DOCUMENT RESUME

ED 315 321 SE 051 219

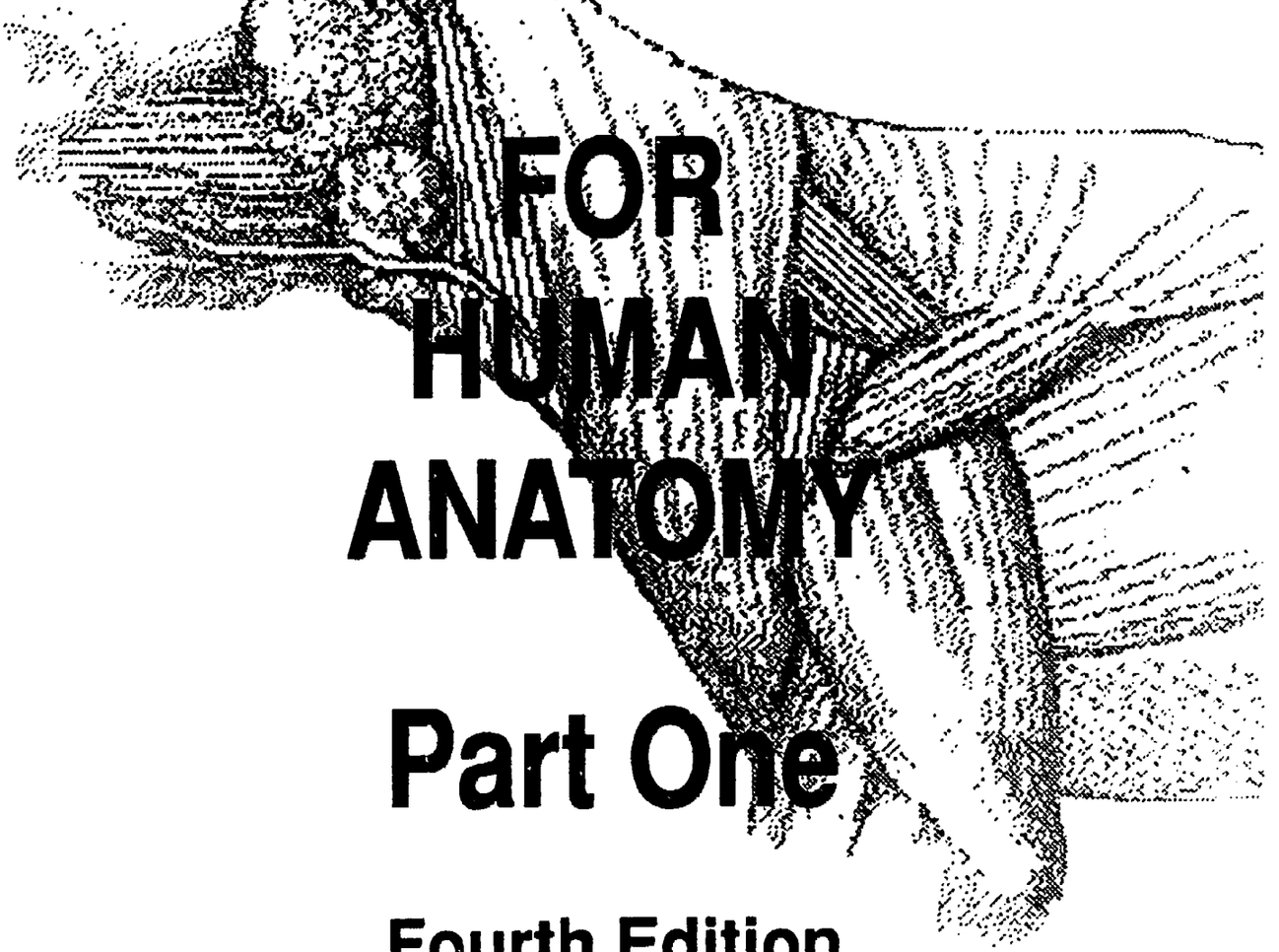
AUTHOR Conrey, Kathleen
TITLE Laboratory Instructions and Study Guide for Human Anatomy. Part One, Fourth Edition.
PUB DATE Sep 89
NOTE 91p.; For related documents, see SE 051 218-221. Black and white illustrations will not reproduce clearly.
AVAILABLE FROM Aramaki Design and Publications, 12077 Jefferson Blvd., Culver City, CA 90506 ($7.75).
PUB TYPE Guides - Classroom Use - Materials (For Learner, (051)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS *Anatomy; *Biological Sciences; *College Science; Higher Education; *Human Body; *Laboratory Procedures; Science Activities; Science Education; Secondary Education; Secondary School Science; Teaching Guides; Teaching Methods

ABSTRACT

During the process of studying the specific course content of human anatomy, students are being educated to expand their vocabulary, deal successfully with complex tasks, and use a specific way of thinking. This is the first volume in a set of laboratory instructions and study notes which are designed to accompany a lecture series in human anatomy. This volume includes investigations of the skeleton including bones and joints; studies of the musculature of the body; and studies of the nervous system including the central, autonomic, motor and sensory systems. General instructions and laboratory procedures are followed by illustrations of anatomical concepts using cat and sheep organs as dissection specimens. Appendices include anatomical checklists and a set of homework sheets to accompany the laboratory exercises. (CW)

LABORATORY INSTRUCTIONS AND STUDY GUIDE FOR HUMAN ANATOMY



Part One

Fourth Edition

by KATHLEEN CONREY

LABORATORY INSTRUCTIONS
AND STUDY GUIDE

FOR HUMAN ANATOMY

Part One
Fourth Edition

The author is a Professor of Natural Sciences at El Camino College. She holds a master's degree from the Department of Human Anatomy, University of California, San Francisco, and has been teaching human anatomy at the community college level since 1967.

by KATHLEEN CONREY

Aramaki Design & Publications
12077 Jefferson Boulevard, Culver City, California
(213) 822-9800

Fourth Edition, September, 1989

First edition and first printing 1982

Printed in the United States of America

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OSTEOLOGY LABS: GENERAL INSTRUCTIONS

DO THE LAB EXERCISES

Each scheduled lab period concentrates on a particular section of the skeleton. Lab exercises that are specific to the bones for that days assignment are provided.

STUDY SPECIMENS

You have available for your use a bone box containing one half of a disarticulated human skeleton, either right or left, including half of a skull, and parts of the vertebral column. There will also be one or perhaps two articulated human skeletons in the classroom that you may use for reference. When we study the skull you will beproided with whole skulls, disarticulated skulls and fetal skulls.

USE REFERENCE BOOKS

While looking at the bone read its description in your textbook and use many different pictures of the bone from various reference books. Anatomy is a 3-dimensional visual subject and you need to engage fully in the discovery process during lab.

USE THE CHECKLISTS

Turn to the osteology checklists in the appendix. Study the articulated and disarticulated skeletons and skulls, and learn to distinguish **all** the features included on the checklists. The checklists are like a contract; if a feature of the bone is not on your checklist you don't have to remember it.

DISTINGUISH RIGHT / LEFT

• You must be able to distinguish right from left on all the bones of the disarticulated skeleton (except for the smaller bones of the face, and the bones of the hand and foot). To do this, use the following 3 steps (in any order). Only after applying all three steps can you decide for sure between right and left.

STEPS:

1. Distinguish medial from lateral.

2. Distinguish superior from inferior.

3. Distinguish anterior from posterior.

STUDY THE X-RAYS

Look at the X-Rays on display at the front of the room. The view box has only so much room for display at any one time. You are expected to shuffle through the X-Rays on the view box, taking X-Rays down and put new ones up until you have looked through them all. Most of the X-Rays will have labeled feature and many textbooks and reference books have pictures of X-Rays. A good way to understand what you are looking at is to bring the actual bone to the view box and sight along the bone as you study the X-Ray. Imagine that you have X-Ray eyes and can see both sides of the bone at once.

BONE COMPOSITION

• Adult bone is composed of mineralized osteoid tissue. Both components of bone together are stronger than either component alone.

• Examine the chicken bones that have been soaked in vinegar. The acid dissolves the minerals in the bone, leaving only osteoid tissue. Describe the bone. Can you bend it?

• Next examine the chicken bones that have been baked. The heat has carbonized the osteoid tissue, leaving only the minerals. Will this bone bend?

Bones of Pectoral Girdle & Upper Limb

1. Go through the checklist on page 46. Carefully observe the features of the bones until you can easily recognize whether the bone comes from the right or the left side of the body. *Make sure you practice this sufficiently, the more rehersals the better.*

2. Palpate your own clavicle and notice that it's superior surface is covered by skin only (no muscle attachments). *The pull of muscles creates rough markings on bones, therefore the superior surface of the clavicle is relatively smooth and unmarked compared to the rougher inferior surface.*

3. To distinguish between a right and a left clavicle, hold the bone as here directed, matching it to your own body after each step.

a. The thinner flattened end of the bone is the lateral end. Hold it flat.

b. Hold the side with rough markings on both ends down.

c. Hold the medial end of the bone so that it bulges forward.

4. *Look at the X-Ray* of a broken clavicle. The clavicle serves as a strut holding the shoulder in place. A fracture of the clavicle is one of the most common skeletal injuries, and results from a direct fall on the shoulder or from a fall on the elbow with the shoulder abducted.

5. Roll the ulnar nerve against the posterior surface of the medial epicondyle of your humerus with your fingers. This is the "funny bone", so called because the ulnar nerve is found just below the skin, between the skin and the bone.

6. Hold a matching radius and ulna against one another and carefully observe how they articulate at their proximal and distal ends. *It should now be clear to you why the "ulnar notch" belongs to the radius, and the "radial notch" belongs to the ulna.*

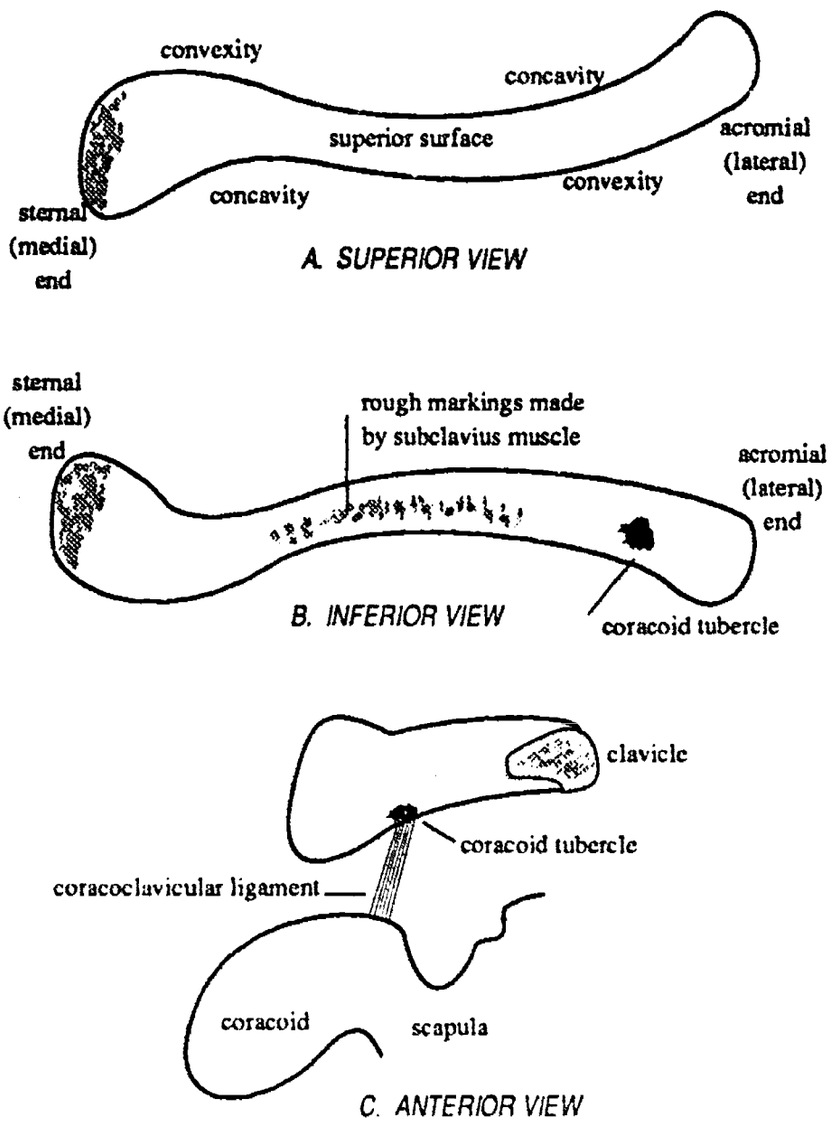


Fig. 1- Three Views of the Right Clavicle

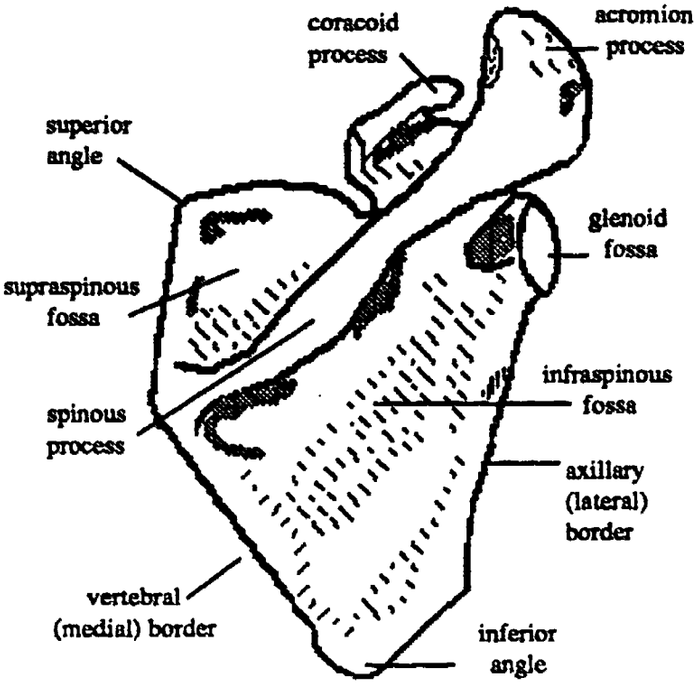


Fig. 2- Posterior View of Right Scapula

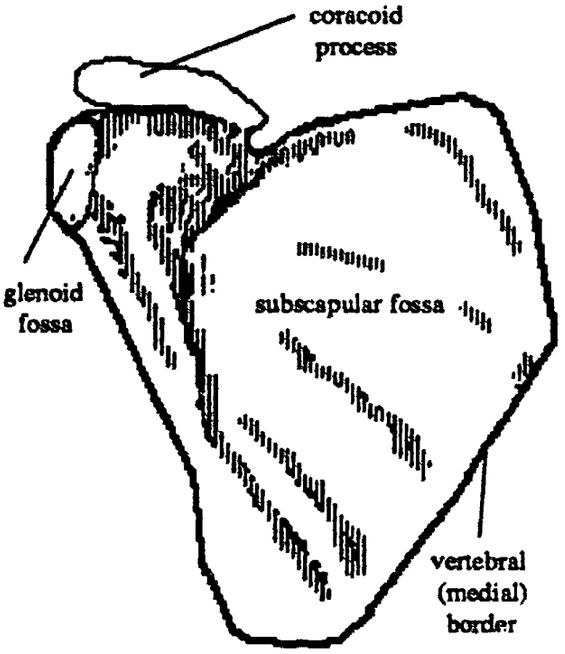


Fig. 3- Anterior View of Right Scapula

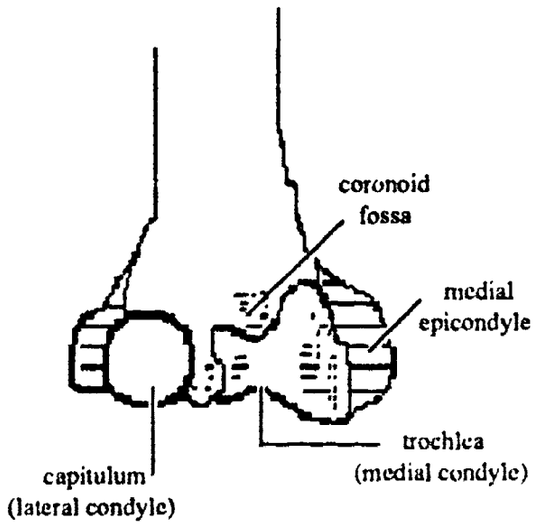


Fig. 4- Distal End of Right Humerus anterior view

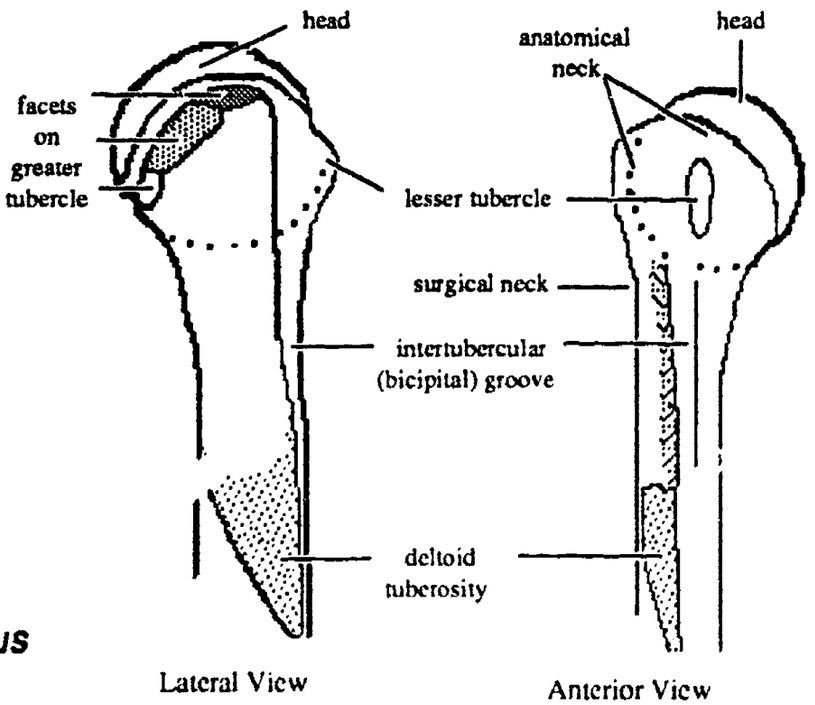


Fig. 5- Proximal End of Right Humerus

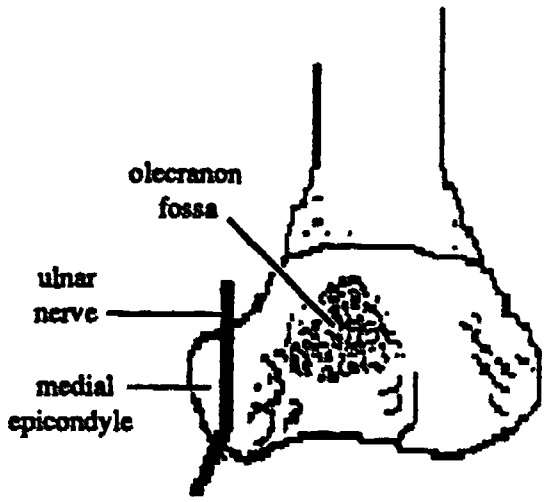


Fig. 6- Distal End of Right Humerus posterior view

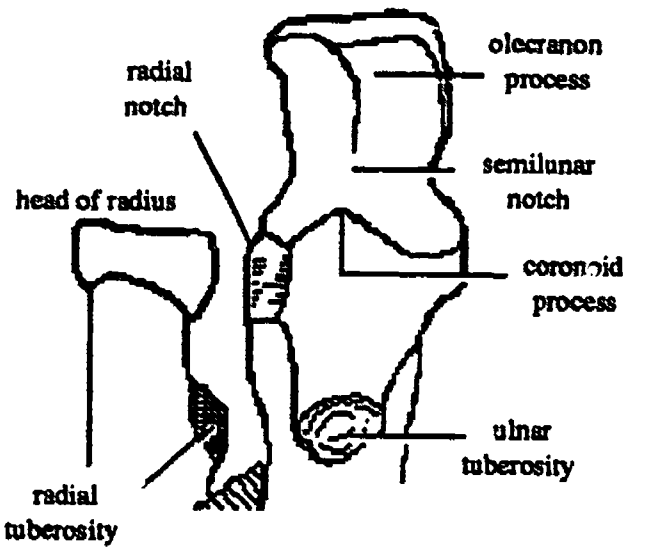


Fig. 7- Anterior View of Proximal Radius and Ulna

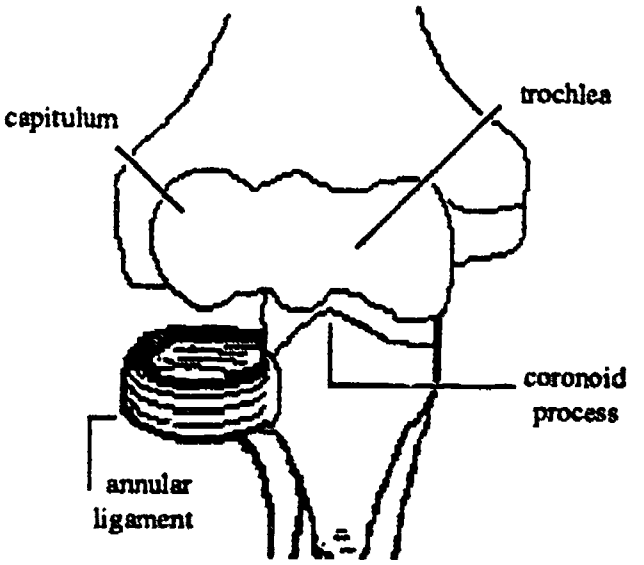


Fig. 8- Anterior view of Humerus and Ulna showing annular ligament for head of radius

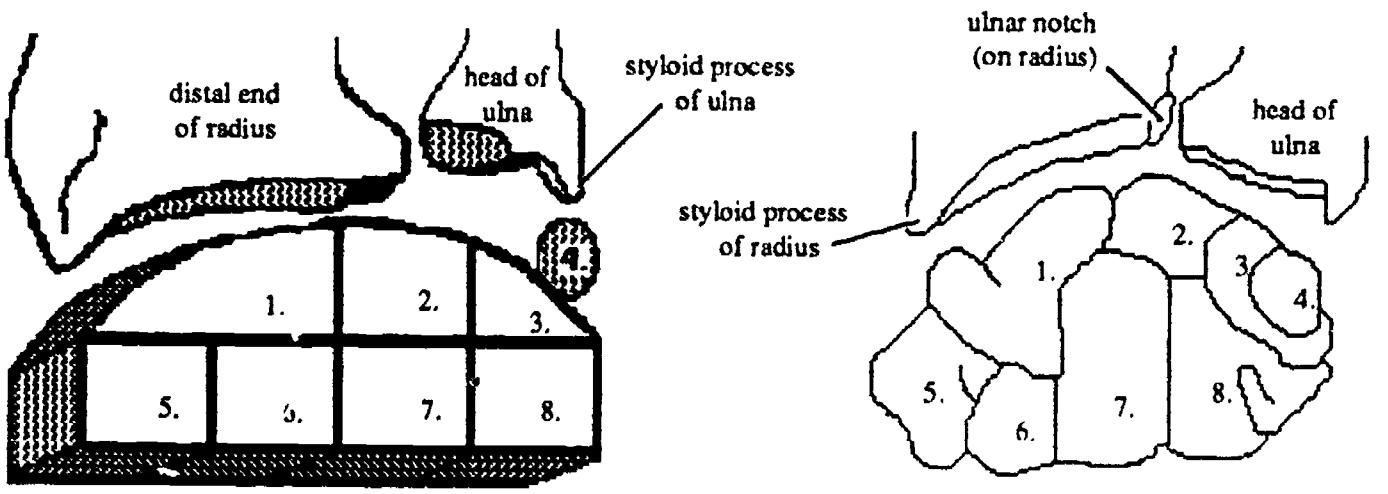


Fig. 9- Anterior View of Right Carpus

KEY: 1. navicular 2. lunate 3. triangular 4. pisiform
5. greater multangular 6. lesser multangular 7. capitate 8. hamate

Bones of Pelvic Girdle and Lower Limb

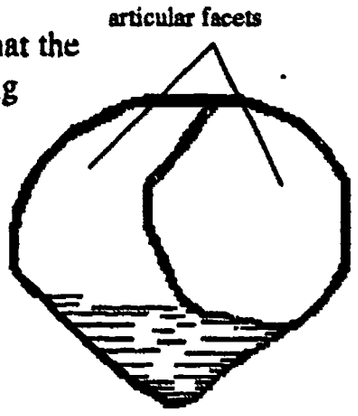
1. Go through the checklist on page 47. Carefully observe the features of the bones until you can easily recognize whether the bone comes from the right or the left side of the body. M ke sure you practice this sufficiently, the more rehérsals the better.

2. To distinguish between a right and a left patella:

a. Hold it so that the apex is pointing away from your body and the articular surface is down

b. Place it on the table.

c. The side to which it falls, is the side to which it belongs.



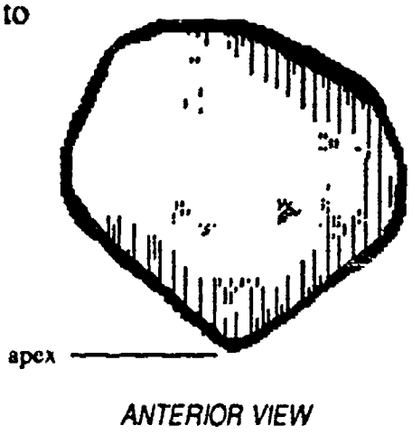


Fig.10.- Two Views of Right Patella

3. It is difficult to distinguish between a right and left fibula, chiefly because it is difficult to distinguish anterior from posterior. Carefully observe the articulated skeleton then practice with the disarticulated fibula.

4. While observing the articulated pelvic girdle, locate the false pelvis and the true pelvis.

5. Carefully study **figures 11 & 12** showing the approximate lines of fusion for the three bones of the innominate.

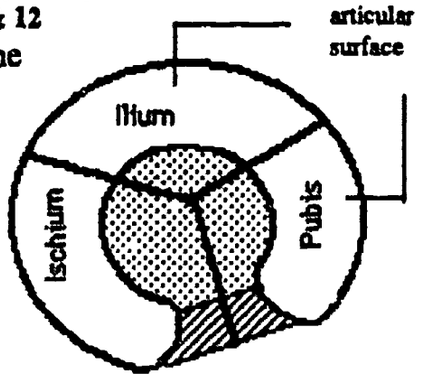


Fig. 11- Interior of Acetabulum showing lines of fusion

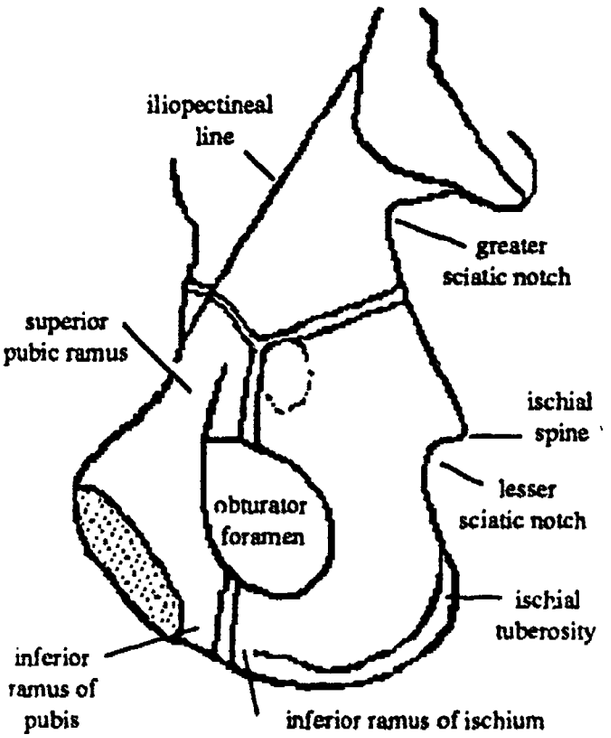


Fig. 12- Right Innominate Bone medial view showing lines of fusion

These lines of fusion ossify between ages 20-25.

6. To distinguish a male pelvic girdle from that of a female compare the subpubic angles of each to the angle made by spreading your index finger and middle finger as far apart as you can without straining. The angle between your two fingers will match the subpubic angle of a male skeleton. See **figure 13.**

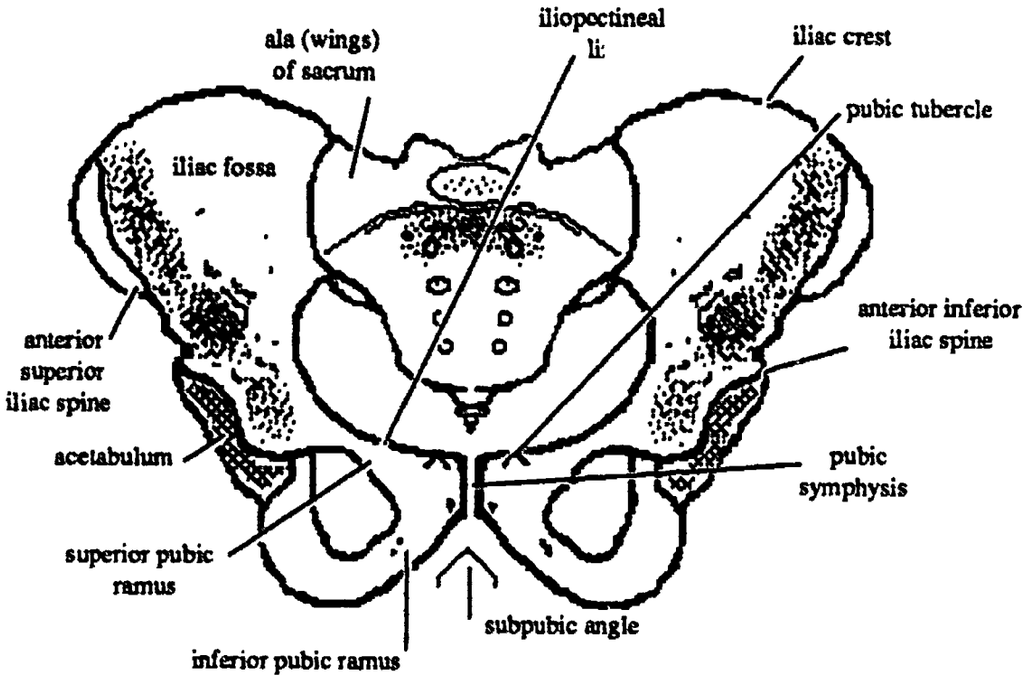


Fig. 13- Articulated Pelvic Glirdle, Anterior View

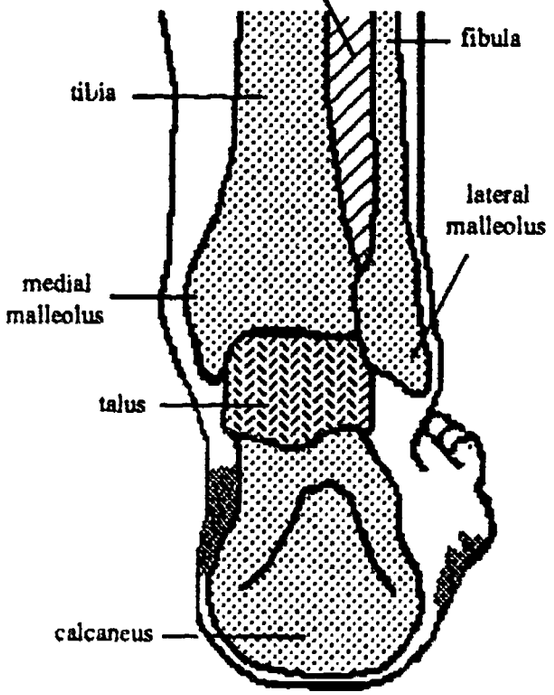


Fig. 14- Posterior View of Ankle

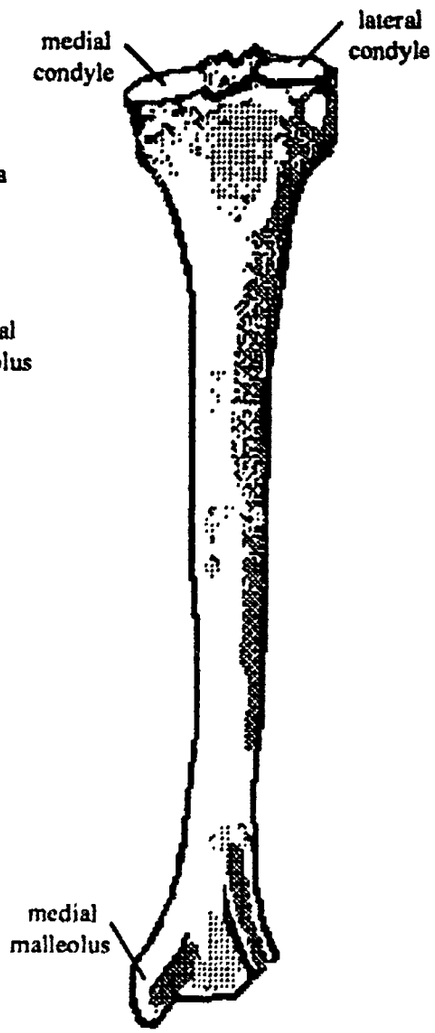


Fig. 15– Right Tibia posterior view

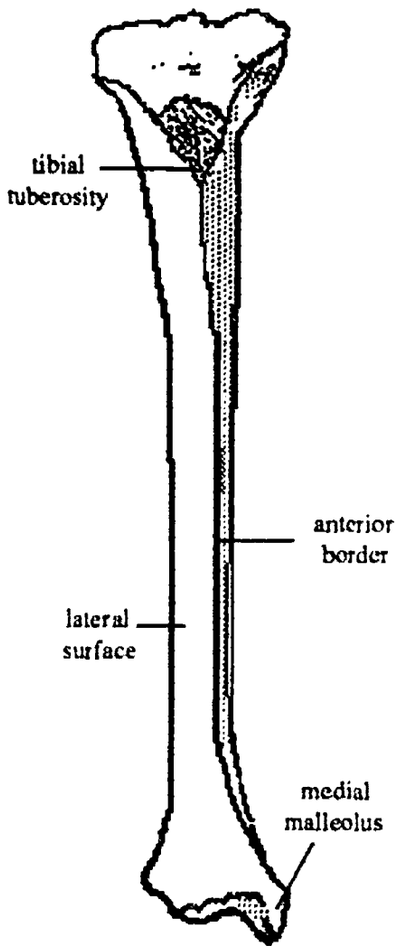


Fig. 16– Right Tibia anterior view

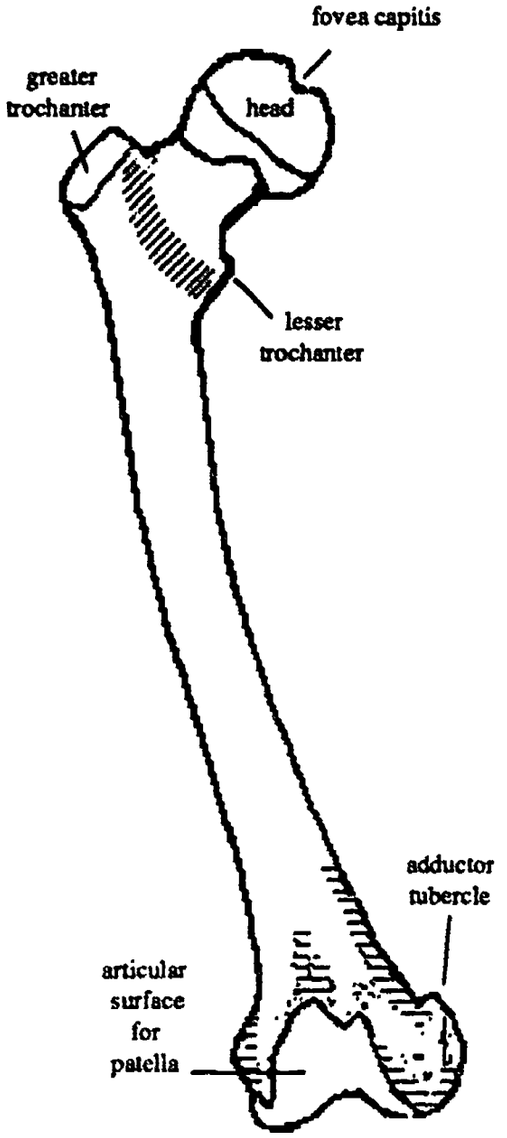


Fig. 17- Right Femur anterior view

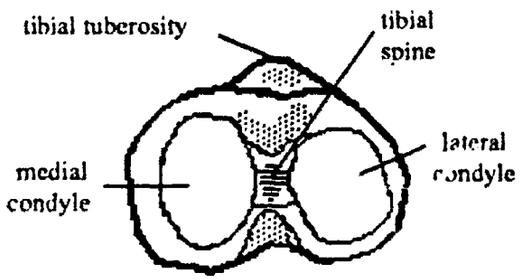


Fig. 18- Superior View of Tibia

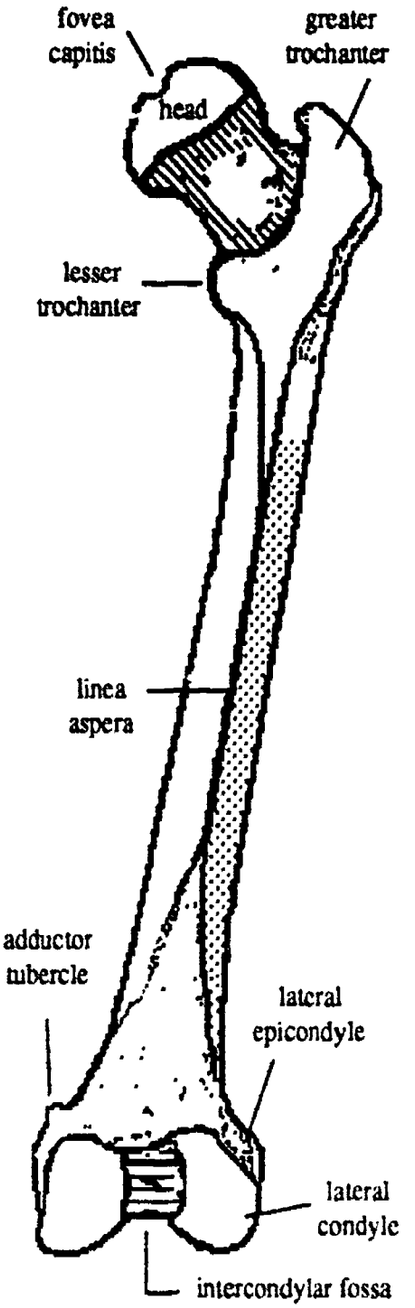


Fig. 19- Right Femur posterior view

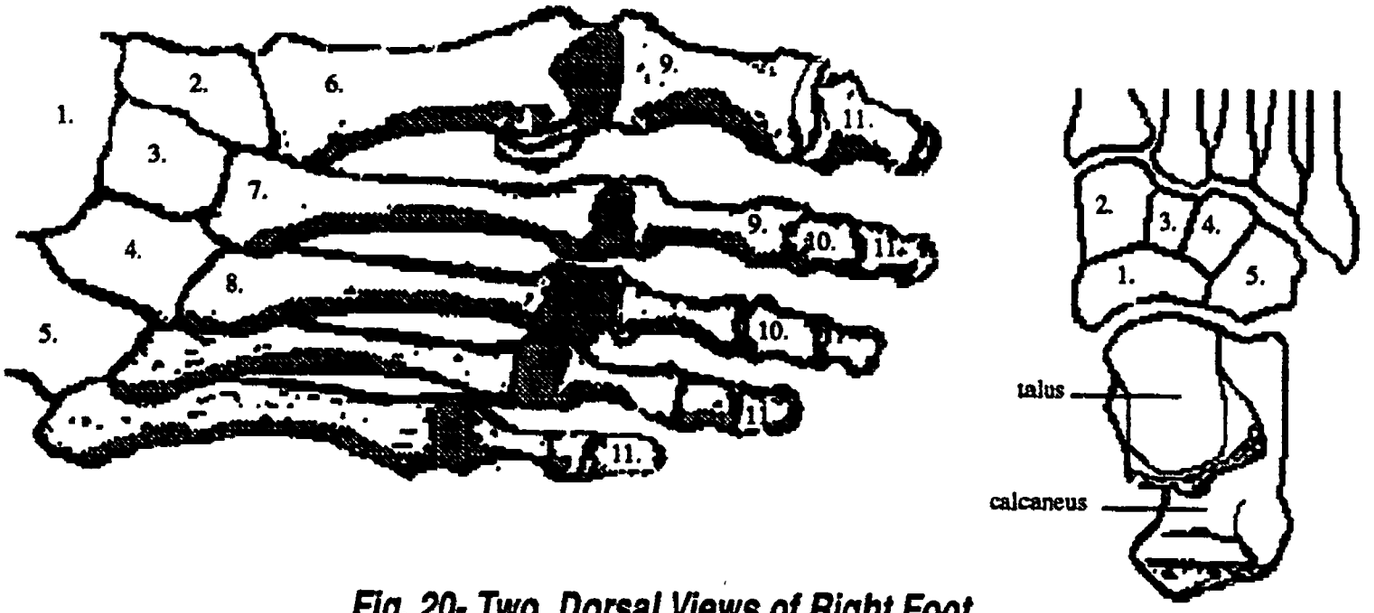


Fig. 20- Two Dorsal Views of Right Foot

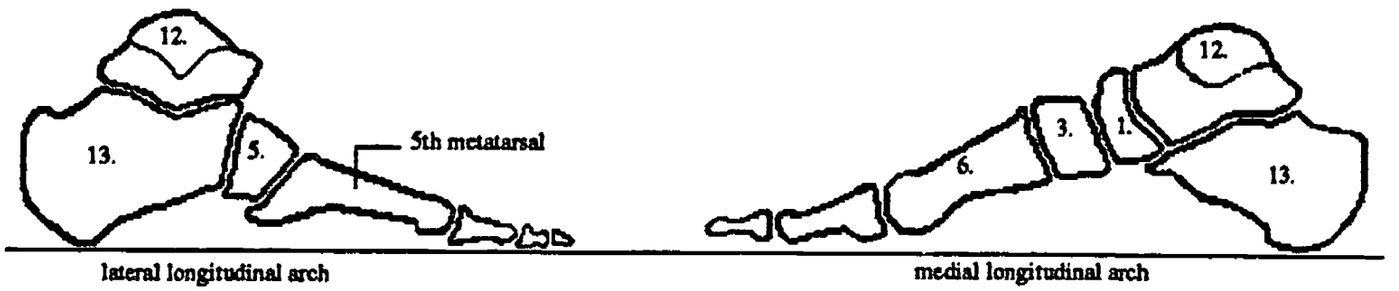


Fig. 21- Medial View and Lateral View of Right Foot

Key to Figures 20 and 21

1. navicular
2. medial cuneiform
3. middle cuneiform
4. lateral cuneiform
5. cuboid
6. 1st metatarsal
7. 2nd metatarsal
8. 3rd metatarsal
9. proximal phalanx
10. middle phalanx
11. distal phalanx
12. talus
13. calcaneus

Bones of the Axial Skeleton

1. Carefully observe the parts of a typical vertebra. The vertebra of choice for this exercise is a midthoraic vertebra.

3. On the articulated skeleton, carefully observe the differences between the upper, middle, and lower thoracic vertebrae. If handed a single thoracic vertebra be able to estimatewhich area of the thoracic region it comes from. Practice this skill.

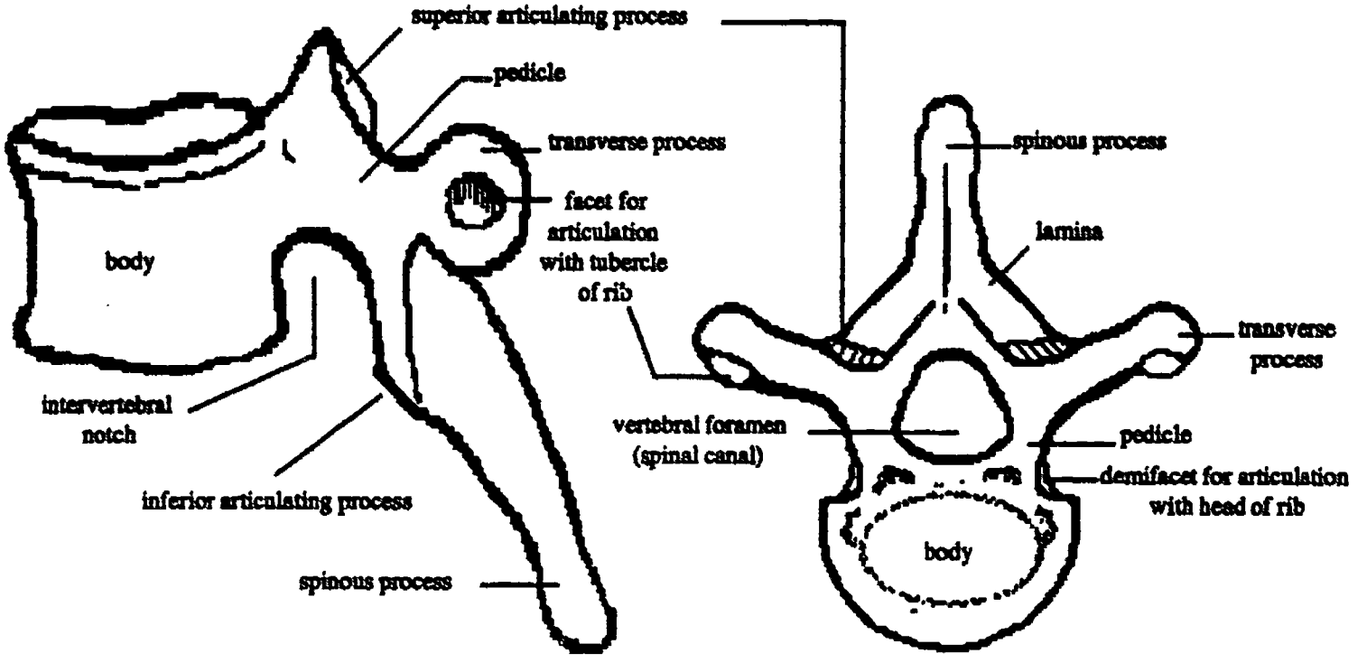


Fig. 22- Lateral and Superior Views of a Typical Midthoracic Vertebra

2. Go through the checklist on page 48. Observe the regional features of the vertebrae very carefully so that when challenged you will be able to classify any disarticulated vertebra with respect to whether it is a cervical, thoracic, or lumbar vertebra. Make sure you practice this skill sufficiently with the disarticulated vertebrae.

4. Be able to recognize Atlas and Axis as well as C_7 and T_{12}. Look for transitional features on these latter two; each one has some of the features of the region above, and some of the features of the region below.

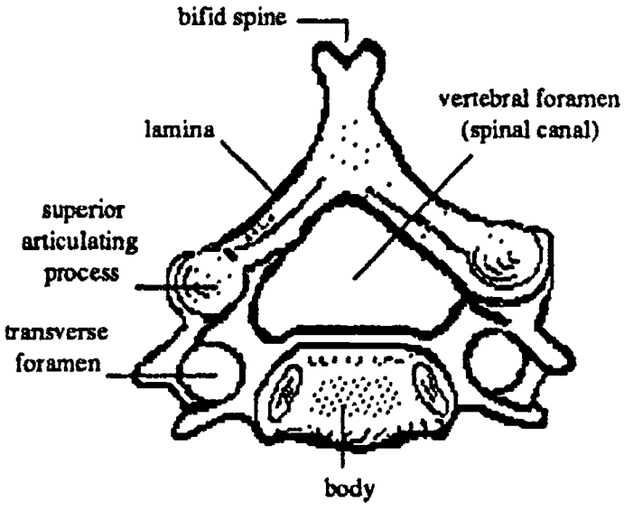


Fig. 23.- Superior View of Cervical Vertebra

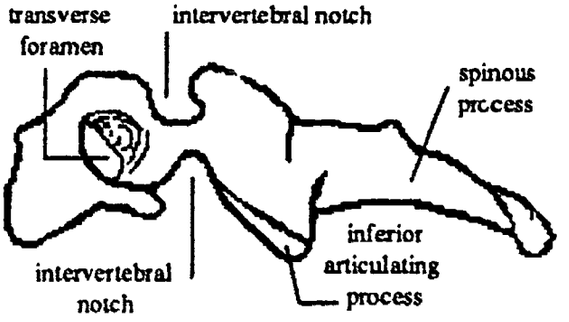


Fig. 24- Vertebra Prominens (C7)

Lateral view showing long spinous process.

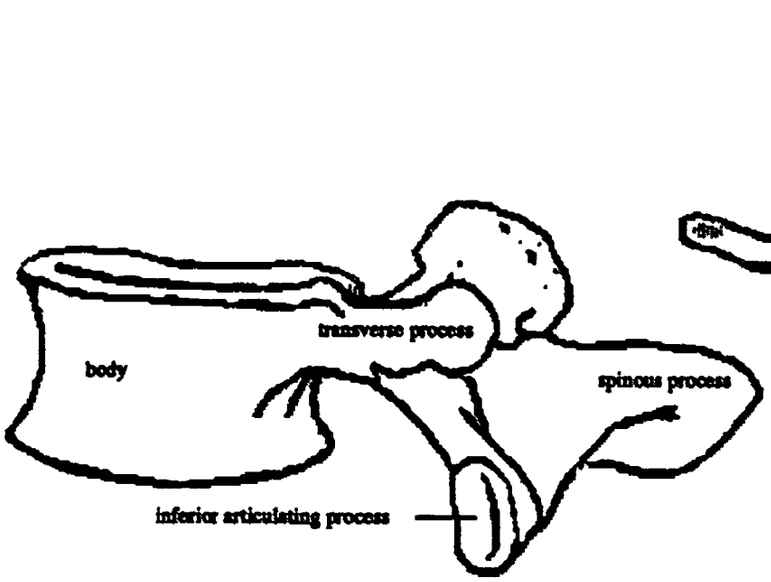


Fig. 25- Lumbar Vertebra, Lateral View

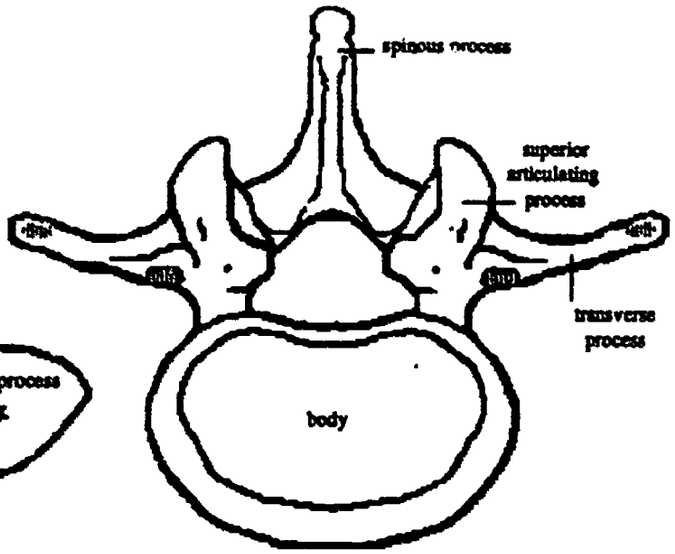


Fig. 26- Lumbar Vertebra, SuperiorView

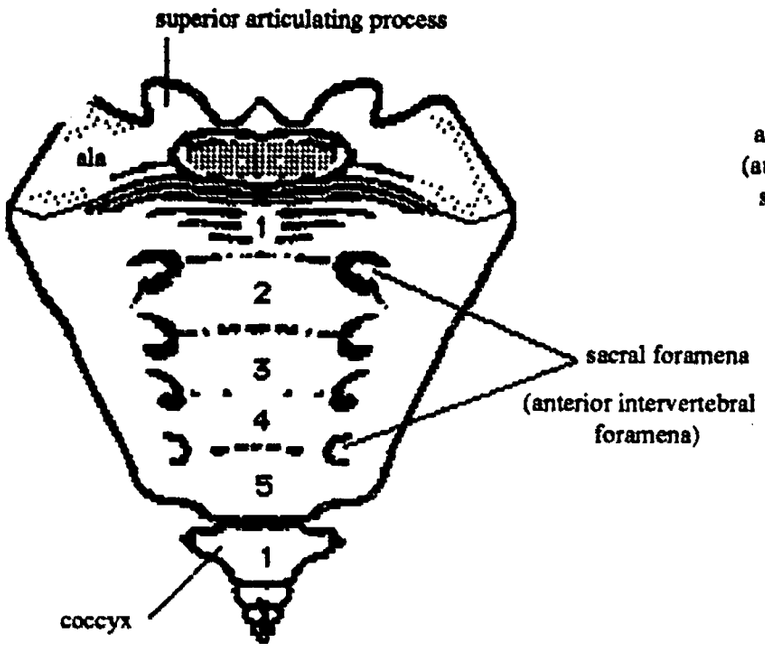


Fig. 27- Anterior View of Sacrum

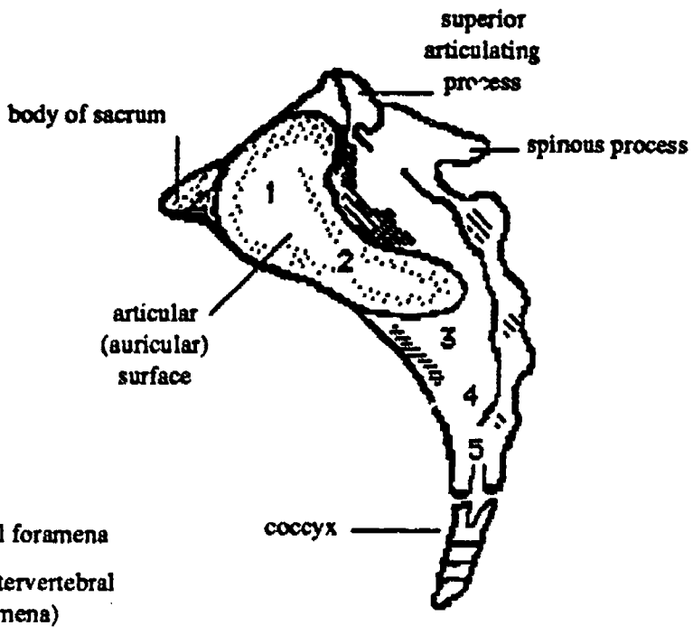


Fig. 28- Lateral View of Sacrum

5. Look at the X-Rays of the vertebral column, including those that show examples of scoliosis and lordosis.

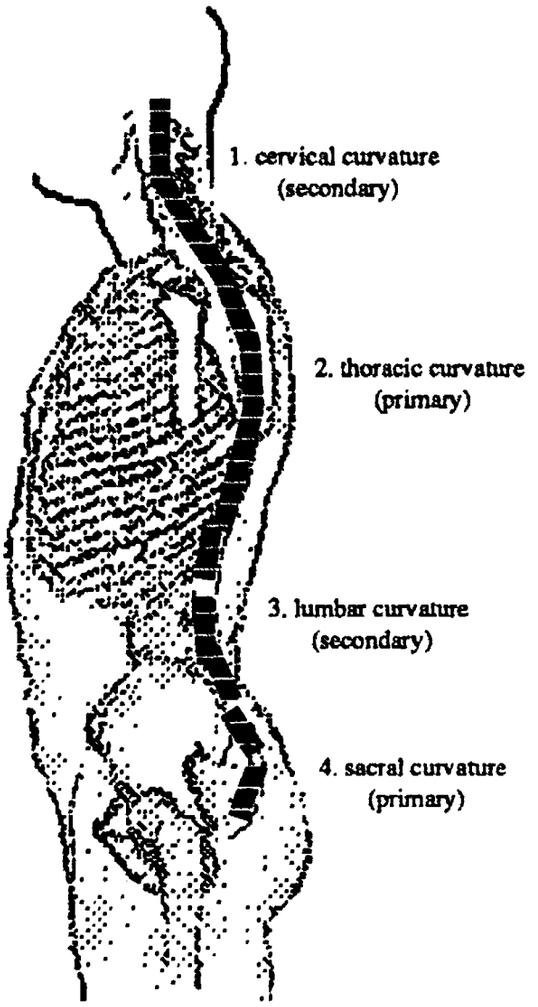


Fig. 29- Lateral View of Spine Showing Normal Adult Spinal Curvatures

An exaggerated thoracic curvature is called KYPHOSIS.
An exaggerated lumbar curvature is called LORDOSIS.

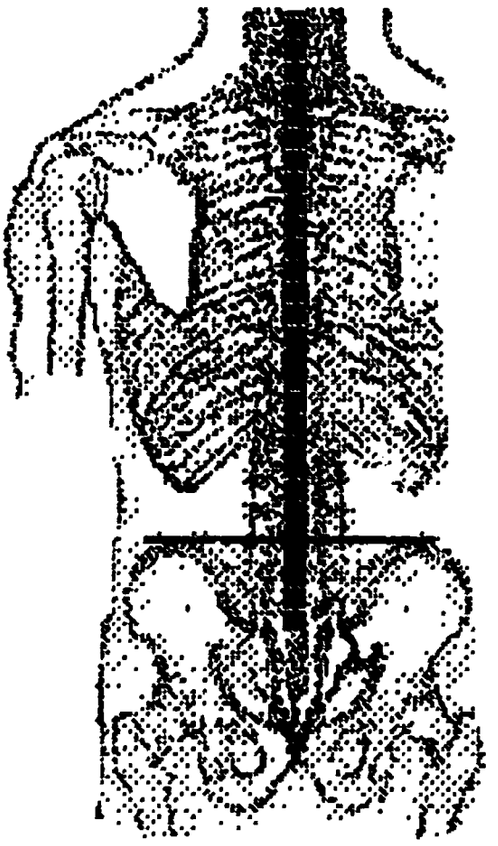


Fig. 30- Anterior-Posterior View of Spine Showing Normal Vertical Alignment

Lateral deviation from the normal A-P axis is called SCOLIOSIS.

6. Carefully observe the rib cage. How many different vertebrae are touched by one rib in the cervical region? In the thoracic region? In the lumbar region? How many intercostal spaces are there? How many floating ribs are there? How many false ribs?

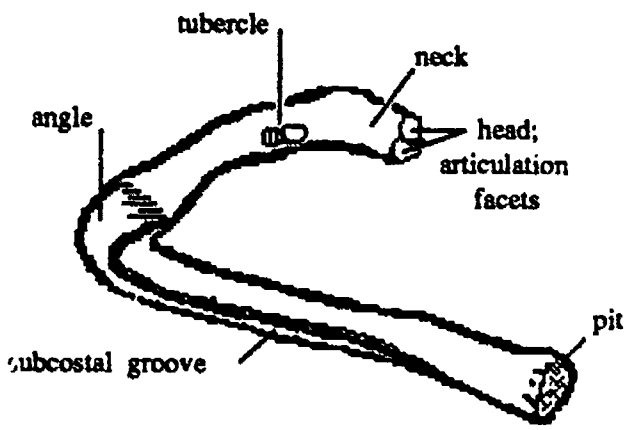


Fig. 31- Left Ninth Rib posterior inferior view

7. Observe the sternum. Locate the sternal angle and the jugular notch. Notice that the sternal angle is a reliable landmark for the second rib, and the jugular notch is level with the second thoracic vertebra.

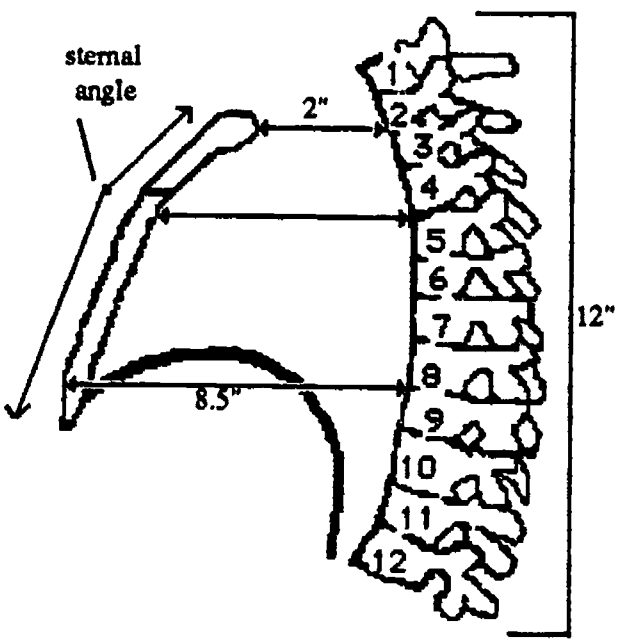


Fig. 33- Bony Thorax, Midsagittal View showing levels and lengths

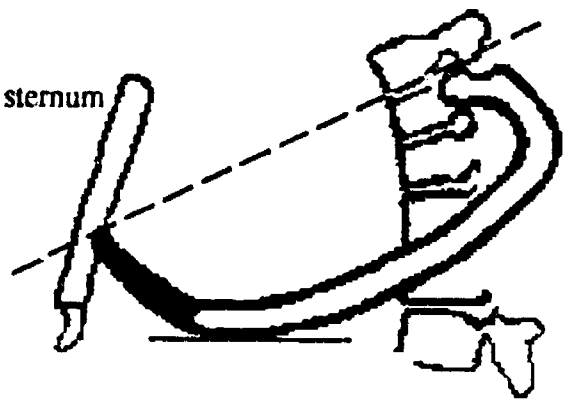


Fig. 32- Lateral View of Rib <u>In Situ</u>

Sternal end of rib lies at lower level than vertebral end. Middle of costal arch lies at a lower level than either end of the rib.

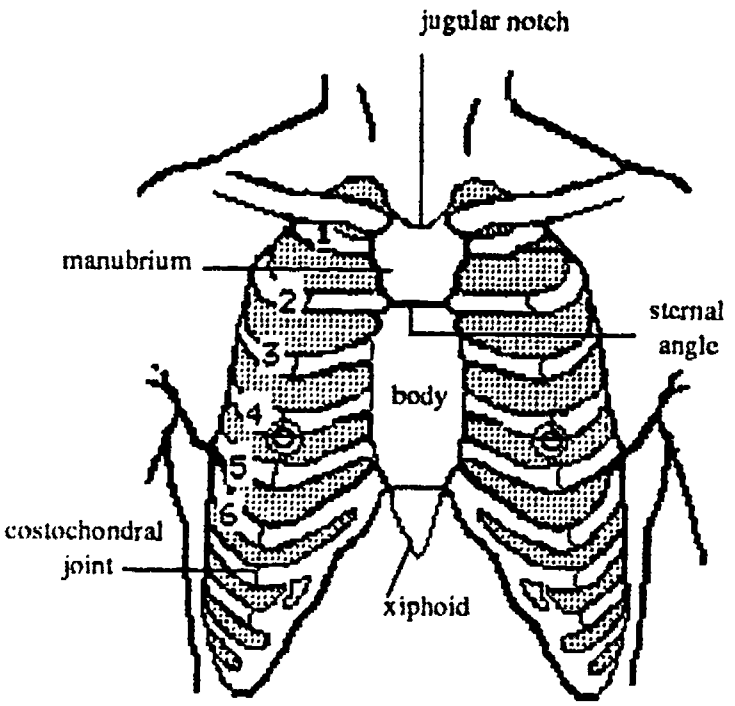


Fig. 34- Bony Thorax, Anterior View showing levels and landmarks

Bones of the Skull

1. It is most important to carefully study the checklist for the skull, pages 49 - 50.

Key to Figs. 35-36

1. sphenoid, greater wing
2. nasal
3. coronal suture
4. squamosal suture
5. lambdoidal suture
6. zygomatic portion of temporal bone
7. external auditory meatus
8. mastoid portion of temporal bone
9. styloid process of temporal bone
10. mental foramen of mandible
11. alveolar margins of mandible
12. sagittal suture
13. external occipital protuberance
14. superior nuchal line
15. inferior nuchal line
16. occipital crest

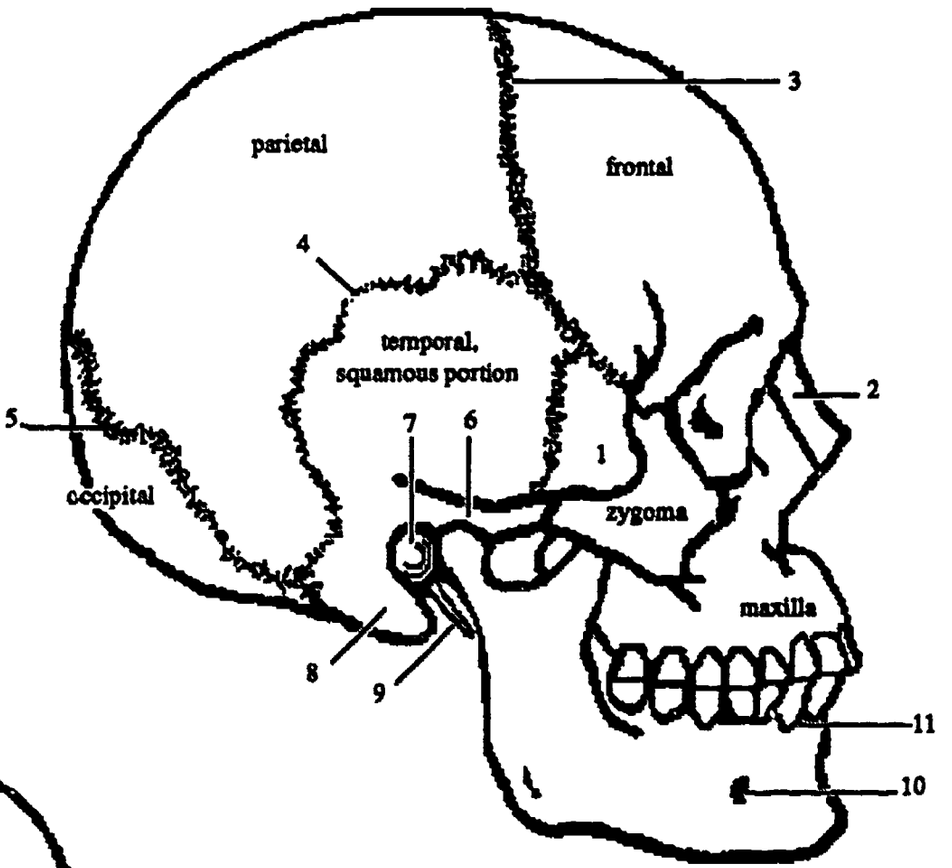


Fig. 35- Lateral View of Skull

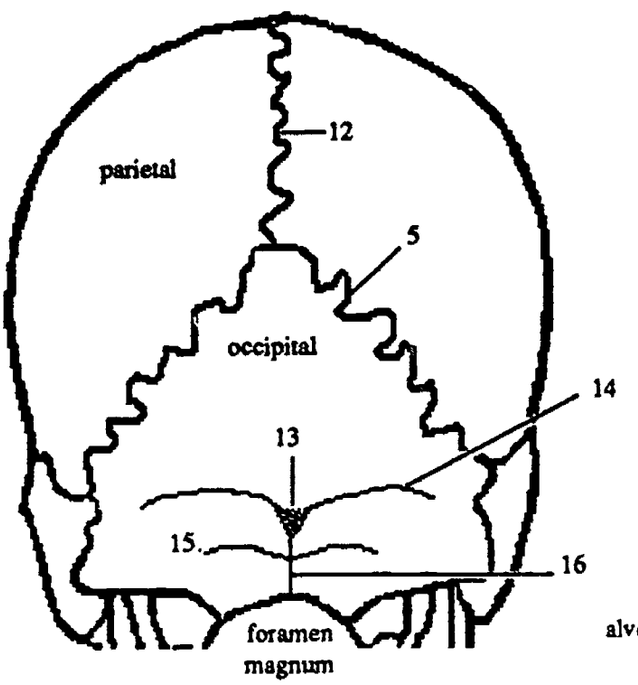


Fig. 36- Posterior View of Skull

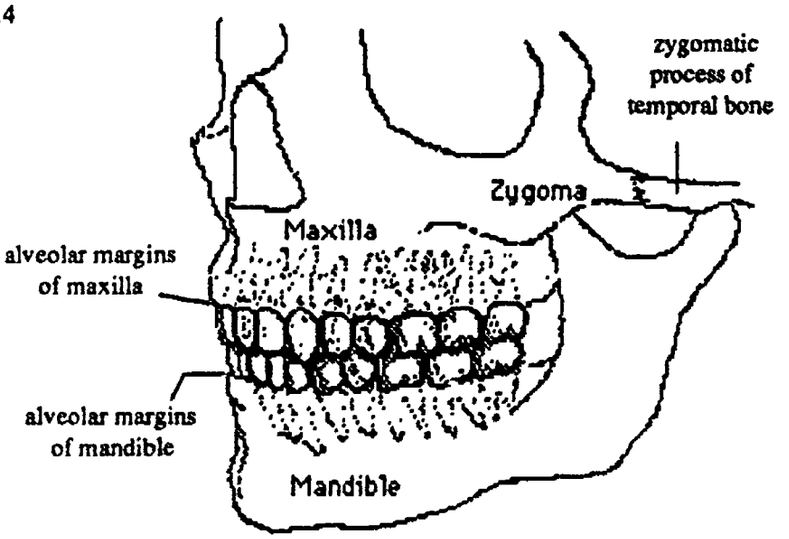


Fig. 37- View Showing Teeth In Situ

2. While looking at the interior of the articulated human skull learn to associate each foramen with the structures that use it, as given in the following table:

Fig. 38- Major Foramena of the Skull & the Structures That Use Them

FORAMEN	USED BY :
Cribriform Plate	Cranial Nerve I olfactory
Optic Canal	Cranial Nerve II optic
Superior Orbital Fissure	Cranial Nerves III, IV, part of V & VI occulomotor, trochlear, trigeminal, abducens
Foramen Rotundum Foramen Ovale Foramen Spinosum	Cranial Nerve V trigeminal
Internal Auditory Meatus	Cranial Nerves VII & VIII facial and auditory
Jugular Foramen	Cranial Nerves IX, X, XI, & Jugular Vein glossopharyngeal, vagus, spinal accessory
Hypoglossal Canal	Cranial Nerve XII hypoglossal
Carotid Foramen Carotid Canal Foramen Lacerum	Carotid Artery

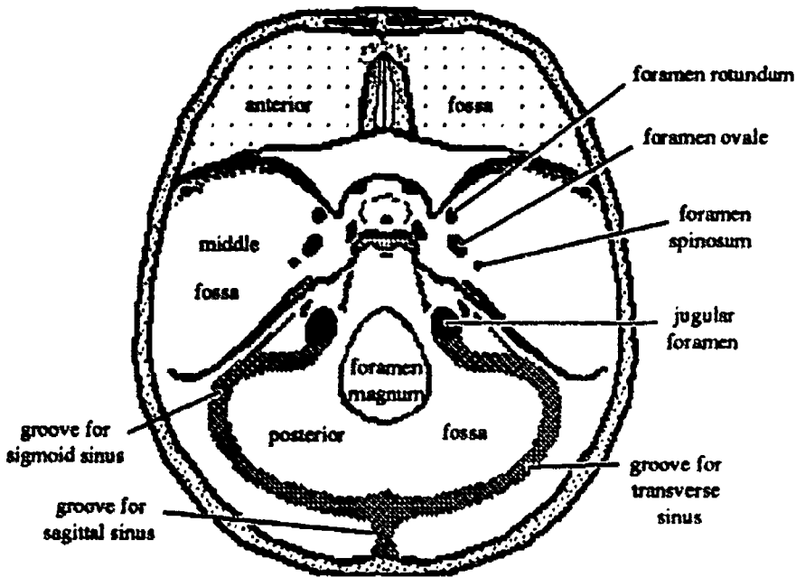


Fig. 39- Interior of the Skull Showing the Main Fossae

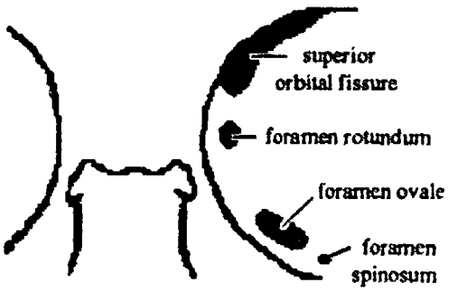


Fig. 40- Crescemt Shaped Chain of Foramina in Greater Wing of Sphenoid

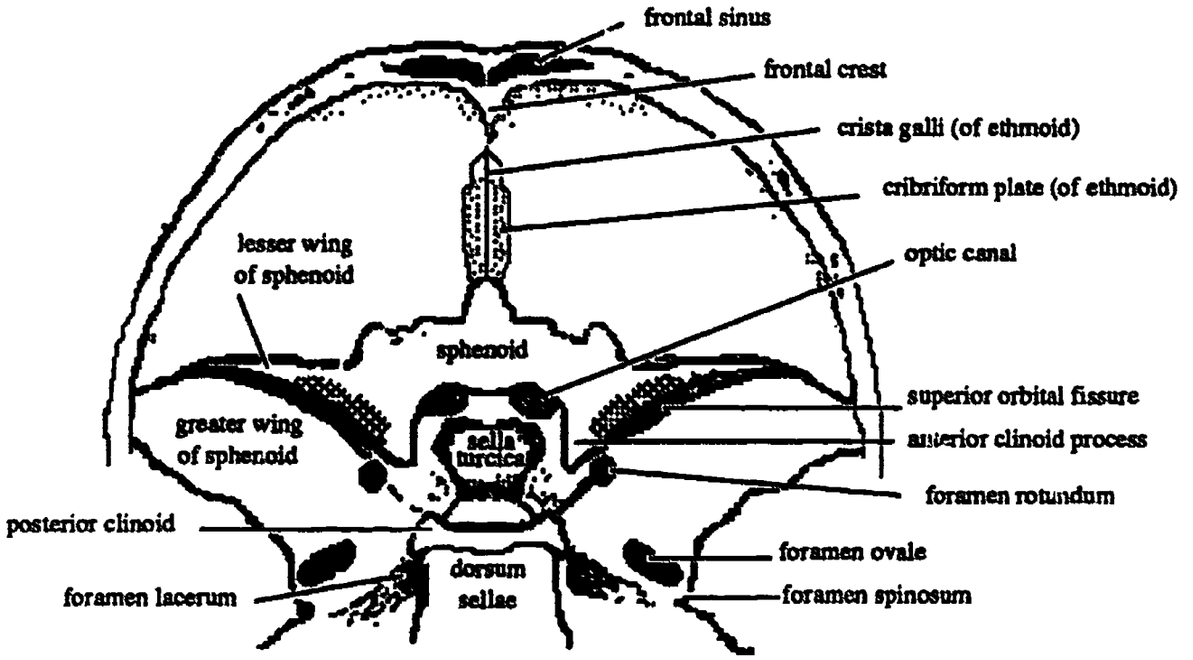


Fig. 41- Details of the Anterior and Middle Fossae of the Skull

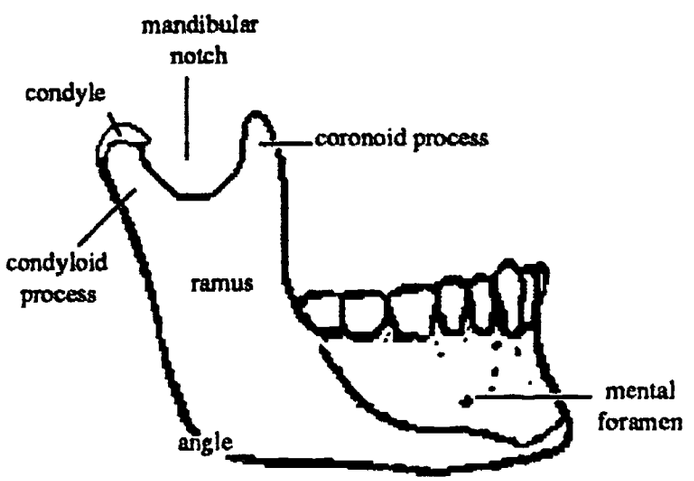


Fig. 42- Lateral View of Mandible

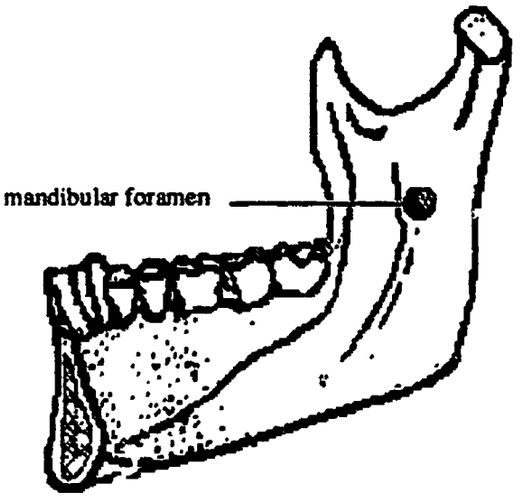


Fig. 43- MedialView of Mandible

3. The following exercise is designed to draw your attention to special features of the articulated skull that involve more than one bone, and hence are not part of the regular checklist. Fill in the blanks by observation and with the help of textbooks. Note that a bone is counted twice if left and right are both involved. See the second example.

Fig. 44- Parts of the Skull that Involve More Than One Bone

Nasal Septum	2 bones : perpendicular plate of ethmoid & vomer
Hard Palate	4 bones: palatine x 2 ; maxilla x 2 (palatine process of the maxilla)
Foramen Lacerum	3 bones:
Jugular Foramen	2 bones:
Foramen Spinosum	usually 2 bones:
Zygomatic Arch	2 bones:
Inferior Orbital Fissure	5 bones:
Orbital Fossa	7 bones:
Nasal Cavity	13 bones:
Choanae	5 bones:

Key to Fig. 45

1. frontal	5. ethmoid
2. zygoma	6. sphenoif
3. maxilla	7. superior orbital fissure
4. lacrimal	8. inferior orbital fissure

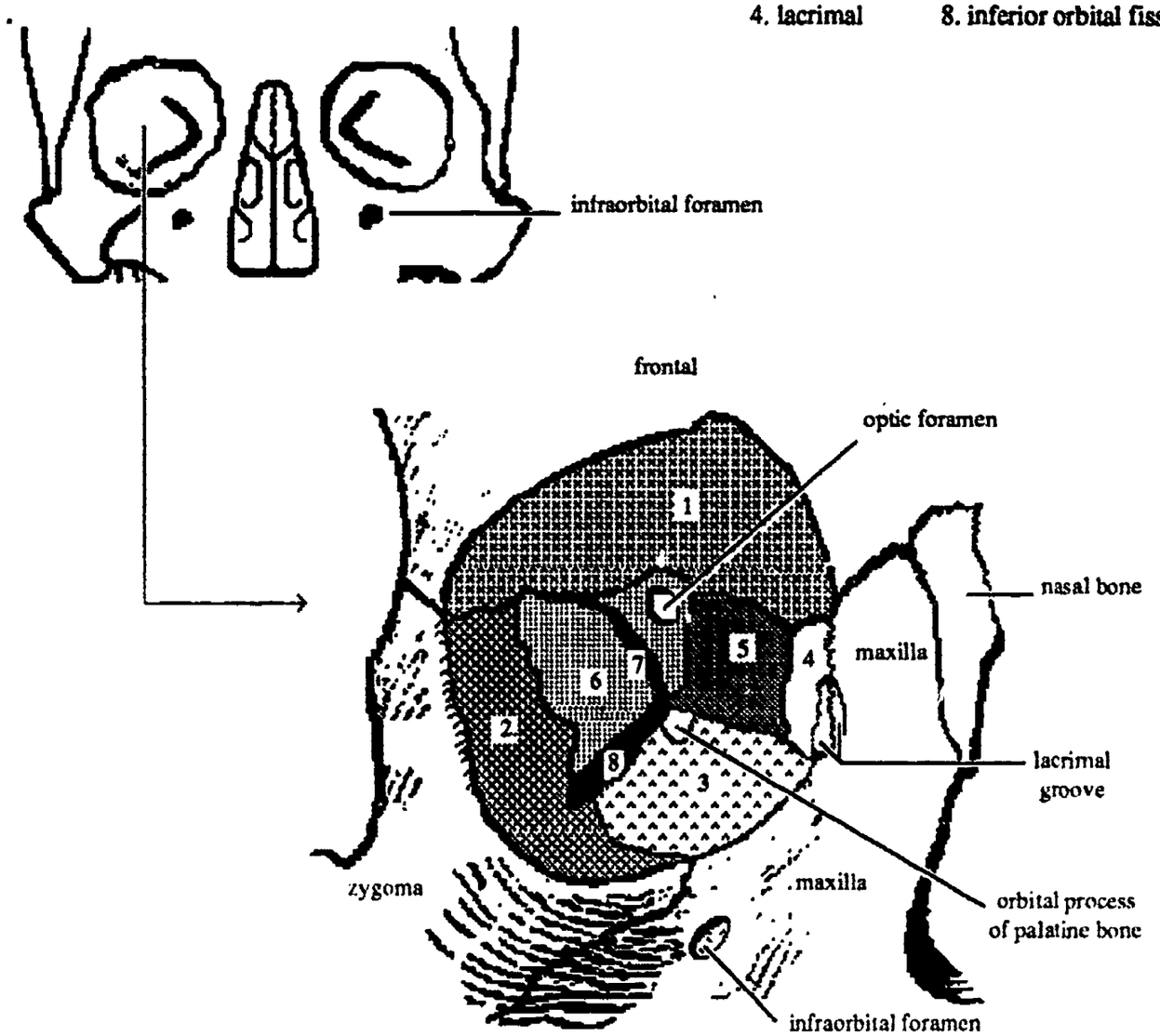


Fig. 45- Details of the Right Orbital Fossa, Anterior View

Joints and Ligaments:

1. Use the articulated skeleton to identify and observe the joints mentioned in your arthrology checklist p. 51. While observing the joint keep in mind its classification in terms of degree of movement.

2. Locate the following specific joint features on whatever illustrations are available to you. Some illustrations are provided in the book of lecture notes, but you will want to consult other reference sources as well.

annular ligament
radial collateral ligament
ulnar collateral ligament
interosseous membrane
tibial collateral ligament
fibular collateral ligament
capsular ligament of the knee
medial meniscus
lateral meniscus
anterior cruciate ligament
posterior cruciate ligament
patellar ligament
anterior iliofemoral ligaments
sacrospinous ligament
sacrotuberous ligament
sacroiliac ligaments

3. Examine the demonstration specimen of a cow's knee joint which has been obtained from a local butcher shop, and dissected by your instructor. Observe as many of the following features as the specimen permits:

compact bone
spongy bone
yellow bone marrow
red bone marrow
epiphyseal plates
femoral condyles
articular cartilage
medial and lateral menisci
anterior cruciate ligament
posterior cruciate ligament
patellar ligament
collateral ligaments
capsular ligament
synovial membrane
synovial fluid

Skinning The Cat

PRELIMINARIES

• First determine the sex of your specimen for yourself. Do not rely on the sex determination supposedly made by the biological supply house. They seem to be wrong about 50% of the time.

• Carefully follow the directions given below for removing the entire skin in one piece. The removed whole skin will be used (like an overcoat) to wrap the cat in for storage. The mammary glands and the muscle of the skin itself (*cutaneous maximus* and *platysma*) should come off with the skin since they are not attached to the skeleton. (They do however attach to the superficial muscles in the axillary and jaw regions.

AREAS WHERE SPECIAL CAUTION IS NEEDED:

1. When removing the skin in the chest region be careful not to cut or tear the thin *xiphihumeralis* muscle. It is best to pull the skin from anterior to posterior in this area.

2. In the axillary region the *cutaneous maximus* muscle interdigitates with the edges of the *latissimus dorsi* and the *pectoralis* muscles. This tends to make the anatomy of the axillary region very confusing because bits of *cutaneous maximus* may be obscuring the underlying muscles. The solution to this problem is to carefully peel away any remaining *cutaneous maximus* until the underlying muscle grain is visible and the *latissimus* and *pectoral* muscles are positively identified.

3. On the forelimb, crossing the front of the elbow joint is an extremely narrow and thin straplike muscle, the *brachioradialis*. Watch for it when removing the skin. It stands out from the surface of the arm and sometimes adheres to the skin and is torn in the process of removing the skin.

4. In the hindlimb and tail region leave an apron of skin around the genital area.

5. In the inguinal region you will encounter large fat deposits. These masses of fat can be removed after the skin is off. If your cat is a male, first locate the paired spermatic cords in the inguinal region and take care not to cut them when removing the skin and fat in this area.

6. After the skin has been removed, the specimen is perpetually at risk of drying out. It is difficult or impossible to make a good dissection on dried out tissue. During the lab period, cover the cat with the removed skin (when not actually dissecting.) When bagging the cat for storage first wrap it in the removed skin. Check the plastic storage bag for holes, and tie the mouth of the bag tightly with string. These precautions will help to keep the specimen moist.

PROCEDURE:

1. Begin with the cat in the supine position. Make the first tiny opening in the skin with scissors in the midventral line. **These cuts should be made with scissors, not with the knife.**

2. Next enlarge the initial opening. by inserting the closed scissors into the opening. Spread the scissors. The spreading technique that you have just used will be useful throughout the dissection of the cat.

3. Once you have enlarged the initial opening you may then prepare the incision line for a short distance by inserting the closed blunt scissors (or your fingers) into the opening and running them horizontally be-

neath the surface of the skin to separate skin from body. Do not insert the point of the scissors at too steep an angle or you will damage the superficial muscles.

4. With scissors cut the ski.. along the prepared incision line from the pubis to the neck and then laterally along the limbs (level with the shoulders and level with the groin). Insert the the blunt end of the scissors under the skin and leave the pointed end of the scissors on top of the skin.

5. Now make circular incisions around the paws about 2 inches from the distal ends of the limb. You will be leaving a covering of skin on the paws.

6. In the neck region the skin is quite thick and difficult to work with. Run your fingers (or closed scissors) up under the skin toward the head as high as you can all the way around the neck. Next, using scissors make a circular cut in the neck skin about half an inch above the shoulders. You will be leaving the skin on the head for the time being but it is necessary to leave a loose flap of an inch or more for later access.

7. Actual removal of the body skin is accomplished by pressing against the body with one hand and pulling the skin away from the body with the other hand. Avoid using the scalpel or scissors until you encounter an area that will not come free using your fingers and hands alone. Use the scalpel only as a last resort. **When using a scalpel always hold the blade of the scalpel flat rather than vertical. Always stretch and elevate the tissue before cutting.** ***Never cut down*** **and** ***never cut blindly*** **when using a scalpel.**

Dissection Preliminaries

• The muscles of the body are layered on top of one another, and some of the muscle layers are quite thin. Each muscle is wrapped in connective tissue (fascia), and the same connective tissue also forms fascial planes that separate the muscles into layers.

• To locate and identify a muscle you must first remove enough fascia from its surface to allow you to clearly see the grain (fiber direction) of the muscle. Then you must compare what you see before you with a "map" or illustration of the area

• Once you have located a muscle, the objective of dissection is to separate it along its entire length, so that you can demonstrate to yourself the points of origin and insertion, and determine for yourself the shape and thickness of the muscle.

• In doing this, **Use your thumbs more than your knife.** Usually the fascial planes can be separated with your fingers or thumbs. **Use the scalpel only as a last resort.**

• If you adequately separate and loosen each muscle from its neighbors, it is only rarely that will you need to transect or detach any muscle in order to observe the deeper layers. In any case never do so unless you have first determined the entire length of the muscle from origin to insertion, and have also determined how thick the muscle is.

• For the study of muscles use the checklist as a review only. **It is inappropriate to use the check lists as a dissection guide** because they are broken into regions without regard to layers (superficial vs deep).

• Follow the dissection sequence specified. **Do not** skip any part of the sequence because the various areas blend one into another.

• Dissect primarily the left side of the cat, doing the right side only as time permits. Most cat illustrations show of the left side of the body.

• Position the head of the cat to your left on the dissection table. This is the way the specimens will be laid out for examinations, and you will find it easier to orient yourself if you are accustomed to seeing the cat in this position.

CAT MUSCLES WITH NO HOMOLOGUE IN MAN

Pectoantebrachialis
Sphinihumeralis
Rhomboideus Capitis
(a.k.a. Levator Scapulae Dorsalis)
Epitrochlearis
Caudofemoralis
Tenuissimus
Extensor Digitorum Lateralis

CAT MUSCLE NAME CHANGES

The following cat muscles are very similar to certain human muscles. When you encounter these cat muscles it is recommended that you substitute the corresponding human muscle name in recognition of this similarity.

CAT MUSCLE NAME	HUMAN MUSCLE NAME
Levator Scapulae Ventralis	Levator Scapulae
Serratus Ventralis	Serratus Anterior
Adductor Femoris	Adductor Magnus
Clavobrachialis	Clavodeltoid

Fig. 46- Cat Muscle Name Changes

Dissection of Superficial Shoulder and Back Muscles

PRELIMINARIES:

To work on this area it will be necessary to peel the skin of the head upward over the ears. Make a midline incision under the chin and also on the back of the neck.

1. CLAVOTRAPEZIUS:

Trace the origin of this muscle all the way to the superior nuchal line at the back of the head. Elevate the muscle and separate it from underlying muscles. Separate the posterior edge from the acromiotrapezius.

2. ACROMIOTRAPEZIUS:

The origin of this muscle is a thin aponeurosis in the dorsal midline of the body between the shoulder blades. Try not to damage the aponeurosis. Separate the inferior border of this muscle from the spinotrapezius and elevate it off of the underlying muscles.

3. SPINOTRAPEZIUS:

This is a flat triangular muscle which originates in the middle of the back as a sharp pointed "V" on the surface of the latissimus dorsi muscle. Elevate and separate it from the latissimus.

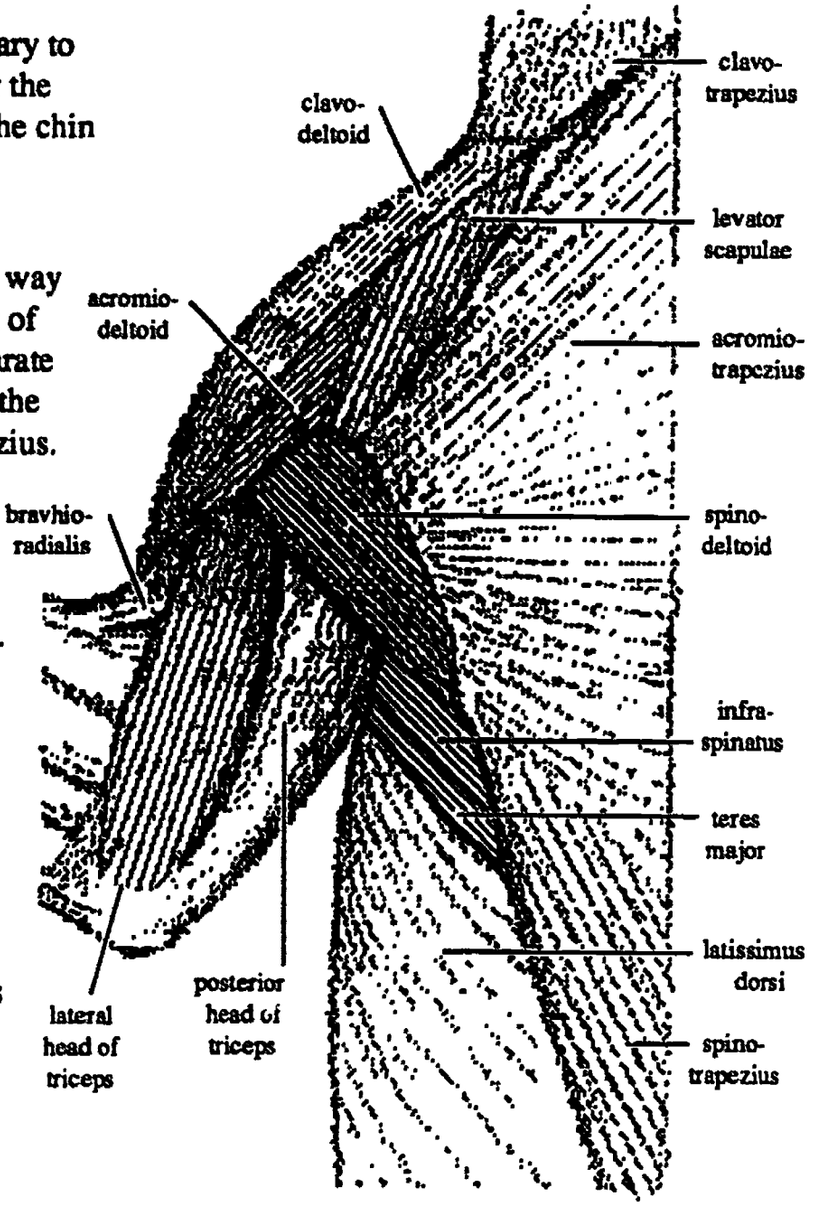


Fig. 47- Superficial Back and Shoulder Muscles of the Cat, dorsal view

4. CLAVODELTOID (CLAVOBRACHIALIS):

This muscle looks like an extension of the clavotrapezius, but if you will abduct the shoulder you will observe a crease over the clavicle which marks the end of the clavotrapezius and the beginning of the clavodeltoid. The clavodeltoid partially overlaps the pectoralis major. Carefully elevate the fascia in this area until the edge of the clavodeltoid is clearly seen. Clear the clavodeltoid completely

5. ACROMIODELTOID:

In the cat the acromiodeltoid is a completely separate muscle though it is partially overlapped by the clavodeltoid. Clear all surrounding connective tissue from the borders of the muscle. It comes to a point on the lateral surface of the humerus.

6. SPINODELTOID:

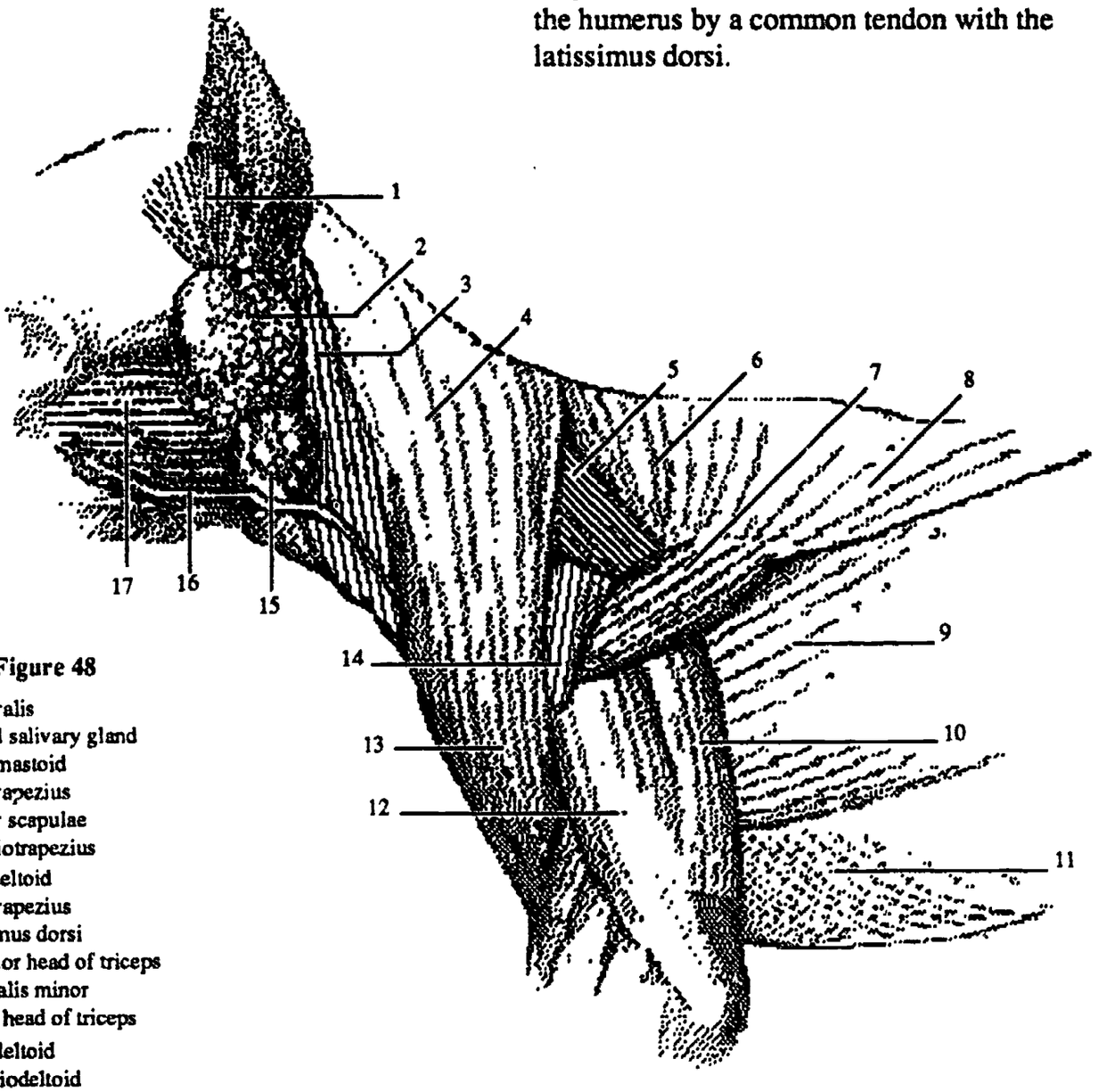
In the cat the spinodeltoid is also a completely separate muscle. Look for it lateral to the acromio-trapezius and posterior to the acromio-deltoid. Clear all surrounding connective tissue from the borders of the muscle.

7. LATISSIMUS DORSI:

This large flat muscle originates as an aponeurosis in the low back region and inserts on the humerus. It's anterior ventral edge fuses with the edge of the pectoralis minor muscle. Separate this area of fusion and completely loosen and free all surfaces and borders of this muscle.

8. TERES MAJOR:

This muscle originates on the border of the scapula and inserts on the medial surface of the humerus by a common tendon with the latissimus dorsi.



Key to Figure 48

1. temporalis
2. parotid salivary gland
3. sternomastoid
4. clavotrapezius
5. levator scapulae
6. acromiotrapezius
7. spinodeltoid
8. spinotrapezius
9. latissimus dorsi
10. posterior head of triceps
11. pectoralis minor
12. lateral head of triceps
13. clavodeltoid
14. acromiodeltoid
15. submandibular salivary gland
16. anterior facial vein
17. masseter

Fig. 48- Superficial Back, Neck, and Shoulder Muscles of the Cat, lateral view

Dissection of the Pectoral and Anterior Abdominal Wall Muscles:

PECTORAL MUSCLES:

1. PECTOANTEBRACHIALIS:

There is no homologue for this muscle in man. This is a very thin straplike muscle lying on the surface of the pectoralis major. It is especially thin in young animals. It inserts on the fascia of the forearm (*antebrachium)* below the elbow. Loosen this muscle completely from the underlying muscle all the way from origin to insertion. Sever the insertion.

2. PECTORALIS MAJOR:

There is a superficial head and a deep head which overlap one another but are considered to be one muscle. In the cat this muscle is smaller than the pectoralis minor.

3. PECTORALIS MINOR:

This is the largest chest muscle in the cat. The insertion of this muscle in the cat is not homologous to that in man. In the cat the pectoralis major only partly overlaps the pectoralis minor. The different fiber directions of the two muscles will be your main guide to distinguishing between them

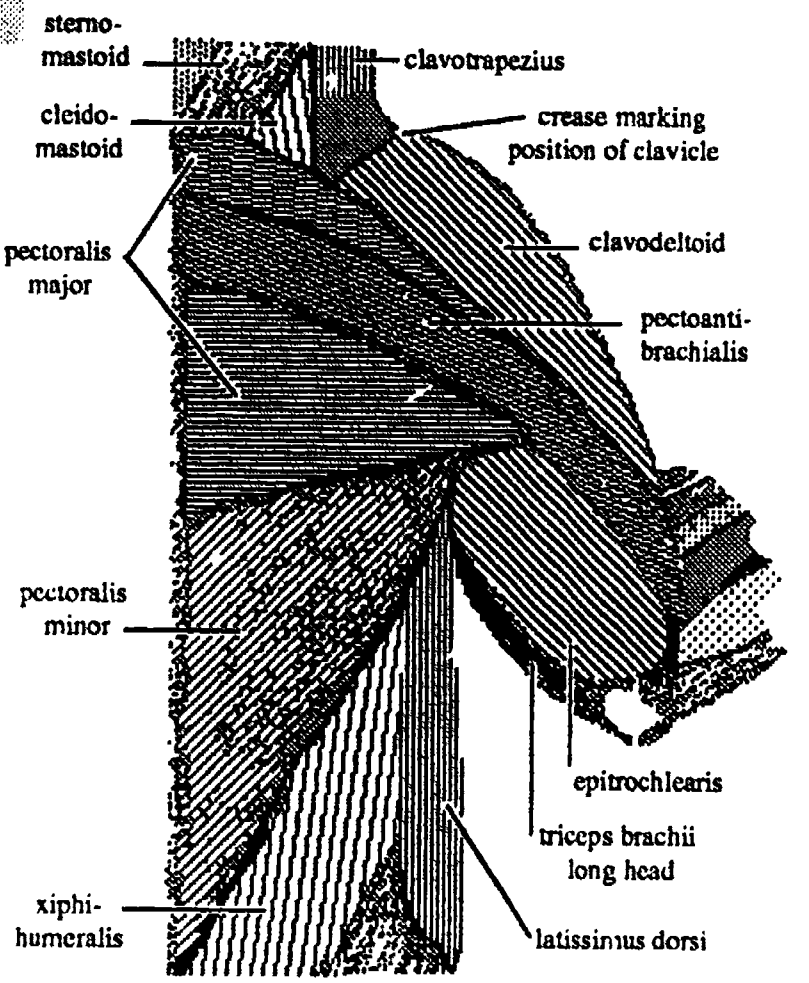


Fig. 49- Pectoral Region, and Upper Arm of the Cat ventral view, superficial muscles.

4. XIPHIHUMERALIS:

There is no homologue for this muscle in man. The fibers of this muscle run at an angle to and underneath pectoralis minor.

ANTERIOR ABDOMINAL WALL:

1. EXTERNAL OBLIQUE:

The fibers pass downward toward the midline from origin to insertion. The ventral portion of the muscle is an *aponeurosis*.. Transect the muscle on the side of the abdomen, and at right angles to the grain in order to expose the next deeper layer whose fibers run at a different angle. Proceed slowly and carefully as this is a difficult maneuver.

2. INTERNAL OBLIQUE:

In the cat the fibers run almost transversely rather than obliquely. The ventral portion is an aponeurosis. Transect this muscle on the side of the abdomen. It is very thin and this maneuver is even more difficult to do than it was for the external oblique.

3. TRANSVERSUS ABDOMINIS:

This is the deepest layer; it is very thin and lies directly over the parietal peritoneum. Do not transect.

4. RECTUS ABDOMINIS:

This is a narrow strap of muscle sandwiched between the aponeurosis of the oblique muscles. Do not dissect this muscle.

Anterior Neck and Head

PRELIMINARIES:

• Loosen additional skin up to the jaw on both sides of the neck.

• On the left side remove skin from the jaw to the temple. The fascia is very thick in this area. Clean the fascia off of the external jugular vein, leaving the lymph nodes attached.

• Elevate the external jugular vein off of the underlying muscles without cutting it. Clean the super-ficial fascia off of the muscles under the vein.

• Locate and expose the sub-mandib-ular salivary gland and the parotid salivary gland.

• Locate the following muscles and separate them cleanly from origin to insertion:

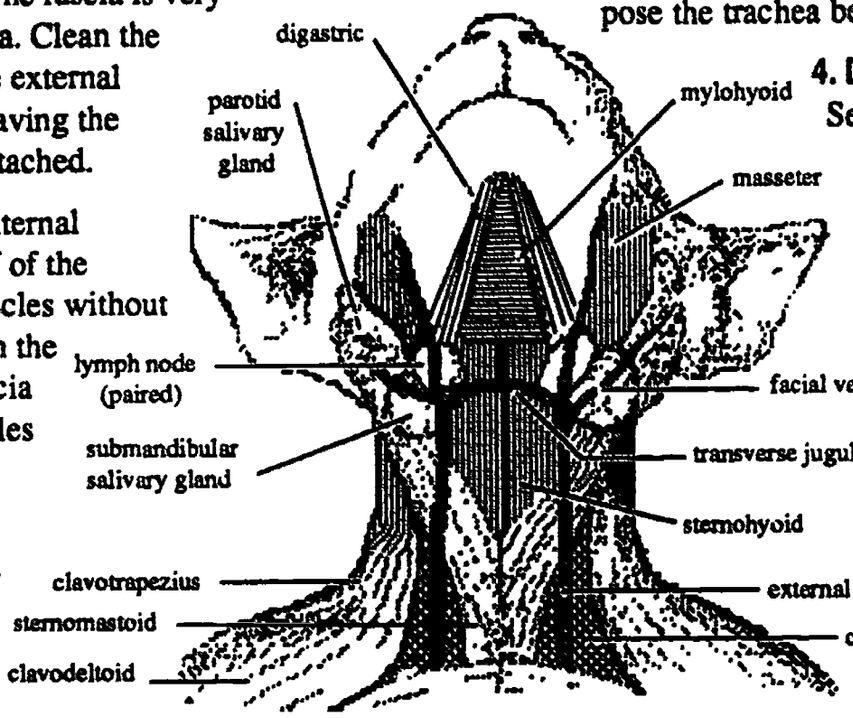


Fig. 50- Anterior Neck Region of the Cat superficial structures

1. STERNOMASTOID:

This is a broad strap of muscle that extends from sternum to mastoid process of temporal bone, running underneath the submandibular and parotid salivary glands. In the cat the sternomastoids are united at the sternum. With scissors separate the two sides in the midline and trim the anterior border to make a clean straight edge.

2. CLEIDOMASTOID:

In cats this is separate fromthe sternomas-toid. It is largely overlapped by the cla-votrapezius. Separate it cleanly from all sur-rounding muscles and fascia.

3. STERNOHYOID:

These are two narrow straps of muscle on either side of the midline in the anterior neck, deep to the sternomastoid. With scis-sors separate them in the midline and ex-pose the trachea beneath them.

4. DIGASTRIC:

Separate the digas-trics. They follow the line of the jaw on both sides of the neck.

5. MYLOHYOID:

This muscle is deep to the digas-trics; it's fibers run trans-versely across the midline.

6. MASSETER:

Locate this muscle deep to the parotid glands. The duct of the parotid passes over the surface of this muscle on it's way to the mouth. If you are extremely careful and a little lucky you will find this duct.

7. AURICULARIS:

This is a superficial muscle attached to the external cartilage of the ear and used in cats to move the ear.

8. TEMPORALIS:

Find this muscle high on the side of the head, deep to the auricularis muscle. It is best distinguished from the a·ricularis muscles by its fiber direction. It inserts on the coronoid process of the mandible.

Dissection of the Deep Back and Neck Muscles

1. LEVATOR SCAPULAE:
In the cat this muscle lies deep to the clavotrapezius, anterior to the acromiotrapezius and at right angles to the spinodeltoid. Locate it and clear it from origin to insertion.

2. SPLENIUS CAPITIS:
This muscle lies deep to the clavotrapezius. It inserts on the back of the head.

3. RHOMBOIDS:
Transect the acromiotrapezius and reflect it; the rhomboids lie deep to it. Extend the forelimb of the cat to imitate the position of the arm in man, and you will see that the rhomboids now appear much the same as they do in man. There is no homologue in man for the thin straplike **rhomboideus capitis** (levator scapulae dorsalis). The **rhomboideus major** in cats is smaller than the **rhomboideus minor** and is named by position rather than size.

4. SERRATUS ANTERIOR:
This a fan shaped muscle with the appearance of a serrated edge where the individual slips of origin arise from the anterior surfaces of the first ten ribs.

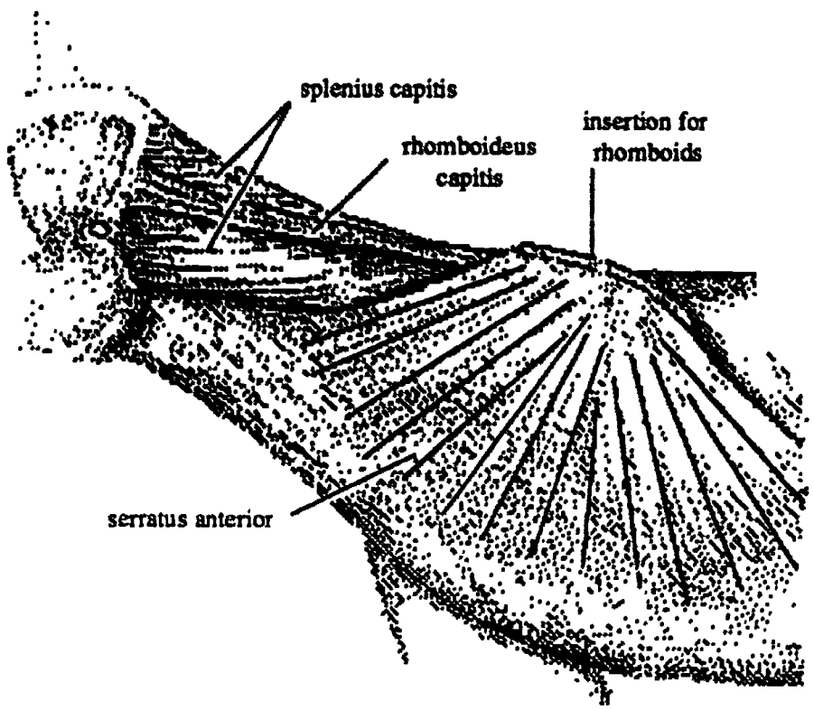


Fig. 51- Deep Back and Neck, Left Side, Lateral View

Trapezius and Latissimus dorsi have been removed.

Dissection of Deep Shoulder Muscles

1. INFRASPINATUS:
This muscle is partly obscured by the spinodeltoid, which in cats originates in part from the surface of the infraspinatus (their being insufficient room for it on the spine of the scapula). Sever the origin of the spinodeltoid and lift it off of the infraspinatus. Also sever the origin of acromiodeltoid and reflect it so that the entire extent of infraspinatus can be seen. Follow it all the way to the insertion on the head of the humerus.

2. TERES MINOR:
If you followed the instructions in the previous paragraph you should now be able to locate teres minor. It is very small and lies right next to the insertion of the infraspinatus. Teres minor also inserts on the head of the humerus just one position below the infraspinatus' insertion.

3. SUPRASPINATUS:
Supraspinatus occupies the supraspinous fossa of the scapula. Examine it's insertion at the top of the humerus (greater tubercle).

4. SUBSCAPULARIS:
Subscapularis occupies the subscapular fossa on the ventral surface of the scapula. It inserts on the greater tubercle of the humerus.

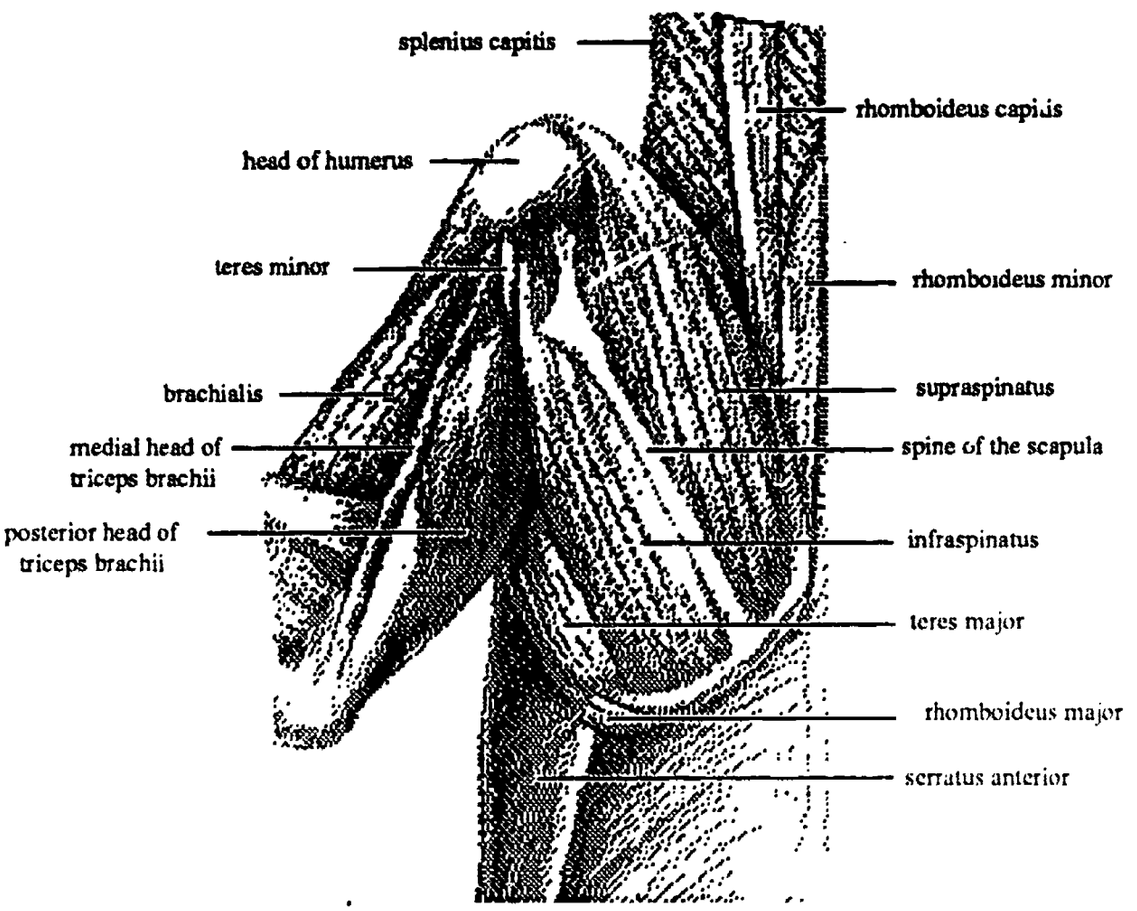


Fig. 52- Muscles of Deep Shoulder and Upper Arm of the Cat left side, dorsal view

Trapezius, Deltoid, and lateral head of Triceps Brachii have been removed.

Dissection of the Arm and Forearm Muscles

UPPER ARM MUSCLES

EXTENSORS

1. EPITROCHLIARIS

The epitrochliaris is a thin flat muscle immediately beneath the fascia. The muscle originates from the surface of the latissimus dorsi and inserts on the olecranon process of the ulna; it has no human homologue. Detach the insertion of this muscle.

2. TRICEPS BRACHII:

In the cat the three heads of the triceps look like three separate muscles. Indentify each part.

a. The **long head** is the largest and most posterior. Its origin is the scapula, and its insertion is on the olecranon process.

b. The **lateral head** originates on the upper end of the humerus and inserts on the olecranon process. Bisect this head in order to see the medial head of the triceps and the anconeus muscle.

c. The **medial head** lies deep to the lateral head. It is long and slender.

3. ANCONEUS:

The anconeus muscle also lies deep to the lateral head of the triceps. It is small, flat, and triangular in shape, and usually has a characteristic dark or pinkish color that is helpful in recognition.

FLEXORS

1. BICEPS BRACHII:

The biceps brachii is found on the ventral surface of the brachium, somewhat hidden by the insertion of the pectoralis major.

2. BRACHIALIS:

Brachialis is on the lateral surface of the brachium, ventral to the triceps. Notice that the pointed lower end of the acromiodeltoid insertion points to the brachialis. This feature is helpful for the positive identification of brachialis. The lower end of brachialis is overlapped by the brachioradialis.

3. BRACHIORADIALIS

Brachioradialis in the cat is a flat narrow ribbon of muscle that arises from the lateral surface of the brachialis. It inserts on the styloid process of the radius.

4. PRONATOR TERES:

Pronator teres arises from the medial epicondyle of the humerus and inserts on the radius. Look for it on the anterior medial side of the elbow joint.

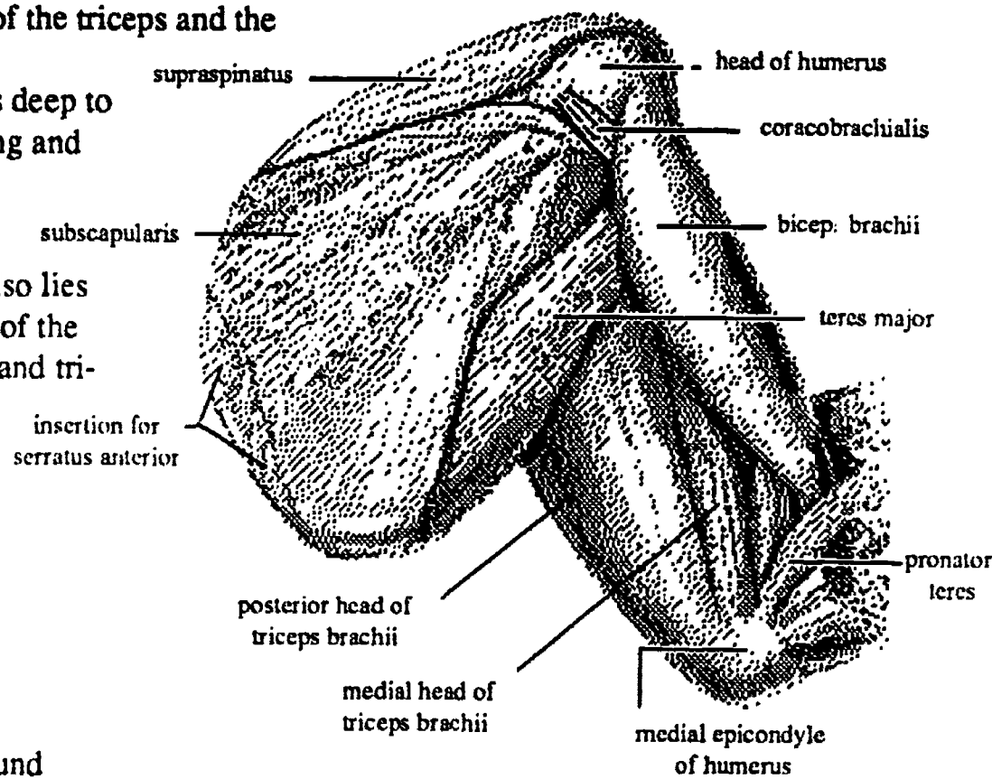


Fig. 53- Muscles of Deep Shoulder and Upper Arm of the Cat ventral view, left side

Serratus anterior has been detatched from vertebral border of scapula.

MUSCLES OF FOREARM

FLEXORS

1. FLEXOR CARPI RADIALIS:
Flexor carpi radialis lies next to the pronator teres.

2. PALMARIS LONGUS:
In the cat this muscle is much larger and more important than it is in man. It is the largest of the flexors and inserts on all the digits, therefore it is not homologous to man. In man the palmaris longus inserts on the palmar aponeurosis, and is absent in some people.

3. FLEXOR CARPI ULNARIS:
This muscle is seen next to the palmaris longus. It forms the lateral border of the forearm.

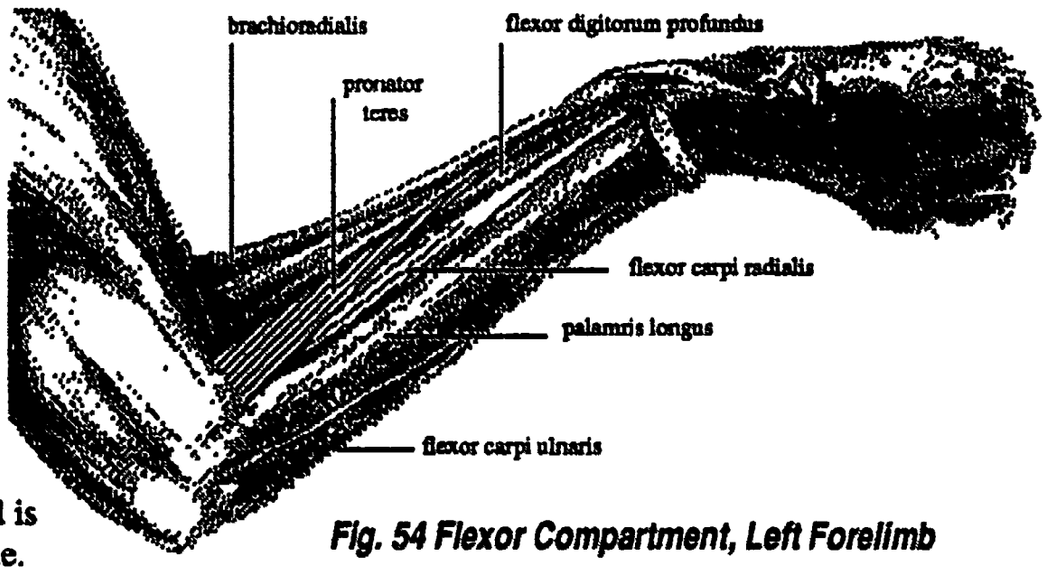


Fig. 54 Flexor Compartment, Left Forelimb

EXTENSORS

1. EXTENSOR CARPI RADIALIS LONGUS:
This is a narrow muscle, that lies next to the brachioradialis on the dorsal side of the forearm.

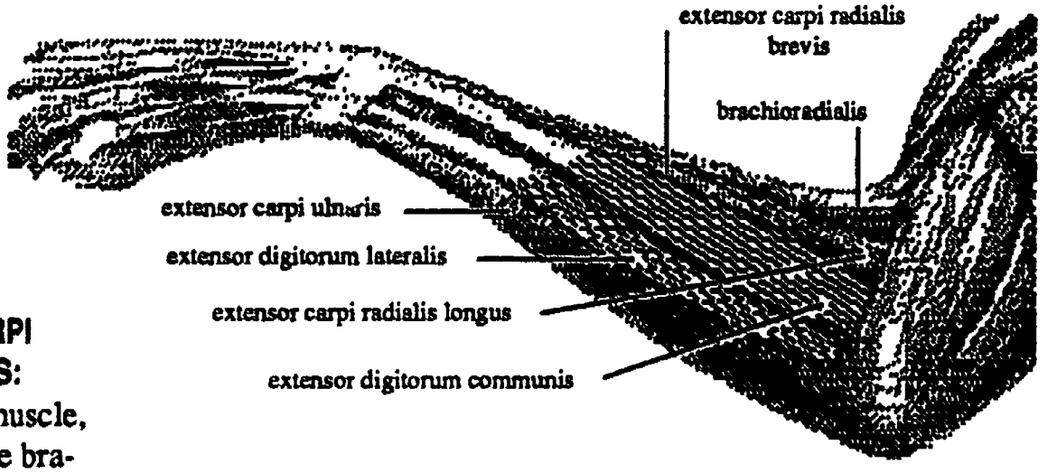


Fig. 55- Extensor Compartment, Left Forelimb

2. EXTENSOR CARPI RADIALIS BREVIS
lies next to the longus.

3. EXTENSOR DIGITORUM COMMUNIS
lies next to the extensor carpi radialis. Notice the tendons of insertion that spread out to all four digits.

4. EXTENSOR DIGITORUM LATERALIS
This muscle has no homologue in man.

5. EXTENSOR CARPI ULNARIS
This muscle lies next to the extensor digitorum lateralis

Dissection of theThigh and Gluteal Region

PRELIMINARIES:

Start by separating the more obvious muscles. Do not remove any blood vessels from the thigh. Remove as much fat and fascia from the gluteal region, close to the tail, as possible.

The tough thick fascia encasing the thigh is called the *fascia lata.* The strongest part of this fascia is found on the anterior and lateral surfaces of the thigh, and this part is called the *iliotibial band.* Lift the fascia and with scissors trim the edges of the *iliotibial band.* Detach the insertion of the iliotibial band from the lateral knee area and reflect it.

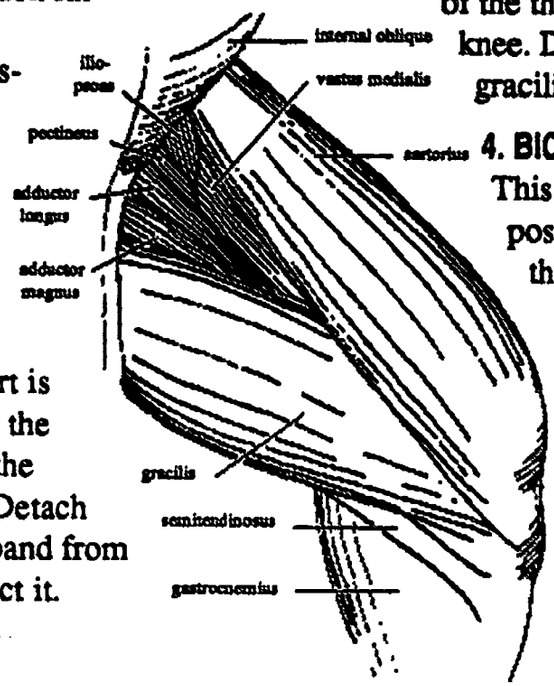


Fig. 56- Superficial Thigh Muscles Left Leg, Medial View

SUPERFICIAL MUSCLES:

1. TENSOR FASCIA LATA:
This is a muscle embedded in the proximal end of the iliotibial band of fascia. Elevate the iliotibial band forcefully and you will see the muscle. Part of the muscle also overlaps the gluteus medius. Detach this part from the gluteus medius.

2. SARTORIUS:
This is the broad, thin, flat muscle, which is the most superficial muscle in the anterior and medial thigh region. It runs on the diagonal from lateral thigh to medial knee. Detach the insertion of the sartorius at the medial knee.

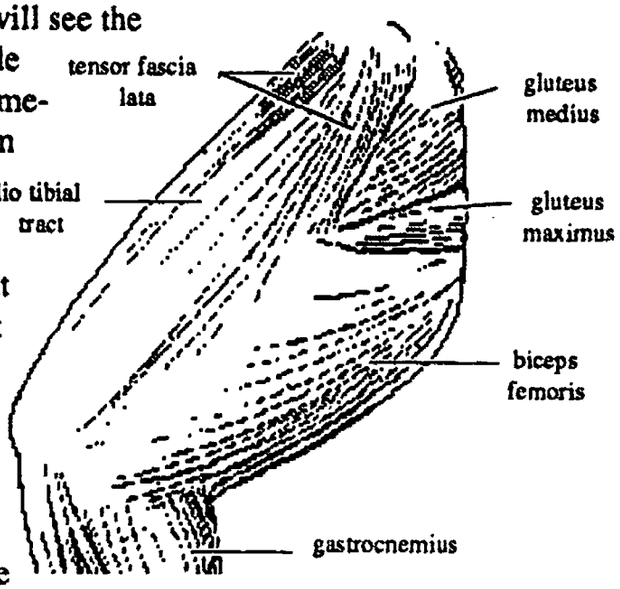


Fig. 57- Superficial Thigh Muscles Left Leg, LateralView

3. GRACILIS:
This muscle very much resembles the sartorius in that it also is broad, thin, and flat. How ever, gracilis runs straight down the medial surface of the thigh from the crotch to the knee. Detach the insertion of gracilis from the medial knee.

4. BICEPS FEMORIS:
This is a massive muscle on the posterolateral surface of the thigh. Free the borders of this muscle, and elevate it off of the surface of the underlying muscles. Identify the large sciatic nerve which runs deep to the biceps, and take care not to damage the nerve. Detach the insertion of the biceps from the lateral knee. Clearly demonstrate the origin at the ischial tuberosity.

5. CAUDOFEMORALIS:
Separate the caudofemoralis muscle from the anterior border of the biceps. In man this muscle would be part of the gluteus maximus.

6. GLUTEUS MAXIMUS:
The gluteus maximus is immediately anterior to the caudofemoralis. In cats it is quite small, smaller than the gluteus medius. Notice that the sciatic nerve emerges from underneath the gluteus maximus on its passage into the posterior thigh.

4. GLUTEUS MEDIUS:
This muscle is partly overlapped by two neighboring muscles, the gluteus maximus posteriorly, and the tensor fascia lata muscle anteriorly. Separate the three muscles so that they are clearly distinct.

DEEP MUSCLES:

1. SEMIMEMBRANOSUS:
Return to the posteromedial thigh, and locate semimembranosus, which is a massive muscle beneath the gracilis. Do not detach this muscle. Trace it to the ischial tuberosity, which is also the origin for the biceps femoris and the semitendinosus. In humans this muscle is strictly a posterior thigh muscle. In cats it is so large that it occupies much of the medial thigh.

2. SEMITENDINOSUS:
This muscle lies close upon the semimembranosus in the posterior thigh, medial side. Do not detach it. Trace it to it's origin.

3. ADDUCTOR MAGNUS:
This muscle is large and triangular shaped, and is seen in the medial thigh anterior to the semimembranosus.

4. ADDUCTOR LONGUS:
This muscle lies parallel to and anterior to the adductor magnus in the medial thigh. It is quite small.

5. PECTINEUS:
Look high in the thigh, above (anterior to) adductor longus, and just medial to the femoral artery, vein and nerve.

6. ILIOPSOAS:
Look just lateral to the femoral artery, vein and nerve in the anterior thigh. The muscle will look very small at first. It is actually just the distal end of a very large muscle which is emerging from the body cavity. To see more of it use a probe to push against the body wall in the groin region.

QUADRICEPS FEMORIS GROUP

1. VASTUS LATERALIS:
This is a very large muscle covering the anterolateral surface of the thigh. It partly overlaps the rectus femoris.

2. RECTUS FEMORIS:
Look medial to the vastus lateralis. It is overlapped by both vastus lateralis and vastus medialis. Transect the rectus femoris.

3. VASTUS MEDIALIS:
Look medial to the rectus femoris.

4. VASTUS INTERMEDIUS:
Look deep to the rectus femoris. It is often a darker or pinker color than the neighboring muscles.

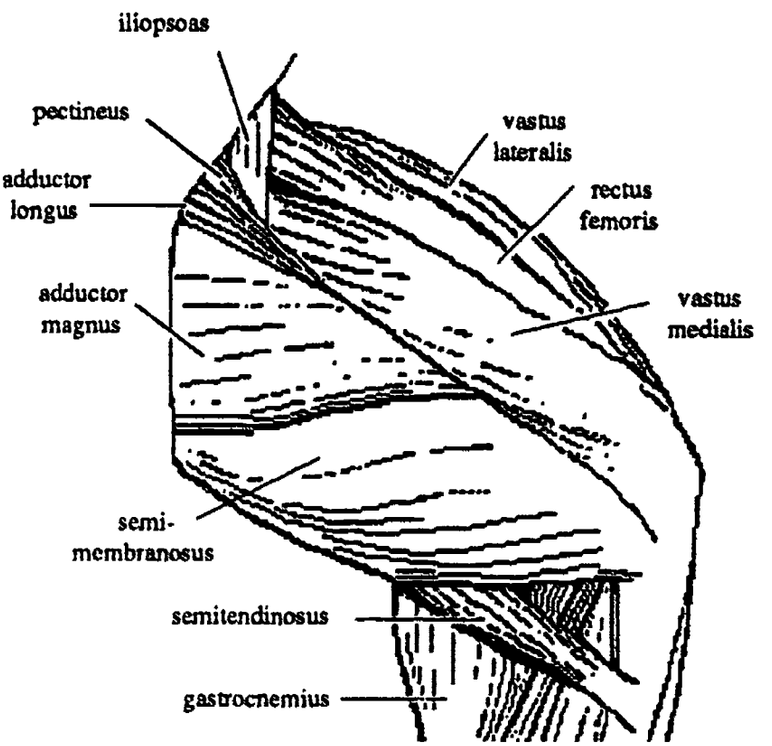


Fig. 58- Deep Thigh Muscles Left Leg, Medial View

Dissection of the Lower Leg Muscles

TENDOCALCANEUS GROUP:

1. GASTROCNEMIUS:
This is the large superficial muscle of the calf. Free all surfaces of the muscle, and follow it from origin on the femur to insertion as part of the *tendocalcaneus* (Achilles' tendon).

2. SOLEUS:
In the cat the soleus is a small muscle. Look for it deep to the gastrocnemius on the lateral side of the leg. It joins the *tendocalcaneus*, but does not cross the knee joint since it originates on the fibula..

3. PLANTARIS:
Behind the knee the plantaris lies between the two heads of the gastrocnemius. It then passes deep to the gastrocnemius and lies between the gastrocnemius and soleus. In the cat the plantaris is larger than the soleus. Like the soleus it too joins the *tendocalcaneus*. It can best be seen on the medial side of the leg since on the lateral side of the leg it is fused with the gastrocnemius.

ANTERIOR CRURAL GROUP:

1. TIBIALIS ANTERIOR:
This muscle lies just lateral to the tibia in the anterior leg. Notice that it inserts at the base of the 1st metatarsal on the medial side of the foot, just as it does in man.

2. EXTENSOR DIGITORUM:
Observe the tendons of this muscle as they spread out to the toes on the top surface of the foot. Notice the retinaculum which holds the tendons down at the ankle.

3. EXTENSOR HALLUCIS:
This muscle is absent in the cat.

LATERAL CRURAL GROUP:

PERONEUS LONGUS, BREVIS, & TERTIUS:
Observe their tendons on the lateral side of the ankle. They are arranged just as they are in man, with peroneus tertius passing in front of the lateral malleolus, and the others passing behind the lateral malleolus. Carefully peel away the connective tissue which keeps the tendons of the longus and brevis behind the malleolus. Lift the tendons out individually with a blunt probe.

MEDIAL CRURAL GROUP:

Observe that these tendons pass behind the medial malleolus of the ankle, just as they do in man. Carefully peel away the fascia which keeps these tendons in place so that you can observe them individually. Lift them out from behind the malleolus with your blunt probe. Peel the fascia away from the bottom of the foot and observe the broad flat ligament that serves as a spring for the arch of the foot.

1. FLEXOR DIGITORUM LONGUS, & FLEXOR HALLUCIS LONGUS.
Flexor digitorum longus lies anterior to the plantaris on the medial side of the lower leg. Its tendon passes behind the medial malleolus at the ankle and fuses with the tendon of the larger **flexor hallucis longus** on the plantar surface of the foot. The common tendon then divides and is distributed to all of the toes. In humans the tendon of flexor hallucis longus stays separate.

2. TIBIALIS POSTERIOR:
The tendon of this muscle lies anterior to that of flexor digitorum as they both pass behind the medial malleolus. Find the tendon first, because the muscle itself is hard to see since it is small and flat and completely hidden deep to the flexor digitorum.

3. POPLITEUS :
The popliteus forms the floor of the popliteal fossa. It is a small muscle in humans, but a large one in the cat. Look for it deep to the lateral head of the gastrocnemius.

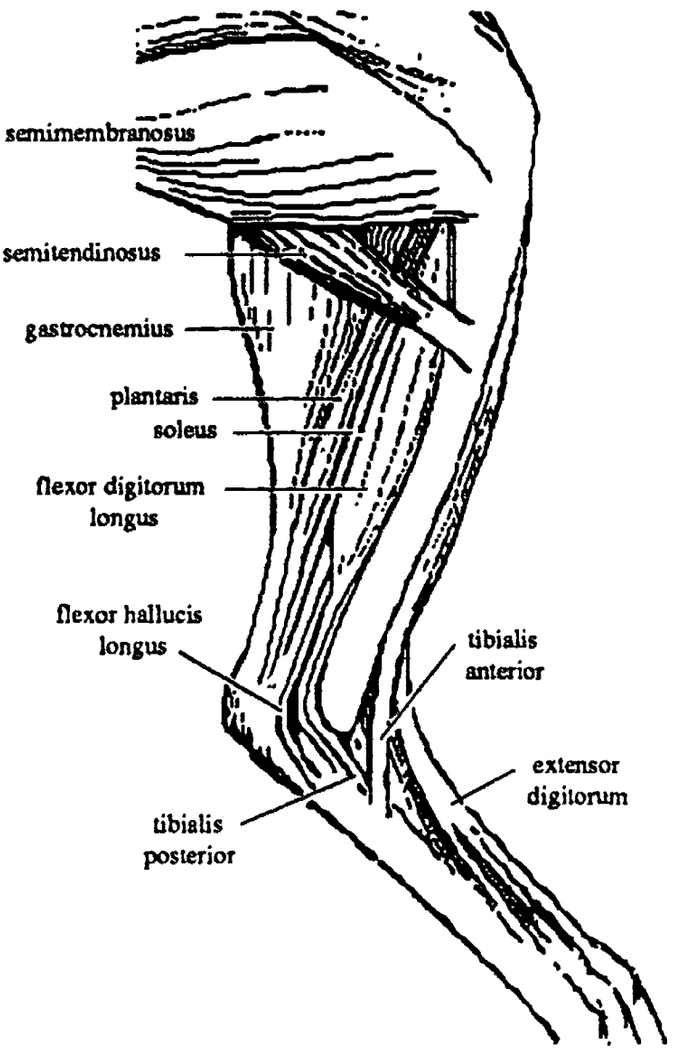


Fig. 59- Muscles & Tendons of Lower Leg Medial View, Left Leg

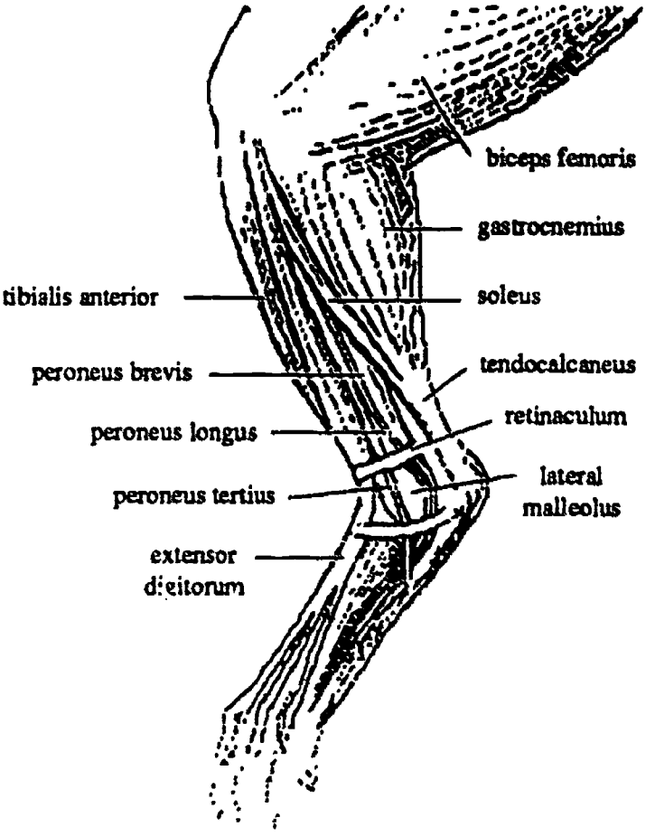


Fig. 60- Muscles & Tendons of Lower Leg LateralView, Left Leg

Suggestions for Laboratory Study of Human Muscles

INTRODUCTION:

• The three attributes of a muscle that are usually emphasized in a lecture and in reference books are **action, origin,** and **insertion.** Of these three the most important attribute is **action,** however action usually cannot be understood (let alone remembered) unless origin and insertion are first clearly located.

• If you are having difficulty understanding how a particular muscle does what it is said to do, locate its origin and insertion on the laboratory skeleton and visualize how the skeleton will move when the insertion is brought closer to the origin. It is also very helpful to take note of the grain (fiber direction) of the muscle, and which side of a joint the muscle crosses. (anterior, posterior, medial, or lateral).

ORIGIN & INSERTION:

• The origin is the fixed end, or at least the less moveable end, usually the proximal end.

• The insertion is the end which is most moveable, usually the distal end.

ACTION:

• The action of a muscle refers to the kind of movement that a muscle causes at a joint.

• Muscles do work only when they contract or shorten. A muscle which is being stretched is not doing work. Stretching is passive.

• The **prime mover** is the primary agent causing any given movement.

• **A synergist** is a muscle which is functioning to steady a movement or help accomplish a movement by another muscle. Synergists cooperate with one another at the same joint which , i.e. cause the same or a similar action at that joint.

• An **antagonist** is a muscle whose movement counteracts the action of any given prime mover. Antagonists are on opposite sides of a joint from one another. When the prime mover is working the antagonist must relax.

• TWO HELPFUL CHECKLISTS FOR HUMAN MUSCLES ARE INCLUDED IN THE APPENDIX :

Two checklists for human muscles are included in the Appendix. The checklist on pages 53-56 is a summary of the major human muscles arranged into groups according to their most important actions. The second checklist, on pages 57-58 arranges the human muscles by body region.

Laboratory Study of Nerve Cells & Spinal Cord

NERVE (AXON) CROSS SECTION

• Using low power on the compound microscope identify the following:

1. **EPINEURIUM;**
the connective tissue sheath around the outside of the nerve.
2. **PERINEURIUM;**
the connective tissue surrounding the bundles (fasciculi) of nerve fibers.
3. **ENDONEURIUM;**
the connective tissue surrounding each individual nerve fiber.

• Using high power identify the following:

4. **AXON (AXIS CYLINDER)**
5. **MYELIN SHEATH**
6. **NEURILEMMA**
7. **NUCLEUS OF A SCHWANN CELL:**
(seen in the neurilemma region)

NERVE (AXON) LONG SECTION

• Using low power on the compound microscope identify the following:

1. **AXON**
2. **MYELIN**
3. **NODES OF RANVIER**
4. **NEURILEMMA**

ADDITIONAL SLIDES:

Examine any other nervous system slides that are available to you such as a **spinal cord smear (showing large anterior horn cells)**, a motor nerve ending (motor end plate), a muscle spindle (stretch receptor), and various brain cell preparations. Nerve cells do not stain well, and thus historically the nervous system has been difficult to study microscopically.

SPINAL CORD CROSS SECTION

• Using the dissecting microscope, identify the following:

1. **VENTRAL HORN**
2. **DORSAL HORN**
3. **DORSAL ROOT GANGLION**
4. **ROOTS OF THE SPINAL NERVE**
5. **CENTRAL CANAL**
6. **CENTRAL GRAY MATTER**
7. **DORSAL MEDIAN SEPTUM**
8. **VENTRAL MEDIAN FISSURE**
9. **LATERAL HORN (IF PRESENT)**
10. **ANTERIOR HORN CELLS**

SPINAL CORD MODEL

• Examine a model of the spinal cord in cross section. Identify all of the items on the spinal cord checklist on page 59.

Dissection of Cat Peripheral Nervous System

PRELIMINARIES:

Opening the Visceral Cavities:
In order to proceed with the following dissection of the peripheral and autonomic nerves it will be necessary to open the visceral cavity of the cat.

With the cat in the supine position elevate a fold of the body wall in the abdominal region. Insert the point of a scissors through the body wall and make a midventral incision. Enlarge the incision enough to be able to locate the diaphragm by inserting your finger into the incision. Extend the incision from the pubic region to the diaphragm.

Again insert the point of the scissors through the body wall this time above the diaphragm and next to the sternum. Extend the incision anteriorly until you reach the top of the sternum.

In the pelvic region cut from the midline laterally on both sides. Cut the diaphragm free from its attachment to the anterior body wall. Bend the chest wall laterally until you have adequate access to the chest cavity (some ribs will have to be cracked).

CERVICAL PLEXUS

PHRENIC NERVES...

Locate these nerves in the mediastinum of the chest. They pass between the pericardium and the pleura on each side of the chest, and end on the diaphragm. Clear them of fat and excess connective tissue, and trace them to their origin in the cervical region. In humans the phrenic is mostly C4, with some contribution from C3 and C5. In cats the phrenic is formed by C5 and C6.

BRACHIAL PLEXUS

This plexus supplies the muscles and skin of the anterior compartment of the upper arm. It was exposed during the dissection of the muscles of the chest and arm. If more exposure is needed. cut carefully through the pectoralis group in the axillary region, looking for the strong white cords which are the nerves. You are responsible for identification of the four terminal branches of the plexus. Elevate the ventral portion of the plexus with a probe and look for a formation which resembles the capitol letter M.

MUSCULOCUTANEOOUS NERVE

This is a small nerve, the most lateral nerve of the M formation. It passes along the lower edge of the biceps brachii muscle, and supplies the biceps, coracobrachialis, and brachialis muscles.

MEDIAN NERVE

This nerve forms the middle bar of the M. It travels with the brachial artery, and together they pass through the humerus (supracondyloid foramen, not present in the human) to reach the forearm. The median nerve supplies muscles in the forearm and hand, anterior compartment, radial side.

ULNAR NERVE

This nerve forms the most medial branch of the M. It passes over the medial epicondyle of the humerus, protected by skin only (the "funny bone"), into the forearm, where it supplies forearm and hand muscles of the anterior compartment, ulnar side.

RADIAL NERVE

This is the largest of the four terminal branches of the brachial plexus. It is also the most posterior in position, and it supplies all of the posterior compartment muscles of both arm and forearm.

INTERCOSTAL NERVES

There are twelve pair of these emerging from the vertebral column in the dorsal region of the thoracic cavity, passing between and parallel to the ribs, traveling with the intercostal arteries and veins. They supply the intercostal muscles.

LUMBOSACRAL PLEXUS

SCIATIC NERVE

This is the largest of the peripheral nerves. It can be observed in the gluteal and dorsal thigh regions, emerging from beneath the gluteus maximus and quadratus lumborum muscles and traveling beneath the biceps femoris muscle of the thigh. It supplies the muscles of the dorsal thigh and all of the lower leg, splitting into two branches, tibial and peroneal, in the popliteal fossa.

FEMORAL NERVE

Look for this nerve in the inguinal region, ventral thigh, traveling with the femoral artery and vein. It supplies the ventral thigh muscles.

Dissection of the Autonomic Nervous System in the Cat

REQUIRED WORK:

SYMPATHETIC TRUNK IN THE THORAX

Push the lung out of the way and examine the surface of the vertebral column beneath the parietal pleura. There are two of these trunks, one on each side of the thoracic well, lying near the heads of the ribs. Each is quite delicate, looking like white thread. Most of the ganglia are quite small, hardly visible to the naked eye. You may use the dissecting scope to examine them more closely, and with luck may be able to see the rami communicantes connecting the ganglia to the spinal nerves.

VAGUS NERVE IN THE THORAX

Pick up the carotid artery in the neck. Look for a nerve adhering closely to the artery and running parallel to it. This is the vago-sympathetic trunk. The vagus separates from the sympathetic trunk just before entering the thorax, at the level of the first rib.

Each vagus gives off a **recurrent laryngeal branch** headed for the larynx. The left recurrent laryngeal nerve hooks around the aortic arch. The right recurrent laryngeal nerve hooks around the subclavian artery.

OPTIONAL WORK:

SYMPATHETIC TRUNK IN THE ABDOMEN

Follow the thoracic sympathetic trunks through the diaphragm to observe the abdominal portion. Here the two sympathetic trunks lie near one another on the surface of the vertebral bodies near the midline. They are concealed by the psoas muscles, and they gradually become smaller and harder to see as they descend toward the lumbar region.

VAGUS NERVE IN THE ABDOMEN

The main descending portion of each vagus in the mediastinum gives off many branches to heart and lungs. Below the root of the lung each vagus forms a dorsal and ventral branch which then unite, penetrating the diaphragm along with the esophagus and forming a plexus on both the lesser and the greater curvatures of the stomach. This plexus also blends with the solar (celiac) plexus of the sympathetic division. Fibers from this plexus extend to the abdominal viscera as far as the transverse colon.

COLLATERAL GANGLIA:

There are three major sympathetic ganglia found in the abdominal cavity They are easy to locate due to the fact that they lie close to the artery for which each is named, just at the point where the artery branches off of the abdominal aorta. The first two lie so close to one another that they are spoken of jointly as the solar plexus.

Observation of the ganglia may optionally be reserved until such time as the abdominal arteries are dissected. The ganglia are described here for the sake of completeness.

1. CELIAC GANGLION:
Look for it at the base of the celiac artery.

2. SUPERIOR MESENTERIC GANGLION:
Look for it at the base of the superior mesenteric artery.

3. INFERIOR MESENTERIC GANGLION:
Look for it at the base of the inferior mesenteric artery.

Laboratory Study of the Sheep Brain

The sheep brain is much larger than the cat brain, and is therefore very much more convenient to work with. Study the intact (whole) brain first, and then follow instructions for cutting it in half through the mid-sagittal plane.

MENINGES

DURA MATER

The dura mater is most likely missing, having been left behind in the sheep's skull when the brain was removed. The only piece of dura still sure to be present is the pituitary diaphragm (**diaphragma sellae**) surrounding the infundibulum of the pituitary on the inferior surface of the brain.

Remove the pituitary gland, taking care to leave the cranial nerves attached to the brain stem. Use scissors to cut the cranial nerves free from the diaphragma sellae.

PIA MATER

The pia matter is present clinging to the surface of the brain, but is too delicate to be visible.

ARACHNOID MATER

The arachnoid mater is the layer of meninges most in evidence. Identification can be confirmed by noticing that the membrane stretches from the top of one gyrus to the top of the neighboring gyrus; it does not dip down into the sulci as it would if it were pia mater.

SUBARACHNOID SPACES

The subarachnoid space is any space underlying the arachnoid membrane. Some of these spaces are larger than others and hence have names. Identify the following:

1. CISTERNA MAGNA:

The cisterna magna is located on the dorsal surface of the brain at the lower edge of the cerebellum, next to the spinal cord.

2. PONTINE CISTERN:

The pontine cistern is seen on the ventral surface of the brain stem at the lower edge of the pons.

3. INTERPEDUNCULAR CISTERN:

The interpeduncular cistern is seen on the ventral surface of the brain stem at theupper edge of the pons.

4. SUPERIOR CISTERN:

The superior cistern is seen on the dorsal surface of the brain superior to the cerebellum and between the cerebellum and occipital lobe.

FISSURES

1. MEDIAN LONGITUDINAL FISSURE:

The median longitudinal fissure is the same as themidsagittal fissure.

2. TRANSVERSE FISSURE :

The transverse fissure is between cerebellum and occipital lobe.

3. LATERAL (SYLVIAN) FISSURE

The lateral fissure is very shallow in the sheep brain due to the small size of the temporal lobe.

OTHER STRUCTURES

CORPORA QUADRIGEMINA

Separate the transverse fissure widely and look down at the surface of the midbrain; the four rounded swellings are the **corpora quadrigemina,** i.e.the two superior **colliculi** and the two inferior colliculi. The pineal body is also visible between the two superior colliculi.

LATERAL GENICULATE BODIES

Bend the temporal lobe of the cerebrum away from the midbrain, and trace the optic tracts from the optic chiasm to the dorsal surface of the brain stem. They will lead you directly to the lateral geniculate bodies of the thalamus.

CORPUS CALLOSUM:
Look down into the midsagittal fissure to see the corpus callosum.

CEREBELLAR PEDUNCLES :
There are three: middle, superior, and inferior. The middle peduncle connects the pons to the cerebellum; the superior peduncle connects the corpora quadrigemina to the cerebellum, and the inferior peduncle connects the spinal cord to the cerebellum.

VERMIFORM BODY OF CEREBELLUM
The vermiform body is a midline structure on the posterior surface of the cerebellum.

PINEAL BODY
The pineal body can be seen on the dorsal surface of the brain just anterior to the corpora quadrigemina.

INFERIOR VIEW OF BRAIN

Refer to Fig. 56 and identify the following:

1. OLFACTORY BULBS

2. OLFACTORY TRACTS

3. OLFACTORY TRIGONE:
The olfactory trigone (also called the anterior perforate substance) is the area of cortex found between the olfactory tracts.

4. OPTIC NERVES

5. OPTIC CHIASM

6. OPTIC TRACTS

7. INFUNDIBULUM
The infundibulum is also called the **stalk of the pituitary.**

8. MAMMILLARY BODY
This is the only part of the hypothalamus visable from the outside of the intact brain.

9. UNCUS
The uncus is gray matter (cortex) belonging to the temporal lobe. Follow the olfactory tracts to the uncus.

10. CEREBRAL PEDUNCLES
These white matter structures belong to the midbrain. They connect the forebrain to the hind brain.

11. PONS

12. MEDULLA

13. PYRAMIDS OF THE MEDULLA
The pyramids are two faint swellings barely visable on the inferior surface of the meulla.

14. CRANIAL NERVES:
Try to identify all XII pair of cranial nerves. (IX & X are usually not visible)

15. BASILAR ARTERY & CIRCLE OF WILLIS
The basilar artery is the midline artery seen on the inferior surface of the medulla and pons.The circle of Willis is seen in the vicinity of the cerebral peduncles.

Review your work to this point by using the checklist for the whole sheep brain found in the appendix on page 60.

SAGITTAL SECTION

To make a sagittal section follow these instructions: Rest your whole brain on its dorsal surface on a cutting board. Use a large carving knife (not a scalpel). Line the knife up exactly in the midline. Make one slow steady continuous slicing motion, with the knife moving from anterior to posterior, making every effort to stay exactly in the midline at all times. Study both halves since the midline structures will usually show up better on one side than on the other.

At this point in your work turn to the checklist for the sheep brain in sagittal section found in the appendix. **Using the checklist on page 60 and Fig. 56, identify all the structures mentioned.**

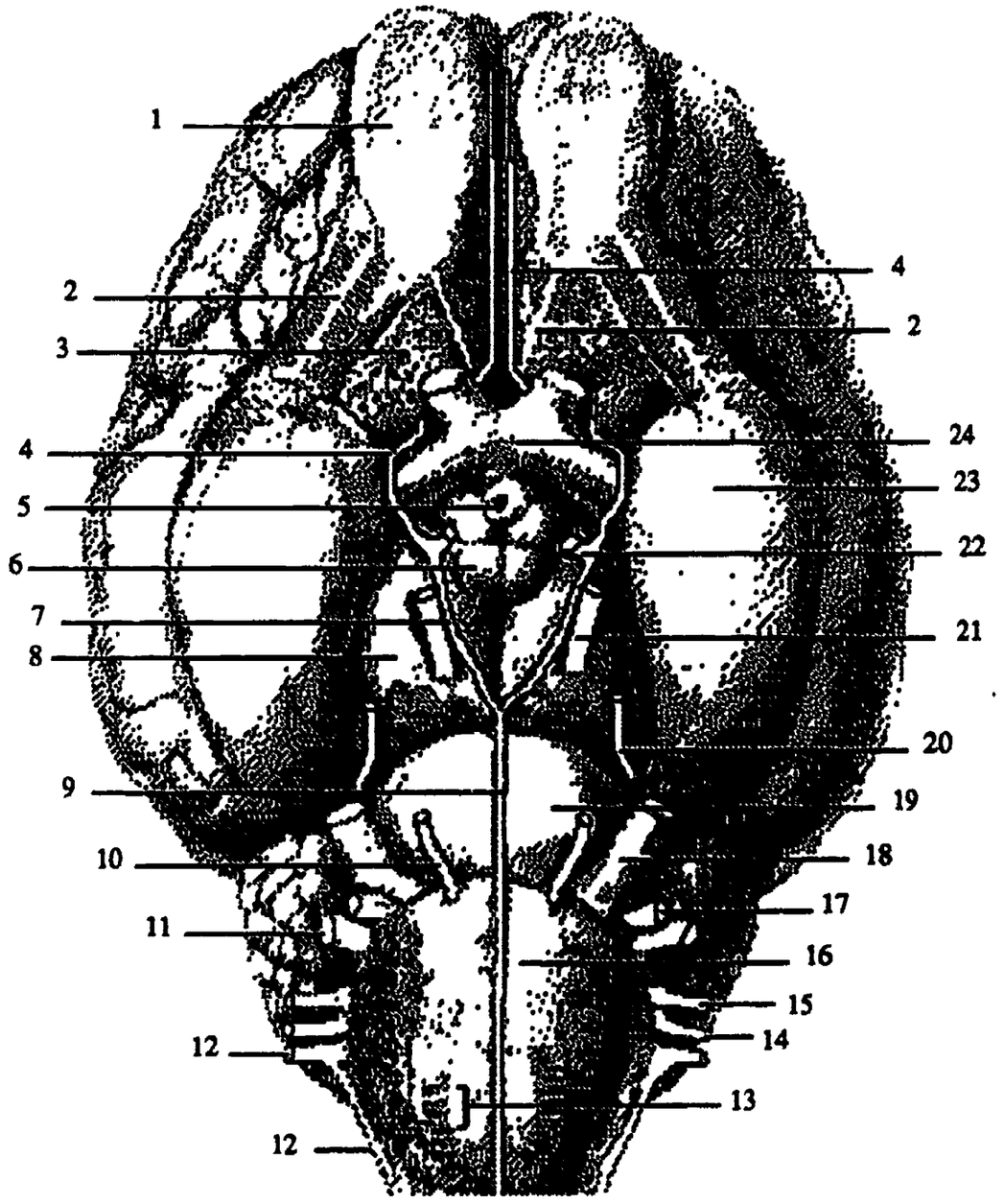


FIG. 56 SHEEP BRAIN, INFERIOR VIEW

KEY TO FIGURE 56

1. cranial nerve I (olfactory bulb)
2. olfactory tract (stria)
3. olfactory trigone (anterior perforate substance)
4. anterior cerebral artery
5. infundibulum
6. mammillary body of hypothalamus
7. posterior communicating artery
8. cerebral peduncle
9. basilar artery
10. cranial nerve VI (abducens)
11. cranial nerve VIII (auditory)
12. cranial nerve XI(spinal accessory)
13. cranial nerve XII (hypoglossal)
14. cranial nerve X (vagus)
15. cranial nerve IX (glossopharyngeal)
16. medulla
17. cranial nerve VII (facial)
18. cranial nerve V (trigeminal)
19. pons
20. cranial nerve IV (trochlear)
21. cranial nerve III (oculomotor)
22. internal carotid artery
23. uncus of temporal lobe
24. optic chiasm

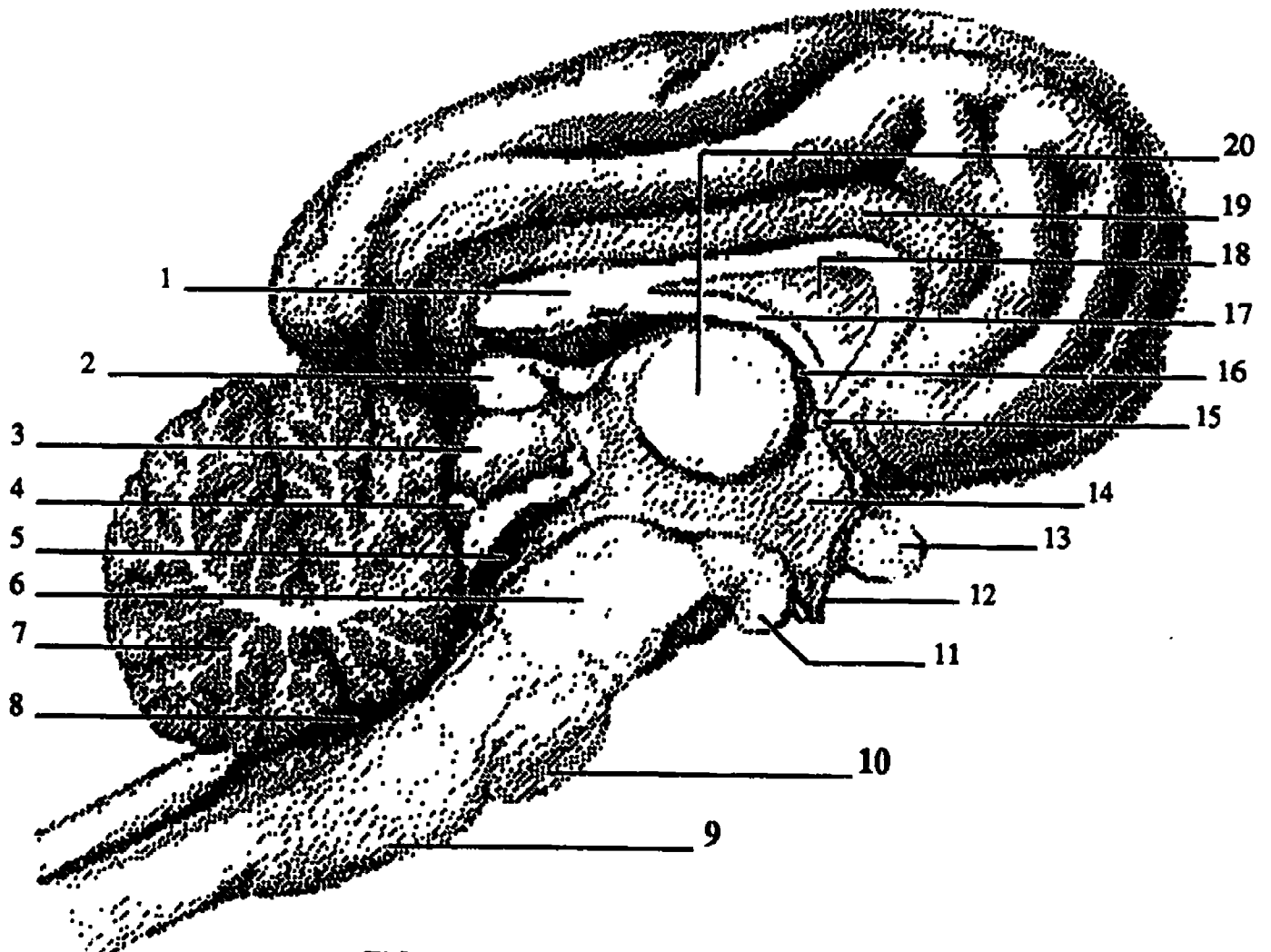


FIG. 57. SHEEP BRAIN, MIDSAGITTAL VIEW

1. corpus callosum
2. pineal body
3. superior colliculus
4. inferior colliculus
5. cerebral aqueduct
6. cerebral peduncles
7. arbor vitae of cerebellum
8. IVth ventricle
9. medulla
10. pons
11. mammillary body
12. infundibulum
13. optic chiasm
14. hypothalamus & IIIrd ventricle
15. anterior commissure
16. interventricular foramen
17. fornix
18. septum pellucidum
19. cingulate gyrus
20. massa intermedia of thalamus

Laboratory Dissection of the Cow Eye

The cow eye is quite large and almost identical to the human eye, and hence is a suitable subject for dissection. The preservatives will have affected the otherwise transparent cornea and lens to varying degrees so that these structures will appear translucent or opaque rather than transparent.

EXTERNAL ANATOMY

The outside surface of your specimen has much attached fat which helps to cushion the eye in it's bony fossa. You will also note the presence of several extrinsic muscles attached to the eyeball. Trim away the fat and muscles and identify the following:

1. SCLERA:
the tough white external tunic of the eye

2. CORNEA:
the transparent portion of the sclera in the anterior position.

3. CONJUNCTIVA:
A continuous layer of epithelium covering the anterior surface of the cornea and sclera, and the under surface of the eyelids. In humans it is transparent, in cows, it is pigmented so that no "white of the eye" shows.

4. OPTIC NERVE:
located at the posterior pole of the eyeball.

INTERNAL ANATOMY:

To examine the internal anatomy of the eye use scissors to puncture the sclera 1/4 inch outside the edge of the cornea. Make a circular (360 degree) incision following the edge of the cornea. Grasp the edges of the incision and separate the front of the eye from the back of the eye.

• Identify the following on the anterior portion of the specimen:

1. SUSPENSORY LIGAMENTS:
transparent threads attaching lens to ciliary body; stretch them and they will break.

2. LENS:
remove it and observe that it magnifies print.

3. CILIARY BODY:
black, resembling the gills of a mushroom.

4. IRIS:
observe closely to identify circular and radial muscles

5. PUPIL:
the hole in the middle of the iris.

6. ANTERIOR CHAMBER:
the space in front of the iris.

7. POSTERIOR CHAMBER:
the space behind the iris.

• Identify the following on the posterior portion of the specimen, :

1. VITREOUS HUMOR:
remove it from the vitreous chamber and observe that it magnifies print; it's function is to hold the retina smooth against the choroid layer.

2. RETINA:
the white inner tunic that collapses as the vitreous humor is removed.

3. OPTIC DISC:
the attachment point for the retina; the point at which optic nerve exits from the eye.

4. CHOROID LAYER:
the black pigmented middle tunic of the eye.

5. TAPETUM LUCIDUM:
An iridescent portion of the choroid layer; is not present in humans. It is this structure which causes the eyes of some animals to shine with reflected light when caught in the glare of headlights at night. It is a special adaptation for vision in dim light that works by reflecting light back onto the retina that would otherwise escape.

6. SCLERA:
the "whites of the eye"

APPENDIX A

CHECKLISTS

One of the greatest difficulties encountered by any student of anatomy is that the amount of material in the various reference books is so overwhelming that left to himself or herself the student cannot decide what to study and what to leave alone. One of the chief functions of the checklists provided here is that they serve to set boundaries for the student so that he or she will not become bogged down by this familiar dilemma. However, you are expected to know the checklist thoroughly, and you would be well advised to rehearse the list frequently, until you know it's details from memory.

Bones √ list: Pectoral Girdle & Upper Limb

CLAVICLE

sternal end
acromial end
coracoid (conoid) tubercle
markings made by muscles and ligaments (on inferior surface)

SCAPULA

FOSSAE:
subscapular
supraspinous
infraspinous
glenoid

BORDERS:
axillary
vertebral
superior

ANGLES
superior
inferior

PROCESSES:
scapular spine
coracoid process
acromion process

HUMERUS

PROXIMAL END:
head
greater tubercle
lesser tubercle
intertubercular (bicipital) groove
anatomical neck
surgical neck
deltoid tuberosity

DISTAL END:
medial epicondyle
lateral epicondyle
capitulum
trochlea
coronoid fossa
olecranon fossa

RADIUS

head
radial tuberosity
styloid process
ulnar notch

ULNA

olecranon process
semilunar notch (trochlear notch)
radial notch
coronoid process
ulnar tuberosity
styloid process

CARPAL BONES

PROXIMAL ROW
(begin on thumb side):
Navicular
Lunate
Triangular
Pisiform

DISTAL ROW
(begin on thumb side):
Greater Multangular
Lesser Multangular
Capitate
Hamate

SYNONYMS
(For the carpal bones you may *wish* to use synonyms, but it is *not required* that you know them.)
Navicular = Scaphoid
Triangular = Triquetrum
Greater Multangular = Trapezium
Lesser Multangular = Trapezoid

METACARPALS

one through five

DIGITS:

proximal phalanges
medial phalanges
distal phalanges
(thumb has no medial phalanx).
sesamoid bone (of thumb)

Bones √ list: Pelvic Girdle & Lower Limb

INNOMINATE BONE

acetabulum
obturator foramen
greater sciatic notch
lesser sciatic notch
iliopectineal line (arcuate line)
pelvic brim (pelvic inlet)

ILIUM

auricular (articular) surface
anterior superior iliac spine
anterior inferior iliac spine
iliac crest
iliac fossa

ISCHIUM

ischial tuberosity
ischial spine
inferior ramus of the ischium
superior ramus of the ischium

PUBIS

pubic arch (subpubic angle)
pubic tubercle
pubic symphysis (symphysis pubis)
inferior ramus of the pubis
superior ramus of the pubis

FEMUR

head
neck
greater trochanter
lesser trochanter
linea aspera
medial and lateral condyles
medial and lateral epicondyles
adductor tubercle
intercondylar fossa
patellar surface
fovea capitis (for ligamentum teres)

TIBIA

medial and lateral condyles
intercondylar eminance or tibial spine
tibial tuberosity
medial malleolus

FIBULA

head
lateral malleolus

PATELLA

articular surface (2 large facets)
apex

TARSUS

calcaneus
talus
navicular
cuneiforms (medial, intermediate, lateral)
cuboid (distal row, lateral side)

METATARSUS

(one through five)

PHALANGES

(proximal, medial, distal, except big toe has only two)

Bones √ list: Axial Skeleton

VERTEBRAL COLUMN

VERTEBRAL PARTS

(mid-thoracic)
body of the vertebra
transverse process
spinous process
2 superior articular processes
2 inferior articular processes
lamina
pedicle
vertebral arch
vertebral foramen
intervertebral foramena
intervertebral notches

VERTEBRAL REGIONS

(special regional features)

CERVICAL REGION

- transverse foramena on all 7 vertebrae
- bifid spine on most.

Atlas (C1):
anterior arch
posterior arch
body is absent.

Axis(C2)
dens (odontoid process).

Vertebra Prominens (C7)
prominent spinous process.

THORACIC REGION

- 2 facets or 4 demifacets on body of vertebra for head of rib
- 1 facet on transverse process for rib tubercle
- intervertebral articulations permit lateral rotation

LUMBAR REGION

- massive body
- thick rectangular spinous process
- thin bladelike transverse processes
- interlocking intervertebral articulations

SACRAL REGION

note surface for articulation with ilium

COCCYX

3-5 rudimentary, nodular appearing vertebrae)

REST OF AXIAL SKELETON

STERNUM

manubrium
body
xiphoid process
sternal angle
suprasternal notch (jugular notch)
facets for clavicle
facets for costal cartilages 1-7

RIBS

head
neck
body
angle
tubercle
costal groove
articulations

HYOID BONE:

the only nonarticulating bone in the body.

Bones √ list: Skull

CRANIAL BONES

FRONTAL BONE:
supraorbital foramen
frontal sinus

OCCIPITAL BONE:
external occipital crest
external occipital protuberance
superior nuchal line
inferior nuchal line
occipital condyles
foramen magnum
hypoglossal foramen

TEMPORAL BONES (2):
squamous portion
petrous portion
mastoid process
styloid process
zygomatic process
carotid foramen
carotid canal
foramen lacerum (in part)
stylomastoid foramen
mastoid air cells
external auditory meatus
internal auditory meatus
auditory canal

PARIETAL BONES (2)

SPHENOID BONE (1):
sella turcica
anterior clinoid processes (2)
posterior clinoid processes (2)
lateral pterygoid processes (2)
medial pterygoid processes (2)
greater wings (ala) (2)
lesser wings (ala) (2)
superior orbital fissure (2)
optic canal (2)
optic foramen (2)
foramen lacerum (in part)
foramen ovale (2)
foramen spinosum
foramen rotundum (2)
sphenoid sinuses (2)

ETHMOID BONE (1):
crista galli
cribriform plate
perpendicular plate
superior conchae (2)
middle conchae (2)
olfactory foramena

FACIAL BONES

ZYGOMATIC (2)

LACRIMAL (2)

NASAL (2)

MAXILLARY (2):
alveolar margins
palatine process
zygomatic process
lacrimal groove
maxillary sinus
infraorbital foramen
incisive foramen

PALATINE (2)
horizontal process
orbital process

INFERIOR NASAL CONCHAE (2)

VOMER (1)

MANDIBLE (1):
coronoid process
condyloid process
angle
ramus
mental symphysis
mental foramen
mandibular foramen
mandibular notch
alveolar margins

PARTS OF THE SKULL INVOLVING MULTIPLE BONES

Nasal Septum
Hard Palate
Inferior Orbital Fissure
Foramen Lacerum
Jugular Foramen
Orbital Fossa
Zygomatic Arch
Nasal Cavity
Choanae (posterior entrance to nose)

VENOUS SINUSES

Groove for the Superior Sagittal Sinus
Groove for the Transverse Sinus
Groove for the Sigmoid Sinus

SUTURES OF THE SKULL

Coronal
Sagittal
Squamosal
Lambdoidal

EAR OSSICLES (6)

MALLEUS
INCUS
STAPES

FETAL SKULL

FONTANELS (WITH SYNONYMS)
Frontal (Anterior)
Occipital (Posterior)
Sphenoidal (Anterolateral)
Mastoid (Posterolateral)

NOTICE THE FOLLOWING:
absence of mastoid proc ess
absence of external auditory canal (with consequent exposed eardrum)
flat (short) face
two parts to frontal bone and mandible

X-RAYS OF THE SKULL

AIR SINUSES
sphenoid
frontal
maxillary
ethmoid air cells
mastoid air cells

NOTICE THE FOLLOWING:
sella turcica
zygomatic arch
perpendicular plate of ethmoid
orbital fossa

Arthrology √ list

FIND THE FOLLOWING JOINTS ON THE ARTICULATED SKELETON.

tempromandibular
atlantooccipital
atlantoaxial
acromioclavicular
sternoclavicular
sternal angle
sternochondral
costochondral
costovertebral
costotransverse
glenohumeral
humeroulnar
radiohumeral
proximal radioulnar
distal radioulnar
intermediate radioulnar
radiocarpal
femeropatellar
proximal tibiofibular
distal tibiofibular
intermediate tibiofibular
symphysis pubis
sacroiliac

Muscles √ list: Cat Muscles

HEAD & NECK
temporalis
auricularis
masseter
sterno- & cleidomastoid
splenius capitis
digastric
mylohyoid
sternohyoid

SHOULDER JOINT
clavo-, acromio-, & spinodeltoid
latissimus dorsi
teres major & minor
supraspinatus
infraspinatus
subscapularis

PECTORAL GROUP
pectoantebrachialis
xiphihumeralis
pectoralis major & minor

ABDOMINAL WALL
external & internal oblique
transversus
rectus abdominis

SCAPULA MOORING MUSCLES
serratus anterior
rhomboids major, minor, capitis
levator scapulae
pectoralis minor
clavo-, acromio-, & spinotrapezius

ELBOW JOINT
epitrochlearis
biceps & triceps brachii
brachialis
brachii
anconeus
brachioradialis
pronator teres

FOREARM
extensor carpi radialis longus & brevis
extensor digitorum communis & lateralis
extensor carpi ulnaris
flexor carpi radialis
palmaris longus
flexor carpi ulnaris

GLUTEAL REGION
gluteus maximus & medius
caudofemoralis
tensor fascia lata

THIGH
sartorius
iliopsoas
rectus femoris
vastus lateralis, medialis, intermedius
gracilis
adductor magnus & longus
pectineus
biceps femoris
semimembranosus
semitendinosus

LOWER LEG
tibialis anterior
extensor digitorum
gastrocnemius
soleus
plantaris
peroneus longus, brevis, tertius
flexor digitorum
flexor hallucis
tibialis posterior
popliteus

Muscles √ list: Human Muscles Listed by Actions

HEAD AND NECK

FACIAL EXPRESSION
frontalis
occipitalis
corrugator
procerus
orbicularis oculi
nasalis
levator labii superioris
(quadratus labii superioris)
levator anguli oris
zygomaticus major
risorius
orbicularis oris
depressor anguli oris
depressor labii inferioris
mentalis
buccinator
platysma

MASTICATION (JAW)
temporalis
masseter
medial pterygoid
lateral pterygoid

ELEVATE LARYNX
(for speech and swallowing)
stylohyoid
digastric
mylohyoid

DEPRESS LARYNX
(for speech and swallowing)
sternohyoid
omohyoid
thyrohyoid

EXTEND NECK (HEAD)
trapezius (clavo)
semispinalis capitis
splenius capitis (x2)
levator scapulae (x2 reversed)

ANTERIOR FLEXION OF HEAD (NECK)
sternocleidomastoid (x2)

LATERAL FLEXION OF HEAD (NECK)
trapezius (clavo)
levator scapulae (reversed)

ROTATE HEAD (NECK)
sternocleido mastoid
splenius capitis

TRUNK

EXTEND TRUNK (SPINE)
erector spinae group

ANTERIOR FLEXION OF TRUNK (SPINE)
rectus abdominis
psoas major (and minor)
iliacus

LATERAL FLEXION OF TRUNK (SPINE)
quadratus lumborum

ROTATE TRUNK (SPINE)
external oblique
internal oblique
transversus abdominis

COMPRESS ABDOMEN
rectus abdominis
external oblique
internal oblique
transversus abdominis

BREATHING
diaphragm
external intercostals
internal intercostals
scalenii

PECTORAL GIRDLE AND UPPER LIMB

MUSCLES ACTING ON THE SCAPULA

ELEVATE SCAPULA
trapezius (clavo)
levator scapulae

ADDUCT SCAPULA
(retraction)
trapezius (acromio)
rhomboids (major & minor)

DEPRESS SCAPULA
trapezius (spino)
pectoralis minor

ABDUCT SCAPULA
serratus anterior

MUSCLES ACTING ON SHOULDER

FLEX ARM
pectoralis major
coracobrachialis
deltoid (clavo)

EXTEND ARM
latissimus dorsi
teres major
deltoid (spino)

ABDUCT ARM
supraspinatus
deltoid (acromio)

ADDUCT ARM
latissimus dorsi
teres major
pectoralis major
coracobrachialis
deltoid (spino & clavo)

LATERAL ROTATION OF ARM
infraspinatus
teres minor
deltoid (spino)

MEDIAL ROTATION OF ARM
subscapularis
latissimus dorsi
teres major
pectoralis major
deltoid (clavo)

MUSCLES ACTING ON THE ELBOW

FLEX FOREARM
biceps brachii
brachialis
brachioradialis
pronator teres

triceps brachii
anconeus

PRONATE FOREARM
pronator teres
pronator quadratus

SUPINATE FOREARM
biceps brachii
brachioradialis
supinator

MUSCLES ACTING ON WRIST AND FINGERS

PALMAR FLEX ION OF WRIST
palmaris longus
flexor carpi ulnaris
flexor carpi radialis
flexor digitorum: superficial/deep

EXTENSION (DORSIFLEX) OF WRIST
extensor carpi radialis longus
extensor carpi radialis brevis
extensor carpi ulnaris
extensor digiti minimi
extensor digitorum communis
extensor pollicis longus & brevis

ABDUCT WRIST
flexor carpi radialis
extensor carpi radialis longus
extensor carpi radialis brevis

ADDUCT WRIST
flexor carpi ulnaris
extensor carpi ulnaris

FLEX FINGERS
flexor digitorum superficial/deep

EXTEND FINGERS
extensor digitorum communis
extensor digiti minimi
extensor pollicis longus & brevis

PELVIC GIRDLE AND LOWER LIMB

MUSCLES ACTING ON HIP JOINT

FLEX THIGH
Iliopsoas
Tensor fascia lata
Sartorius
Gluteus medius
Rectus femoris

EXTEND THIGH
Gluteus maximus
Gluteus medius
Hamstring group:
- Biceps femoris
- Semitendinosus
- Semimembranosus

ABDUCT THIGH
Gluteus medius
Gluteus minimus
Tensor fascia lata
Sartorius

ADDUCT THIGH
Adductor group:
- Gracilis
- Pectineus
- Adductor magnus
- Adductor longus
- Adductor brevis

LATERAL ROTATION OF THIGH
Gluteus maximus
Gluteus medius
Sartorius
6 Deep gluteal muscles

MEDIAL ROTATION OF THIGH
Gluteus medius
Gluteus minimus

MUSCLES ACTING ON KNEE JOINT

FLEX KNEE
Hamstring group:
- Biceps femoris
- Semitendinosus
- Semimembranosus

Sartorius
Gastrocnemius
Plantaris
Popliteus

EXTEND KNEE
Quadriceps femoris:
- Rectus femoris
- Vastus lateralis
- Vastus intermedius
- Vastus medialis

BRACE KNEE (MEDIAL SIDE)
Sartorius
Gracilis
Semitendinosus
Semimembranosus

BRACE KNEE (LATERAL SIDE)
Biceps femoris
Tensor fascia lata
Gluteus maximus

BRACE KNEE (ANTERIOR)
Quadriceps femoris:
- Rectus femoris
- Vastus lateralis
- Vastus intermedius
- Vastus medialis

MUSCLES ACTING ON ANKLE AND TOES

FLEX ANKLE
(dorsiflex)
Tibialis anterior
Extensor digitorum longus
Extensor hallucis longus
Peroneus tertius

EXTEND ANKLE
(plantar flex)
Tibialis posterior
Peroneus longus
Peroneus brevis
Gastrocnemius
Soleus
Plantaris
Flexor hallucis longus
Flexor digitorum longus

FLEX TOES
Flexor hallucis longus
Flexor digitorum longus

EXTEND TOES
Extensor digitorum longus
Extensor hallucis longus

INVERT ANKLE
Tibialis anterior
Tibialis posterior

EVERT ANKLE
Peroneus longus
Peroneus brevis
Peroneus tertius

Muscles √ list: Human Muscles Listed by Region

HEAD AND NECK

FACE

frontalis
occipitalis
corrugator
procerus
orbicularis oculi
nasalis
levator labii superioris
(quadratus labii superioris)
levator anguli oris
zygomaticus major
risorius
orbicularis oris
depressor anguli oris
depressor labii inferioris
mentalis
buccinator
platysma

JAW

temporalis
masseter
medial pterygoid
lateral pterygoid

ANTERIOR NECK STRAP MUSCLES

SUPRAHYOID GROUP

stylohyoid
digastric
mylohyoid

INFRAHYOID GROUP

sternohyoid
omohyoid
thyrohyoid

POSTERIOR TRIANGLE OF NECK

BORDERS OF THE TRIANGLE

sternocleidomastoid
trapezius

CONTENTS OF THE TRIANGLE

splenius capitis
levator scapulae
scalenus posterior
scalenus medial
scalenus anterior

TRUNK

DEEP MUSCLES OF BACK & NECK

erector spinae : .
semispinalis capitis
spleneus capitus

ANTERIOR ABDOMINAL WALL

rectus abdominis
external oblique
internal oblique
transversus abdominis

POSTERIOR ABDOMINAL WALL

iliopsoas:
  psoas major
  psoas minor
  iliacus
quadratus lumborum

PECTORALGIRDLE AND UPPER LIMB

MOORING MUSCLES OF SCAPULA

trapezius
rhomboid major
rhomboid minor
levator scapulae
serratus anterior
pectoralis minor

ROTATOR CUFF GROUP

supraspinatus
infraspinatus
teres minor
subscapularis

BETTER LEVERAGE AT SHOULDER

deltoid
latissimus dorsi
teres major
pectoralis major
coracobrachialis

ARM

(Muscles which act on the elbow joint)
biceps brachii
brachialis
brachioradialis
pronator teres
triceps brachii
anconeus
supinator
pronator quadratus

ANTERIOR FOREARM

(Muscles which act on the wrist & fingers)
palmaris longus
flexor carpi ulnaris
flexor carpi radialis
flexor digitorum superficiais and profundus

POSTERIOR FOREARM

(Muscles which act on the wrist & fingers)
extensor carpi radialis longus
extensor carpi radialis brevis
extensor digitorum communis and indicis
extensor digiti minimi
extensor carpi ulnaris

THUMB

extensor pollicis longus
extensor pollicis brevis
abductor pollicis longus
flexor pollicis longus

PELVIC GIRDLE AND LOWER LIMB

GLUTEAL REGION

gluteus maximus
gluteus medius
gluteus minimus
tensor fascia lata
deep gluteal group

POSTERIOR THIGH (HAMSTRINGS)

biceps femoris
semitendinosus
semimembranosus

MEDIAL THIGH (ADDUCTORS)

gracilis
adductor magnus
adductor longus
adductor brevis
pectineus

ANTERIOR THIGH

iliopsoas
sartorius
quadriceps femoris
- rectus femoris
- vastus lateralis
- vastus medialis
- vastus intermedius

ANTERIOR LEG

tibialis anterior
extensor hallucis
extensor digitorum
peroneus tertius

LATERAL CRURAL GROUP

peroneus longus
peroneus brevis

POSTERIOR LEG

SUPERFICIAL GROUP

gastrocnemius
soleus
plantaris
popliteus

DEEP GROUP

tibialis posterior
flexor digitorum
flexor hallucis longus

Nervous System √ lists: Miscellaneous Lists

MICROSCOPE WORK REVIEW

PERIPHERAL NERVE SLIDES:

epineurium
perineurium
endoneurium
axon
myelin
neurilemma
Schwann cell nucleus
node of Ranvier

SPINAL CORD SLIDES:

ventral horn
ventral horn cells
dorsal horn
lateral horn (if present)
dorsal root ganglion
roots of the spinal nerve
central canal
dorsal median septum
ventral median fissure

SPINAL CORD MODEL

dorsal median septum
ventral median sulcus
dorsal white column (funiculus)
ventral white column
lateral white column
central canal of spinal cord
dorsal white commissure
ventral white commissure
dorsal horn
lateral horn
anterior (ventral) horn
dorsal root of spinal nerve
dorsal root ganglion
mixed spinal nerve
ventral root of spinal nerve

CAT : PERIPHERAL NERVOUS SYSTEM

phrenic nerve
brachial plexus
- musculocutaneous nerve
- median nerve
- ulnar nerve
- radial nerve

intercostal nerves
sciatic nerve
femoral nerve

CAT: AUTONOMIC NERVOUS SYSTEM

sympathetic trunk
vagus nerve

Nervous System √ lists: Sheep Brain

WHOLE SHEEP BRAIN

MISCELLANEOUS

MENINGES:
dura
arachnoid

SUBARACHNOID SPACES
cisterna magna
pontine cistern
interpeduncular cistern
superior cistern

CRANIAL NERVES,
all 12 pair (IX & X may not be visable)

FISSURES
median longitudinal fissure
transverse fissure
lateral (Sylvian) fissure

RHOMBENCEPHALON

METENCEPHALON
cerebellar peduncles
middle peduncle
superior peduncle
inferior peduncle
vermiform body of cerebellum
pons

MYLENCEPHALON
medulla
pyramids of medulla

MESENCEPHALON

cerebral peduncles
corpora quadrigemina

PROSENCEPHALON

TELENCEPHALON
olfactory bulbs
olfactory tracts
olfactory trigone, (anterior perforate substance)
uncus

DIENCEPHALON
corpus callosum
pineal body
lateral geniculate bodies of thalamus
optic nerves
optic chiasm
optic tracts
infundibulum
mammillary body of hypothalamus

SAGITTAL SECTION

MISCELLANEOUS

lateral ventricle
IIIrd ventricle
foramen of Monro
cerebral aqueduct
IVth ventricle

RHOMBENCEPHALON

METENCEPHALON
cerebellar cortex
arbor vitae
superior cerebellar peduncles
inferior cerebellar peduncles
pons

MYLENCEPHALON
medulla oblongata

MESENCEPHALON

corpora quadrigemina
superior colliculi
inferior colliculi
cerebral peduncles

PROSENCEPHALON

TELENCEPHALON
cerebral cortex

DIENCEPHALON
corpus callosum
septum pellucidum
fornix
thalamus
lateral geniculate body of the thalamus
massa intermedia of the thalamus
hypothalamus
infundibulum
mammillary body
pineal body
optic chiasm

Nervous System √ lists: Human Brain Models

MISCELLANEOUS

cranial nerves I-XII
ventricles I-IV
foramen of Monro
cerebral aqueduct

RHOMBENCEPHALON

MYELENCEPHALON

medulla oblongata
pyramids of the medulla
decussation of the pyramids

METENCEPHALON

cerebellum
cerebellar cortex
arbor vitae
pons
cerebellar peduncles
superior peduncle
middle peduncle
inferior peduncle

MESENCEPHALON

Cerebral Peduncles
Corpora Quadrigemina
superior colliculi
inferior colliculi

PROSENCEPHALON

TELENCEPHALON

olfactory bulbs
olfactory tracts
olfactory trigone
uncus
cingulate gyrus (above and parallel to the corpus callosum)
hippocampus

LOBES

frontal lobe
parietal lobe
occipital lobe
temporal lobe

FISSURES

- midsagittal fissure
- central fissure (of Rolando)
- lateral fissure (Sylvian fissure)
- parieto-occipital fissure (midsagittal view)
- calcarine fissure (midsagittal view at right angles to parieto-occipital fissure, extending to tip of occipital pole)
- cingulate fissure (midsagittal view above cingulate gyrus, which is above the corpus callosum)
- collateral fissure (inferior view, runs the length of temporal lobe)

CORTEX

- precentral gyrus (motor)
- prefrontal cortex (emotional control, thinking, planning)
- postcentral gyrus (sensory)
- visual cortex (walls of calcarine fissure)
- visual association areas
- motor speech area (frontal lobe just above Sylvian fissure)
- speech association areas
- hearing projection cortex
- hearing association areas
- olfactory discrimination cortex (uncus and cingulate gyrus)

DIENCEPHALON

thalamus
lateral geniculate bodies
medial geniculate bodies
epithalamus (pineal body)
hypothalamus
mammillary bodies (two)
fornix

BASAL NUCLEI

caudate nucleus
lentiform nucleus
corpora striata

TRACTS (WHITE MATER)

internal capsule
corona radiata
corpus callosum
anterior commissure

Nervous System √ list: Cow Eye

sclera
cornea
conjunctiva
optic nerve
suspensory ligaments
lens
ciliary body
iris
pupil
anterior chamber
posterior chamber
vitreous humor
retina
optic disc

Nervous System √ list: Human Eye Model

choroid layer
tapetum lucidum
sciera
sclera
choroid layer
retina
rods
cones
bipolar layer
macula lutea
fovea centralis
optic nerve
optic disc
cornea
iris
lens
suspensory ligaments
ciliary process
canal of Schlemm
anterior chamber
posterior chamber
vitreous chamber
lacrimal gland
conjunctiva

INTRINSIC MUSCLES OF THE EYE

circular muscles of iris
radial muscles of iris
ciliary body (contains ciliary muscles)

EXTRINSIC MUSCLES OF THE EYE

superior rectus
inferior rectus
lateral rectus
medial rectus
superior oblique
inferior oblique

Nervous System √ list: Human Ear Model

cochlea (bone)
cochlear duct (membrane)
vestibule
utricle
saccule
semicircular canals
semicircular ducts
scala vestibuli
scala tympani
organ of Corti
cochlear nerve
vestibular nerve
oval window
round window
eustachian tube
ear ossicles
tympanic membrane (ear drum)
inner ear
middle ear
external ear
auricle

APPENDIX B

Homework

Introductory Homework: Terminology

1. Fill in the blanks in the chart with the correct directional term for the human and for the cat. The body parts are often found in different positions in the human as compared to the cat. For example, in humans the ventral surface faces anteriorly, whereas in the cat the ventral surface is inferior.

Body Part or Surface	Term Describing Position	
	Human	Cat
ventral	anterior	
dorsal		
cephalic		
caudal		

2. Fill in the blanks in the chart with a synonym for the body plane. The synonym will be different for the human and for the cat. For example: In humans the frontal plane is also the coronal plane, but in the cat the frontal plane is the same as the _____ plane.

Plane	Synonym	
	Human	Cat
frontal	coronal	
transverse		

3. Fill in the blanks with the term which best describes the position stipulated (assume that the person is in standard anatomical position unless the word **always** is used).

a. the spine is _____ to the umbilicus.

b. the knee is always _____ to the hip.

c. thumb is always _____ to the elbow.

4. The serous membrane lining the thoracic cavity is called the:

_____

(2 words)

5. The serous membrane lining the abdominal cavity is called the:

_____

(2 words)

6. The serous membrane covering the outside of the lungs is called the:

_____

(2 words)

7. What is the difference between a sagittal and a midsagittal section?

Osteology Homework: Pectoral Girdle & Upper Limb

1. Look up "fractures" in your medical dictionary, and define the following kinds:

simple

compound

greenstick

2. If you fall and catch yourself on the heel of your hand with the arm extended stiffly, the fracture most likely to result is called Colles' Fracture. Look it up in the dictionry. What bone is involved and where is the break?

3. What is the difference between the surgical neck and the anatomical neck of the humerus?

4. Look up the following terms in your medical dictionary. Jot down some notes on the meanings of the Latin or Greek roots. Notice how these will help you relate to the topic of study.

capitulum

condyle

coracoid

epicondyle

hamate (hamatum)

lunate

pollex

styloid

trochlea

5. What are nutrient foramena?

NOTES:

Osteology Homework: Pelvic Girdle & Lower Limb

1. Look up the following terms in your medical dictionary. Jot down some notes on the meanings of the Latin or Greek roots. Notice how these will help you relate to the topic of study.

acetabulum

articular

aspera (as in linea aspera)

auricular

cuboid

fossa

fovea

hallux

innominate

popliteal

ramus

2. What is the fovea capitis? Where is it?

3. What is the ligamentum teres (ligamentum capitis)?

NOTES:

Osteology Homework: Axial Skeleton

1. Draw the normal curvatures of the adult spine. Label the "secondary" curvatures?. Label the primary (fetal) curvatures.

NOTES:

2. Define:

kyphosis

lordosis

scoliosis

3. Where precisely are the intervertebral discs found; what is their function?

4. What are the annulus fibrosus and the nucleus pulposus of a vertebral disc?

5. A laminectomy is done in order to gain access to a herniated disc. What does the "lamina" part of this term refer to?

Osteology Homework: the Skull

1. Look up the following terms in your medical dictionary. Jot down some notes on the meanings of the Latin or Greek roots. Notice how these will help you relate to the topic of study.

ala

alveolar

carotid (carotic)

coronoid

cribriform

crista galli

glosso- (glossal)

incisive

jugular

lacerum (lacerate)

lacrimal

mental

nuchal

petrous

pterygoid

sella turcica

septum

sphenoid (spheno-)

squamous

vomer

2. What are Wormian bones?

3. What is the difference between the paranasal sinuses and the venous sinuses of the brain. Name each.

4. Why doesn't the fetal skull have a mastoid process? Be clear about the difference between cause and effect.

5. Which of the fontanels stays "open" the longest? When does it close?

6. The sigmoid sinus exits the skull through the jugular foramen, and enters the neck. What is this vein called in the neck?

7. Fill in the spaces on the chart to show what bones are present in the structure listed on the left. The number of bones is given in parentheses. If the same bone is present twice (for example, both palatine bones) it is counted twice. The second problem is an example of this.

PROBLEM	ANSWER
1. nasal septum (2 bones)	
2. hard palate (4 bones)	
3. inf.orbital fissure (5 bones)	
4. foramen lacerum (3 bones)	
5. jugular foramen (2 bones)	
6. orbital fossa (7 bones)	
7. foramen spinosum (usually 2 bones)	
8. zygomatic arch (2 bones)	
9. nasal cavity (13 bones)	
10. choanae (4 bones)	

Osteology Homework: Ossification

1. Find the following terms in your medical dictionary. Take notes on the Latin or Greek roots. Notice how these meanings will help you relate to the topic.

cancellous

chondroblast;

chondrocyte

diaphysis

embryonic (embryologic)

endochondral

epiphysis (epiphyseal plate)

hemopoiesis; (haemo-; hemato-)

hypertrophic

intramembranous

necrosis (necrotic)

osteoblast;

osteoclast

osteocyte;

osteogenic

periosteal bud

periosteum

spicule

2. Give a precise definition of **diffusion**.

3. Name three things that interfere with diffusion of nutrients to the cells in the center of the cartilage precursor.

4. a. Why is the periosteal bud important.
b. Why doesn't it invade the cartilage precursor earlier?

5. What causes the epiphyseal plate to close?

6. What is the cause of pituitary dwarfism?

7. Compare giantism and acromegaly.

8. List the sequence of events in endochondral ossification in correct order. Memorize these.

9. List the cause effect relationships for the above (#8.) from memory:

Osteology Homework: Arthrology

1. Look up the following terms in your medical dictionary. Jot down some notes on the meanings of the Latin or Greek roots. Notice how these will help you relate to the topic of study.

amphi-

annular

arthralgia

arthritis

arthro-

bursitis

intracapsular

meniscus

retinaculum

synovial

tendosynivitis

2. Classify each of the following joints using both of the following schemes:

I. Fibrous	A. Synarthrosis
II. Cartilagenous	B. Amphiarthrosis
III. Synovial	C. Diarthrosis

acromioclavicular

interosseous membrane

sterno clavicular

symphysis pubis

glenohumeral

tempromandibular

humero-ulnar

costochondral joints

radiohumeral

sterno chondral

proximal radio-ulnar

sutures

distal radio-ulnar

radiocarpal

femeropatellar

atlanto-occipital

distal tibiofibular

atlanto-axial

3. Give specific examples of each of the following types of joints:

ball and socket joint

symphysis joint

hinge joint

gliding joint

pivot joint

4. What joint is moving when you nod your head yes?

5. What joint is moving when you shake your head no?

Myology Homework

1. Look up the following terms in your medical dictionary. Jot down some notes on the meanings of the Latin or Greek roots.

anconeus

antibrachium

biceps

cleido

crura

fascia

gracile

nucha

pectoral (pectus)

peroneal

planta

platy-

popliteal

profunda

quadrate

quadriceps

rectus

sartorius

serrate

soleus

splenium

teres

2. Define aponeurosis?

3. Define the following in terms of muscle function:

a. origin

b. insertion

c. action

4. In terms of muscle function:

define synergist

define antagonist

4. There are different but equivalent ways of naming specific muscle actions. As examples, fill in the blanks of the following exercise.

a. Flexion of the hip, = flexion of the _____ , = flexion of the _____.

b. Extension of the knee, = extension of the _____, = extension of the _____.

c. Abduction of the arm, = abduction of the _____, = abduction of the _____.

d. Flexion of the forearm = flexion of the_____ , = flexion of the _____.

5. Name the muscles that move the mandible?

6. Regarding the muscles of facial expression, which ones are for:

Smiling

Grimacing

Frowning

Kissing

Other

7. The extensor muscles of the weight bearing joints are called posture muscles because they are antigravity muscles. Name the following:

a. four posture muscles of the head and neck:

b. posture muscle group of the spinal column:

8. Which muscles compress the abdomen (for urination, defecation, vomiting, parturition, sneezing, coughing)

9. Name a synergist of the rhomboid muscles.

10. Regarding the muscles which move the elbow, which ones are for

a. Pronation (Medial Rotation) :

b.Supination (Lateral Rotation):

11. Name a flexor muscle and an extensor muscle, both of which abduct the wrist:

12. Name a flexor muscle and an extensor muscle, both of which adduct the wrist:

13. Some muscles cause actions at more than one joint. Name the muscle or muscle group:

a. that crosses the shoulder joint and the elbow joint:

b. that flexes the elbow and supinates the arm:

c. that flexes the elbow and pronates the arm.

d. that weakly flexes the elbow and strongly flexes the wrist and fingers:

14.. Name a synergist of the gluteus maximus.

15. Name an antagonist of the iliopsoas muscle.

16. Name an antagonist of the quadriceps femoris group.

17. Name the posture muscles of the hip joint:

18. Name the posture muscles of the knee joint:

19. Name the muscles which brace the extended knee.

20. Regarding the muscles which move the ankle, which ones are for

Eversion:

Inversion:

21. Some muscles cause actions at more than one joint. Name the musc'e or muscle group:

a. that causes flexion of the hip and extension of the knee:

b. that causes extension of the hip and flexion of the knee:

c. that flexes the spine and flexes the hip

22. Name a muscle that extends the ankle and flexes the toes.

23. Name a muscle that flexes the ankle and extends the toes.

NOTES:

Nervous System Homework: Introduction

1. Define the following divisions of the nervous system.

a. Central Nervous System (CNS)

b. Peripheral Nervous System (PNS)

c. Autonomic Nervous System (ANS)

2. Find the following nervous system terms in your medical dictionary. Jot down some notes on the meanings of the roots.

afferent

efferent

facilitation

glia

impulse

inhibition

internuncial

myelin

synapse

3. Draw a diagram of the anatomy of a synapse, and describe how an impulses crosses the synapse.

4. True or False: At a nerve-nerve synapse impulses pass from the axon of a neuron to the axon of the next neuron. Explain

5. True or False: Dendrites can be thought of as being extensions of the surface area of the axons.

6. True or False: Axons carry impulses toward their cell body.

7. Name the glia and their functions.

8. Clearly distinguish between (define):

endoneurium

perineurium

epineurium

9. Explain the "jelly roll" theory of myelin formation. Make a clear distinction between myelin and neurilemma.

10. True or False: Myelin helps with nerve regeneration. Explain.

11. Compare and contrast the following pairs of terms:

white matter / gray mater

nerve / tract

nucleus / ganglion

receptors / effectors

afferent / efferent nerves

Nervous System Homework: Spinal Cord and Peripheral Nerves

1. Find the following nervous system terms in your medical dictionary. Jot down some notes on the meanings of theroots.

cauda

cisterna

conus

equinia

filum

phrenic

plexus

reflex

sciatic

wrist drop

2. T1 isn't grouped with the intercostal nerves. What is it part of?

3. Compare and contrast: sensory, motor, and internuncial neurons, relating each to their role in the nervous system.

4. Compare and contrast Anterior Horn Cells to Lateral Horn Cells.

5. Explain the process which creates the cauda equina.

6. What is the filum terminale?

7. Where is the conus medullaris?

8. Why are spinal taps done at the L_4-L_5 level of the spinal cord?

9. How many pairs of spinal nerves are there?

10. List the number of spinal nerves that exit from each region of the spinal cord.

11. Name the four major nerve plexuses and list the spinal nerves that feed into each.

12. Name the major peripheral nerves arising from each of the plexuses, and name the parts of the body served by each nerve.

13. Name the largest of the peripheral nerves.

14. Damage to which terminal nerve would result in:

death by suffocation

inability to extend the hip joint

wrist drop

ankle drop

15. True or False: The ascending and descending pathways of the spinal cord are located in the white mater (not gray mater) of the cord. Explain

16. True or False:The spinal cord extends to the base of the 5th sacral vertebra. Explain

17. True or False: In a reflex arc impulses pass from an internuncial neuron to a sensory neuron. Explain

18. True or False: A lumbar puncture involves removing cerebral spinal fluid from a subarachnoid space. Explain

19. True or False: The dorsal horn of the spinal cord contains the cell bodies of motor neurons. Explain

20. True or False: The posterior horn of the spinal cord contains cell bodies of preganglionic neurons of the sympathetic nervous system. Explain

21. True or False: The radial nerve is a branch of the brachial plexus.

22. True or False: The phrenic nerve is a branch of the cervical plexus. Explain

23. True or False: When giving intramuscular injections, it is important to know the location of the sciatic nerve in the femoral region. Explain.

24. Practice drawing the cross section of the spinal cord free hand until you can do it quickly; label it.

Homework: Autonomic Nervous System

1. Find the following terms in your medical dictionary. Write notes on the Latin and Greek roots.

autonomous

collateral

ejaculation

homeostasis

hypo-

hypothalamic

para-

parasympathomimetic

paravertebral

peristalsis

ramus

splanchna

sympathomimetic

vaso-

vasoconstrictive

2. How is motor supply to skeletal muscle different from motor supply to smooth muscle?

3. Clearly distinguish between preganglionic and postganglionic motor nerves.

4. Draw a diagram showing a white ramus communicans and a gray ramus communicans.

5. With *words*, clearly define the differences between a white and a gray ramus communicans.

6. What is a splanchnic nerve?

7. "Thoracolumbar" is a synonym for the sympathetic system, and "craniosacral" is a synonym for the parasympathetic system. Explain why.

8. Explain why "adrenergic " refers to the sympathetic system, and "cholinergic" refers to the parasympathetic system.

9. What *cranial* nerves carry parasympathetic motor neurons? Give the nerve by name and number (Roman numeral).

10. True or False: Cell bodies of *preganglionic* neurons of the *sympathetic* division of the autonomic nervous system are located in the *lateral* horn of the spinal cord.

11. True or False: The pupil of the eye *dilates* due to stimulation of the *craniosacral* division of the autonomic nervous system.

12. Preganglionic sympathetic axons may pass through the chain ganglia without synapsing. True or False?

13.True or False: The vomiting center is in the medulla oblongata.

14. On a separate piece of paper create a chart in which you compare and contrast the sympathetic and parasympathetic systems with reference to the following topics:

location of the ganglion
relative length of the postganglionic neuron
relative length of the preganglionic neuron
location of the cell body of the preganglionic neuron
neurotransmitter chemical used at the postganglionic synapse
general physiologic action (summary statement)
hypothalamic control centers

15. Create another chart comparing the two systems as to details of physiologic action. Include the following target organs and functions:

blood vessels of the skin and muscles
blood vessels of the viscera.
heart rate
respiration rate
bronchiole constriction
pupil of the eye
piloerection
sweat glands
saliva secretion
other G. I. Tract secretions
urinary sphincter
anal sphincter
sexual functions (erection and ejaculation)

Nervous System Homework: Cranial Nerves

1. Find the following terms in your medical dictionary. Notice the Latin and Greek roots. You may find it helpful to write some notes on your findings.

abducens

abduct

extrinsic

glosso-

intrinsic

oculomotor

ophthalmic

proprioception

somatic

tic douloureux

trigeminy

trochlea

vagus

visceral

2. True or False: The auditory nerve also carries impulses regulating balance.

3 True or False: The glossopharyngeal nerve connects to most of the internal viscera.

4. Which two cranial nerves are motor to the face?

5. Which are for taste, and also innervate a salivary gland? (It is impossible to swallow dry items, they must be moistened.)

6. What four nerves help with swallowing?

7. What four nerves are parasympathetic motor nerves?

8. What three nerves help with speech (two via the vocal cords and one via the tongue)?

9.. Which three nerves help to move the eyeball around?

NOTES:

Homework: Meninges, Ventricles, Cerebral Spinal Fluid

1. Find the following terms in your medical dictionary. Notice the Latin and Greek roots. You may find it helpful to write some notes on your findings.

aqueous

arachnoid

cephalic (cephalo-)

cerebrospinal

falx

granulation

hydro-

pia

tentorium

trabecula

villus (villi)

2. True or False: The dura mater is the layer of the meninges closest to the surface of the brain and spinal cord.

3. True or False: The pia mater forms the floor of the subarachnoid spaces.

4. How many are there (one or two) of each of the following:

Lateral ventricle

IIIrd Ventricle

IVth Ventricle

Foramen of Monro

Aqueduct of Sylvius

Foramen of Magendie

Foramen of Luschka

5. Where is the cerebrospinal fluid made?

6. What is cerebrospinal fluid for?

7. What is a synonym for "spinal tap"?

8. What is the immediate cause of hydrocephalus?

9. Trace a molecule of CSF circulating from the lateral ventricle to the jugular vein.

Nervous System Homework: The Human Brain

1. Find the following terms in your medical dictionary and take brief notes on their meanings as these will help you remember the information on the brain.

accommodation

amygdala

aphasia

arbor

archi-

Broca's area

callosum

caudate

chiasma

circadian rhythms

collateral

colliculus

corona

corticospinal

decussation

discrimination

encephalo-

encephalogram

fornix

geminate

geniculate (geniculum)

gonadotrophin (=g[illegible]dotropin)

hippocampal

insular

lentiform

meso-

meta-

myelo-

neo-

paleo-

pallium

para-

peduncle

perforate

phren-

pineal

presby-

presbyophrenia

presbyopia

proso-

putamen

quadri-

radiate

reticular

rhinal

spinothalamic

stapedius

stria

supra-

tele-

tympanum

uncus

vitae

Wernicke's area

2. Briefly summarize the functions of the following major structures:

medulla (gray matter)

pyramids of the medulla (white matter)

pons, gray matter

pons, white matter

cerebellum, gray matter

superior colliculi

thalamus

lateral geniculate body

hypothalamus

3. Name the lobes of the telencephalon.

4. Name the subcortical nuclei (gray matter) of the telencephalon.

5. Name six white matter structures of the telencephalon.

6. Name the parts of the diencephalon.

7. What cranial nerves are attached to the medulla?

8. What cranial nerves are attached to the pons?

9. What cranial nerves are attached to the cerebral peduncles (midbrain)?

10. What cranial nerve is attached to the diencephalon?

11. What cranial nerve is attached to the telencephalon?

12. What are the parts of the corpora striata?

13. Name one major commissure tract of the brain and give it's function.

14. Name one major descending tract of the brain and give it's function.

15. Name one major ascending tract of the brain and give it's function.

16. Why is the cerebral cortex convoluted?

18. True or False: The motor area of the cerebral cortex is in the parietal lobe. Explain.

19. True or False: The thalamus has a control center for body temperature.

20. True or False: The thalamus receives pain and temperature information. Explain.

21. True or False: The surfaces of all parts of the brain are gray matter. Explain.

22. True or False: The surface of the spinal cord is gray matter.

23. True or False: The respiratory control center and the heart rate control center are in the medulla.

24. True or False: The hypothalamus is the next higher level of control over the medulla.

25. True or False: The limbic system can influence the hypothalamus.

26. True or False: Our emotions can influence the functions of the autonomic nervous system. Give an example.

27. True or False: The cortex can influence the limbic system. Give an example.

28. True or False: The cortex can influence the hypothalamus. Give an example.

29. True or False: It is possible to learn some measure of voluntary control over the functions of the autonomic nervous system. Explain.

30. True or False: Injury to one of the areas of the brain concerned with (language) will probably result in some type of aphasia.

31. True or False: The lateral spinothalamic tract carries information regarding pain.

32. True or False: The ventrospinothalamic tract carries information regarding temperature.

33. True or False: The staggering gate of the alcoholic is due to brain damage in the cerebellum.

34. True or False: In order to be fully conscious of pain one's cerebral cortex must be intact.

Nervous System Homework: The Eye

1. Look up the following words in your medical cyclopedic dictionary, being alert for root meanings that apply to this unit of study.

accommodation, visual

atrophy

exophthalmos

fovea

glaucoma

hypermetropia

hyperopia

intraocular

lutea

macula

myopia

opthalmoscope

presbyopia

rhodopsin

2. Trace the pathway of light through the eye, listing all the structures in sequence through which the light passes to reach the rods and cones of the retina.

3. Using the list generated in #2 above, state the effect (if any) that each structure has on the bending of light rays.

4. In terms of cause/effect , state what happens to the curvature of the lens. when the ciliary muscles contract and when they relax. Why is this different in presbyopia.

5. Explain the relationship between eyeball length and focusing difficulties in myopia and hyperopia.

6. Name the three layers of the wall of the eye and the function of each.

7. Clearly distinguish between the blind spot and the macula lutea.

Nervous System Homework: The Eye

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Nervous System Homework: The Ear

1. Look the following words up in your medical dictionary, being alert ɔ root meanings useful in the present context.

ambient

ambient pressure

auricle

cerumen

cochlea

fenestra

fenestra cochlea

incus

lith-

malleus

ossicles

otitis media

oto-

otolith

otopharyngeal tube

pinna

scala

stapes

tectorial

tympanum

utricle

2. Explain the function of the Eustachian tuoe in relation to ambient pressure changes.

3. List the sequence of events by which a sound wave is changed into nerve stimulation.

5. How will different loudnesses affect the organ of hearing?

6. How will different pitches affect the organ of hearing?

7. Describe how the semicircular canals work.

7. Describe how the utricle and saccule work for detection of gravity when you are not moving (l.ow do you know up from down?). Secondly, how do they register a change in head position?