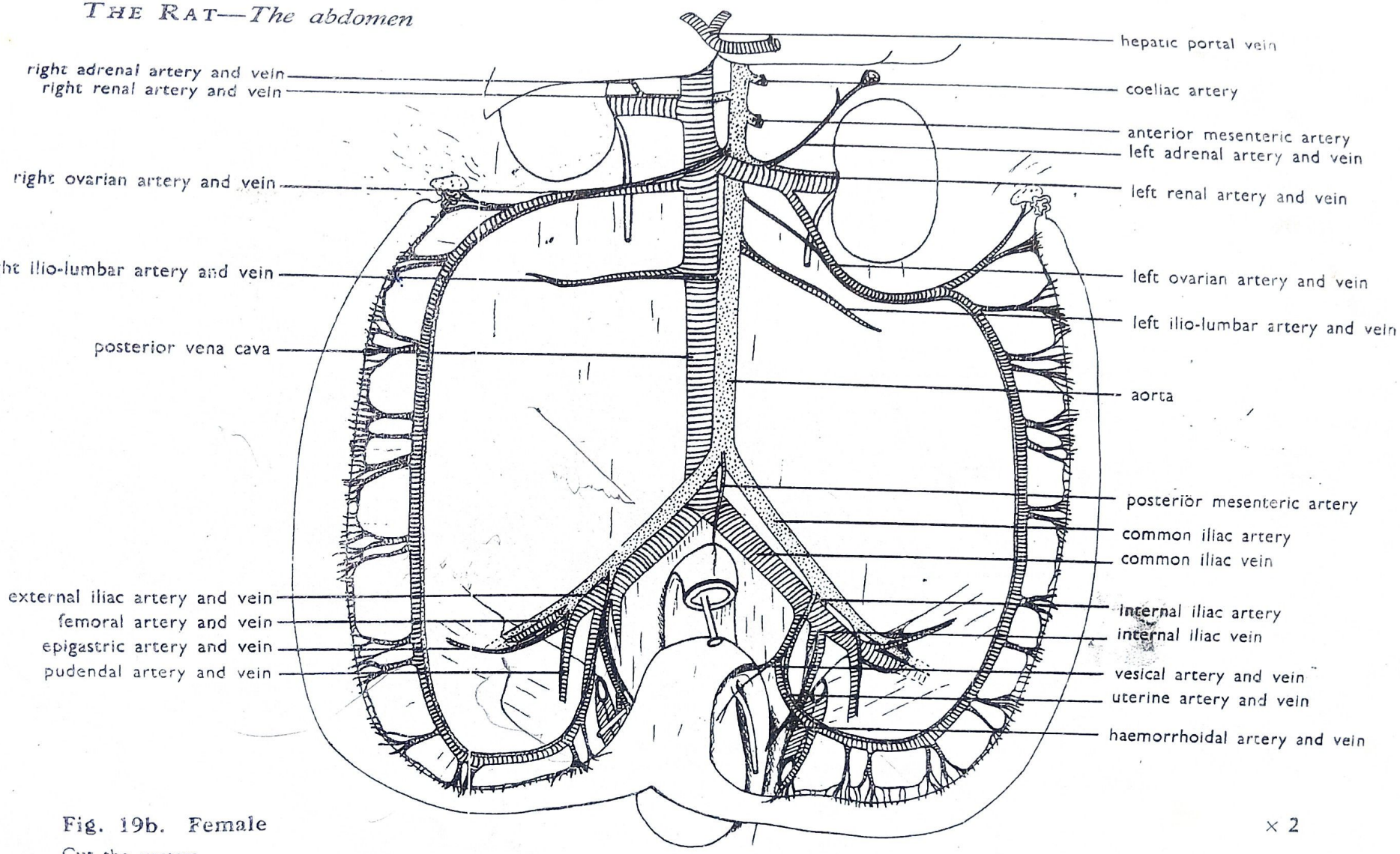


Fig. 19b. Female × 2

Cut the ureters.
Pin the rectum as shown.
Lay the vagina and bladder as shown, pinning if necessary.
The blood-vessels can be traced through the groin by easing away the muscle and connective tissue with forceps. Trim with scissors if necessary.
Clear away the remains of the mesentery and fat to display the aorta and posterior vena cava fully.

NOTES. (1) In some specimens the aorta passes ventral to the left renal vein.
(2) The position of branching of the iliac arteries is very variable. As shown in the diagram, it is not always the same on the two sides of the same rat, but the branches can easily be identified by tracing their distribution.

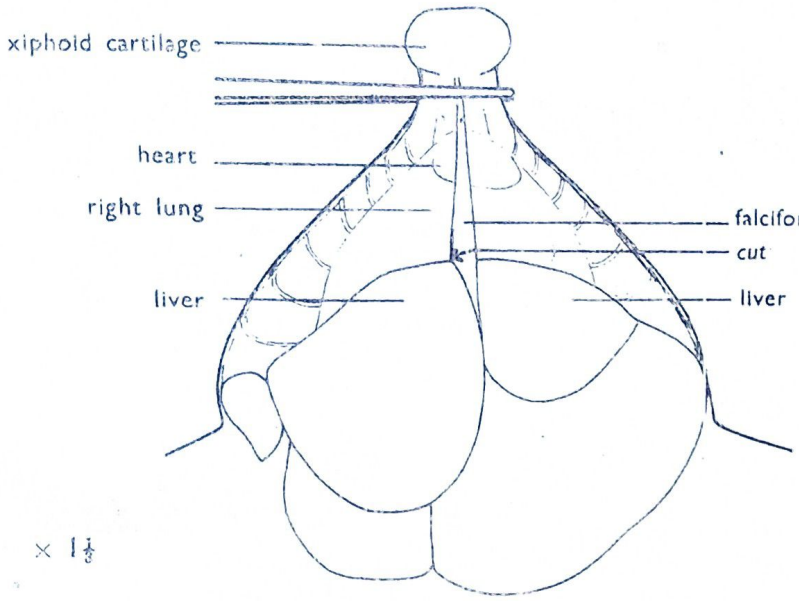
DRAW

The Rat—The Diaphragm

The diaphragm should be examined on a freshly-killed specimen. It hardens and becomes opaque when preserved. Its elasticity and the negative pressure in the thorax cannot then be observed.

Open the abdominal cavity—see Fig. 4.

Remove the alimentary canal—see Fig. 12.



× 1⅓

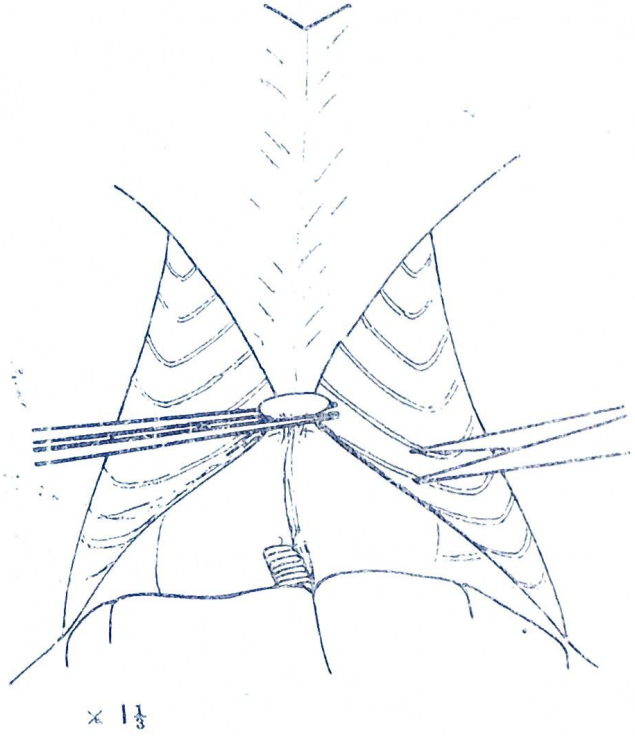
Fig. 20

Grip the xiphoid cartilage and raise it.

View the diaphragm from its posterior surface.

Notice the lungs and heart showing through the diaphragm where it is held in close contact with them by the negative pressure in the thoracic cavity.

Cut the falciform ligament so that the liver can fall further away from the diaphragm.



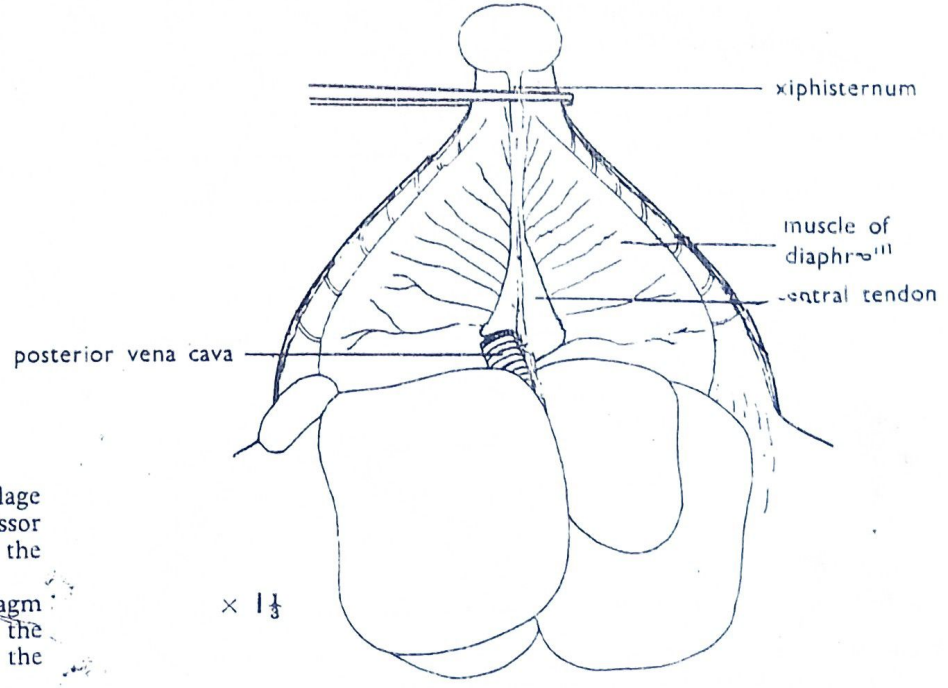
× 1⅓

Fig. 21

While holding the xiphoid cartilage well up insert the point of a scissor blade through the side wall of the thorax. Make a small slit.

Notice that AT ONCE the diaphragm springs away from the lung on the CUT SIDE ONLY as the air enters the pleural space.

Repeat to perforate the other pleural cavity.



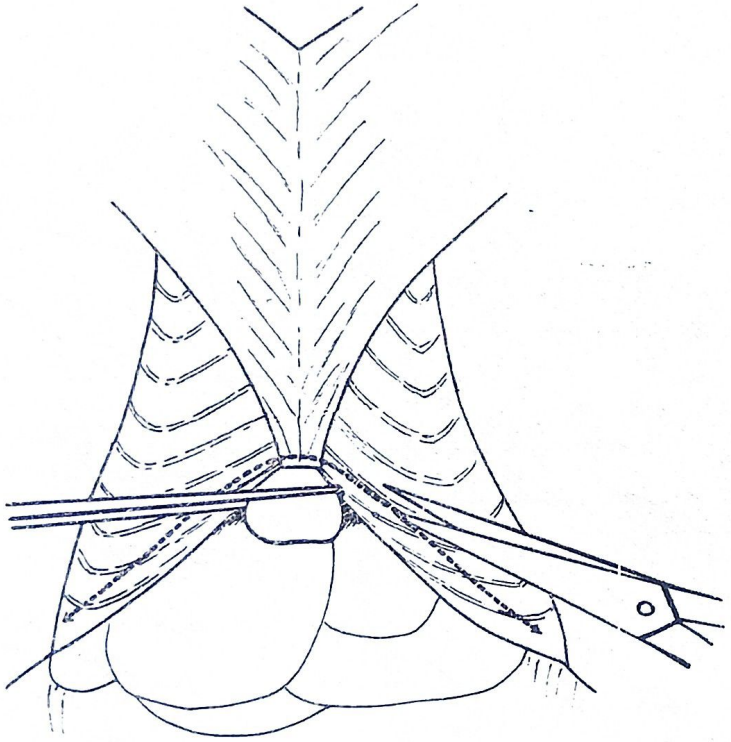
× 1⅓

Fig. 22 Observe and DRAW the diaphragm.

(*a*) OPENING UP THE THORACIC CAVITY

It is not essential to open the abdomen and remove the alimentary canal before dissecting the thorax, but this is usually done because the material in the canal putrifies very rapidly. If the abdomen is left entire it is not necessary to tie back the diaphragm as shown in Fig. 24.

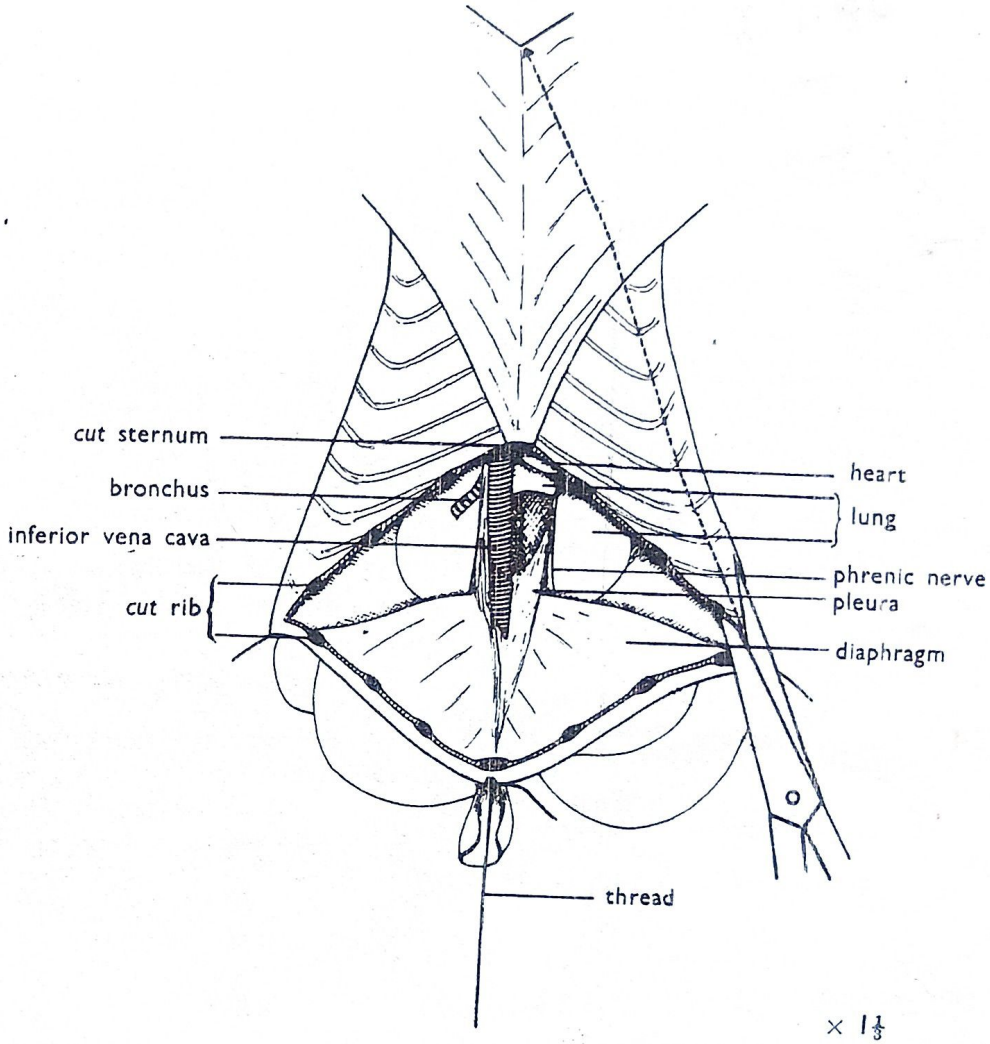
Remember that ANY BLEEDING from the finer vessels which are inevitably cut MUST BE KEPT MOPPED UP with a soft rag. If this is not done the tissues become uniformly stained and the nerves especially are more difficult to identify.



× 1½

Fig. 23

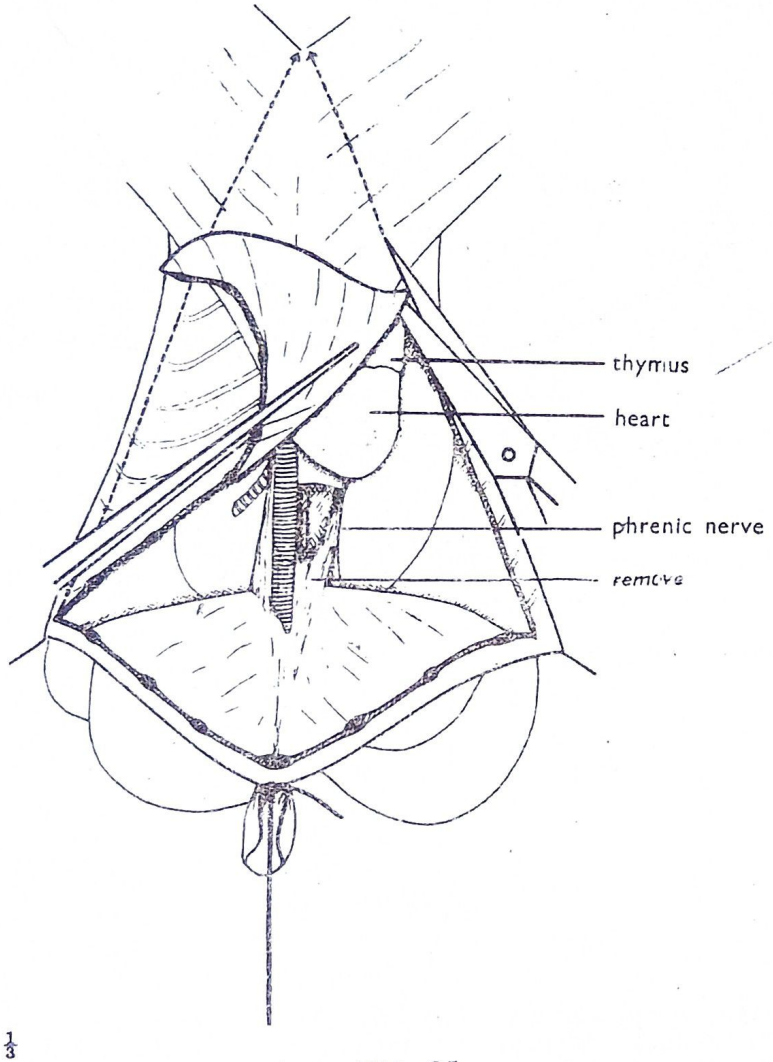
Grip the xiphoid cartilage, insert a blade of a pair of scissors through the slit already made (see Fig. 21), and cut through the posterior part of the thoracic wall along the line indicated.



× 1⅓

Fig. 24

Tie a thread round the xiphoid cartilage and attach the other end of the thread to the tail of the rat or to a pin so that the diaphragm is pulled back as shown.
NOTE. The pleura surrounding the mediastinum are ruptured by the tension. Cut through the side wall of the thorax along the line indicated—see also Fig. 25.

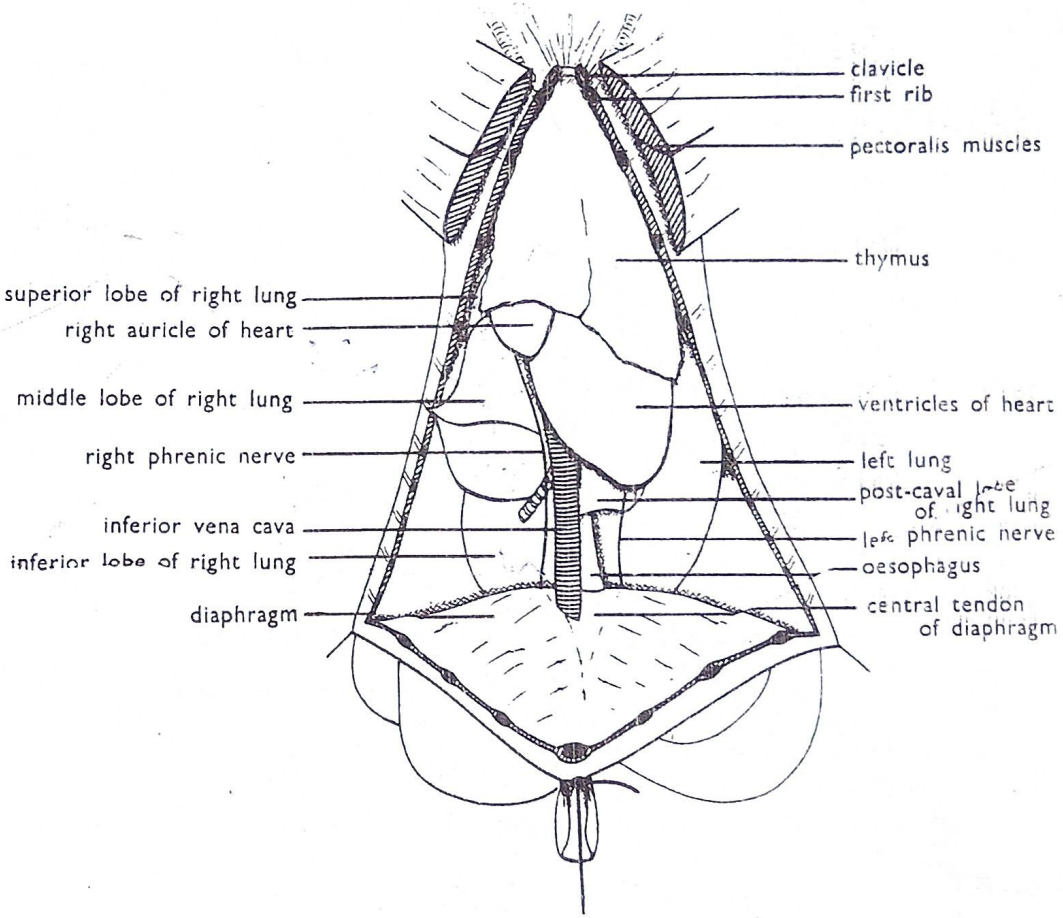


× 1⅓

Fig. 25

Continue the cut to the apex of the thorax turning the ventral part of the wall aside and pulling it slightly so that there is less danger of cutting the heart. Repeat on the other side to remove the ventral part of the thoracic wall entirely. Clear away loose parts of the pleura.

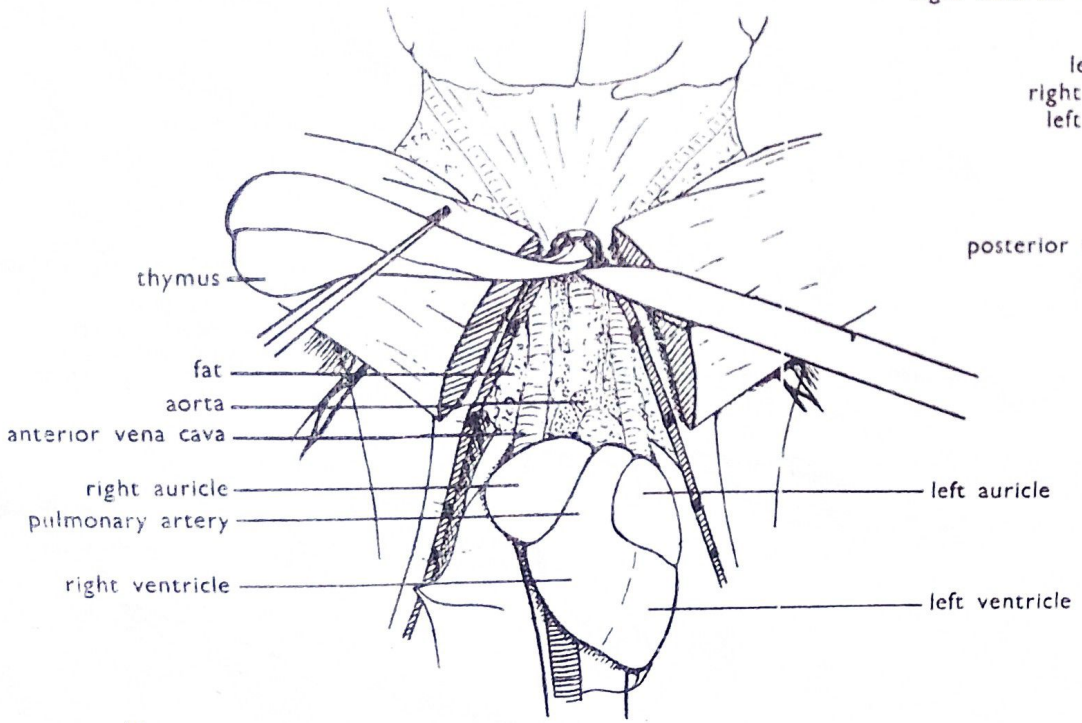
NOTE. BE SURE TO CUT THROUGH THE ANTERIOR RIBS AND TO REMOVE THE STERNUM COMPLETELY.



× 1⅓

Fig. 26

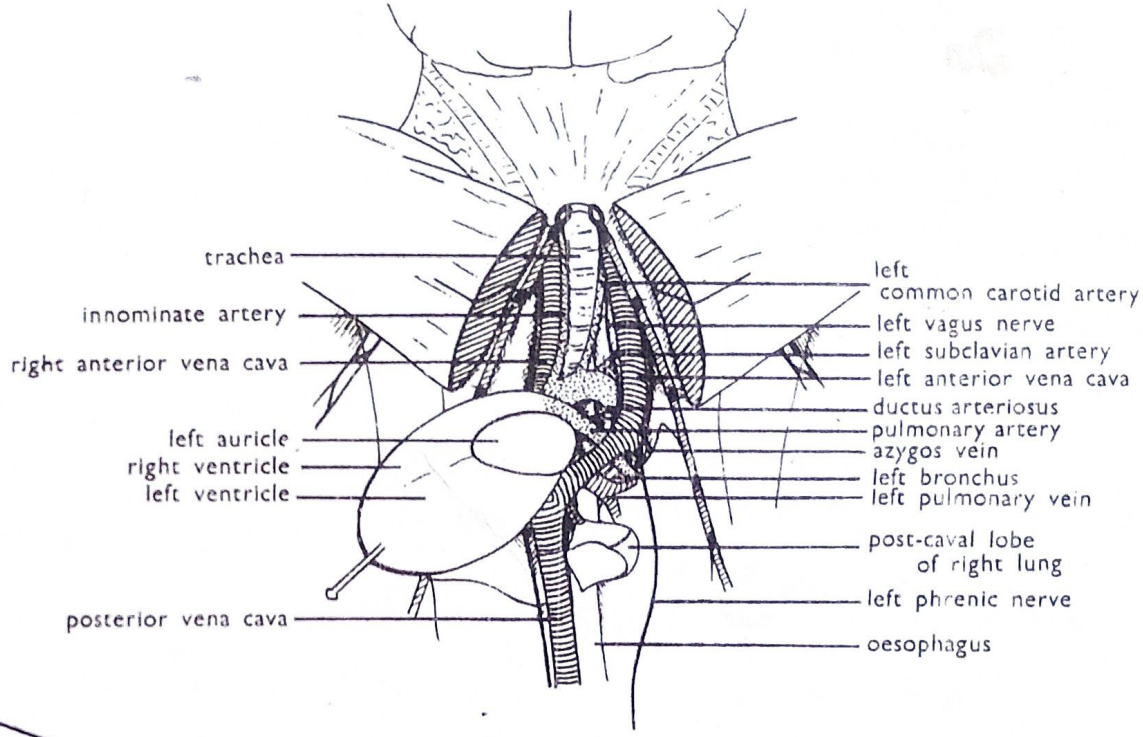
Observe and DRAW the contents of the thorax as they appear at this stage.



× 1⅓

Fig. 27

Remove the thymus gland.
Clear away the fat from around the great vessels.
N.B. WATCH FOR AND DO NOT DESTROY THE PHRENIC AND VAGUS NERVES—see Fig. 28.



× 1⅓

Fig. 28

Pin the heart to the RIGHT of the RAT.
Observe the structures shown in diagram.
DRAW
NOTE. If desired this diagram may be combined with Fig. 34.

(*c*) THE BLOOD-VESSELS AND NERVES OF THE NECK

The blood-vessels and nerves of the fore-limbs are not usually studied in detail, but their relation to those of the neck and thorax should be noted.

A hand lens may be found useful when looking for the fine nerves of the neck.

N.B. MOP UP ALL CAPILLARY BLEEDING AT ONCE with a soft cloth.

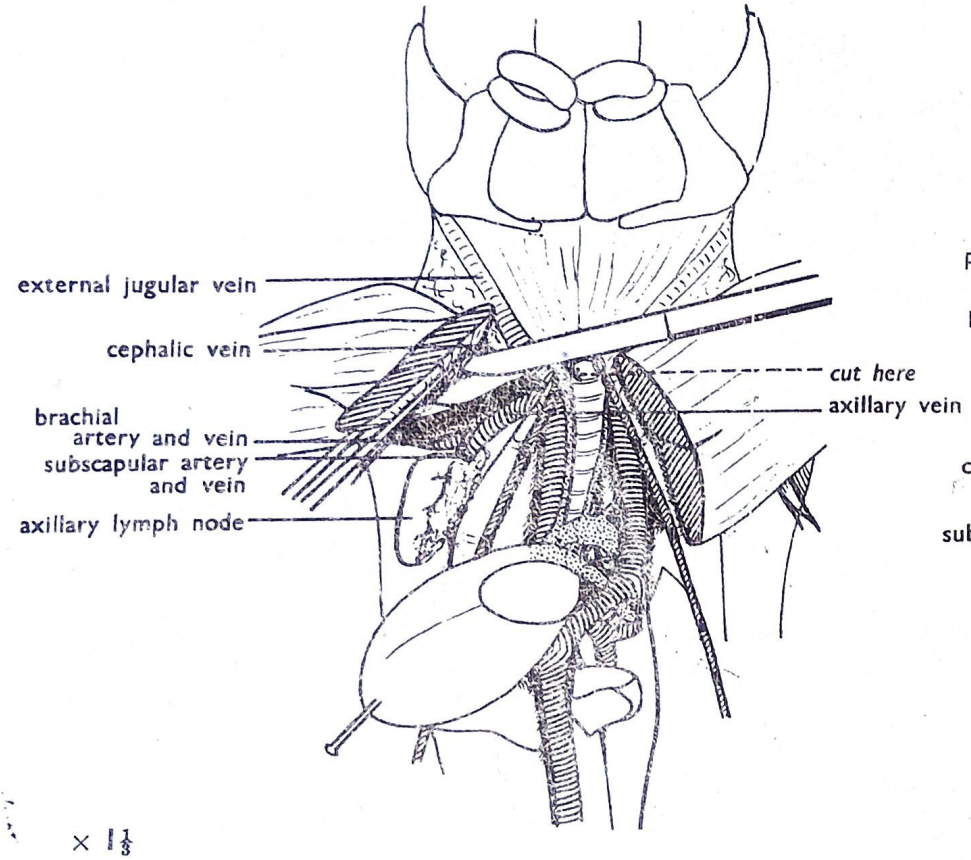


Fig. 29

Lift the pectoralis muscles and carefully clear them from the axillary vessels and nerves.

Keep the blocks of muscle entire and cut each of them as close as possible to its insertion—see Fig. 30.

Cut between the clavicle and the first rib to trace the connection between the axillary vein and the anterior vena cava, i.e. the very short subclavian vein. Push the rib aside and trim if necessary.

N.B. BE CAREFUL NOT TO CUT THE PHRENIC NERVE.

Repeat on the other side.

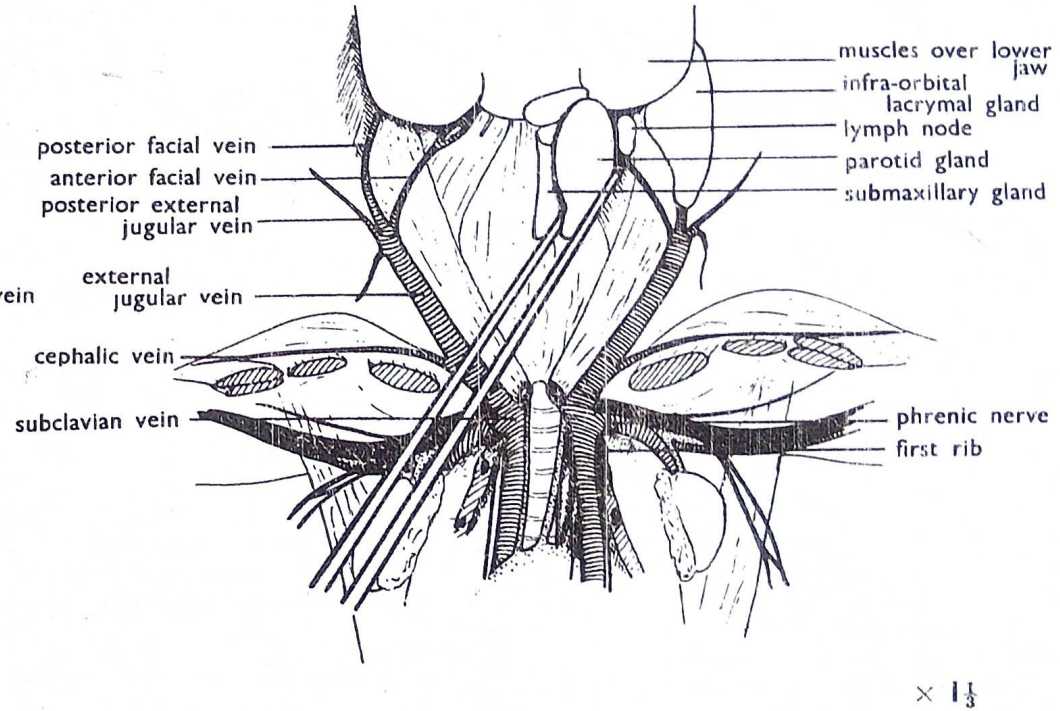


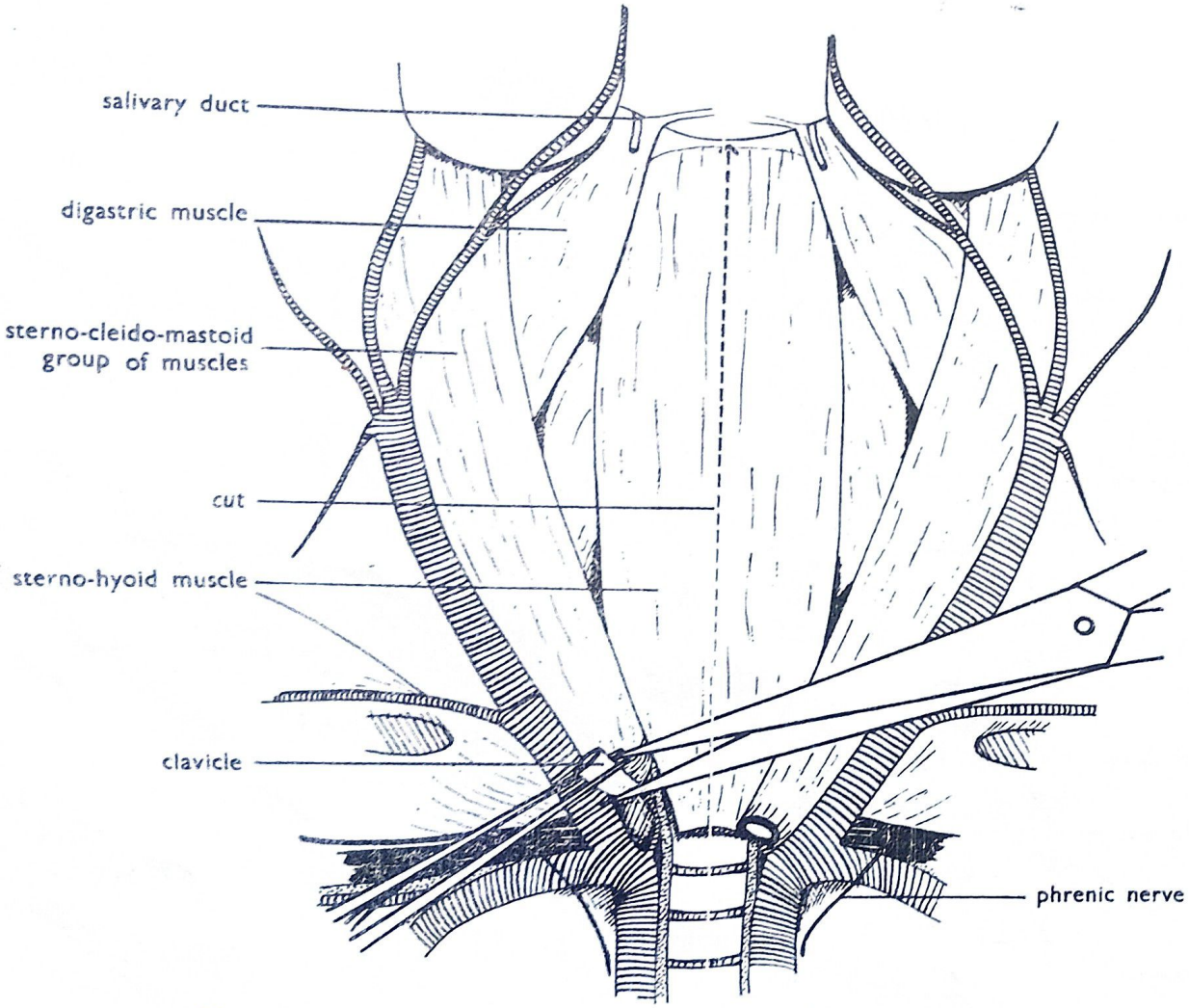
Fig. 30

Clear away any fat and connective tissue that may be masking the external jugular veins.

Lift aside the salivary glands and trace the anterior facial vein.

Remove the glands and the lymph nodes.

Remove the infra-orbital lacrymal gland to expose the posterior facial vein.



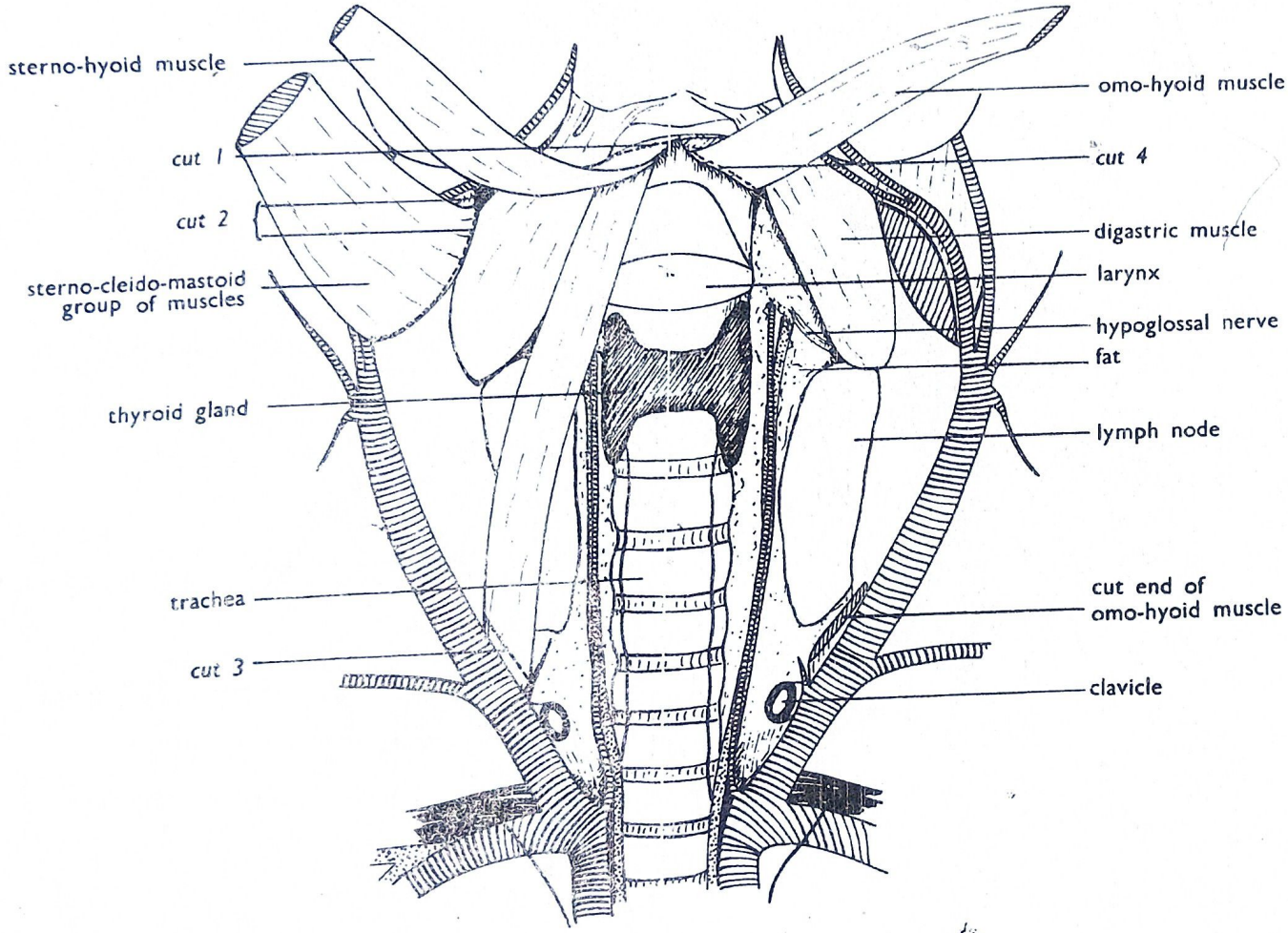
× 2⅔

Fig. 31

Lift the clavicle and trim it as close to the external jugular vein as possible.

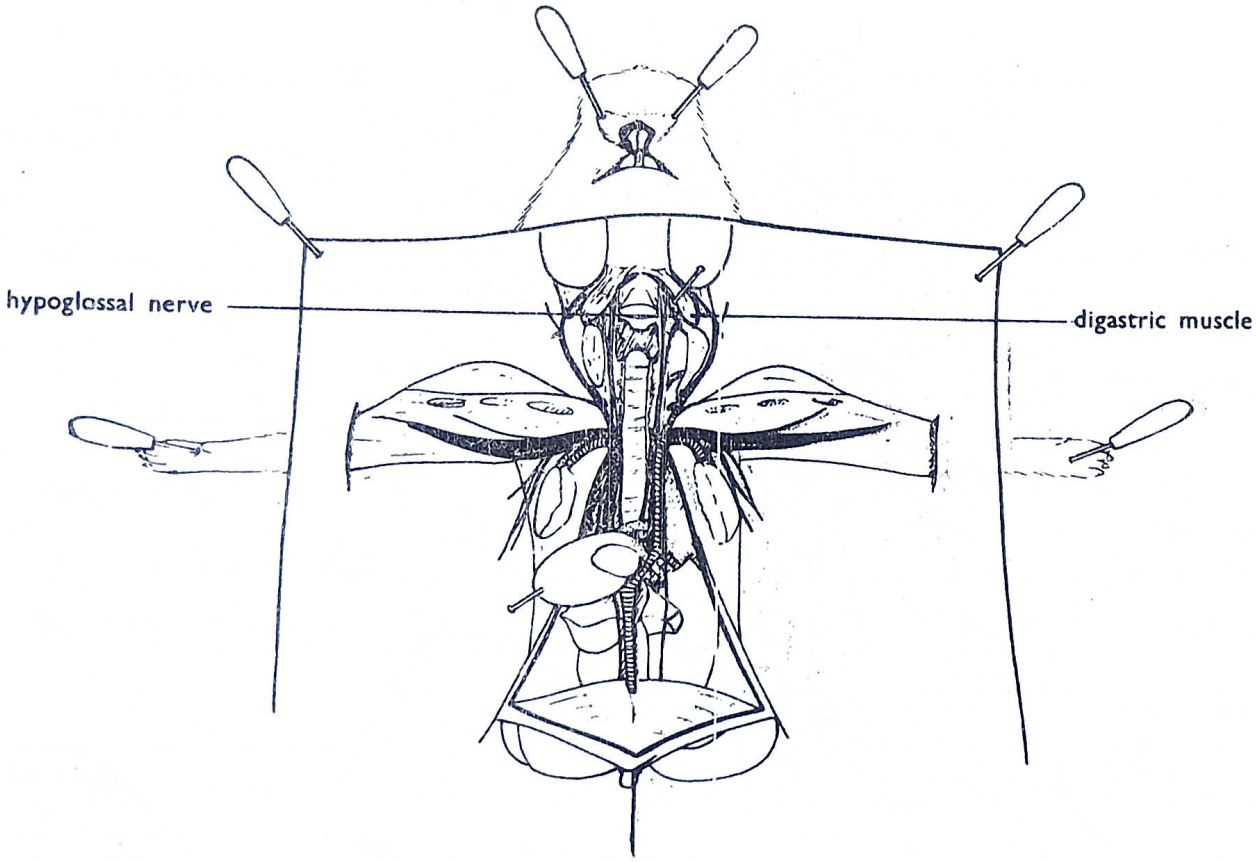
Cut between the blocks of sterno-hyoid muscle along the line indicated.

N.B. Be careful not to damage the trachea and larynx which lie immediately underneath these muscles.



× 2⅔

Fig. 32
Loosen and cut the sterno-hyoid, sterno-cleido-mastoid and omo-hyoid muscles as indicated—cuts 1, 2, 3, and 4.



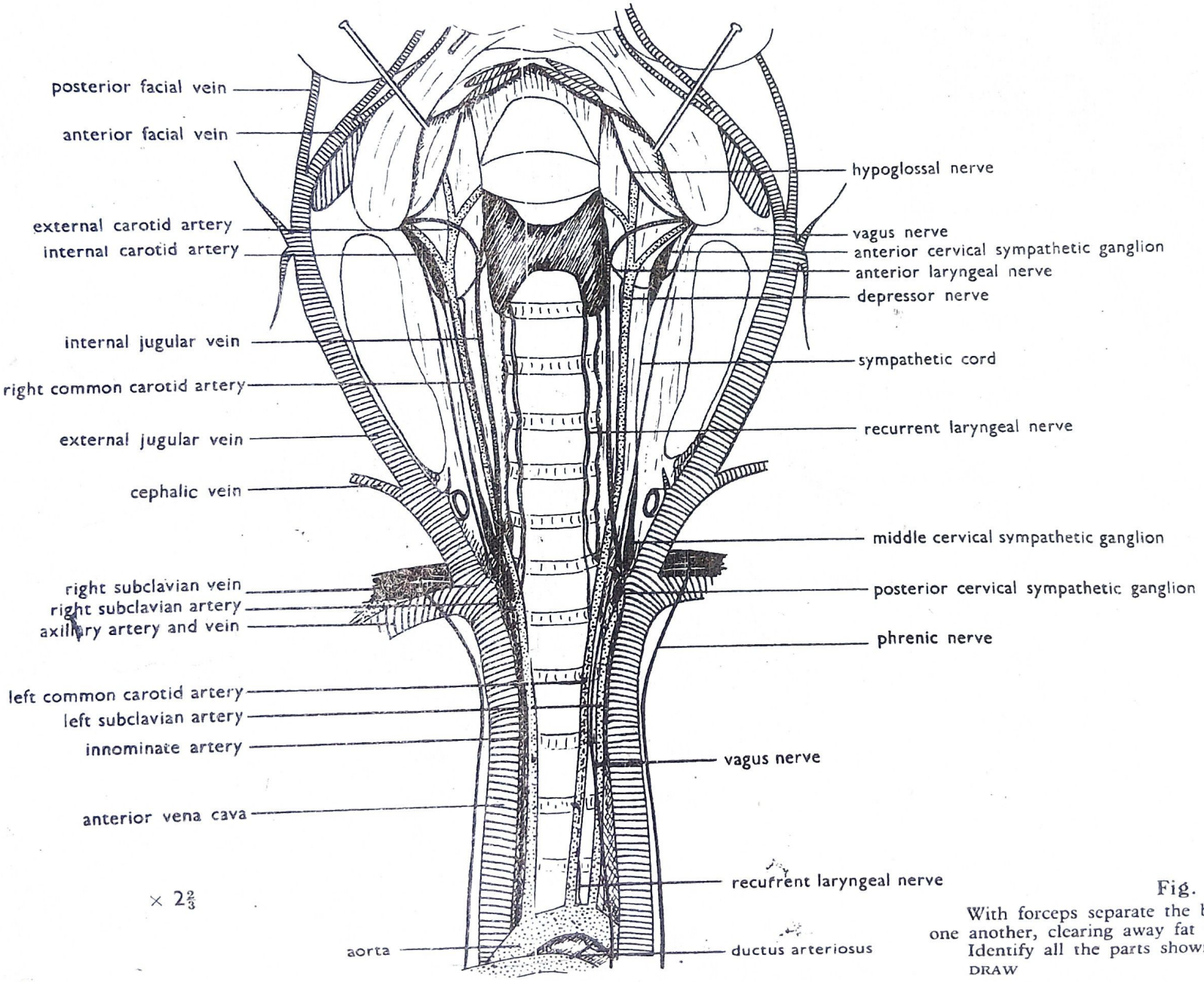
× ⅔

Fig. 33

Place pins through the upper lips as shown. This arches the neck slightly and makes the display of the nerves and blood-vessels of the neck easier.

Remove some of the fat carefully until the hypoglossal nerve can be identified.

Pin aside the posterior part of each digastric muscle carefully avoiding the nerve.



× $2\frac{2}{3}$

Fig. 34

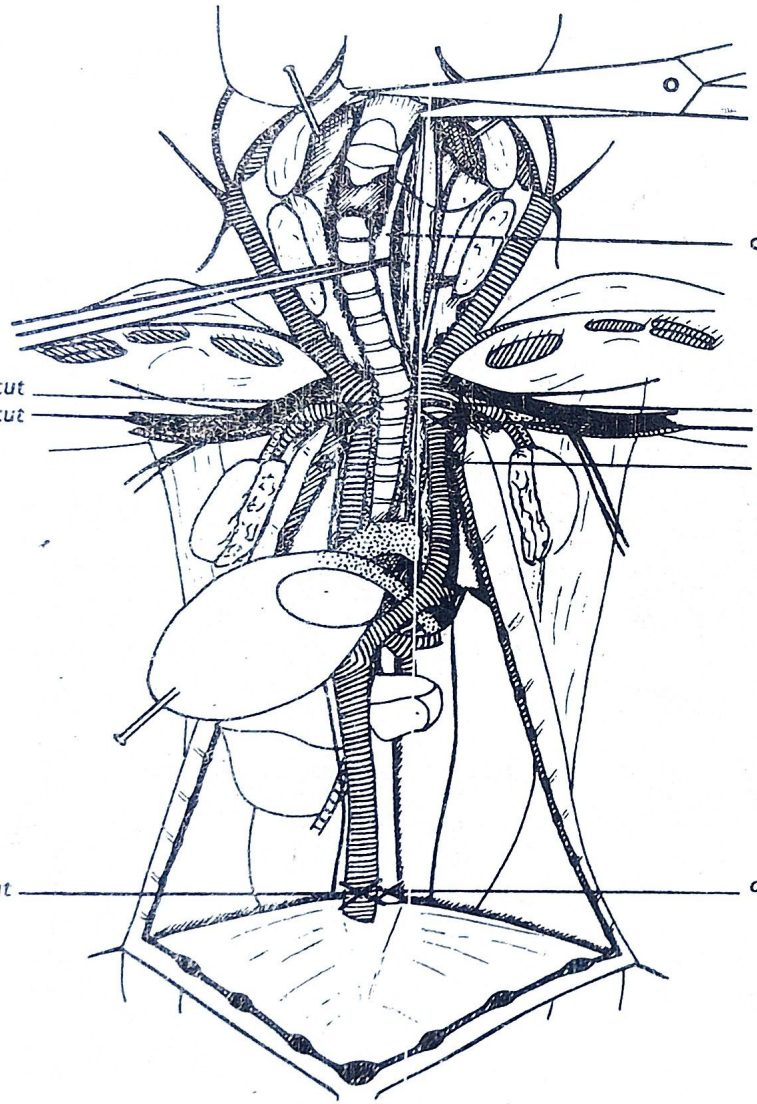
With forceps separate the blood-vessels and nerves from one another, clearing away fat where necessary. Identify all the parts shown in diagram.

DRAW

(*d*) EXAMINATION OF THE HEART AND LUNGS ISOLATED

A more detailed study of the heart and lungs than that shown in Figs. 27 and 28 may be performed by removing them from the body and dissecting them separately.

When fresh, the isolated heart-lung preparation is soft and difficult to handle. A day or more in formalin makes the following parts of the dissection much easier.



× 1⅓

Fig. 35

Loosen the trachea and oesophagus from the back of the neck.

Cut through the pharynx immediately anterior to the larynx.

Cut the venae cavae, the innominate, left common carotid and left subclavian arteries at the points marked X.

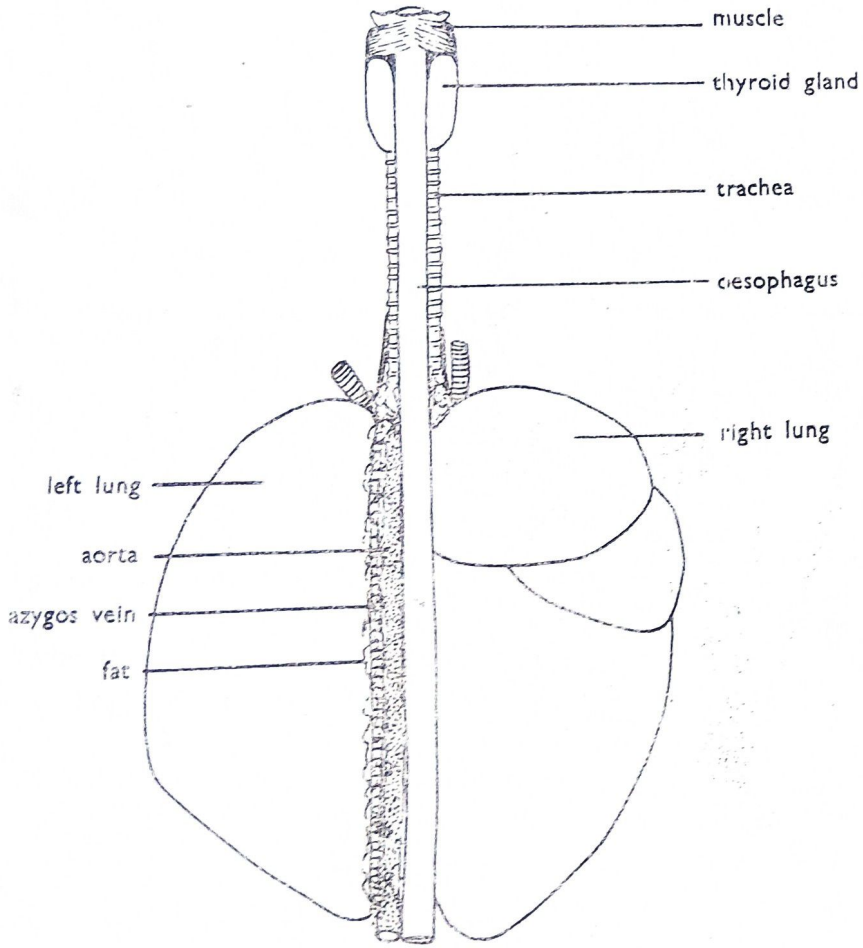
NOTE. There is no need to ligature these blood-vessels.

Cut the oesophagus close to the diaphragm.

The aorta and azygos vein can then be seen and cut also close to the diaphragm.

Loosen the oesophagus, aorta and azygos vein from the back of the thorax.

Lift out the heart, lungs and oesophagus together.

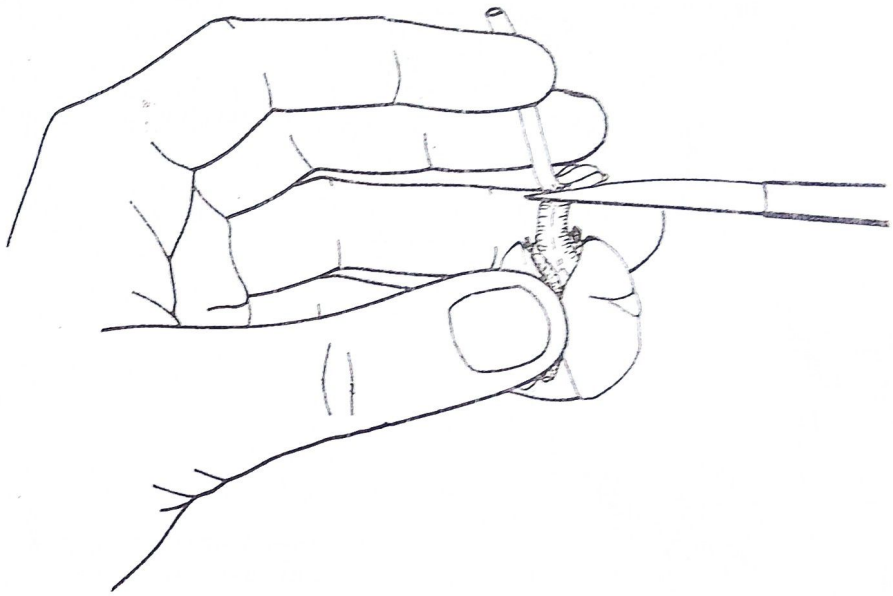


× 2

Fig. 36

Observe the parts now isolated in dorsal view. Note the relationship of the oesophagus to the larynx and trachea.

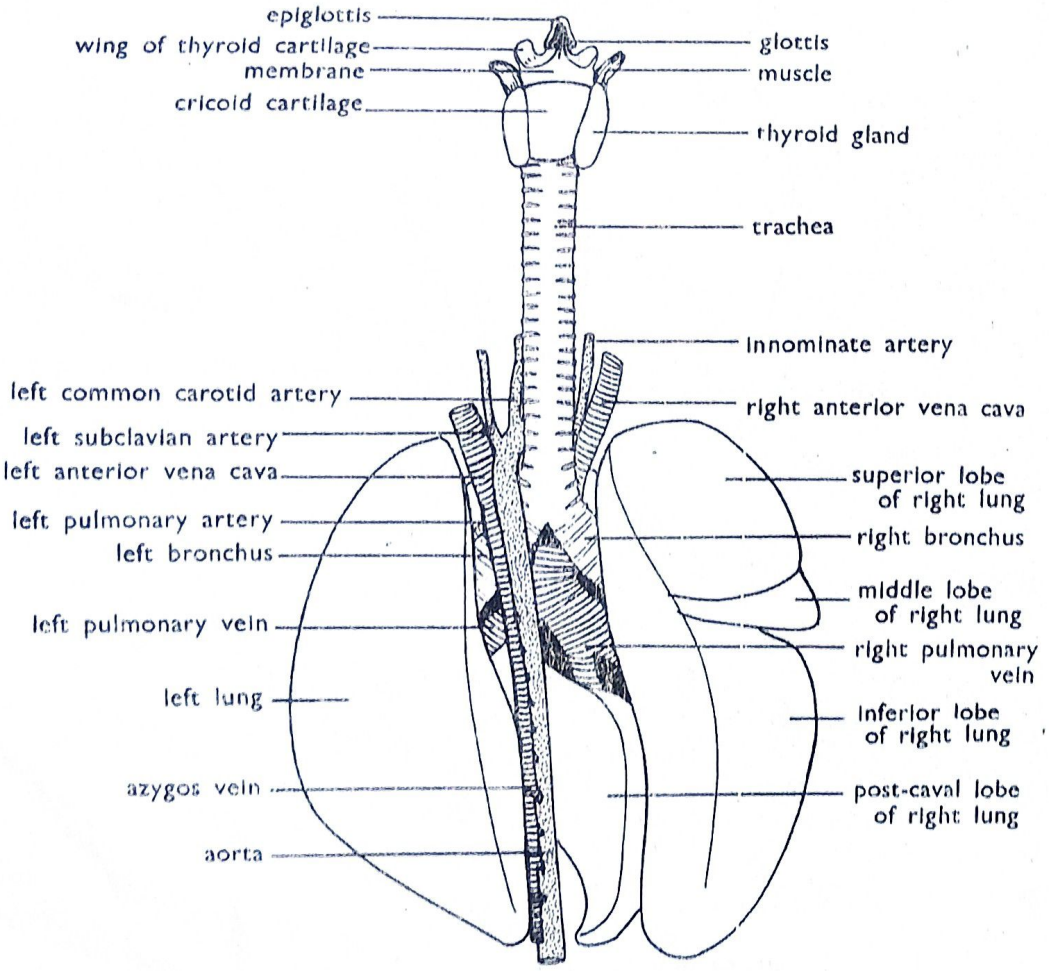
DRAW



× ⅔

Fig. 37

Starting at the posterior end, separate the oesophagus from the trachea, holding the preparation as shown.



× 2

Fig. 38

Clear any fat from the bronchi and blood-vessels. Identify the parts shown in dorsal view.
DRAW

× 3

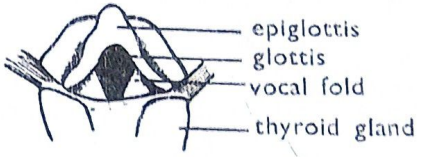


Fig. 39

Examine the larynx in antero-dorsal view.
DRAW.

× ⅔

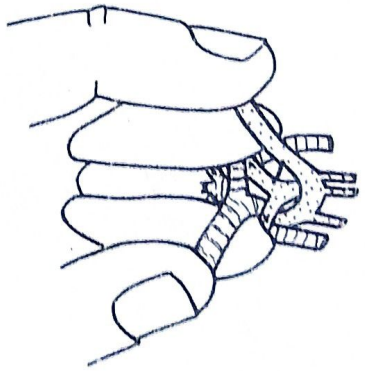


Fig. 40

Separate the bronchi from the pulmonary arteries.
Cut through each pulmonary vein and pulmonary artery as close as possible to the lungs—i.e. at points marked **X**.

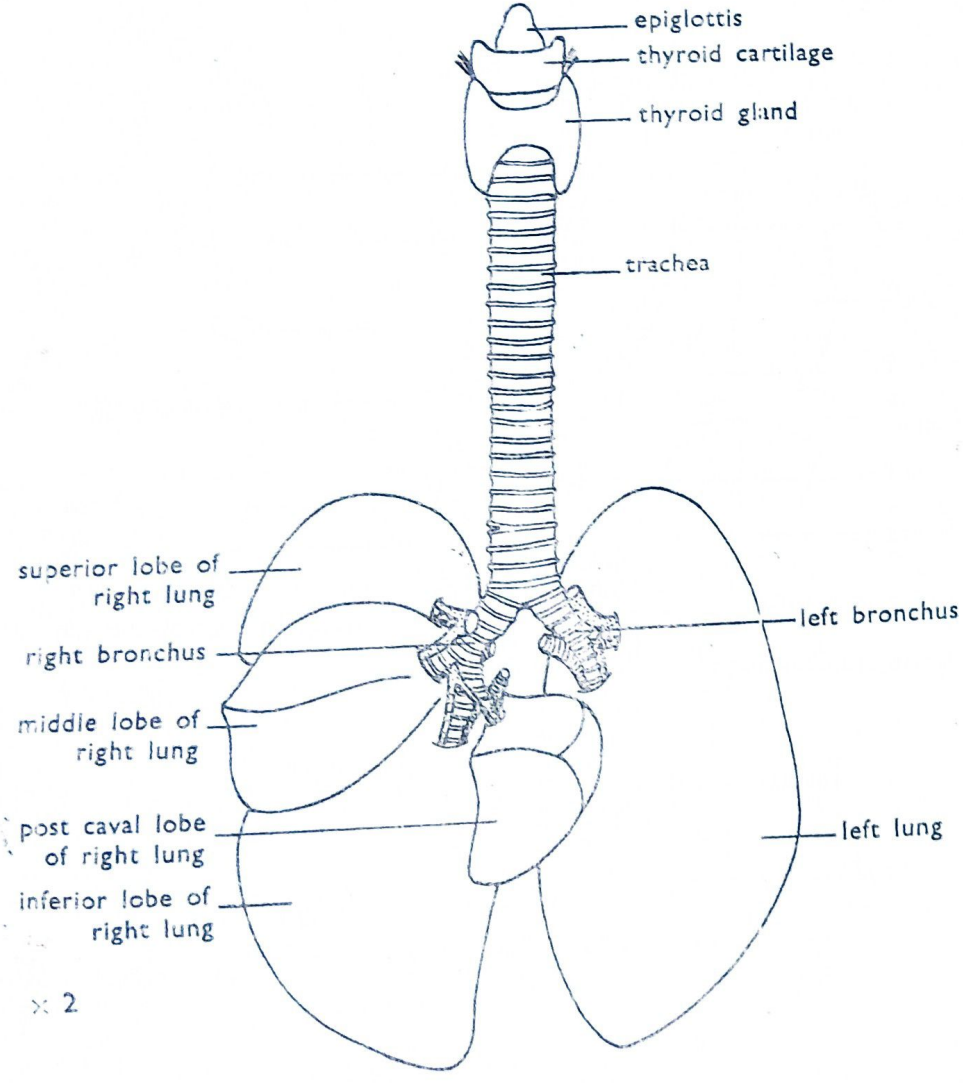


Fig. 41

Examine the lung preparation in ventral view. DRAW.

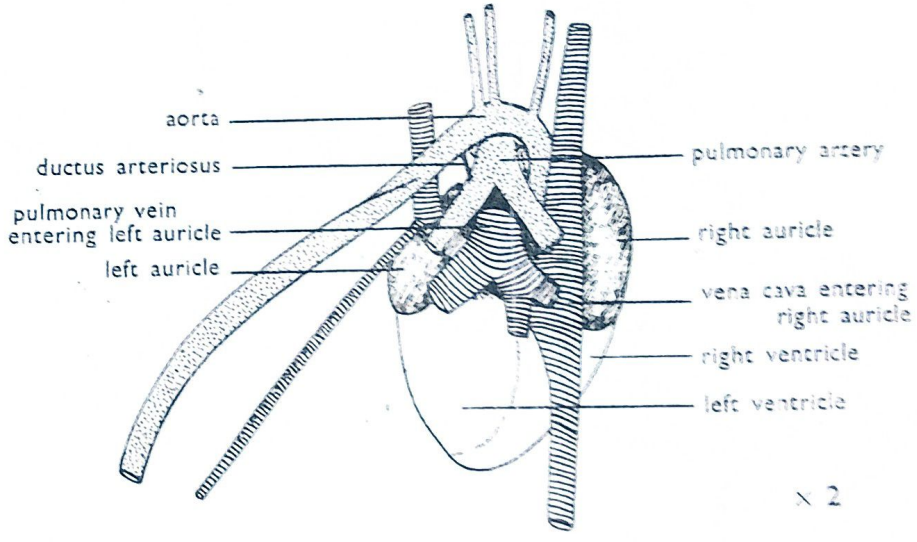


Fig. 42

Lay aside the aorta and azygos vein.

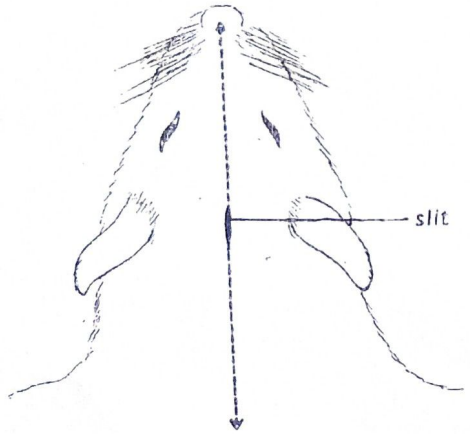
Study the dorsal view of the heart and the relation of the blood-vessels to it.

DRAW.

NOTE. The heart of the rat is too small to be convenient for dissection but it can be opened up as shown for the rabbit—page 186.

Nervous tissue is very soft and has very little elasticity. Even after 'hardening' with formalin it is much softer and more easily cut than other tissues. It is therefore very easily damaged by any slip of the instruments and the removal of the brain requires much care and patience. The skull must be cut away in VERY SMALL PIECES and the pressure on the instruments must be fully under control all the time.

A hand lens will be found useful when examining the cranial nerves.

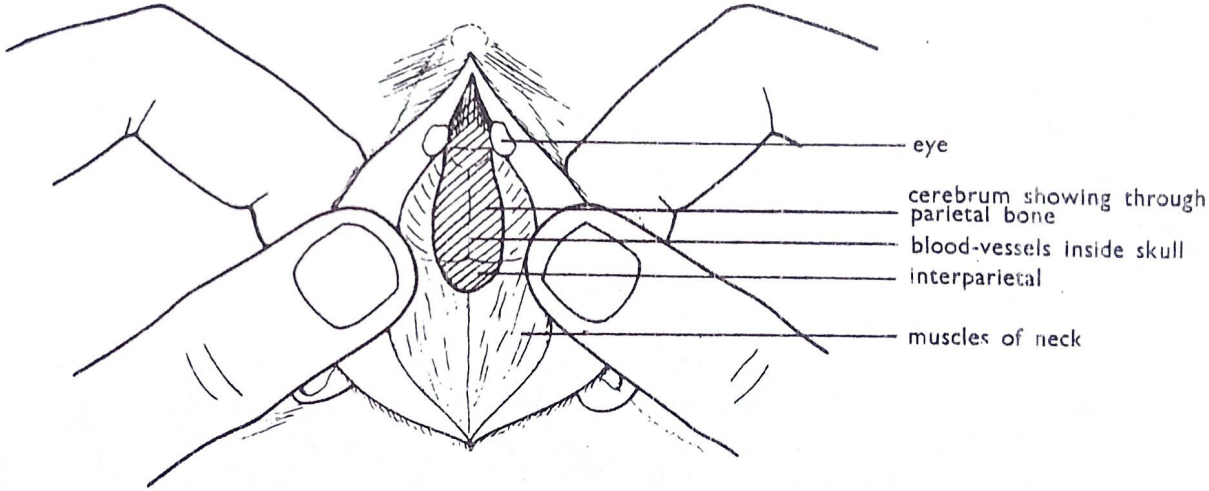


× ⅔

Fig. 43

Hold the rat dorsal side uppermost.

Make a small slit in the skin between the pinnae. Continue the slit forwards to the snout and backwards to the level of the fore-limbs.



× ⅔

Fig. 44

Pull aside the skin, using the thumb and forefinger of each hand as shown. Notice the brain showing through the roof of the skull.

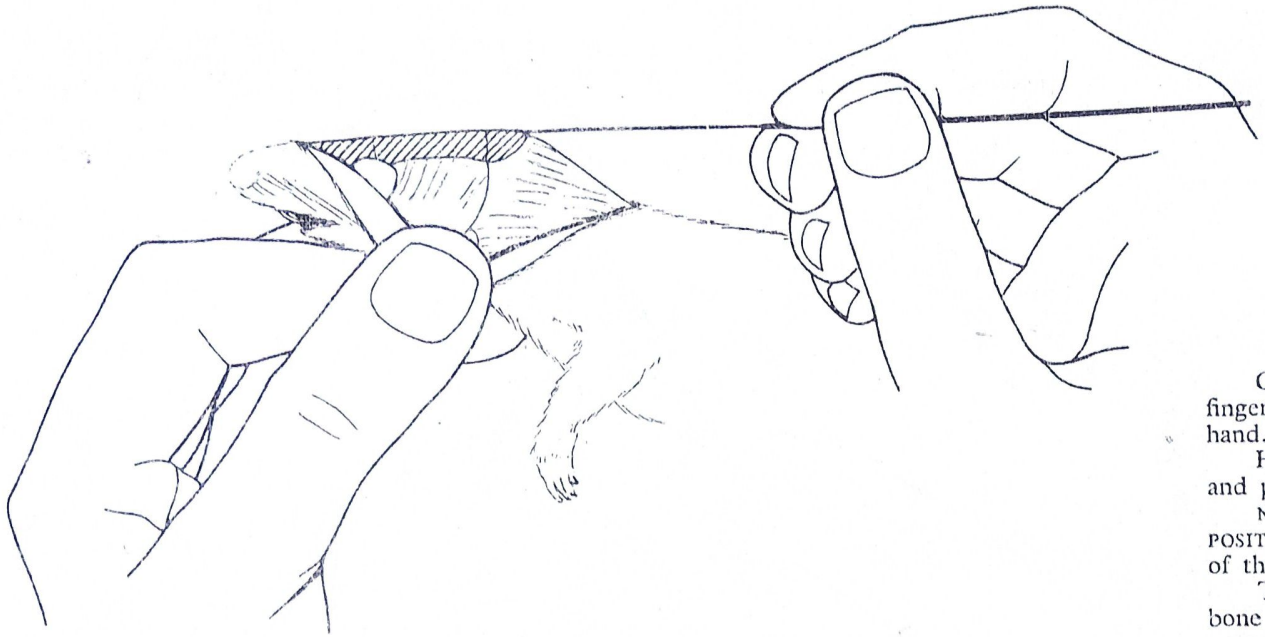


Fig. 45

Grip the head of the rat with the thumb and second finger and support the chin with the first finger of the left hand. The free part of the skin helps to give a good grip.

Hold a scalpel level with the back of the skull as shown and pierce the interparietal bone.

NOTE. It is very important to MAINTAIN THE HORIZONTAL POSITION OF THE SCALPEL. Any tilting will either cause piercing of the brain or failure to perforate the skull.

The entry of the scalpel point causes the interparietal bone to crack away along the sutures with the parietals and squamosals.

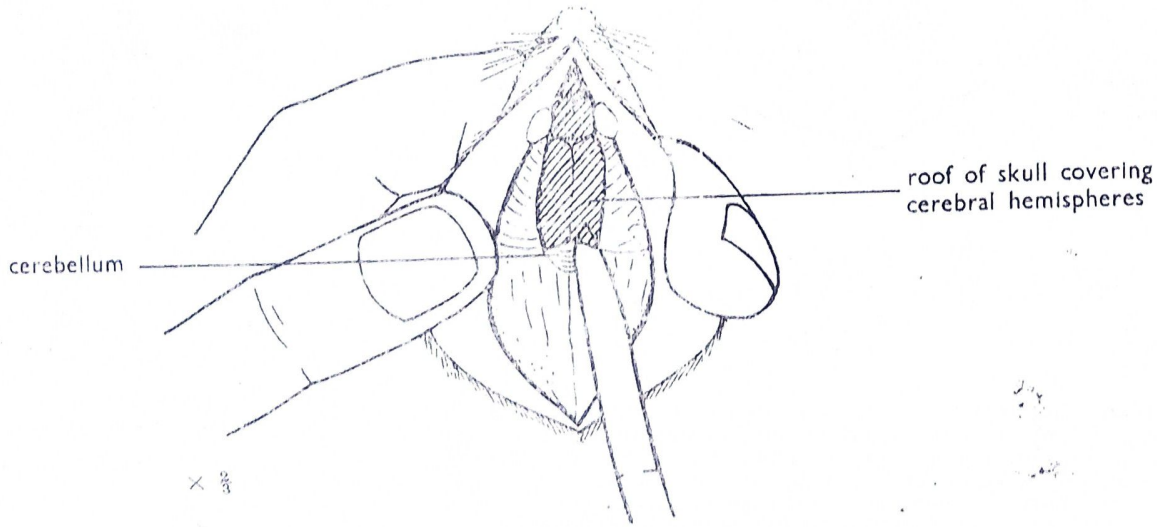


Fig. 46

Notice the exposed part of the cerebellum.
With a scalpel chip away the roof of the skull over the area indicated by the dotted lines.

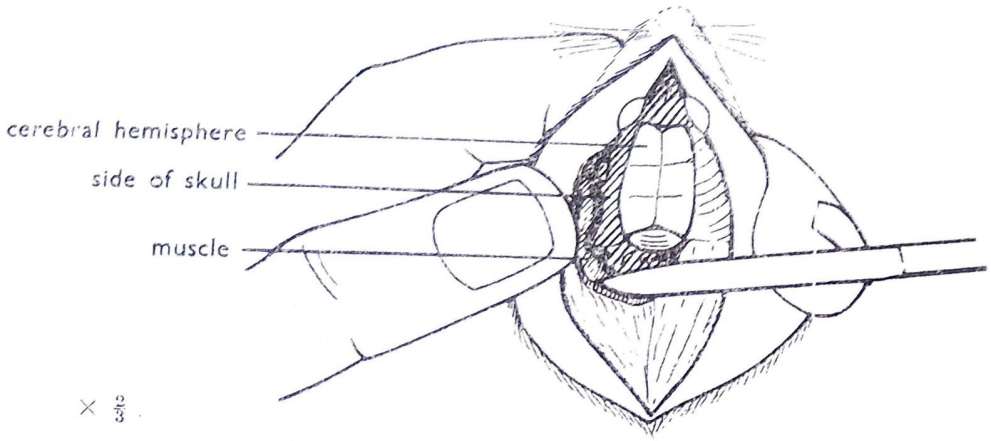


Fig. 47

Scrape aside the muscles to expose the sides and posterior part of the skull.

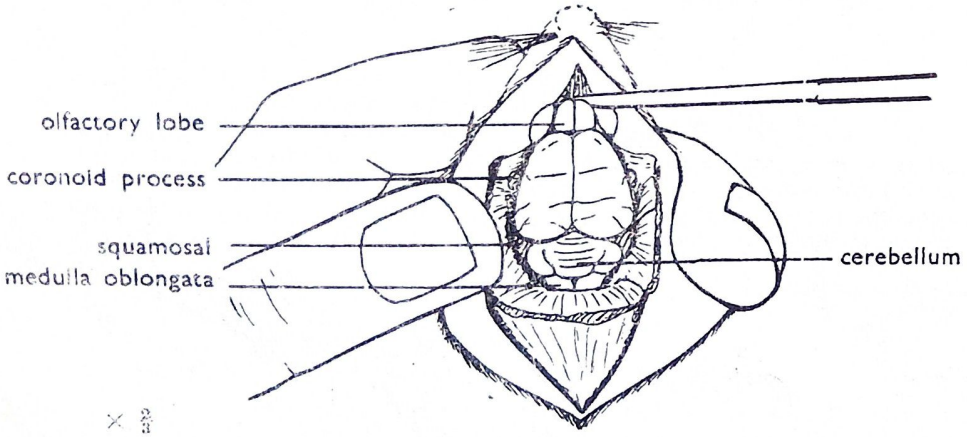


Fig. 48

Chip away the bone until the olfactory lobes, cerebral hemispheres and the main part of the cerebellum are exposed.

Remove the dorsal parts of the atlas and axis vertebrae to expose the first part of the spinal cord.

Cut under the olfactory lobes.

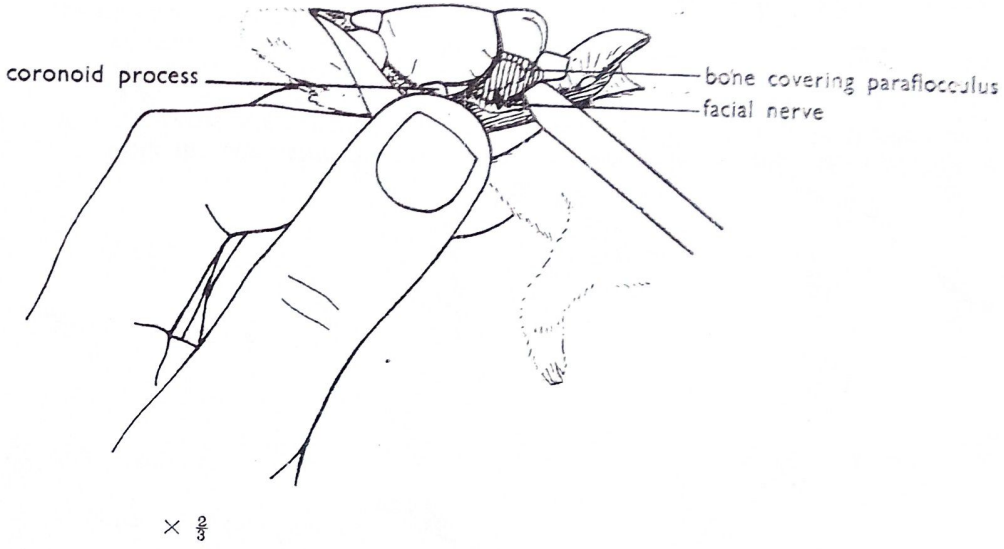


Fig. 49

Cut through the spinal cord.

Cut UNDER THE SKULL as indicated, cutting the posterior cranial nerves in the process.

Continue till the facial nerves are cut.

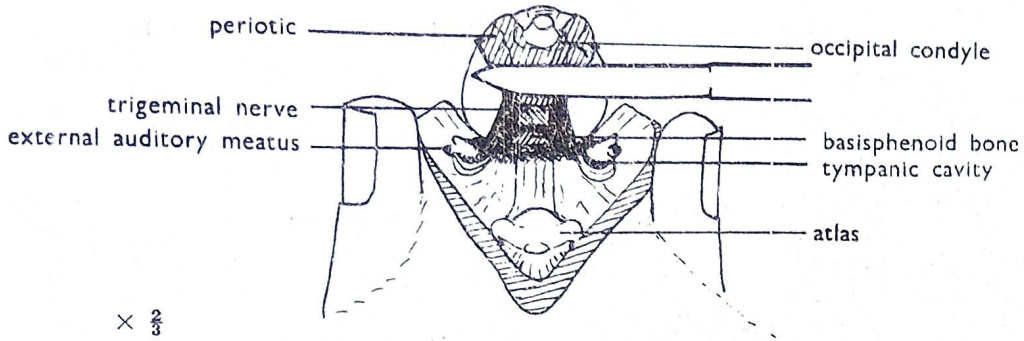


Fig. 50

Change the grip and the position of the scalpel. Prise the posterior part of the base of the skull upwards. This breaks the suture between the occipital and basisphenoid bones and also between the tympanic bulla and the periotic.

Notice the large trigeminal nerves. Cut these nerves as close as possible to the foramina through which they leave the skull.

Cut the optic nerves also—see Fig. 51.

Remove the brain from the head.

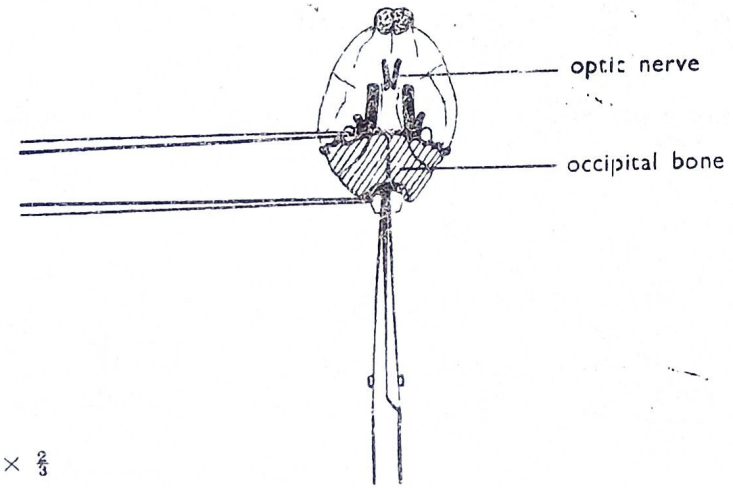


Fig. 51

Grip the piece of the base of the skull which is still attached to the brain. Using scissors, cut through the occipital bone in the mid-ventral line.

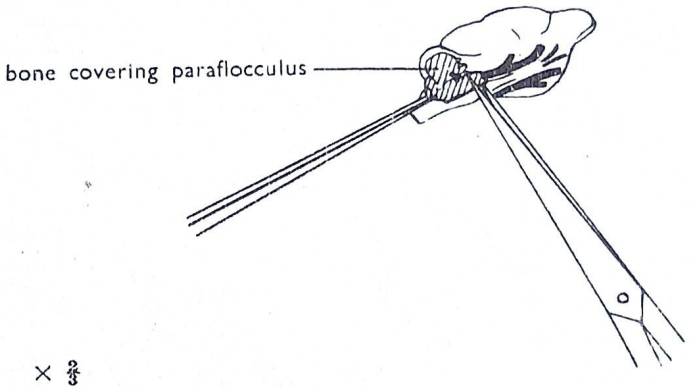


Fig. 52

Grip the bone with forceps and cut it away little by little from the auditory region. Leave the occipital condyle as long as possible as it gives the best grip.

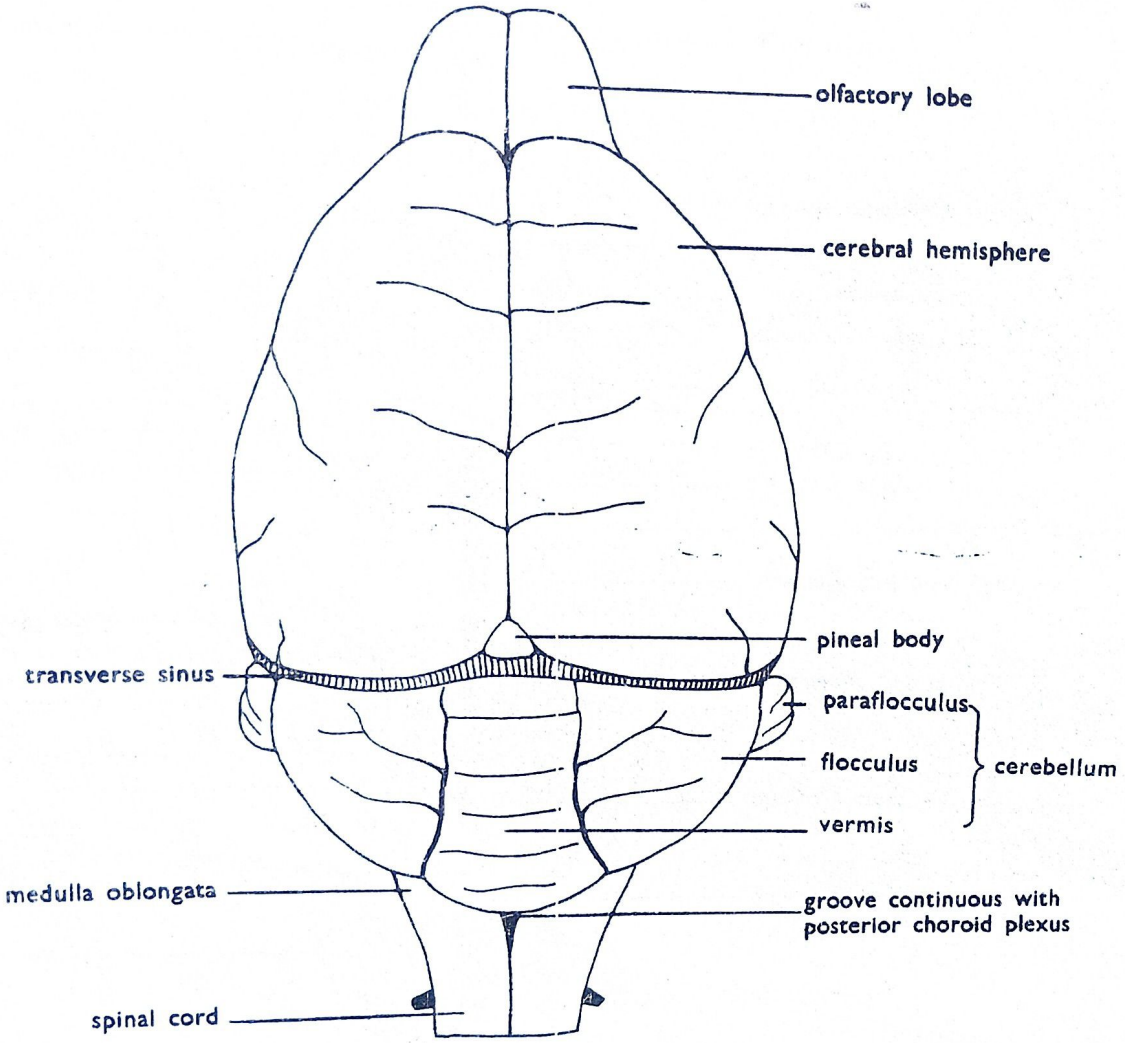
N.B. TRY NOT TO TOUCH OR GRIP THE NERVOUS TISSUE WITH THE INSTRUMENTS

Cut away VERY SMALL PIECES at a time.

BE VERY CAREFUL NOT TO DAMAGE THE PARAFLOCCULUS which is almost entirely surrounded by bone.

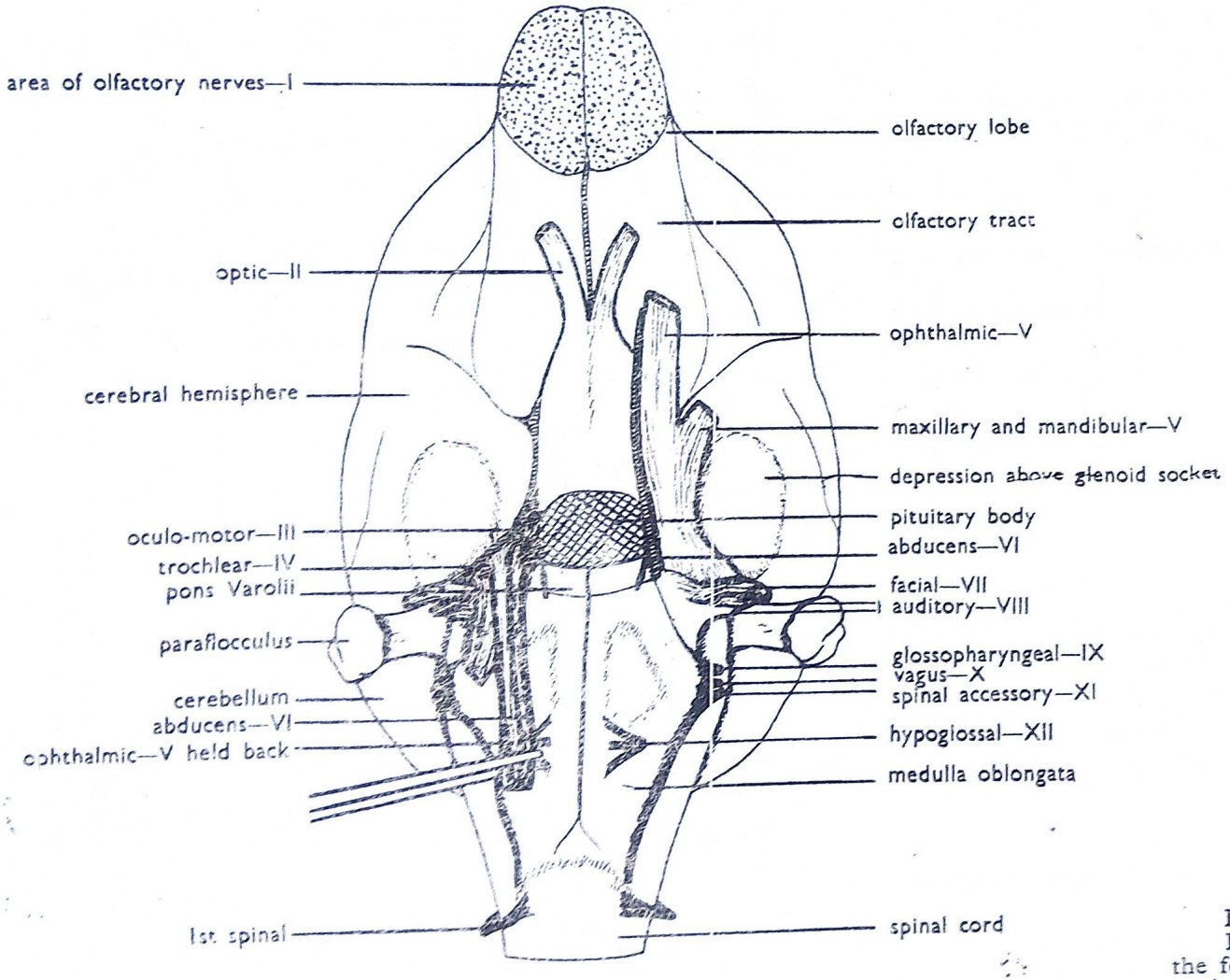
NOTE. The bone can be felt as it is hard and grates against the forceps.

The brain may be supported on the dissecting board or held with the fingers but NOT with instruments.



× 3⅓

Fig. 53
Examine the brain in dorsal view. DRAW.



× 3½

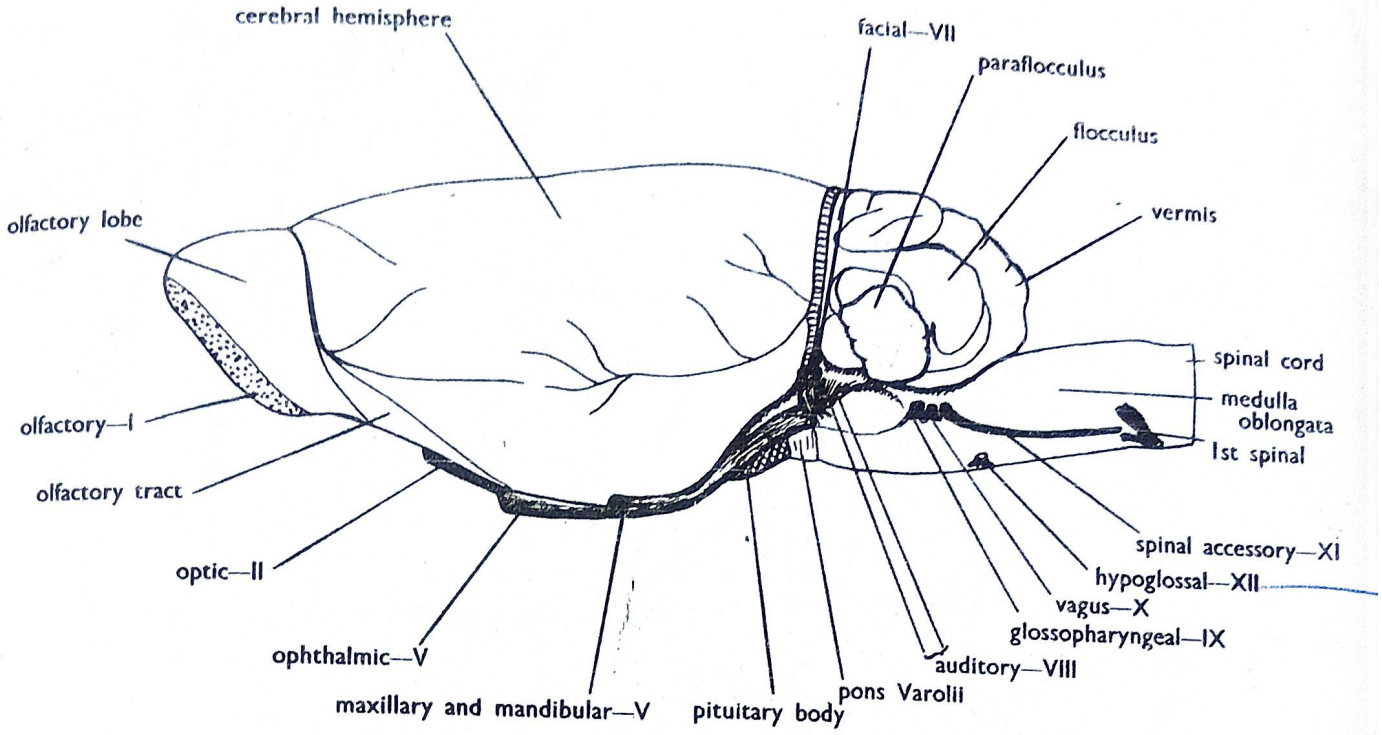
Fig. 54

Examine the brain in ventral view.

Loosen the trigeminal nerve from the ventral surface of the fore-brain and turn it back as shown. Look for the oculomotor, trochlear and abducens nerves which lie close to the trigeminal and are turned back with it.

Holding the trigeminal nerve as shown, DRAW.

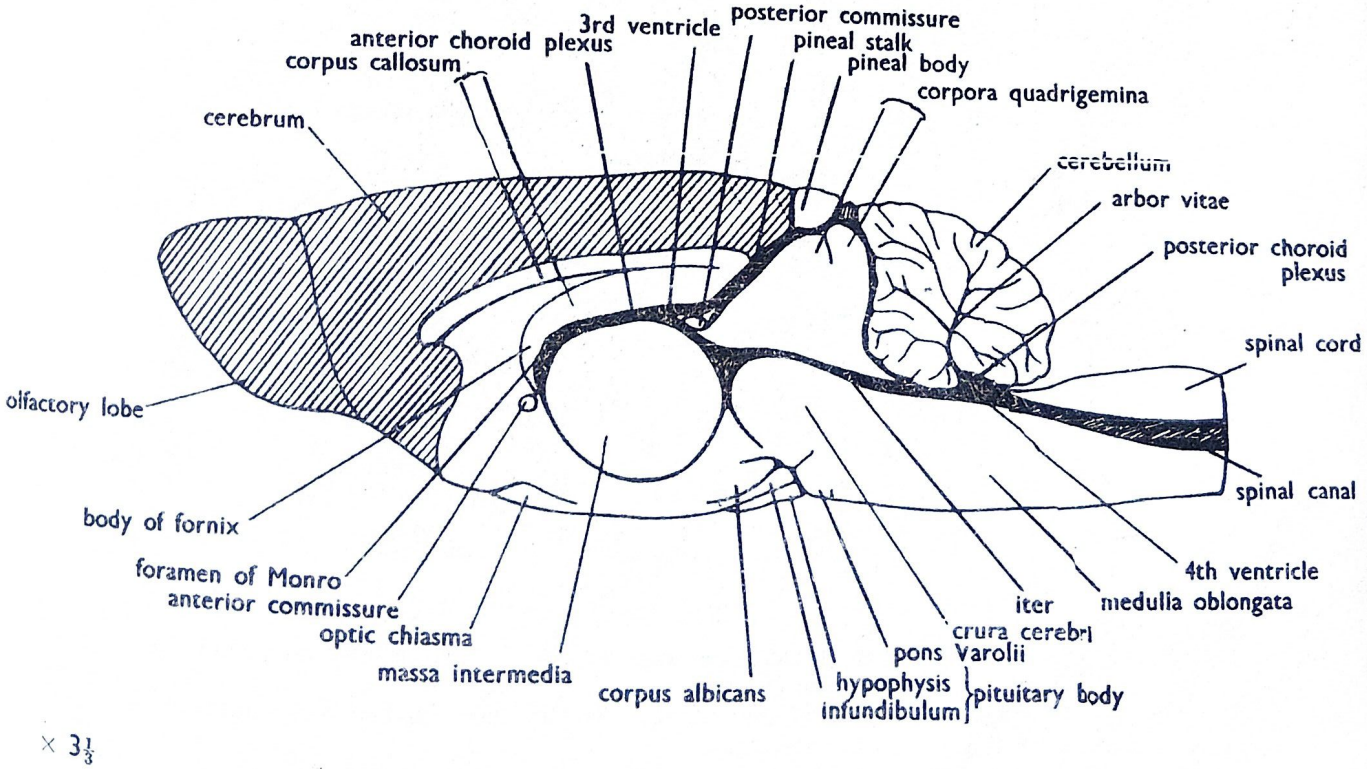
NOTE. Because of the amount of labelling in this diagram the word 'nerve' has been omitted throughout.



× 3⅓

Fig. 55

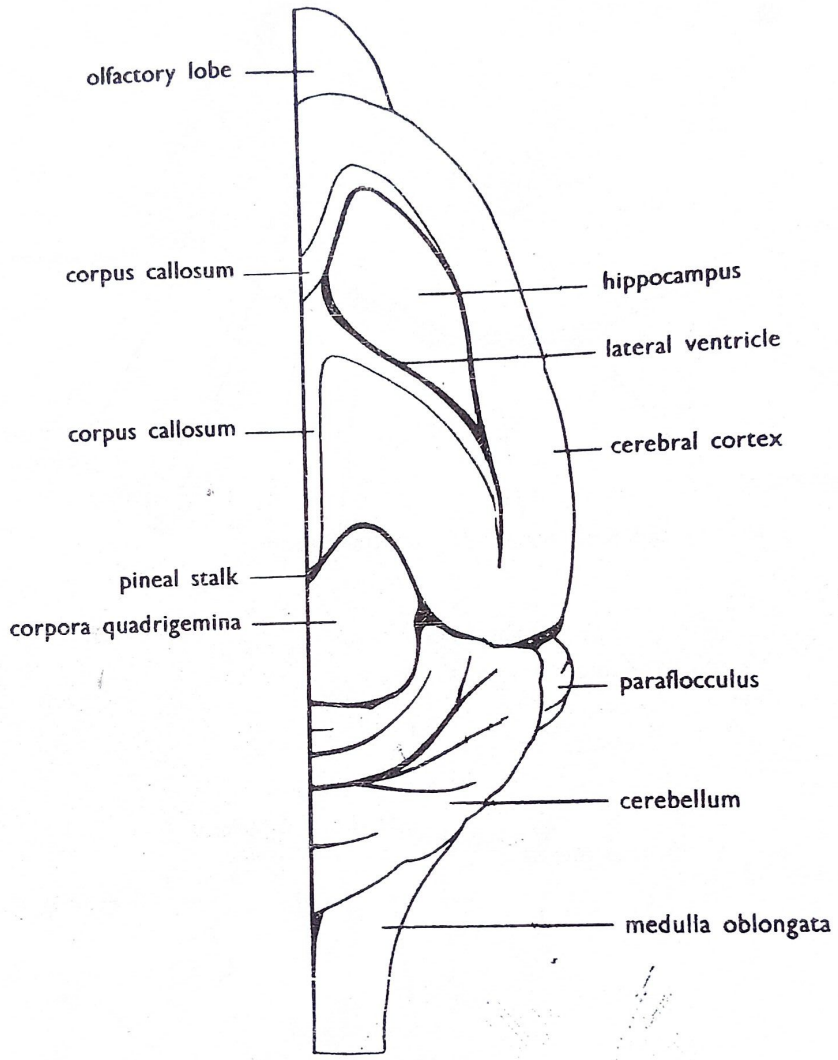
Examine the brain in lateral view.
DRAW



× 3⅓

Fig. 56

Cut through the brain in the median sagittal plane.
Examine the section.
DRAW



× $3\frac{1}{3}$

Fig. 57

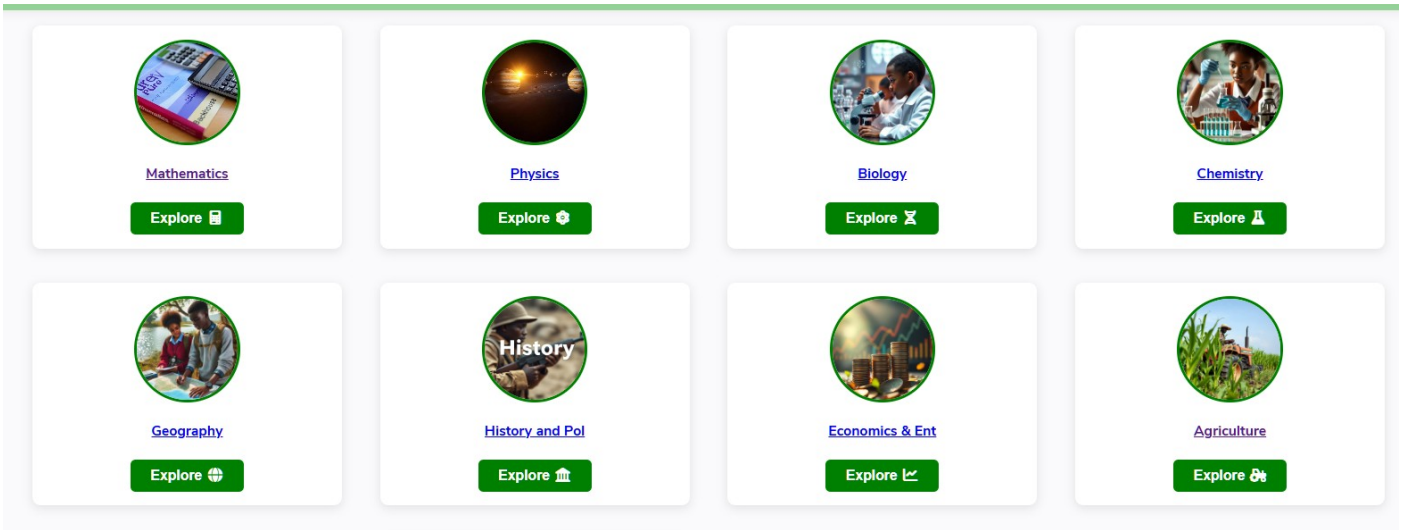
Using one-half of the brain, slice away the dorsal parts little by little until the hippocampus can be seen clearly.

N.B. Keep the cut level through the olfactory lobe, cerebral hemisphere, corpora quadrigemina and cerebellum.

The level required is about one-third down from the dorsal surface.

DRAW

This document was downloaded from https://exoticnotes.com



NOTES for Secondary (S1 – S4)
https://exoticnotes.com/notes/secondary/o-level/

NOTES for Secondary (S5 – S6)
https://exoticnotes.com/notes/secondary/a-level/

PAPERS and Assessment items for Secondary (S1 – S6)
https://exoticnotes.com/papers/secondary/

Scenario Questions (with some Answers) (S1 – S6)
https://exoticnotes.com/scenario-questions

For New A level Curriculum (Notes, Assessment and Constructs, etc)
https://exoticnotes.com/new-a-level-curriculum

For New O level Curriculum (Notes, Scenarios, Papers, AOI, Syllabi, etc)
https://exoticnotes.com/new-o-level-curriculum