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HUMAN ANATOMY

Tashkent 2009

THE MINISTRY OF HIGHEV SECONDARY SPECIALIZED EDUCATION OF THE REPUBLIC OF USBEKISTAN

THE MINISTRY OF HEALTH OF THE REPUBLIC OF USBEKISTAN

TASHKENT PEDIATRIC MEDICAL INSTITUTE

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HUMAN ANATOMY MANNUAL FOR MEDICAL STUDENTS

(MUSCULO-SKELETAL SYSTEM)

Tashkent 2009

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The manual is written for foreign students of medical institutes.
It is designed according to the human anatomy curriculum and confirmed by the Ministry of Secondary and Higher Education and the Ministry of Health of the Republic of Uzbekistan.
The manual includes the main aspects of the normal anatomical structure of musculo-skeletal system, latin terms correspond to the International Nomina Anatomica.

Preface

For many ages the knowledge of the human organism have been gathering but the interest to the subject of anatomy has not been attenuated. The knowledge of anatomy more and more affects the progress in medicine, mainly in clinical thinking. “Doctor who is not anatomist is not only useless, but even harmful”- the greatest Russian scientist, physician Muhin said.

It is on the base of anatomy that all the subjects of medico-biologic, clinical branch are studied, so clinical thinking is formed.

Since Anatomy is the base of medicine, the study begins at the first course.

Recently, Uzbekistan is widening its international relationships. Foreign students study at our institute and find difficult to communicate in Russian. So Russian language text-book are not suitable for them. In order to provide English speaking students with teaching materials the manual of Essential Anatomy has been designed.

The manual includes 3 main sections: musculo-skeletal system, inner organs and vessels, nervous system and sensory organs.

In the first one the aspects of bones structure, their connections are covered with the specific approach to pediatric peculiarities of the body parts. Each item includes self- study section.

This manual provides the user with basic Latin medical terminology, simply defined in English.

We hope the manual will help our students to gain the knowledge in Anatomy, and enjoy the study.

Lesson 1.

General osteology: skeleton, anatomical planes. Initial latin terminology.
General characteristics of the vertebrae
Thoracic vertebrae and their differences (peculiarities)

Anatomy – is a science which studies the structure of the human body. It is usually subdivided into gross anatomy and microscopic anatomy (histology).
We shall study gross anatomy that studies structures seen with the unaided eyes, but microscopic anatomy studies structures as seen with the aid of microscope. It is another science and subject.

«Skeleton» derived from Greeks terminology, and means “to dry” or “dried”. Skeleton consists of 208 bones (fig. 1), which implement have supportive, protective and biologic functions. It weights 5-6 kilograms, in males it is 10% but in females it is 8,5% of body weight.

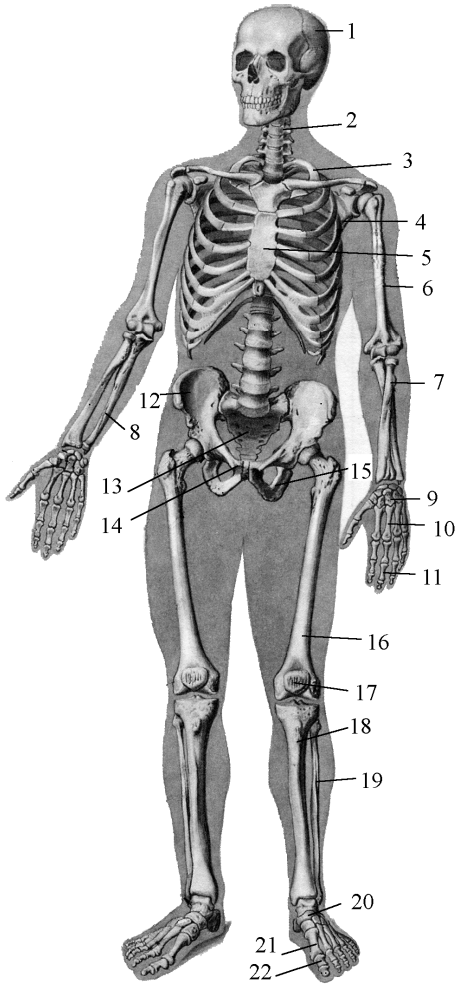


Fig.1. Skeleton. (Anterior view)
1 – skull; 2 – spinal column; 3 – clavicle; 4 – rib; 5 – breastbone (sternum); 6 – humerus; 7 – radius; 8 – ulna; 9 – carpus; 10 – metacarpus; 11 – phalanges; 12 – ilium; 13 – sacrum; 14 –pubis; 15 – ischium; 16 – femur; 17 – patella; 18 – tibia; 19 – fibula; 20 – tarsus; 21 – metatarsus; 22 – phalanges.

The bones consist of bone tissue. Bones are formed from mesoderm of the embryo. In the living body bone tissue consists of 50% water, 28,15% organic substances, including 15,75% of fats and 21,85% inorganic substances. Inorganic substances give bones natural density, but organic substances are needed for their elasticity.

Bones are calcified connective tissue that consisting of cells **(osteocytes)** in a matrix of ground substance and collagen fibers. They

serve as a reservoir for calcium and phosphorus. Bones contain internal soft tissue, the marrow, where blood cells are formed.

The bones are covered with fine dense connective film (layer) which is called **periosteum.**

Bones are classified according the shape, into long, short, flat, irregular, and sesamoid bones; they also are classified according to their structure into tube-like, spongy-like, combined and pneumatic bones.

Tube-like bones are divided into long (fig. 2) and short. Each of them has shaft (**diaphysis)** and two ends of the bone **(epiphyses**), and between them, there is **metaphysis.**

Diaphysis is the central part and is composed of a thick collar of compact bone surrounded by the periosteum. It contains the marrow cavity, where the red or yellow bone's cord lies.

Metaphysis is more recently developed part of the bone adjacent to the epiphyseal disk which between the diaphysis and epiphyses is located.

Epiphyses are composed of a trabecular bony meshwork surrounded by a thin layer of compact bone. They have articular surfaces that are covered by hyaline cartilage.

Long bones are longer than they are wide; they include the clavicle, shoulder (humerus), radius, ulna, femur, tibia and fibula. Short tube-like bones are metacarpals and phalanges bones.

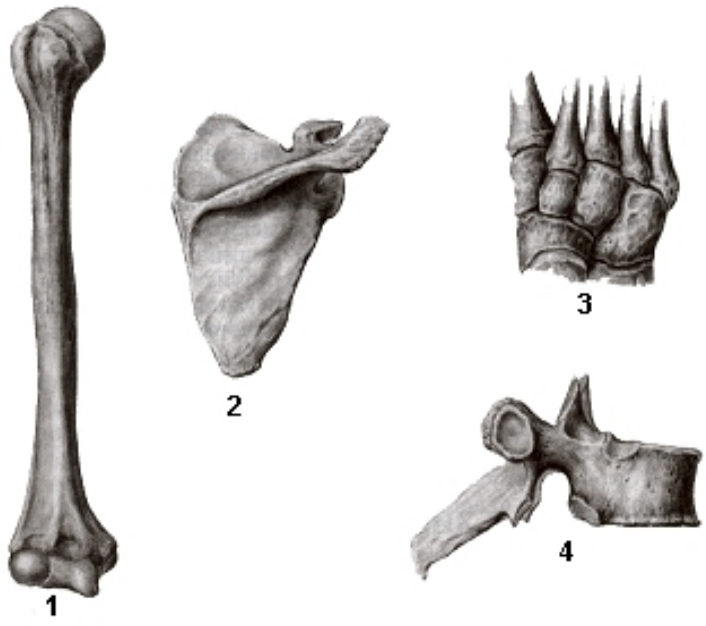


Fig. 2 Diferent kinds of bones.
1- long tube-shaped bone;
2- flat bone;
3- spongy bones;
4- irregular bone.

Flat bones consist of two layers of compact bone: outer (lamina externa) and inner (lamina interna). These layers are separated by spongy bone tissue and marrow space (diploe). Flat bones include the ribs, sternum, scapula, and bones in the vault of the skull.

Also flat bones perform protective function, because they form different cavities (skull, thorax, and pelvis).

Spongy-bones (fig. 2**)** contain mostly spongy bone tissue enveloped by a thin outer layer of dense compact bone tissue.
Spongy bones are subdivided into long and short bones. Long spongy bones are ribs, sternum and clavicle, but short bones are found only in the wrist and ankle. They often are approximately cuboid - shaped, and they in very mobility regions of skeleton are lie.

Compound or irregular bones include bones of mixed shapes, such as bones of the skull, vertebrae, and coxa. They consist of many parts which have various structures. For example, the vertebrae body is a spongy bone, but the arch and processes are flat. Skull base bones are also referred to the compound bones.

Sesamoid bones develop in certain tendons and serve to reduce friction on the tendon, thus protecting it from excessive wear.

Sesamoid bones are commonly found where tendons cross the ends of long bones in the limbs, as in the wrist and the knee. Patella is the biggest sesamoid bone.

Pneumatic or air-bones also contain the air cavity or air cells which drain into nasal cavity (into superior, media, and inferior nasal ways).
The frontal, sphenoidal, ethmoidal and maxillar bones are the air-bones.
In new-born air cavities are not developed, they formed with the growth of the skull bones.

Newborns skeleton is composed of 270 bones, 172 of them are placed in the trunk and head, and the rest of them (98) are placed on the upper and lower extremities.

Anatomical planes. In anatomy, for the study of human organism, are usually used anatomical planes. Also there are four planes:

Sagital plane is a vertical plane lying longitudinally from anterior to posterior in midline, and divided body or organ into two parts –left and right.

Frontal or coronal plane is a vertical plane at right angles to the sagital or parallel to forehead which divides body into anterior and posterior parts.

Transverse plane is a horizontal plane at right angles to both vertical planes which is divided body into upper (superior) and lower (inferior) parts.

Oblique plane is any plane that is not sagital, frontal or horizontal.

Terms used in anatomical description or Latin terminology.

Anterior – facing the front,
Posterior- facing the back,

Median - towards the center, midline
Medial - close to the midline,
Lateral - further away from the midline, referring to one side,
Superior - higher up, from above,
Inferior - below,
Proximal- nearer to the origin,
Distal - opposite,
Superficial- close to the surface,
Profundus - deep,
Sinister - left,
Dexter - right,
Major - big or large,
Minor - small or little.

Bones of the spine

Spine or vertebral column consists of individual vertebrae. There are usually 33-34 vertebrae, which make 5 regions: cervical (7 vertebrae), thoracic (12), lumbar (5), sacral 5 (fused vertebrae) and coccyx 3-5 fused vertebrae, which form sacrum and coccyx bones.

Typical vertebra components are the body, arch and outgrows.

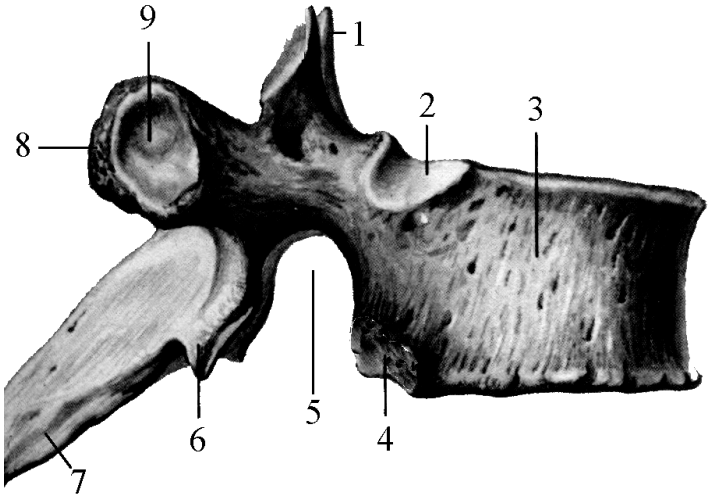


Fig. 3 Thoracic vertebra.

1 – processus articularis superior; 2 –fovea costalis superior; 3 – corpus vertebrae; 4 – fovea costalis inferior; 5 – incisura vertebralis inferior; 6 – processus articularis inferior; 7 – processus spinosus; 8 –processus transversus; 9 – fovea costalis processus transversi.

The body (**corpus vertebrae**) is the form of flattened cylinder, which serves as the major weight-bearing portion of the vertebra.

Vertebral arch **(arcus vertebrae**) is formed by the paired pedicles and lamina on multiple projections and together with the posterior aspect of the body forms the vertebral foramen. Series of the vertebral foramina form the vertebral canal (**canalis vertebralis**) which contains the spinal cord. Vertebral arch gives rise to seven processes: one spinous, two transverse, and four articular.

The single spinous outgrow **(processus spinosus**) is directed backward in the midline of the arch. Two transverse processes **(processus transverses**) extend laterally from the arch. Pair of **superior** and **inferior articular processes (processes articularis superior et inferior)** arise from the vertebral arch at the junctions of the pedicles and lamina. Each articular process contains an articular facet, which is in articular surface of the zygoapophyseal joint.

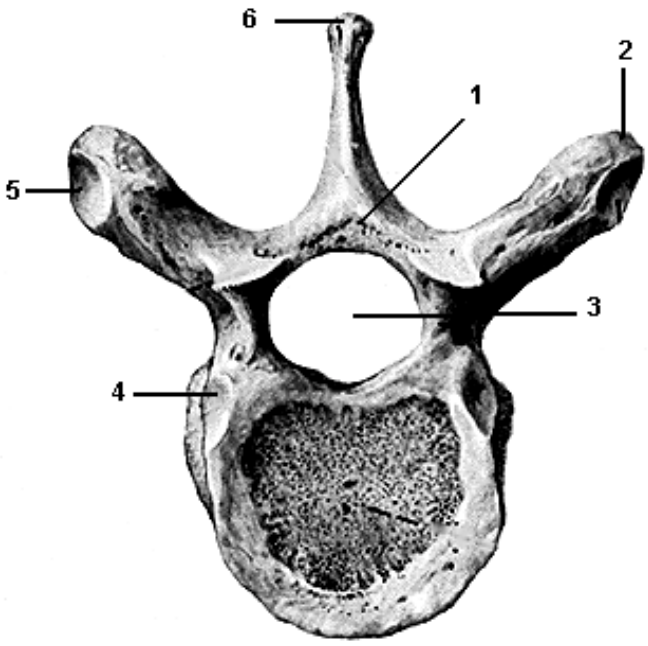


Fig. 4 Typical thoracic vertebra.
(From above).

1 – arcus vertebrae;
2 – processus transverses;
3 – foramen vertebrae;
4 -fovea costalis superior;
5 – fovea costalis transversalis;
6 – processus spinosus.

Between adjacent vertebrae **intervertebral opening (foramen intervertebrale)** is formed, where the spinal nerves and accompanying vessels pass, as they exit the vertebral canal.

The thoracic region of the vertebral column is bound by 12 thoracic vertebrae. They differ from others. Thoracic vertebrae (fig. 3, 4) have upper and lower half facets (**fovea costales superior et inferior**) on the lateral sides of body, for the heads of ribs. The transverse processes have rib's fasets **(fovea costales transversalis)** for articulation with the tubercles of ribs. The costal foveas with the ribs form synovial joints on posteriolateral aspects of the bodies and on the tips of the transverse processes.

Besides that there are very long spinous processes that are directed inferiorly so that they overlap the next lower vertebra.
The first thoracic vertebrae has own complete upper faset for the first rib and half faset for the second rib on its body, and thick, horizontal spine. The bodies from second to ninth vertebrae have pairs of superior and inferior half costal foveae because the ribs head articulates with the corresponding vertebral bodies and intervertebral disks. Tenth thoracic vertebra has only half articular facet which articulates with tenth rib's head. Eleventh and twelfth thoracic vertebra has a complete facet and articulates with only the eleventh and twelfth ribs and has no fasets on its transverse processes.

Newborns vertebra mostly consists of cartilages and by 16-17 years of age they become a bone. By 18-20, cartilageous processes have additional areas of ossification and are fused with the vertebrae.

Questions for self – study:

1. What does anatomy study?
2. What planes are used in anatomy?
3. Define the term: superior, profundus, major….
4. What is the skeleton? What are the parts of skeleton?
5. What kinds of bones do you now?
6. What are the chemical components of bones?
7. What is the anatomical structure of bone?
8. What is the structure of periosteum?
9. What are the general features of vertebrae?
10. What is the structure of thoracic vertebrae?
11. What are the general characteristics of thoracic vertebrae?
12. What are the peculiarities of newborn's vertebrae?

Lesson 2.

Cervical and lumbar vertebrae. Sacral bone and coccyx. Their peculiarities in children.

Cervical section of spinal (vertebral) column consists of seven cervical vertebrae (fig. 5). They are smaller than others and have transverse foramina on each transverse process (**foramen transversarium**). Cervical

vertebrae from second to sixth have a small spinous process, but only the seventh cervical vertebra has a long spinous process.

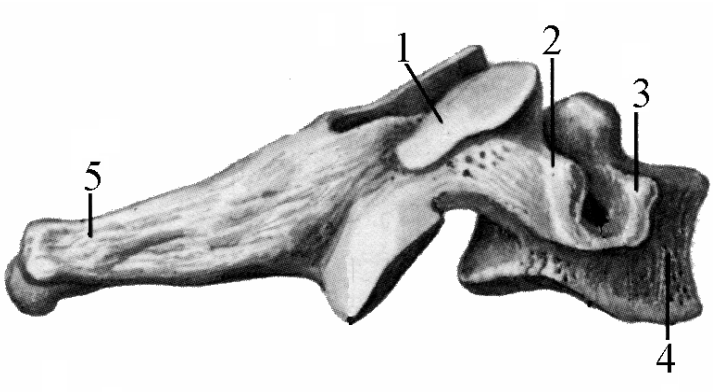


Fig. 5 Sixth cervical vertebra

1 - processus articularis superior;
2 - tuberculum anterius;
3 - tuberculum posterius;
4 - corpus vertebrae;
5 - processus spinosus;

The first cervical vertebra is called "**atlas"** or "**atlant**" (fig. 6) because supports the skull. Atlas does not have a body; during the course of evolution its body became the odontoid process of the axis. It consists of anterior and posterior arches. **Anterior arch (arcus anterior)** is short and has an anterior tubercle (**tuberculum anterius). Posterior arch** (**arcus posterior**) is larger and has groove on its upper surface for the vertebral artery (**sulcus arteria vertebralis)** and its spinous process is represented by a posterior tubercle **(tuberculum posterius).**

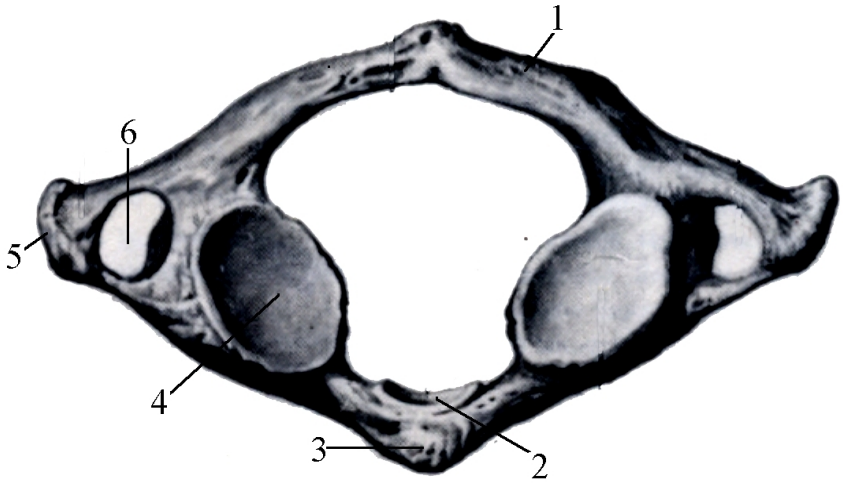


Fig. 6 Fist cervical vertebra (atlas).

1 –arcus posterior atlantis;
2 – fovea dentis;
3 – arcus anterior atlantis;
4 – facies articularis inferior;
5 – processus transversus;
6 – foramen transversarium;

The lateral masses (**massa lateralis**) are united with arches and form **foramen vertebra.** Atlas has no spinous process but has paired transverse processes pierced by **foramen transversarium** for the vertebral artery. Also atlas has large concave superior facets on the upper surface **(facies**

articularis superior) which articulate with the occipital condyles of the skull to form the atlanto-occipital joints and pair facets in lower surface **(facies articularis inferior)** which with the axis form the atlanto -axial joints.

Second cervical vertebra is called "**axis"** (fig. 7). It is characterized by the presence of the **dens** or **odontoid** process, which extends superiorly from body and occupies the anterior aspect of the vertebral foramen between the lateral masses of atlant, and forms the pivot around which the atlas rotates. Dens has facet for articulation with the anterior arch of the atlas on its anterior surface (**facies articularis anterior**). The **laminae** of axis are very thick and **spinous process** is large and bifid, as in most cervical vertebrae.

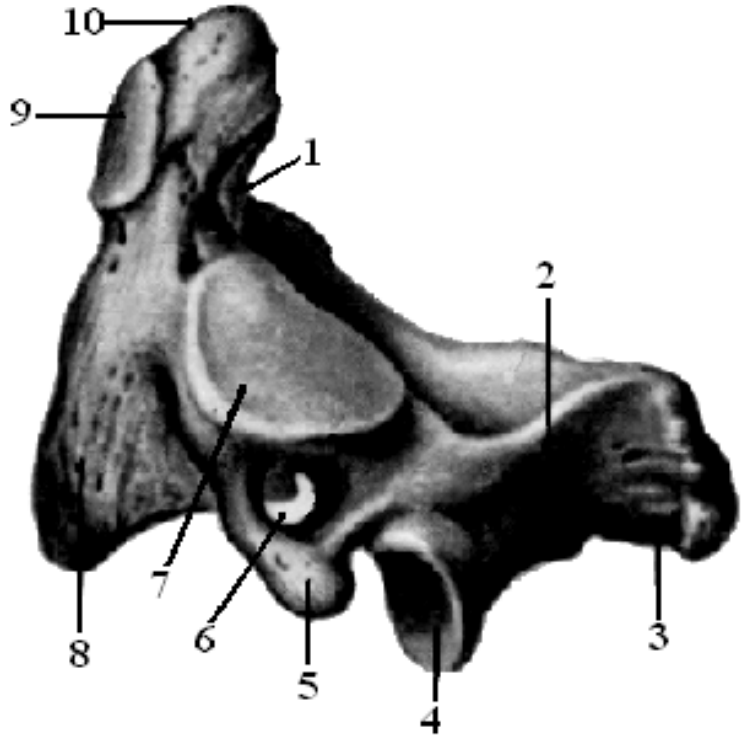


Fig. 7 Second cervical vertebra (axis).

1 – facies articularis posterior; 2 –lamina arcus vertebrae;
3 –processus spinosus;
4 –processus articularis inferior;
5 –processus transversus; 6 –foramen transversarium;
7 –facies articularis superior; 8 –corpus vertebrae; 9 –facies articularis anterior;
10 –dens.

The lower cervical vertebrae C_3 - C_6 are the "typical" cervical vertebrae. Each has a relatively small body, distinguished bifid spinous process and foramina on the transversae processes (C_1-C_6) –**foramen processus transversus**, which transmit the vertebral artery and vein.

Sixth cervical vertebra has the carrotid tubercle - anterior tubercle of C_6 transverse process (**tuberculum carroticum**) where vertebral artery enters the transverse process of C_6.

Seventh cervical vertebra is called **“vertebra prominens**” because it has a long spinous process, which can easily be felt in palpation the neck. This spinous process is horizontal and not bifid, and its transverse processes have not foramen transverse.

Lumbar vertebras.

The lumbar section of spinal column is bound with five lumbar vertebrae (fig. 8). They have the largest bodies, strong massive transverse process and addishinal **mamillary** or **accessory processes (processus mamillaris).**

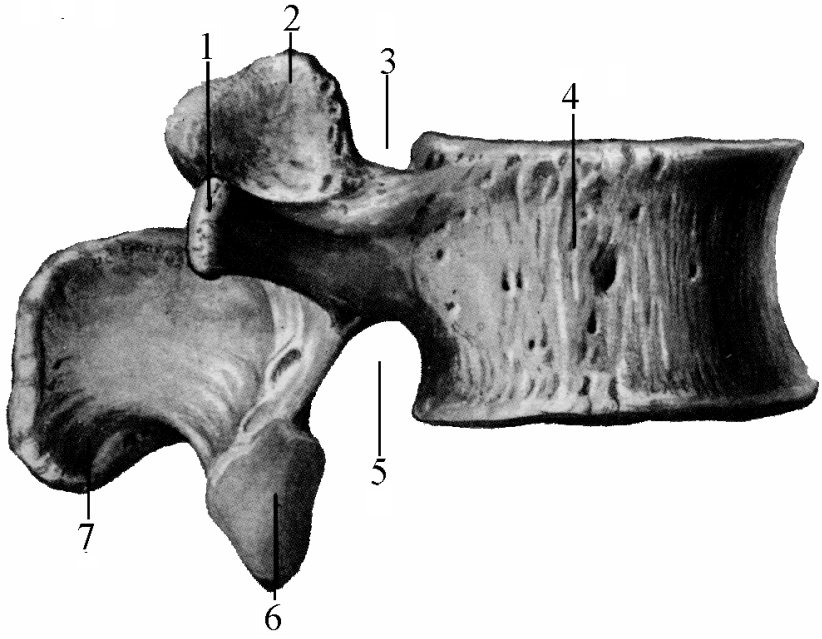


Fig. 8 Third lumbar vertebra.
1 – processus transversus;
2 – processus articularis superior;
3– incisura vertebralis superior;
4 – corpus vertebrae; processus spinosus;
5 – incisura vertebralis inferior;
6 –processus articularis erior; 7 – processus spinosus.

Also lumbar vertebras have short, strong spinous processes that are directed posteriorly and forming the right angle.

Sacrum.

Sacrum (fig. 9) is large, triangular, wedge-shaped bone composed of five fused sacral vertebrae, which unite at 17-25 years of age. It gives the strength and stability to the pelvis. Sacrum has base **(basis ossis sacri),** apex (**apex ossis sacri),** ventral **(facies pelvina**) and dorsal surfaces (**facies sacralis dorsalis**), and four pairs of foramina (**foramina sacralia pelvina and foramina sacralia dorsalia**) for the exit of ventral and dorsal

primary branches of the four sacral nerves. In the middle of the bone there is **sacral canal (canalis sacralis)**. On the lateral parts there are the wings (**alla ossis sacri**), which are fused with iliac bones. Their articular surfaces are called ear-like (**facies auricularis**) On the dorsal aspect of sacrum there are five crests; median sacral crest is formed by the fused spinous processes (**crista sacralis mediana**), pair of intermedian crests (**crista sacralis intermedia)** and lateral crests (**crista sacralis lateralis**) are formed by fused articular and transverse or costal processes. The sacral hiatus or chink **(hiatus sacralis**) is the end of sacral canal. The sacral horns (**cornu sacralis**) locating near the sacral hiatus, which allows the administration of caudal (extradural) anesthesia.

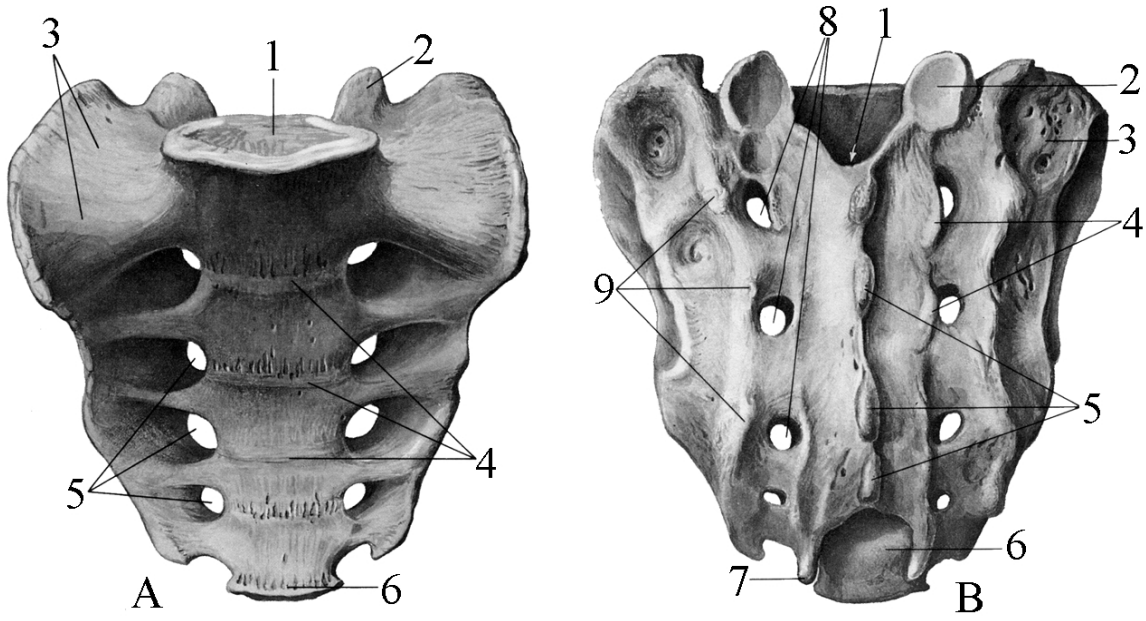


Fig.9 Sacrum.

A – anterior view; B – posterior view.

A – anterior view: 1– basis ossis sacri; 2 – processus articularis superior; 3 – pars lateralis; 4 – lineae transversae; 5 – foramena sacralia anteriora; 6 –apex ossis sacri;
B – posterior view: 1 – canalis sacralis; 2 – processus articularis superior; 3 – tuberositas ossis sacri; 4 – crista sacralis intermedia; 5 – crista sacralis mediana; 6 – hiatus sacralis; 7 – cornu sacrale; 8 – foramina sacralia posteriora; 9 –crista sacralis lateralis.

Coccyx.

Below the sacrum there is a coccyx bone **(os coccygea**), which consists of 3-5 rudimentary vertebrae. Coccyx is a wedge-shaped bone forming the joint of the 4- 5 coccygeal vertebrae that provide attachment for the coccygeus muscles. Coccyx has body and horns **(cornu coccygeum).**

Questions for self – study:

1. What are the peculiarities of cervical vertebrae?
2. What is the structure of the first cervical vertebra?
3. What is the structure of second cervical vertebra?
4. What is the structure of the seventh cervical vertebra?
5. Define the peculiarities of the lumbar vertebrae?
6. What do you know about the structure of sacrum?
7. Name the dorsal or posterior sacral formations.
8. Name and show all formations on the anterior sacral surface.
9. What is the structure of the coccyx?
10. What parts of the spinal column do you know?

Lesson 3.

Breast bone and ribs. Thoracic cage or chest. Spinal column.

Breast bone –sternum (**os sternum**) is a flat bone (fig. 10).

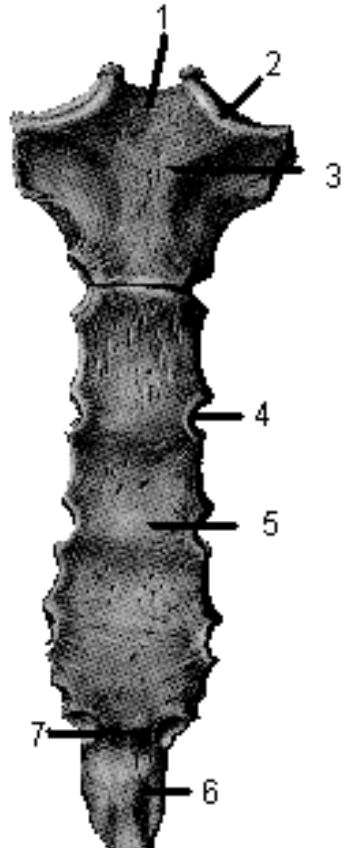


Fig.10 Sternum (brest bone).

1 – incisura jugularis; 2 –incisura clavicularis;
3 – manubrium sterni; 4, 7 – incisurae costales;
5 – corpus sterni; 6 – processus xiphoideus.

It consists of three parts: upper part - **manubrium**, media part - body **(corpus sterni**) and

lower part - xiphoid process (**processus xiphoideus**). Manubrium has the jugular notch **(incisura jugularis**) on the center of superior margin and two clavicles notches (**incisura clavicularis)** on each side for articulation with the clavicle.

On the lateral side of sternum, rib's notches **(incisura costalis**) lie, that articulate with the seven costal cartilages.

Xiphoid process is a flat, cartilaginous process at birth that ossifies slowly from the central core and unites with the body of the sternum after middle age. Between the manubrium and the body of the sternum, sternal angle (**angulus sternalis**) is formed. It is called Louis angle.

Ribs consist of twelve pairs of bones (fig. 11) that form the main part of the thoracic cage, extending from the vertebrae toward the sternum.

Ribs (**costae**) are subdivided into true, false and floating ribs.

The upper seven ribs are considered the **true ribs** because they are attached to the sternum by their costal cartilages.

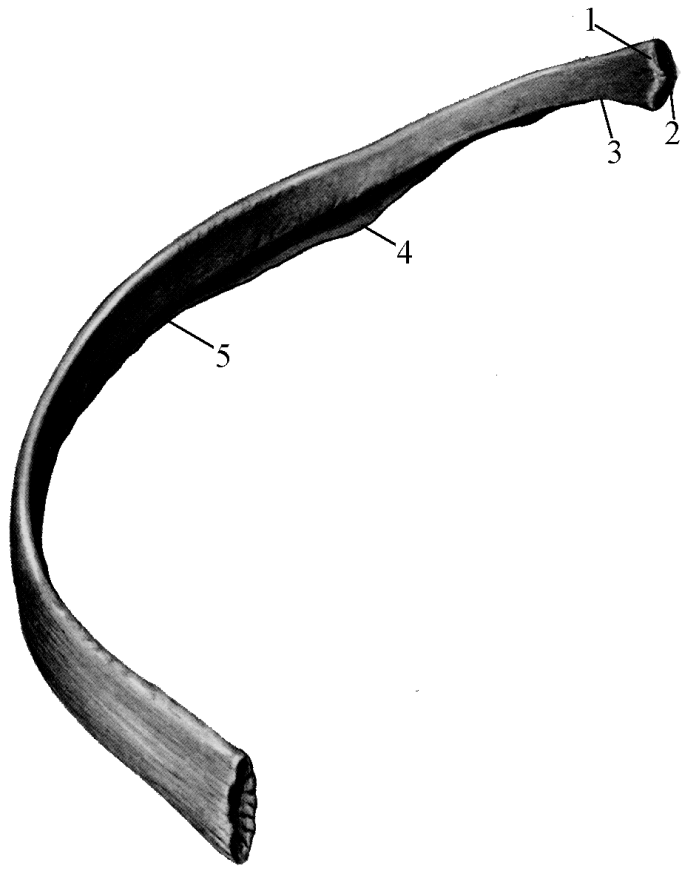


Fig.11 Rib.

1 – caput costae; 2 – facies articularis capitis costae;
3 – collum costae;
4 – sulcus costae;
5 – corpus costae.

The eighth, ninth and tenth ribs articulate indirectly with the sternum. The costal cartilage of each joins the cartilage above. They are **false ribs**.

Last two ribs- eleventh and twelfth are **floating ribs**. They don't articulate with the sternum, they are connected only to the vertebrae.

Each rib is divided into head (**caput costae**), neck (**collum costae**), tubercle (**tuberculum costae**) and body or shaft (**corpus costae**).

Each rib has two tips and two surfaces, and articular facet on its head, which articulates with thoracic vertebra.

The typical ribs, third to ninth, have two articular facets on its head, because they articulate with two vertebrae bodies.
The rib's tubercle has also articular facet, which articulates with the transverse processes of the same number vertebrae with the exception of ribs eleventh and twelfth.

The angle (**angulus costae**) is found just laterally to the tubercle, where the shaft curves abruptly anteriorly.
The first, second, tenth, eleventh and twelfth ribs are atypical ribs.

The first rib is short and acutely curved flattened superoinferioly. It has a single articular faset on its head, which articulates with only first thoracic vertebra. It has a scalene tubercle (**tuberculi musculi scaleni anterior**) for the insertion of the anterior scalene muscle. On its postero-lateral surface we can see area to which scalenus medius muscle is attached. Behind the scalene tubercle is a smooth groove in which lie the subclavian artery (**sulcus arteria subclavia)**.

The second rib is similar to the first, but is about twice as long as the first rib. It has two halves of articular facets on its head, which articulate with the bodies of two vertebrae.

Tenth rib has a single half articular facet on its head which articulates with the tenth thoracic vertebra.

Eleventh and twelfth ribs have a single whole articular facet and articulate with only one vertebra. Floating ribs have no neck, tubercle, angle and cartilage.

Spine or vertebral column consists of 33- 34 vertebrae which make five regions or sections (parts).

There are 7 cervical, 12 thoracic, 5 lumbar, 5 fussed sacral and 4-5 fussed coccyx vertebrae.

The vertebral column is not straight. It has four curvatures: two- kyphosis and two- lordosis.

Kyphosis is in the thoracic and sacral parts. Kyphosis (hunchback) is an abnormal exaggerated thoracic curvature.

Lordosis (swayback or saddleback) is an abnormal accentuation of lumbar curvature. Lordosis is in the cervical and lumbar parts. These three curves of the vertebral column (cervical and lumbar lordosis, thoracic kyphosis) allow increased shock-absorption. Also, active straightening of the thoracic curvature during deep inspiration, that increases the chest volume.

Scoliosis is a condition of lateral deviation due to unequal growth of the vertebral column, pathologic erosion of vertebrae bodies.

Thorax or chest is bound posteriorly by the thoracic vertebrae and the ribs, laterally by the ribs and intercostals spaces, and anteriorly by the sternum, the costal cartilages and ribs. There are thoracic inlet (**aperture thoraces superior)** above, and outlet (**aperture thoraces inferior)** below in the chest.

The thorax may have conical, cylindrical and barrel forms. They are physiologically, normal shapes but pathologic cages may look like hens chest. It occurs in rickets.

Questions for self – study:

1. What is the structure of the breast?
2. What are the peculiarities of the breast in children?
3. What is the structure of the rib, its anatomical formations?
4. What kinds of ribs do you know?
5. Give characteristics of the first rib.
6. Spinal column and its parts.
7. Tell about the second rib.
8. Give characteristics of the floating ribs.
9. What physiological curvatures of the spine column do you know?
10 What are differences of physiologic and pathologic curvatures?
11What does thorax consists of?
12What kinds of normal chests can you name?
13What is abnormal shape of chest?

Lesson 4.

Shoulder girdle and arm bones.

Shoulder girdle consists of two bones. They are clavicle and scapula.

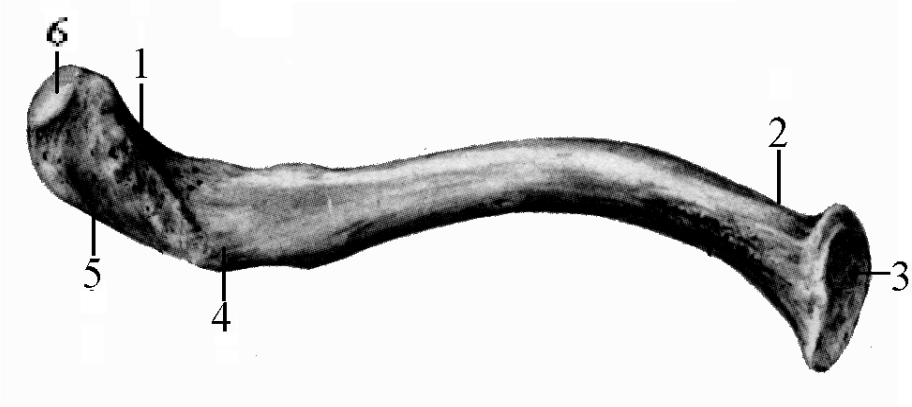
Clavicle (clavicula) is a short ‘’S”-formed (shaped) bone (fig. 12) which articulates with the sternum and the scapula.

Clavicle consists of three parts: body **(corpus claviculae**) and two ends (**extremitas sternalis et extremitas acromialis**).

Body has two curvatures – medial two-thirds are curved forward, lateral one-third is flatted and curved backward. The medial half is round in cross section and has a larger medial end, a small portion of which articulates with the sternum and has articular surface (**facies articularis sternalis**).

Lateral end of bone is flat and it has a small oval facet that articulates with acromion (**facies articularis acromialis**).

Fig.12 Clavicle (collar bone).



1 – extremitas acromialis; 2 – extremitas sternalis; 3 – tuberculum conoideum; 4 –linea trapezoidea; 5 – facies articularis acromialis.

The upper surface of the body is smooth, lower surface has a tubercle **(tuberculi conoidea**) and a line where the trapezion ligament is attached **(linea trapezoidea)**.

Scapula (scapula) is thin and flat triangular bone (fig.13, 14). It projects to the posterior surface of the thoracic wall between second and seventh ribs. There are three angles and three borders. One of the angles is directed inferiorly and called the inferior angle (**angulus inferior),** the superior angle **(angulus superior**) is placed superiomedially; and the lateral angle **(angulus lateralis**) is located superiolaterally and forms joint surface- the glenoid fossa (**cavitas glenoidalis**). Superomedially and superolaterally from the inferior angles there are medial and lateral borders (**margo medialis and lateralis**).

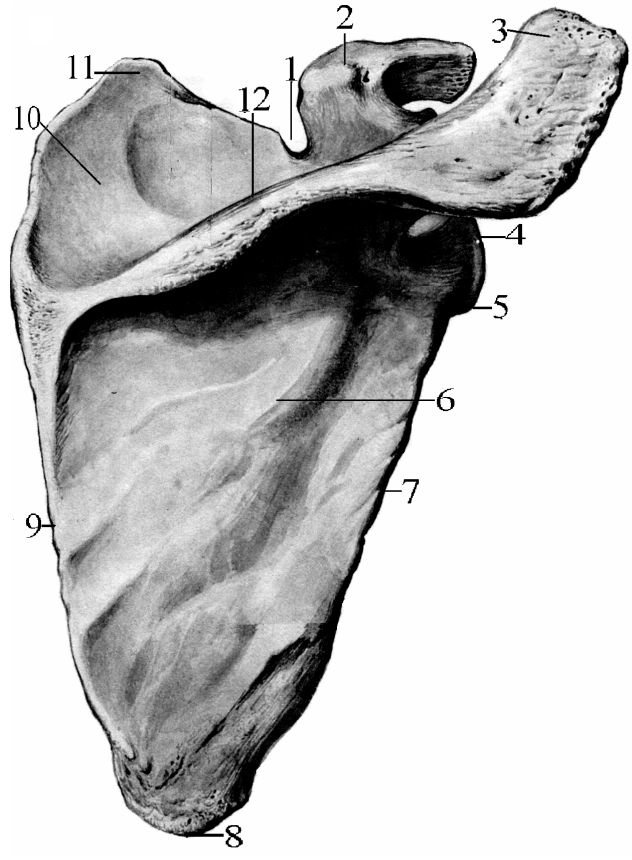


Fig.13 The scapula bone (view of back).
1–angulus superior; 2–angulus lateralis;
3–angulus inferior; 4–spina scapulae;
5–processus corocoideus;
6–acromion;
7–cavitas glenoidalis; 8–fossa infraspinata;
9–margo lateralis; 10–margo medialis;
11–fossa supraspinata.

On the upper border (**margo superior**) the scapular notch (**incisura scapulae**) is located.

The scapula has two surfaces: anterior and posterior. Anterior surface **(facies costalis**) is slightly concave, called **subscapular fossa**.

The posterior or dorsal surface is separated into **supraspinatus** and **infraspinatus fossas** by the obliquely oriented elevated ridge, the spine of the scapula **(spina scapula**). The spine is a triangular-shaped process, extends from the medial border and continues laterally to the acromion process **(processus acromialis**). Acromion formed the lateral end of the spine and articulates with the clavicle. Above scapular spine, and lower two fosses are located (**fossa supraspinata et fossa infraspinata**).
Also scapula has bill-shaped corocoid process (**processus corocoideus**).

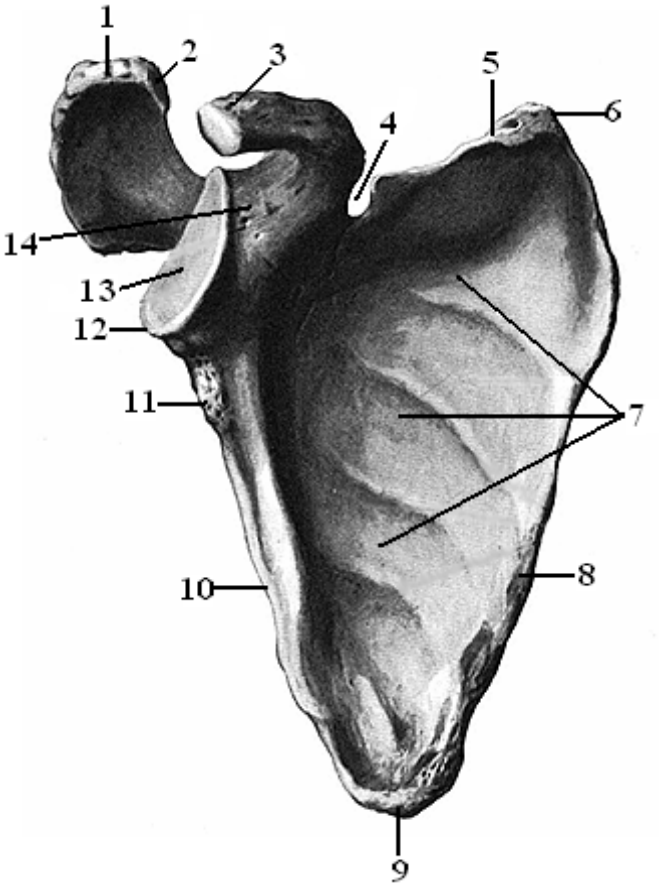


Fig.14 Scapula bone (view of front).

1–acromion;
2–facies articularis clavicularis;
3–processus coracoideus;
4–incisura scapulae; 5–margo superior; 6–angulus superior;
7– fossa subscapularis; 8–margo medialis; 9–angulus inferior;
10–margo lateralis;
11–tuberculum infraglenoidale;
12–angulus lateralis;
13– cavitas glenoidalis;
14–collum scapulae.

It projects anteriorly from the superior border and glenoidal fossa.
Glenoidal cavity (**cavitas glenoidalis**) articulates with the head of the shoulder. It is deepened by a fibrocartilaginous, glenoidal lip (**labrum glenoidale**). There are supraglenoidal and infraglenoidal tubercles (**tuberculum supraglenoidale et tuberculum infraglenoidale),** upperly and lowerly from glenoid cavity, which provides origin for the tendons of muscles.

At last, there is a scapular notch (**incisura scapulae**) which is located on upper border bridged by the superior transverse scapular ligament and converted into a foramen, where suprascapular nerve and vessels go out.

Shoulder bone (**humerus)** is a once bone in the arm (fig.15). It is a long tube- like bone which has a body and two ends. Its expanded proximal end consists of the head and two tubercles. The humeral head (**caput humeri**) has a smooth, rounded, articular surface and articulates with the scapula, it joins the rest of the bone to the anatomical neck (**collum anatomicum**). Away from anatomical neck lesser and greater tubercles are projected. The lesser tubercle **(tuberculum minoris**) is directed anteriorly and is separated from the greater tubercle **(tuberculum majoris**) by intertubercular groove **(sulcus intertubercularis**) where the tendon of the long head of the biceps brachii muscles passes. The greater tubercle lies just in the side laterally to the anatomical neck and consists of three facets for muscles to attach.

The humeral shaft is cylindrical in form. Proximally, between the shaft and neck there is the surgical neck (**collum hirurgicum**) of the humerus, so named because it is common site of fracture. The deltoid tuberosity (**tuberositas deltoidea**) is located laterally at the midlshaft and marks the insertion of the deltoid muscle.

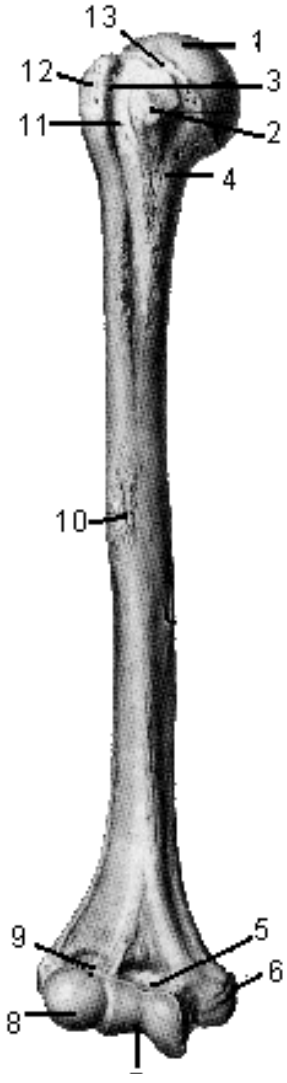


Fig. 15 Humerus; Shoulder bone.

1–caput humeri;
2–tuberculum minus;
3–sulcus intertubercularis;
4–collum chirurgicum;
5–fossa coronoideus;
6–epicondulus medialis;
7–trochlea humeri;
8–capitulum humeri;
9–fossa radialis;
10–tuberositas deltoideus;
11–crista tuberculi minoris;
12–tuberculum majus;
13–collum anatomicum.

As the distal end of the humerus widens it consists of trochlea, capitulum, the coronoid and olecranon fosses and medial and lateral epicondyles.
The trochlea (**trochlea humeri**) articulates with the trochlear notch of the ulna and capitulum **(capitulum humeri**) articulates with the head of the radius.
Above the trochlea on the posterior surface of the humerus, olecranon fossa (**fossa olecrani**) is located, but on the anterior surface coronoid fossa (**fossa coronoidea**) and radial fossa (**fossa radialis**) are founded. The medial epicondyle (**epicondulus medialis**) is larger and is separated from the trochlea by a deep notch. The lateral epicondyle **(epicondulus lateralis**) is less prominent and projects from the capitulum.
Each condyle has a supracondylar ridge that extends superiorly where it joins the shaft.

The newborn's scapula is located higher. Its upper boundary projects from 1-2 ribs, but lower one from 4-5 ribs. All parts of scapula are cartilaginous, expect body and lateral border.

In newborns humerus is short. Its body is ossificated but greater and lesser tubercles are cartilagenous.

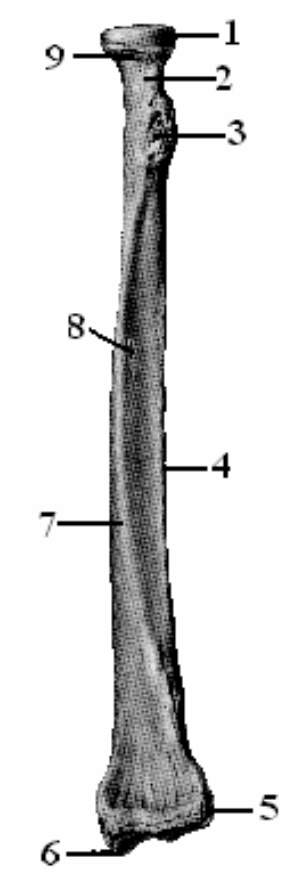
Questions for self – study:

1. What is the structure of clavicle?
2. What borders and angles does scapula have?
3. What is there on the lateral angle of the scapula?
4. What fosses does scapula have?
5. What formations are located in proximal part of the shoulder bone?
6. What formations are located on the distal end of shoulder bone?
7. What is the structure of the body of shoulder bone?

Lesson 5.

Forearm and the hand bones.

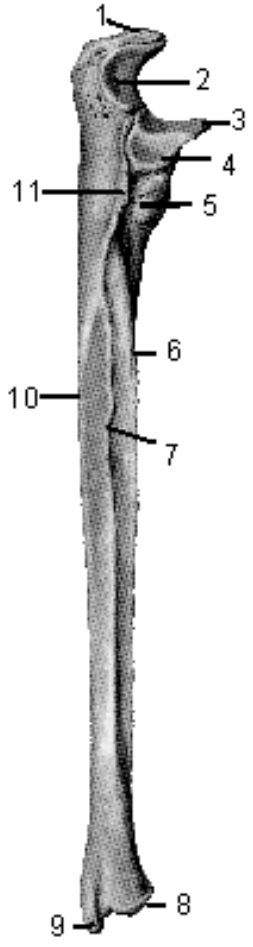
Radius and ulna are the bones of the forearm. They are long tube-like bons. Radius is the lateral bone of the forearm and the ulna is the medial bone. Both bones are connected by interosseus membrain.



Radius (fig.16) is shorter than ulna and has a small cylindrically shaped head (**caput radii)** proximally, which articulates with the capitulum of the humerus. Below there is a tapering neck (**collum radii**) and lower, prominent biceps tuberosity (**tuberositas radii),** just distally to neck.

Fig. 16 Radius.
1–caput radii; 2–collum radii; 3–tuberositas radii; 4–margo interossea; 5–incisura ulnaris; 6–processus styloideus; 7–margo anterior.

The expanded distal end of the bone consists of the styloid process (**processus styloideus**) and two articular surfaces; medially directed ulnar notch (**incisura ulnaris**) and distally - articular surface which with the proximal row of carpal bones, except the pisiform bone, forms a wrist joint and is called **"facies articularis carpi".**



Ulna (fig.17) is the reverse of the radius because it has a large proximal extremity and is quite small distal extremity.

On the upper end there is a trochlear notch (**incisura trochlearis**) with articular surface. There is coronoid process **(processus coronoideus**) found anteriorly and olecranon process **(processus olecranon**) posteriorly.

On the lateral aspect of coronoid process a radial notch (**incisura radialis**) is located, which articulates with the head of radius.

The distal end of the ulna consists of a small cylindrical head (**caput ulnae**) and styloid process (**processus styloideus**).

Fig.17 Ulna.
1–olecranon; 2–incisura trochlearis; 3–processus coronoideus; 4–incisura radialis; 5– tuberositas ulnae; 6–crista musculi supinatoris; 7– margo anterior; 8–margo interossea; 9–circumferentia articularis; 10–processus styloideus; 11 –margo posterior.

Newborns radius is short. The ends are globular in form. Bone's shaft ossified but it doesn't have a bon's cavity. Newborns ulna is wedge-shaped therefore wide part is uppermost and tip is below. Bones shaft is ossified but there is no bone's canal.

Bones of the hand.

Bones of the hand consist of the carpal bones, metacarpal bones and finger phalanges.

Carpal bones (**ossa carpea**) (fig. 18) comprise of an eight small bones which are arranged in two rows. The proximal row (from lateral to medial side) consists of the scaphoid (**os scaphoideum)**, lunate **(os lunatum**), triquetrum (**os triquetrum**) and pisiform bones (**os pisiforme**). The distal row is composed of the trapezium bone (**os trapezium**), trapezoid bone (**os trapezoideum**), capitate bone (**os capitatum**) and hamate bones (**os hamatum**). All wrist bones are called according to their shapes.

Also the bones of the hand include five metacarpal bones and fourteen finger phalanges.

Metacarpal bones (ossa metacarpalia) are five miniature long bones consisting of base (**basis**), shaft **(corpus**) and head (**caput)**. The first metacarpal bone (or the thumb) is shorter and stouter than the others.

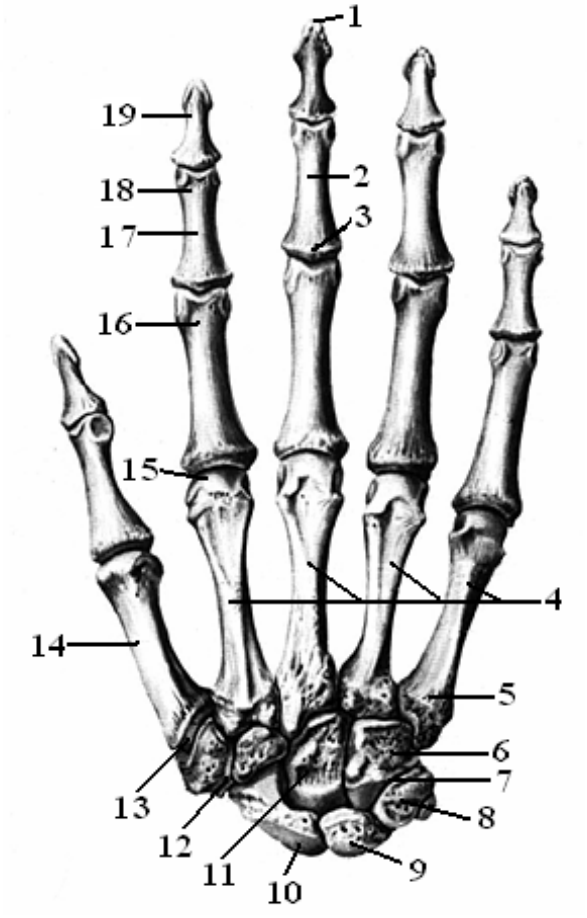


Fig.18. The hand bones (posterior view).

1–tuberositas phalangis distalis; 2–corpus phalangis; 3–basis phalangis; 4–ossa metacarpi; 5–basis ossis metacarpi; 6–os hamatum; 7–os pisiforme; 8–os triquetrum; 9–os lunatum; 10–os scaphoideum; 11–os capitatum; 12–os trapezoideum; 13–os trapezium; 14–os metacarpale I; 15–caput ossis metacarpi;
16–phalanx proximalis; 17– phalanx media; 18– caput phalangis;
19–phalanx distalis.

Phalanges (phalanges digitorum manus). Each of the digits is composed of three phalanges except the thumb which has only two. The phalanges are named by their positions: proximal, middle and distal (**phalanx proximalis, media, and distalis**). Like the metacarpals each phalanx has shaft (**corpus phalangis**), head (**caput phalangis**) distally, and base (**basis phalangis**) proximally, except the distal phalanges, which have only base and a place for nail (**tuberositas phalangis distalis**).

Questions for self – study:

1. What is located on the proximal part of elbow bone?
2. What formations are there on the distal part of ulna?
3. What processes are there in ulna?
4. Describe the structure of the body of ulna?
5. What is there on the upper end of radius?
6. What formations are there on the lower part of radius?
7. Tell about the structure of the body of radius.
8. What parts does the hand consist of?
9. Name all the bones of wrist.
10. What is the structure of metacarpal bones?
11. What is the structure of the finger?

Lesson 6.

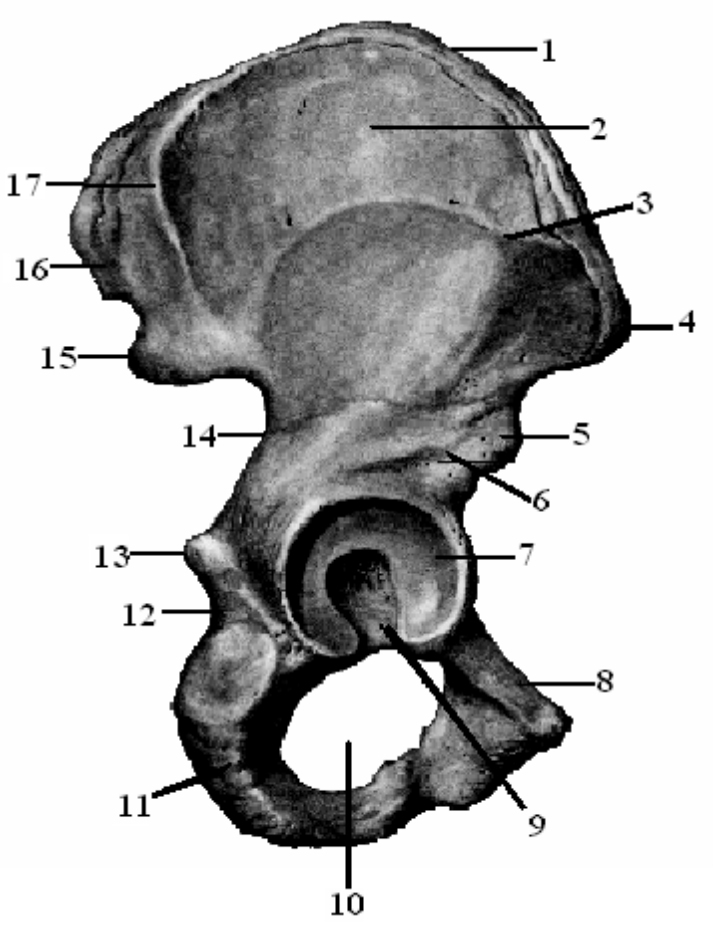
Bones of the pelvis girdle and femur bone.

The adult pelvis is composed of two hip (innominate) bones and the sacrum.

Hip bone (os coxae) (fig.19) is formed by three bones that fuse early in life: the pubis, ilium and the ischium. The bodies of these three bones fused and form a cup-shaped cavity- **acetabulum**, which forms the socket for the head of femur on the lateral side of the hip. It has a deep acetabular notch (**incisura acetabuli**) which is bridged by the transverse acetabular ligament (**ligamentum transversum acetabuli)** and also has moon- shape articulate surface (**facies lunata**).

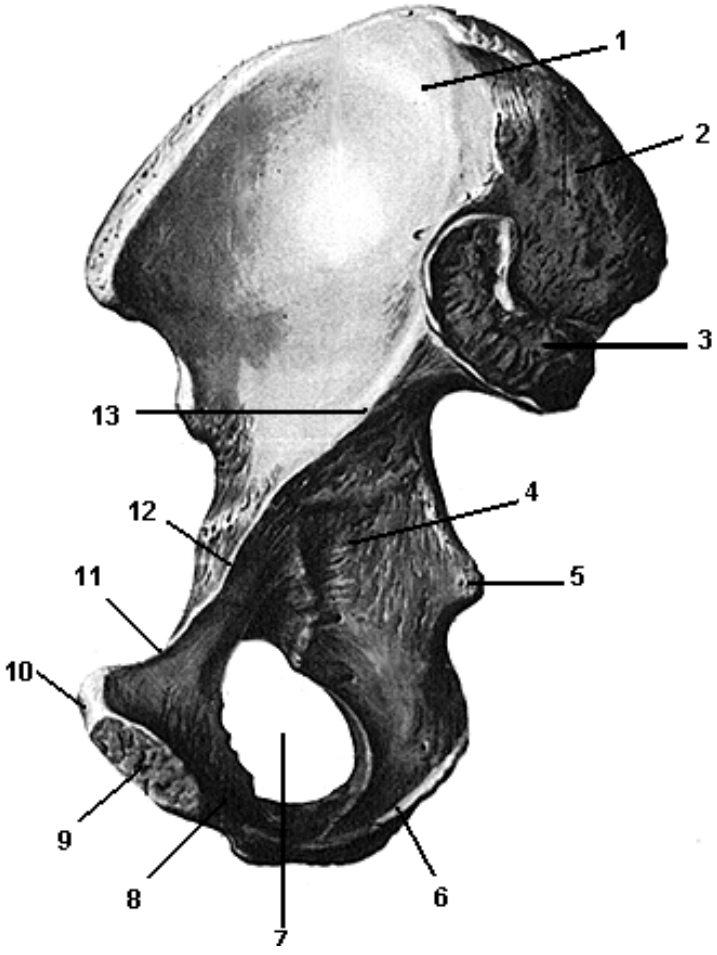
Ilium (os ilium) is the most superior part of the hip bone which consists of the body and wing. Its body **(corpus ossis ilii)** is united with the ischium and the superior ramus of the pubis. The flattened iliac wing

Fig. 19. Coxal (hip) bone, right; (outer surface).



1–crista iliaca; 2–ala ossis ilii; 3–linea glutea anterior; 4–spina iliaca anterior superior; 5–spina iliaca anterior inferior; 6–linea glutea inferior; 7–facies lunata; 8–os pubis; 9– incisura acetabuli 10–foramen obturatorim; 11–os ischii; 12–incisura ischiadica minor; 13–spina ischiadica; 14–incisura ischiadica major; 15–spina iliaca posterior inferior; 16– spina iliaca posterior superior; 17–linea glutea posterior.

Fig. 20. Coxal (hip) bone, right; (inner surface).



1 – fossa iliaca;
2 – tuberositas iliaca;
3 – facies auricularis;
4 – corpus ossis ishii;
5 – spina ishiadica;
6 – ramus ossis ishii;
7 – foramen obturatum;
8 – ramus inferior ossis pubis;
9 – facies symphysialis;
10 – tuberculum pubicum;
11 – ramus superior ossis pubis; 12 – eminentia iliopubica;
13 – linea arcuata.

(**ala ossis ilii**) flares superiorly and has a thickened crest (**crista iliaca**) that finished in front and below with paired iliac spines (**spina iliaca anterior superior and inferior; spina iliaca posterior superior and inferior**). The lateral part of the wing is called gluteal surface (**facies glutea**) and has three gluteal lines (**linea glutea anterior, posterior** and **inferior**) where the gluteus muscles are attached. Ala (wing) on the inner surface has iliac fosse (**fossa iliaca**) where is the origin of the iliac muscle. The posterior aspect of the iliac body forms the auricular surface (**facies auricularis**) that articulates with the sacrum to form sacroiliac joint. The arcuate line (**linea arcuata**) is the prominent elevation that extends anteriorly and inferiorly from the auricular surface toward the pectin pubis. It's the border between the true pelvis below and the false pelvis above.

Pubis bone (os pubis) is located anteromedially and consists of a body (**corpus ossis pubis**) and two branches. The superior pubis branch (**ramus superior ossis pubis**) unites with the ilium, the inferior one **(ramus inferior ossis pubis**) - unites with the ischium. Pubis comprises crest of the pubis (**crista pubicum**), pubis tubercle **(tuberculum pubicum**) and pectineal line or **pectin pubis**. The pubis tubercle projected from the anterosuperior aspect and the pectin pubis is a ridge that extends superolaterally along the superior pubis ramus from the tubercle.

Ischium bone (os ischii) is the lower posterior part of the hip bone. It has body (**corpus ossis ischi**) which forms posterior part of acetabuli, ramus (**ramus ossis ischi**), ischial tuberosity (**tuber ischi**) and an ischial spine **(spina ischiadica**). **Ramus ischi** and the **inferior pubis ramus** surround **the obturator foramen (foramen obturatum**). The tuberosity is the inferior, most important aspect of the hip bone and the point of origin of the harmstring muscles.

Thigh (Femur).

The femur is the largest and longest bone in the human's dody. Proximally is directed a head (**caput femoris**). It is separated from the shaft by the neck. Head of the femur is slightly forward to fit into the acetabulum and has a depression in its articular surface, the **fovea capitis femoris**, to which the **ligamentum capitis femoris** is attached. Neck (**collum femoris**) of the femur connects the head to the body (shaft) and form an angle of about 125 - 130°. Below the neck, two trochanters: greater **(trochanter major**) and lesser (**trochanter minor**) are located. The trochanters are interconnected anteriorly by the intertrochanteric line **(linea intertrochanterica**) and posteriorly by the intertrochanteric crest

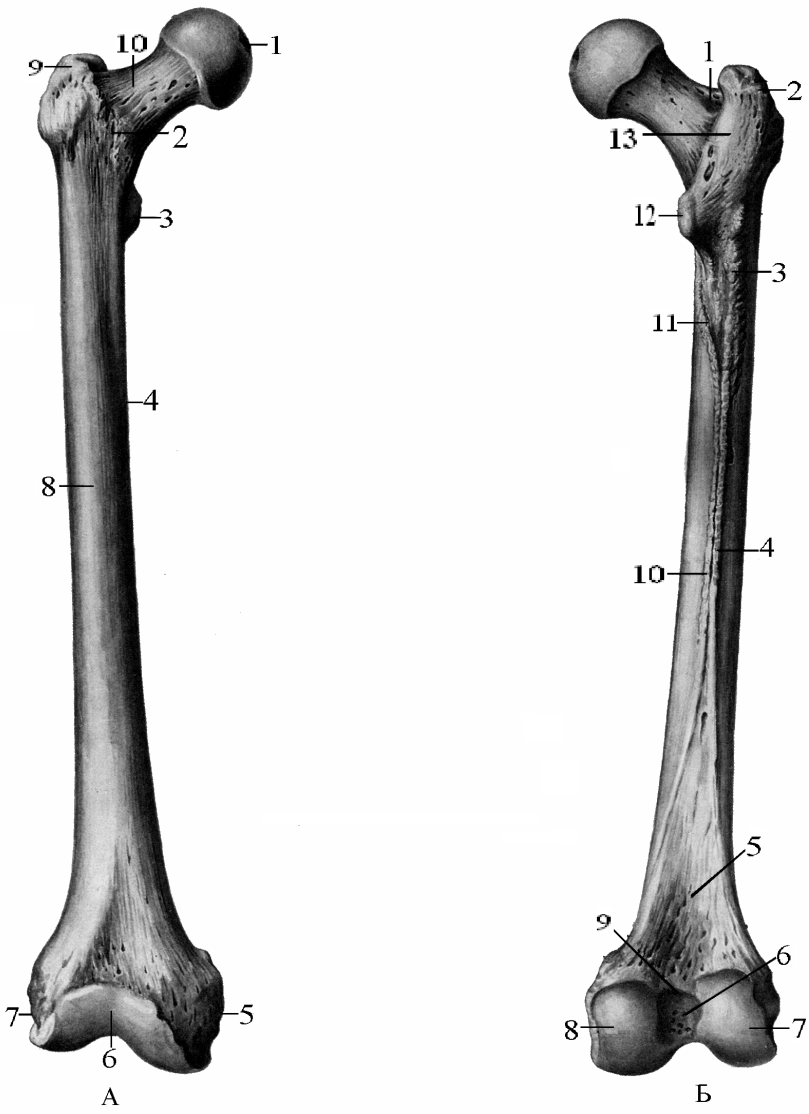


Fig 21. Femur bone.
А–anterior view:
1–caput femoris;
2–linea intertrochanterica;
3–trochanter minor;
4–corpus femoris;
5–epicondulus medialis;
6–facies patellaris;
7–epicondulus lateralis;
8–faces anterior;
9– trochanter minor;
10– collum femoris.
Б–posterior view:
1–fossa trochanterica;
2–trochanter major; crista intertrochanterica;
3–tuberositas glutea;
4–labium mediale linae asperae; 5–facies poplitea;
6–fossa intercjndularis;
7–condulus lateralis;
8 –condulus mediflis;
9–linea intercondularis;
10–labium laterale linae asperae;11–linea pectinea;
12–trochanter minor;
13- crista intertrochanterica.

(**crista intertrochanterica**). Greater trochanter has the trochanteric fossa (**fossa trochanterica**) on its medial aspect.

The shaft (**corpus femoris)** of the femur is long, has cylindrical form and inclined medially from proximal to distal. On posterior aspect of the shaft we can see **“linea aspera**”, which exhibits lateral and medial lips **(labium mediale** et **labium laterale linea aspera**) that are diverging medial and lateral supracondylar lines.

The distal end of the femur is enlarged and consists of the medial and lateral condyles (**condulus medialis et lateralis**), which have articular surfaces, curved from the front to the back and are separated by the

intercondylar fossa (**fossa intercondularis**). Anteriorly, between the condyles we can see the articular surface for the patella **(facies patellaris**). Above each condyle, prominences lie, which are called the medial and lateral femoral epicondyles (**epicondulus medialis et lateralis**).

Patella (patella) is the largest sesamoid bone which is located within the tendon of the quadriceps muscles and articulates with the femur but not with the tibia. It consists of basis (**basis patellae**) and apex (**apex patellae**). Patella attaches to the tibial tuberosity by a continuation of the quadriceps muscle's tendon which called the patellar ligament (**ligamentum patella**).

Patella functions to obviate wear and attrition on the quadriceps tendon as it passes across the trochlear groove and to increase the angle of pull of the quadriceps femoris, thereby magnifying its power.

Questions for self – study:

1. What do you know about the pelvis?
2. What is the structure of pubic bone?
3. What is the structure of ischium?
4. What is the structure of iliac bone?
5. What is the structure of acetabulum?
6. What are the peculiarities of pelvis in children?
7. What is the structure of the proximal end of the thigh?
8. What is the structure of the distal end of the thigh?
9. What is the structure of femur shaft?
10. What is the structure of patella?

Lesson 7.

Bones of the leg and the foot.

The human's leg consists of two tube-like bones: medially lies tibia and laterally-fibula.

Tibia bone (os tibia) (fig. 22) is the weight-bearing bone, forming the ankle and knee joints. It consists of the body **(corpus tibiae**) and two ends. Superiorly it expands to form the flat tibial plateau which is composed of the medial and lateral tibial condyles (**condulus medialis et lateralis**).

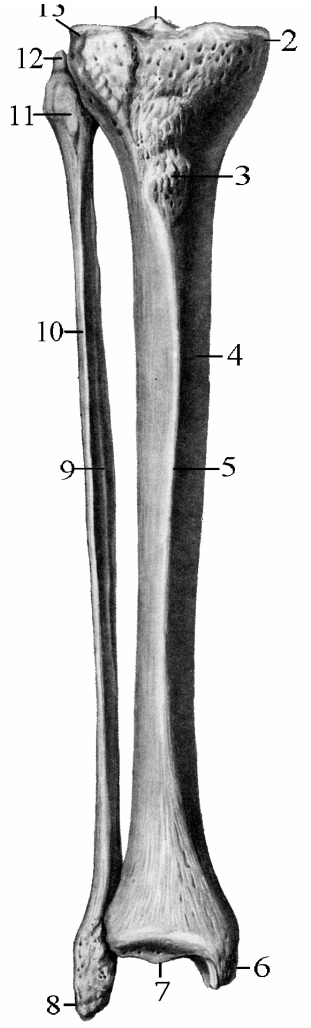


Fig. 22 Bones of the leg.
Tibia and Fibula.

1–eminentia intercondularis;
2–condulus medialis;
3–tuberositas tibia;
4–tibia bone;
5– margo anterior;
6–malleolus medialis;
7–facies articularis inferior;
8 –malleolus lateralis;
9–margo interossea;
10–fibula bone;
11–caput fibulae;
12–apex capitis fibulae;
13–condylus lateralis.

These condyles are entirely covered by articular surface and separated by the intercondylar area (**area intercondularis anterior et posterior**), which contains the intercondylar eminence **(imenencia intercondularis**). On the lateral aspect the lateral condyle has articular surface (**facies articularis fibularis**), which contacts with the fibula's head. Body of tibia (**corpus tibia)** is triangular in form. The anterior border of the shaft is subcutaneous through out its length. Superiorly, there is a prominence - tibial tuberosity (**tuberositas tibiae),** where the patellar ligament inserts. On posterior surface of the upper part of the shaft, soleal line (**linea musculi solei**) is located where soleus muscle is attached.

The distal end of the tibia expands and has a medial malleolus (**malleolus medialis**) which has a malleolar groove **(sulcus malleoli**) for the tendons of the muscles and articular surface on its lateral aspect (**facies articularis malleoli**). Lateral part of distal end also has a facet for articulation with the lower end of the fibula (**incisura fibularis**).

Fibula bone **(os fibula**) (fig. 22) is the lateral thin bone of the leg. It has few or no functions in weight-bearing, but provides attachment for muscles. This thin bone articulates both with the tibia bone and is held firmly to the tibia by the inferosseus membrane. On the upper end there is the head (**caput fibula**) with the tip (**apex capitis fibulae**) and a faset for

articulation with the tibia (**facies articularis capitis fibulae).** The fibula does not participate in the formation of the knee joint.
The distal end of the fibula has the lateral malleolus (**malleolus lateralis**) which helps to form the ankle joint. It also presents the groove **(sulcus**) for the tendons of **the peroneus longus and brevis muscles**. Posteriorly, depression lies, which is called **fossa malleoli lateralis**.

Bones of the foot.

The bones of the foot are subdivided into tarsals, metatarsals and phalanges (fig. 23).

Tarsal bones (Tarsus). The seven tarsal bones are arranged in two rows with one bone between the rows.
Proximally, the talus sits on the calcaneus, distally (medial from lateral) there are three similar cuneiform bones: the medial, intermediate and lateral and the cuboid bone. The navicular bone is positioned between the cuneiforms and the talus.

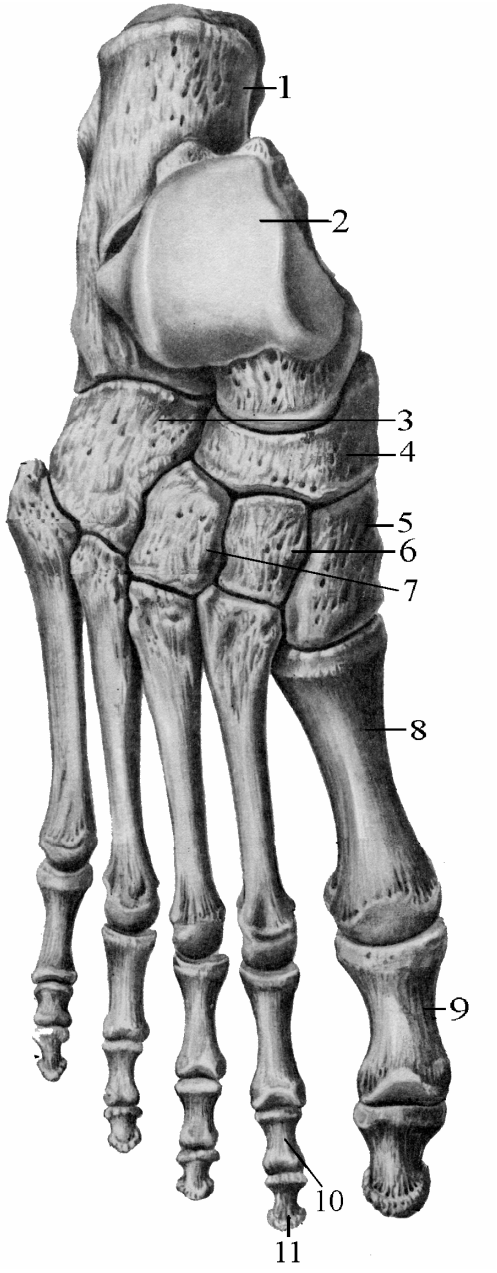


Fig. 23 Bones of the foot.
Apper view.
1- calcaneus;
2- talus;
3- os cuboideum;
4- os naviculare;
5- os cuneiforme mediale;
6 - os cuneilforme intermedium;
7 - os cuneiforme laterale;
8 - os metatatrsale I;
9- phalanx proximalis;
10 - phalanx media;
11- phalanx distalis.

Talus (talus) is the most superior bone in the foot, which transmits the weight of the body from the tibia to other bones of the foot and it is single tarsal bone without muscles attachment.

It has a head (**caput tali),** neck **(collum tali**), shaft (**corpus tali**) and trochlea (**trochlea tali**). Head of talus has articular surface, which joins with the navicular bone **(facies articularis navicularis**). Talus has a deep groove (**sulcus tali**) for the interosseus ligaments between the talus and the calcaneus and has also a groove on the posterior surface of its body for the **flexor hallucius longus tendon**. Head serves as a keystone of the medial longitudinal arch of the foot.

Calcaneus (**calcaneus)** is the largest and strongest bone of the foot bone which lies below the talus. It consists of the body (**corpus calcanei**) and **tuber calcanei**, inclining inferiorly. Superiorly calcaneus has three articular surfaces: anterior, media and posterior. Between medial and posterior surfaces we can see groove (**sulcus calcaneus**) which contacts with groove of talus (**sulcus tali)** forming **sinus tarsi**. On the medial surface of calcaneus there is large protuberance **sustentculum tali,** which supports the talus. On the lateral surface of the calcaneus there is a groove **for peroneus longus muscles tendon**. The distal end joins with the cuboid bone.

Navicular bone (**os naviculare**) is boat-shaped tarsal bone, lying between the head of the talus and three cuneiform bones. Medially it has navicular tuberosity **(tuberositas ossis navicularis**).

Cuneiform bones (ossa cuneiformia). These are three bones: medial, intermediate and lateral, wedge-shaped, which articulate with the navicular bone posteriorly and with three metatarsals anteriorly. The medial cuneiform bone articulates with the base of first metatarsal bone, intermediate with the second metatarsal and lateral with the third metatarsal bone.

Cuboid bone (os cuboideum) is the most laterally placed tarsal bone. It articulates with the calcaneus bone posteriorly and with two (fourth and fifth) metatarsals anteriorly. It has corresponding articular surface, a notch and a groove for the tendon of the **peroneus longus muscles.**

Metatarsal bones (ossa metatarsalia). Metatarsus consists of five short metatarsal bones and has prominent medial and lateral sesamoid bones on the first metatarsal. Each metatarsal bone consists of a base, shaft and head. The first bone is shorter and stouter than others.

Digits - toes (ossa digitorum pedis). There are 14 phalanges on the foot. Each of the digits (toes) is composed of three phalanges: proximal, middle and distal, except the first- great toe which has only two phalanges, proximal and distal which are very strong.

The weight of the body is distributed between the posterior tubercles of the calcaneus and the heads of the metatarsals, the intervening bones forming an arch.
The major static support of the foot is provided by ligaments and dynamic support is added by the intrinsic muscles of the foot.

Questions for self – study:

1. What is there on the proximal end of tibia?
2. What is the structure of the distal end of tibia?
3. What is the structure of fibula?
4. How many parts does foot have?
5. What are the characteristics of tarsal bones, their names?
6. What is the structure of talus?
7. What is the structure of calcaneus?
8. What is the structure of metatarsus?
9. What is the structure of toes bones?
10. What is the arch of the foot?

Lesson 8.

Skull. The structure of occipital and parietal bones.

Skull is the skeleton of the head, which is divided into two parts: cranial and facial.

The skull is formed of eight cranial bones, which make up the head. There are unpaired frontal, occipital, ethmoid and sphenoid bones and paired parietal and temporal bones. Facial part is form of with fourteen facial bones: paired lacrimal, nasal, palatine, inferior turbinate maxillary and zygomatic bones and unpaired vomer and mandible.
The skull without the mandible sometimes is called cranium. The cranial cavity is formed by a roof (**calvaria)** and floor **(basis).**

Calvaria is the skullcap, which is the vault of the skull, without the facial bones. It consists of the superior portions of the frontal, parietal and occipital bones and highest point on the sagital suture. The bones in the skull are mainly fused by means of sutures (fixed joining).

Occipital bone (os occipitale) is one of the unpaired bones in the skull (fig. 24). It lies at the back of the head and consists of four parts: squamous, basilar and two lateral condoyle parts. All this parts are fused and form the hole at the bottom of the skull - **foramen magnum**, where the brain is joined to the spinal cord.

Squamous part **(squama occipitalis)** is wide thin film, which has inner and outer surface. There is a big protrude in the middle of external surface, which is called **protuberantio occipitalis externa**. From here to

posterior aspect of foramen magnum occipital crest **(crista occipitalis externa)** passes, on its right and left sides three nucha or nape lines lie: Iinea nuchae superior, inferior and suprema, which attach the muscles and ligaments.
In the centre of the inner surface cross-shaped eminence **(eminentia cruciformis)** lies, its divides them into four depressions and form the cerebral and cerebellar fossae. Also, there are many grooves, which form cavities or sinuses in the skull. They are: transverse sinus groove **(sulcus sinus transversus),** upper sagital **(sulcus sinus sagitalis superior)** and lower sagital sinus **(sulcus sinus sagitalis inferior)** grooves.

Basilar part **(pars basilaris**) is the front of foramen magnum and fusing to the sphenoidal shaft by 18-20 years of age.

It has two surfaces: inner or cerebral and outer or external. Its inner

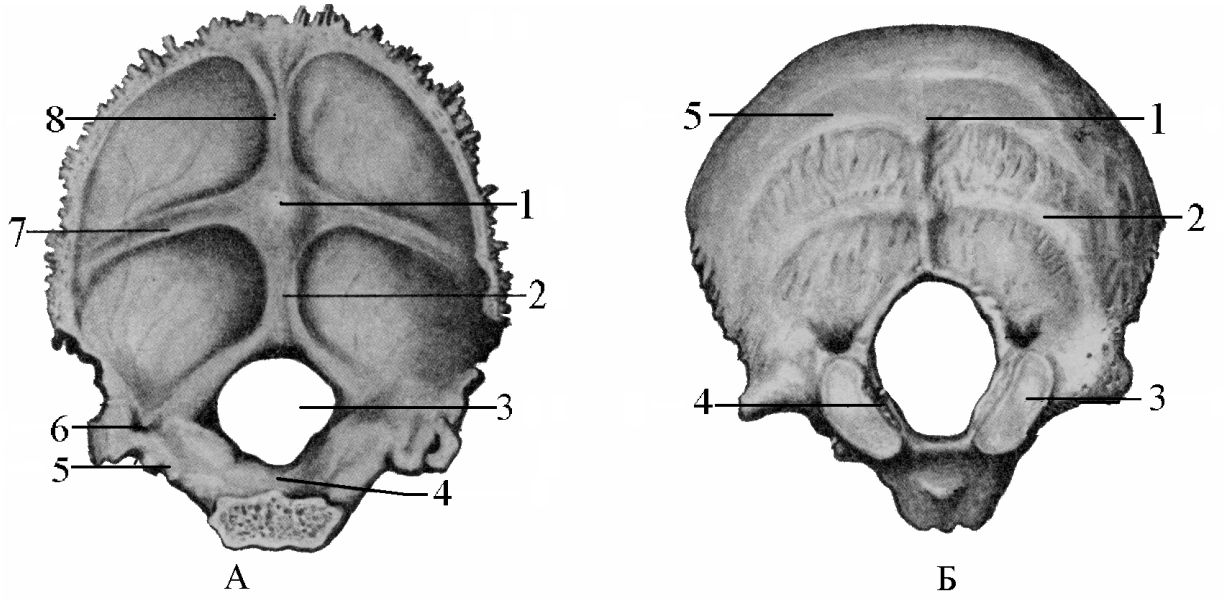


Fig. 24 Occipital bone.
A –anterior and upper view:
1—foramen magnum; 2—clivus; 3—sulcus sinus petrosi inferioris; 4—canalis condylaris; 5—sulcus sinus transversi; 6—sulcus sinus sagittalis superioris; 7— protuberantia occipitalis interna; 8—crista occipitalis interna
B –posterior and lower view:
1—protuberantia occipitalis externa; 2—linea nuchae inferior; 3—condylus occipitalis; 4—pars lateralis; 5—linea nuchae superior.

surface is swayback and forms bending platform or **clivus**, where medulla oblongata lies.
On the both sides of the clivus there are two grooves pass: **sulcus sinus petrosus inferior,** which form lower petrous sinus in the base of the skull and **sulcus sinus petrosa superior** above pyramid.

There is a pharyngeal tubercle **(tuberculum pharyngeum)** on the base's outer surface, where pharynx is attached.

At last, two lateral parts **(pars lateralis),** which surround foramen magnum. On the outer surface of lateral parts we can see round-shaped outgrows which are joined to the atlas. These processes are called condylus occipitalis. Through each of condyle hypoglossal canal pass, where hypoglossal nerve and meningeal artery pass. Also there is a depression behind condyle which is called condyle's fossa **(fossa condularis).** On its bottom, condoyle foramen and canal are found. Here, emissary vein goes out. Laterally from occipital condoyle jugular notch **(incisura jugularis)** and jugular process **(processes jugularis**) lie, and near them sigmoid sinus groove **(sulcus sinus sigmoidei)** passes.

Parietal bone **(os parietale)** - paired flat bone which forms upper part of the skull (fig. 25). Two parietal bones are united by the sagital suture in the middle of calvaria.

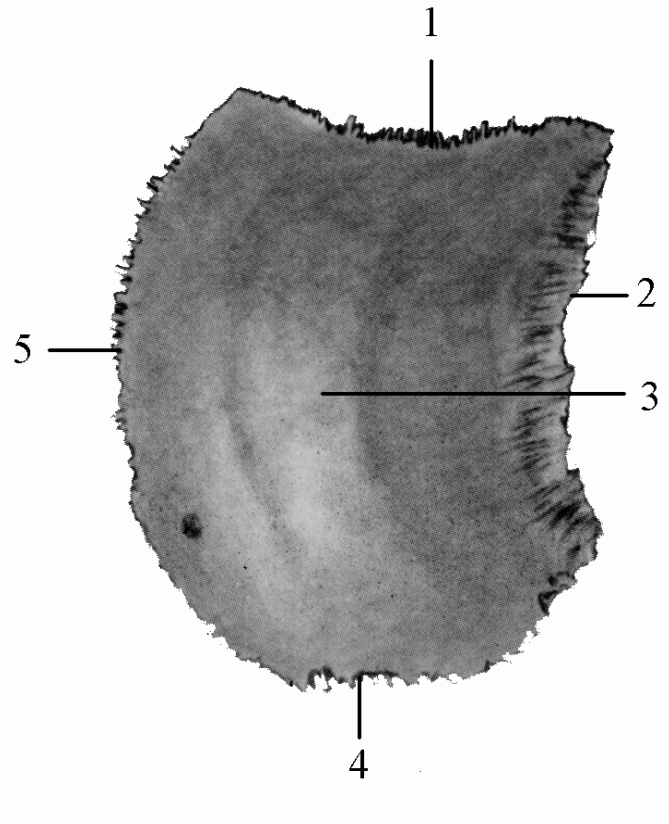


Fig. 25 Parietal bone

1- margo frontalis;

2- margo squamosus;

3- tuber paritale;

4- margo occipitalis;

5- margo sagittalis.

Anteriorly it's united with the frontal bone by coronal suture and posteriorly with the occipital bone united by the lambdoid suture. It has four edges and four angles.

Anterior or frontal edge **(margo frontalis),** posterior or occipital edge **(margo occipitalis),** superior or sagital edge (**margo sagitalis)** and squamous edge **(margo squamosus).** There are frontal, sphenoid, occipital and mastoid angles.

In the middle of the outer surface there is protruding part **(tuber parietale).** Below, we can see two lines **(lineae temporales superior et inferior)**, where the fascia and muscles attach.

On the inner surface along the upper edge, upper sagittal sinus groove passes **(sulcus sinus sagittalis superioris)**. Nearly different size pitches are placed, they are called "foveolae granulares". In the area of mastoid angle there is a sigmoid sinus groove **(sulcus sinus sigmoideus)** where sigmoid sinus is formed. Also here we can see artery grooves **(sulci arteriosi)**.

Questions for self – study:

1. What is the structure of occipital bone?
2. How many parts does occipital bone have?

3. What is the structure of squamous part?
4. What is the structure of the lateral parts?
5. What is the structure of the basilar part of occipital bone?
6. What is the structure of parietal bone?
7. What margins and angles does the parietal bone have?

Lesson 9.

Frontal, ethmoid and zygomatic bones.

Frontal bone **(os frontale)** - unpaired bone forming the front of the upper part of the skull (fig. 26). It has four parts: squamous, two orbital and nasal parts.

Squamous part **(pars squamosa)** is the largest part of the temporal bone. Thise is a thin wide film, which has inner and outer surfaces. Squama is separated from orbital plates with the upper orbital edge or supraorbital margin **(margo supraorbitalis)**. Medially, on this supraorbital margin, frontal notch **(incisura supraorbitalis)** lies, laterally - on the side of zygomatic process **(processus zygomaticus)**, which is united with the frontal process of zygomatic bone.

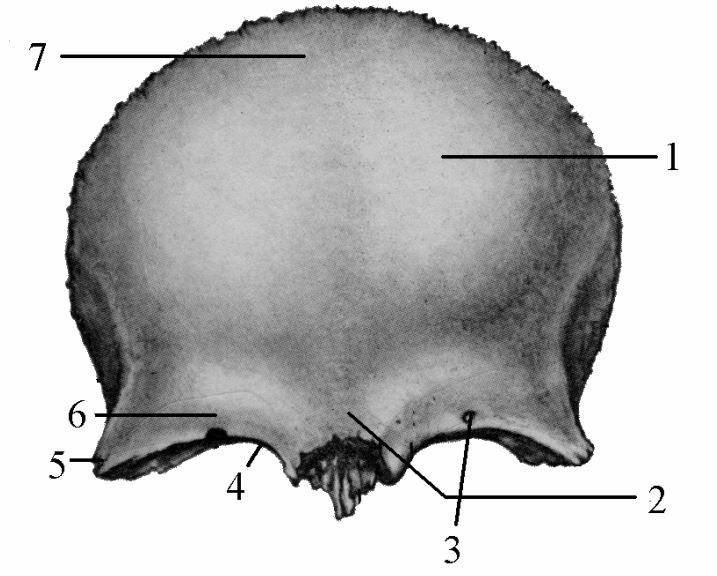


Fig. 26 Frontal bone.

1 - tuber frontale;
2 - glabella;
3 - foramen supraorbitale;
4 - margo supraorbitalis;
5-processus zygomaticus;
6 - arcus supercilliaris;
7 - squama frontalis.

In the centre of squama, flat area lies, it is called glabella. To the left and to the right there are arches of skin with a line of hair – eyebrows **(arcus superciliaris)** and above them palpable large protrude **(tuber frontale).** In the middle of its inner or cerebral surface the upper sagital sinus groove **(sulcus sinus sagitalis superior)** passes to the crista galli-projection from the ethmoid bone. In front of the crista galli there is foramen cecum, which may transmit an emissary vein and falx cerebri is attached to it.

Orbital parts **(pars orbitalis)** are two thin horizontal lying plates, which form the roof of orbital cavities. Both plates are separated from ethmoid notch **(incisura ethmoidalis)**, where cribriform plate **(lamina**

cribrosa) of ethmoid bone is placed. Each plate has cerebral and orbital surfaces. Near the front of the lateral roof of the orbit there is a depression for lacrimal gland **(fossa glandula lacrimalis),** medially there are trochlear notch **(incisura trochlearis)** and trochlear spine **(spina trochlearis)**, where one of the eye's muscles passes.

Nasal part **(pars nasalis)** is formed between two orbital plates. Anteriorly it is united with nasal bone and frontal process of the upper jaw (maxilla). Lowerly, a little sharp-form process **(spina nasalis)** occurs where nasal septum is attached. On the right and left side from middline we can see pair openings **(aperturae sinus rontalis).** They lead to sinus frontalis - air cavity of forehead.

Ethmoid bone **(os ethmoidale)** is located between the orbits and consists of the cribriform plate **(lamina cribrosa)**, perpendicular plate **(lamina perpendicularis)** and two lateral masses enclosing ethmoid air cells, which are called labirints **(labyrinthus ethmoidalis)**. Cribriform plate is top part of the ethmoid bone, lies horizontally and forms the roof of the nasal cavity. The multiple openings in the cribriform plate transmit the rootlets of the olfactory nerve into the superior aspect of the nasal cavity.

Extending upward from the cribriform plate there is the triangular midline process - crista galli, which gives attachment to the falx cerebri. Between the ethmoid and frontal bones in front of the crista galli a small pit **(foramen caecum)** lies.

Perpendicular plate goes in the middle at right angle to the cribriform plate and forms the nasal septum with vomer and septal cartilage.

On the sides of cribriform plate ethmoidal labyrinths hang between the orbit and the nasal cavity. Ethmoidal labyrinth consists of ethmoidal air cells **(cellulae ethmoidales)**, which are numerous small cavities in the labyrinth masses and can be subdivided into three groups: posterior, middle and anterior ethmoidal air cells.

Posterior air cells **(cellulae ethmoidales posterior)** drain into the superior nasal meatus. Middle ethmoidal air cells **(cellulae ethmoidales media)** drain into the summit of the ethmoidal bulla of the middle nasal meatus and anterior air cells **(cellulae ethmoidales anterior)** drain into the anterior aspect of the hiatus semilunaris in the middle nasal meatus. Laterally, ethmoidal air cells are covered with orbital plate **(lamina orbitalis).**

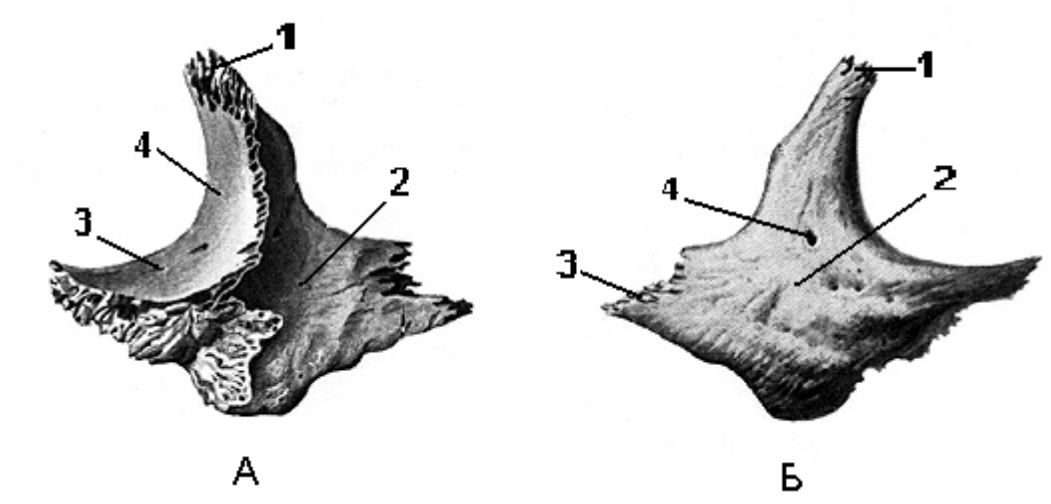


Fig. 27 Cheek bone.

A. inner view: 1 – processus frontalis; 2 – facies temporalis; 3 – foramen zygomaticoorbitale; 4 – facies orbitalis.
B. outer view: 1 – processus frontalis; 2 – facies lateralis; 3 – processus temporalis; 4 – foramen zygomaticofaciale.

Zygomatic bone (os zygomaticum) - chick bone or malar bone, which forms the prominent part of the chick and lower part of the eye socket (fig. 27). It has three surfaces and two processes. One of the surfaces is directed to the eye socket it is called **facies orbitalis**, next is directed to the temporal fossa **(facies temporalis)** and the last one is directed outside and called **facies lateralis**. So, two processes frontal **(processus frontalis)** and temporal **(processus temporalis)** are joined with the same- named bones. The front part of this bone is connected to the upper jaw.
On the eye socket surface there is an opening- **foramen zygomaticoorbitale** which is divided into two: **foramen zygomaticofaciale** and **foramen zygomaticotemporale** where nerves pass, which are called as openings.

Questions for self – study:

1. What is the structure of frontal bone?
2. How many parts does frontal bone have?
3. What is the structure of squamous part?
4. What is the structure of the orbital part?
5. What is the structure of nasal part of frontal bone?
6. What is the structure of ethmoid bone?
7. What is the structure of ethmoidal labyrinth?
8. What is the structure of zygomatic bone?
9. How many processes does zygomatic bone have?
10. How many surfaces are there in zygomatic bone?
11. What kind of openings does the zygomatic bone have?

Lesson 10.

Sphenoid bone.

Sphenoid bone **(os sphenoidale)** is unpaired bone in the skull, which lies in the middle of the skull's basis and forms middle cranial fossa (fig.28, 29).

Sphenoid bone consists of four parts: body (which houses the sphenoid sinus), the greater and the lesser wings, and the pterygoid processes.

The body of the sphenoid bone **(corpus)** forms the central part of the bone and consists of the **sella turcica** (turk's saddle) which borders by

dorsum sella posteriorly and chiasmatic groove **(sulcus chiasmatis)** anteriorly. It is found anteriorly to the tuberculum sella and posteriorly by the **dorsum sella** and has deep central depression in the upper surface, which is called hypophysial fossa **(fossa hypophisialis)** and accommodates the pituitary gland or the hypophisis. Within the body of the sphenoid bone the sphenoid sinus **(sinus sphenoidalis**) is located. On each side of the dorsum sellae there are two tubercles - posterior clinoid processes (**processes clinoidei posteriors**) which give attachment to border of the **tentorium cerebelli** and forms **diaphragma sella**. There is carotid grove (**sulcus caroticus**) located on both sides of the body, where internal carotid artery (**arteria carotis interna)** lies.
Laterally, on each side of the body, pair lesser and greater wings are directed. Lesser wings **(alla minor)** of the sphenoid bone form the anterior cranial fossa, but greater ones- **(alla major**) form middle cranial fossa. Between the lesser and greater wings there is the chink - superior orbital fissure (**fissura orbitalis superior**). The lesser wings have two processes: anterior clinoid processes (**processes clinoideus anterior**), which give attachment to the free border of the tentorium cerebelli.Greater wing of the sphenoid bone forms the anterior wall and the floor of the middle cranial fossa. There are three openings on it, **foramen rotundum**, **foramen ovale** and **foramen spinosus**, where nerves and artery pass.
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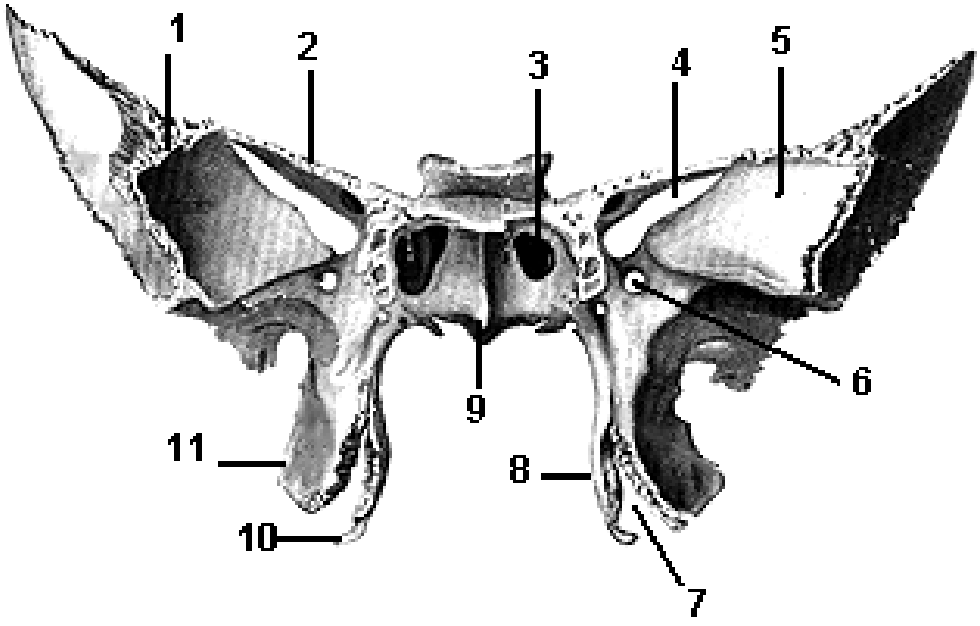


Fig. 28 Sphenoid bone;
anterior view:

1 – alla major; 2 – alla minor; 3 – apertura sinus sphenoidalis; 4 – fissura orbitalis superior; 5 – facies orbitalis; 6 – foramen rotundum; 7 – incisura pterygoidea; 8 – lamina medialis processus ptrygoidei; 9 – crista spenoidalis; 10 – hamulus pterygoideus; 11 – lamina lateralis processus pterygoidei.

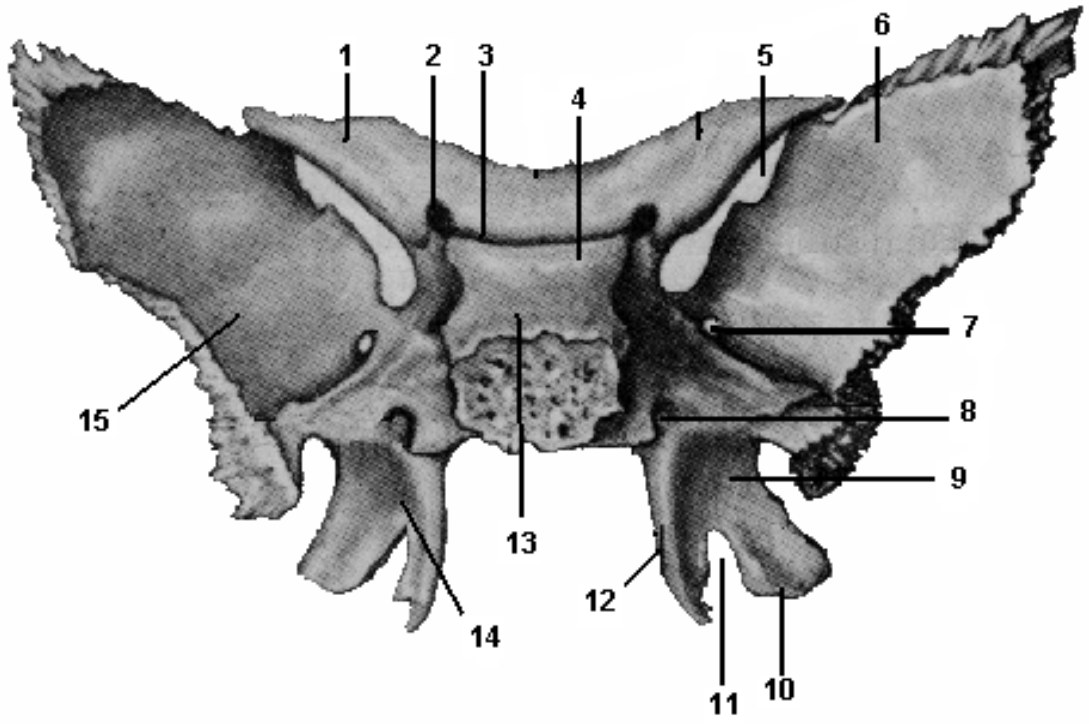


Fig. 29 Sphenoid bone.
Posterior view.
1 – ala minor; 2 – canalis opticus; 3 – sulcus chiasmatis; 4 – fossa hypophysialis;5 – fissura orbitalis superior; 6 – facies cerebralis ala major; 7 – foramen rotundum; 8 – canalis pterygoideus; 9 – processus pterygoideus; 10 – lamina lateralis processus ptergoidei; 11 – incisura pterygoidea; 12 – lamina medialis processus ptergoidei; 13 – corpus sphenoidale; 14 – fossa pterygoidea; 15 – ala major.

Greater wing has four surfaces: brain surface **(facies cerebralis**), orbital surface (**facies orbitalis)**, temporal (**facies temporalis**) and infratemporal (**facies infratemporalis**). The temporal and infratemporal surfaces are separated by infratemporal crest (**crista infratemporalis**).

Pterygoid process (processus pterygoideus) - paired projecting parts of the sphenoid bone pass below and consists of small thin plates medially and laterally **(lamina lateralis processes pterygoidei** and **lamina medialis processes pterygoidei**). Between these plates a depression is formed. This is pterygoidal fossa (**fossa pterygoidea**), which ends with pterygoidal notch (**incisura pterygoidea**). On the base of processus pterygoideus we can see the pterigoid canal (**canalis pterygoideus**), which goes through the pterygoid portion of the sphenoid bone and opens to the posterior wall of the pterygopalatine fossa. The medial plate is longer and has a hook (**processus uncinatus**) on its lower end. It is attachment for muscles and ligaments and is called **hamulus pterygoideus**.

In newborn sphenoid bone has four separate parts, and the body which consists of two parts, and they are divided by a thin cartilaginous layer. The lesser wings are fussed with the body by the cartilaginous layer. Pterygoidal processes are curved to the front and to the sides. Till 2 years of age the body's two parts are fused and at the age of 3 greater wings are

fused with the body. In this period sphenoid sinus is formed. At first child period (2-7years of age) is the same as in adults, but the relief is not clear. In the period of 12 – 15 years of ages the bone has individual and sex signs and at age of 15 – 18 years sphenoid and occipital bones are fused with each other.

Questions for self – study:

1. How many parts does sphenoid bone have?
2. What kinds of surfaces does the sphenoid's shaft have?
3. What is the structure of the body of sphenoid bone?
4. What is the structure of lesser wings?
5. What is the structure of greater wings?
6. How many openings do greater wings have?
7. What is the structure of pterygoid process?
8. What do you know about sphenoid cavity?
9. What is the structure of sphenoid bone in newborn?

Lesson 11.

Temporal bone.

Temporal bone (os temporale) is pair bone, which forms the base and lateral parts of the skull (fig. 30, 31). The temporal bone houses the middle ear cavity- a network of interconnected canals that form the inner ear and participates in the formation of various cranial and extracranial fossae. It is composed of squamous, mastoid, petrosus and tympanic parts.
The squamous portion (pars squamosa) is a thin plate, which formes the side of the skull near the mastoid process, external auditory meatus and the mandibular fossa. Above it there is the zigomatic process **(processus zygomaticus**), which forms the part of the zigomatic arch (**arcus zygomaticus)** where we can see small tubercle **(tuberculum articulare**). Behind the arch the mandibular fossa (**fossa mandibularis**) lies, where the head of the lower jaw enters and forms the joint (articulation temporomandibulare).
The squamous portion has two surfaces- one is cerebral (**facies cerebralis**), another is temporal face (**facies temporalis**), where media temporal artery groove **(sulcus arteria temporalis media**) passes.

Mastoid part (pars mastoidea) is formed by mastoid process (**processus mastoideus)**, which protrudes behind the ear and contains mastoid air cells (**cellulae mastoideae). A**ir cells of the mastoid process communicate with the middle ear by cave of **antrum mastoideum**. In children until five, usually there is only one big cell - antrum, after five years of age the mastoid process consists of numerous cells communicating with one another and then formed antrum. On the inner surface of the mastoid part, sigmoid sinus groove (**sulcus sinus sigmoidei**)

passes. Lower part of mastoid process has **incisura mastoidea** and occipital artery groove (**sulcus arteriae occipitalis**).

Tympanic part (pars timpanica) surrounds the external auditory opening in front, behind and below, and is directed to the external auditory way which leads from the outer ear to the tympanic cavity or eardrum **(membrana tympani).**

Tympanic part is separated from mastoid process by the chink- **fissure tympanomastoidea**, from squamous part- by another chink- **fissure tympanosquamosa,** and from stone-like part is separated by chink- **fissure petrotympanica**.

Petrous part (pars petrosa) of the temporal bone is stone - like structure, forms the base of the skull and encloses the inner and middle ears. It is a pyramid- shaped part, which has three surfaces: anterior, posterior and inferior.

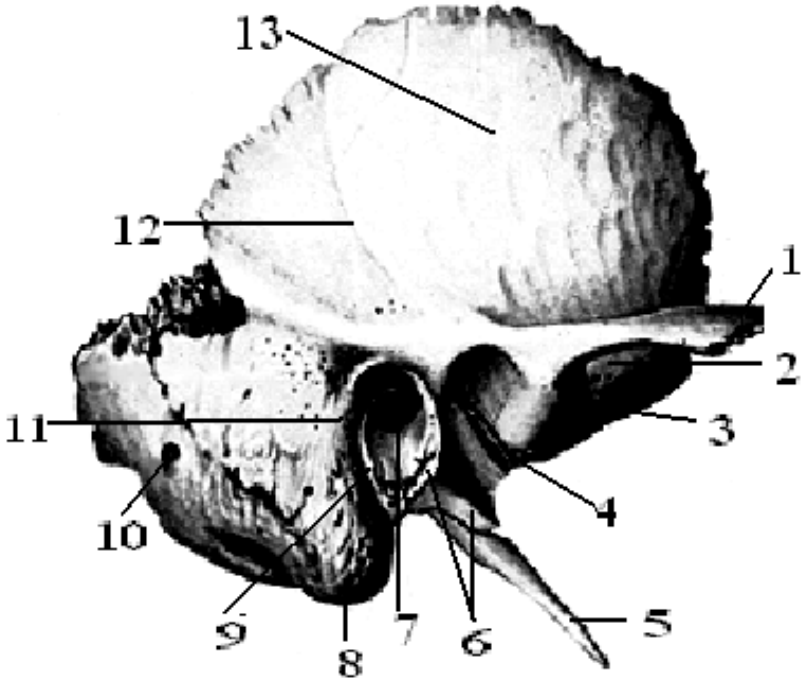


Fig.30 Temporal bone. External view.

1– processus zygomaticus;
2 – tuberculum articulare;
3 – fossa temporalis;
4 – fissure petrotympanica;
5 – processus styloideus;
6 – pars tympanica;
7-poruscusticus externus;
8–processus mastoideus;
9-fissure tympanomastoidea;
10 – foramen mastoideum;
11 – spina suprameatica;
12- sulcus arteria temporalis mediae;
13 – pars squmosa.

The anterior face forms the posterior portion of the floor of the middle cranial cavity and is separated from posterior face with ridge where upper petrosal sinus groove **(sulcus sinus petrosi superioris**) lies. The posterior face is on the posterior cranial fossa and contains the opening of the inner auditory passage **(porus acusticus internus**). Laterally, anterior surface of pyramid is separated from the squamous portion with petrosquamosal chink (**fissura petrosquamosa**). Near it **canalis musculotubarius** lies. In the middle of anterior surface we can see arch- shape eminence, **eminentia arcuata**. Between **fissura petrosquamosa** and **eminentia arcuata** there is a roof of tympanic cavity (**tegmen tympani)** and near the pyramid's apex trigeminal impression (**impressio trigemini**) is found. At last, on the anterior surface of pyramid there are two small openings and chinks where the lesser and greater petrosal nerves pass. Lower surface of pyramid forms the external base of the skull. There are many openings and canales as well as a depression - **fossa jugularis** with the jugular notch (**incisura jugularis**) near them. Here we can see **processus styloideus** and between styloid and mastoid processes there is an opening (**foramen stylomastoideus**).

General canals of temporal bone

1) **Carotid canal** is the biggest canal (**canalis caroticus),** where the inner carotid artery pass. The length of this canal is only 1sm. It starts from external carotid opening (**foramen caroticum externum)** and finishes by inner carotid opening (**foramen caroticum internum).** Continuation of this artery way is on the carotid groove (**sulcus caroticus**).
Arteria carotis interna is the biggest newdishinal that's why it feeds the brain.

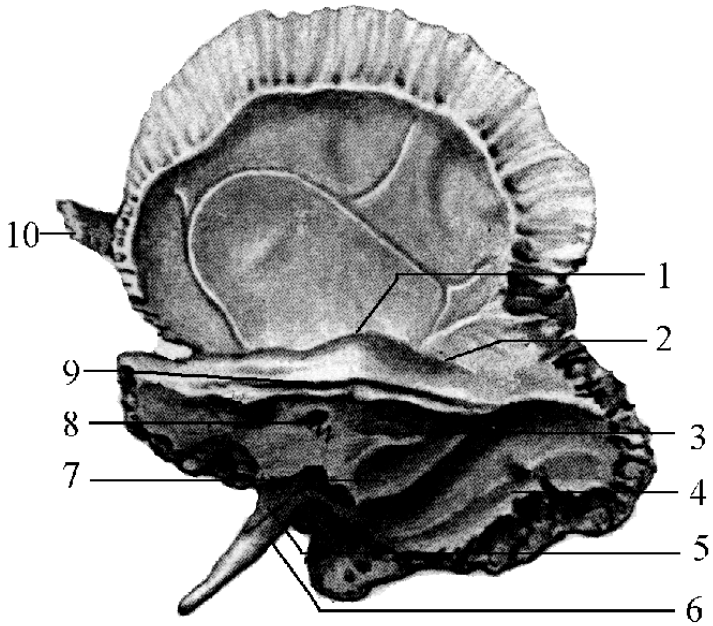


Fig. 31. Temporal bone. Inner surface.

1—eminentia arcuata; 2—tegmen tympani; 3-pars petrosa; 4-sulcus sinus sigmoidei; 5—apertura extena canaliculi cochleae; 6—processus styloideus; 7-apertura externa aqueductus vestibuli; 8—porus acusticus internus; 9—sulcus sinus petrosus superioris; 10—processus zygomaticus.

2**) Canalis musculotubarius**- the muscle and tube canal. It is divided into two parts: in one of them muscle lies (it is **musculus tensoris tympany**, which contracts eardrum); another part is tube in form, it is called **tubae auditivae** or **Eustachian tube**, which goes up to ear cavity.
3) **Canalis facialis**. In this canal face nerves pass, which control face mimic. It starts from bottom of inner ear way (**porus acusticus internus**) and goes horizontally through pyramid, makes angle 90^0, directed downward and ending at **foramen stylomastoidea**.
4**) Canaliculi caroticotympanica** starts from the back wall of carotid artery canal and goes up to eardrum cavity. Through this canal same name artery **(arteria caroticotympanica)** passes.
5**) Canaliculi chorda tympani**- start from wall of face's nerve canal above its end (**foramen stylomastoideus)** and ends in eardrum cavity. Through this canal **nervus chorda tympani** passes.
6**) Canaliculi tympanica** – starts from **fossula tympanica**, goes upward and through lower wall of eardrum comes to its cavity. Through this canal **nervus tympanicus** passes.
7**) Canalis mastoideus**- starts from **fossa jugularis** and ends at **fissure tympanomastoideus.** Ear branch of vague nerves passes through this canal.

Questions for self – study:

1. What is the structure of temporal bone?
2. How many parts does temporal bone have?
3. What is the structure of pyramidal part?
4. What kind of surfaces and margins does the pyramid have?
5. What structures are located on the lower surface of pyramid?
6. What is the structure of tympanic part?
7. What is the structure of mastoid part?
8. What is the structure of squamous part?
9. What kinds of canals does temporal bone have?
10 What is the structure of temporal bone in newborns?

Lesson 12.

The bones of face.

Bones of facial part of skull consists of maxilla (upper jaw), lachrymal, nasal, palatine bones, mandible (lower jaw), vomer, lower nasal conches and hyoid bone. They are fourteen bones.

Upper jaw bone - maxilla, pair bone, consists of body and four processes (fig. 32). Body or shaft (**corpus maxillae**) occupies central part of bone and has ear cavity, which is called "**sinus maxillaris**" or **gaimor**

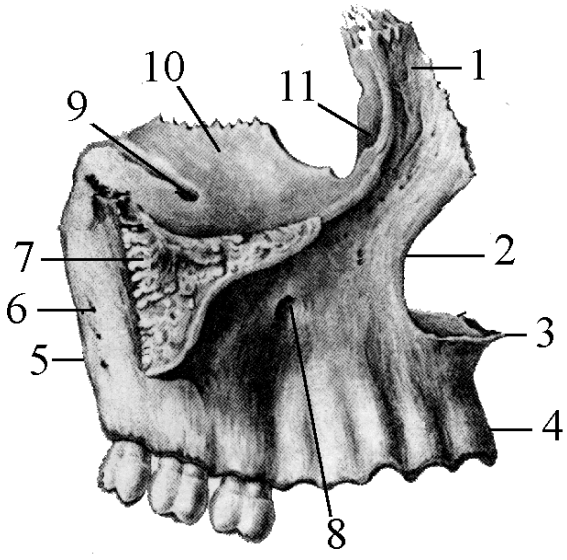


Fig. 32 Maxillar bone, upper jaw; external view.

1- processus frontalis;
2- incisura nasalis;
3- spina nasalis anterior;
4- arcus alveolaris;
5- tuber maxillae;
6- foramina alveolaria;
7- processus zygomaticus;
8- foramen infraorbitale;
9- sulcus infraorbitalis;
10- facies orbitalis;
11- sulcus lacrimalis.

cavity. It is located behind the cheek bone in the upper jaw and by the opening communicates with medial nasal way (**meatus nasi media**).There are four surfaces on the body: anterior, in front **(facies anterior**), orbital (**facies orbitalis),** nasal **(facies nasalis**) and infratemporal (**facies infratemporalis**). Anterior surface is separated from orbital which lower orbital edge **(margo infraorbitalis**) where is opened infraorbital hole (**foramen infraorbitalis**) and under it depression is lie. Depression is above the canine teeth those in the upper jaw are referee to as the "eyeteeth" and called **"fossa canina**"'. Medially, there is nasal notch (**incisura nasalis**), which finishes by sharp projecting below - **"spina nasalis anterior".** The orbital surface of the maxilla is triangular plate, which forms the floor of the orbital cavity. On this face infraorbital groove (**sulcus infraorbitalis)**, infraorbital canal **(canalis infraorbitalis**) are lie. Infratemporal face anteriorly changes to **infratemporal fossa** and has a raised area - **tuber maxilla**, near them greater palatine groove (**sulcus palatinus major)** passes. Nasal surface forms the lateral wall of nasal cavity and has opening - **hiatus semilunaris**, which drains maxillary air sinus in the middle nasal way. In front of this opening lacrimal groove pass (**sulcus lacrimalis)**. There are four processes on the upper jaw bone: frontal, zygoma, alveolar and palatine.

Frontal process (processus frontalis) directed upperly and joins with nasal part of frontal bone. On its inner face ethmoidal crest (**crista ethmoidalis**) is located.

Zygomatic process (**processus zygomaticus)** is directed up and out and joined with zygomatic bone.

Alveolar process (processus alveolaris) of the upper jaw bone is arch like, where teeth sockets lie. There are eight sockets into which a tooth fits. In front surface of alveolar arch we can see prominences above each of tooth -**juga alveolaria.**

Palatine process (processus palatinus) of maxilla are lying horizontally (transverse) and fused with same process of opposite side, and form anterior 2/3 parts of the hard palatine. Its upper surface forms the floor of the nasal cavity and lower surface forms the roof of the mouth with the numerous lengthwise grooves (**sulci palatini**). In the midline palatin suture (**suturae palatini media)** is formed, that has incisor opening (**foramen incisivus**) anteriorly.

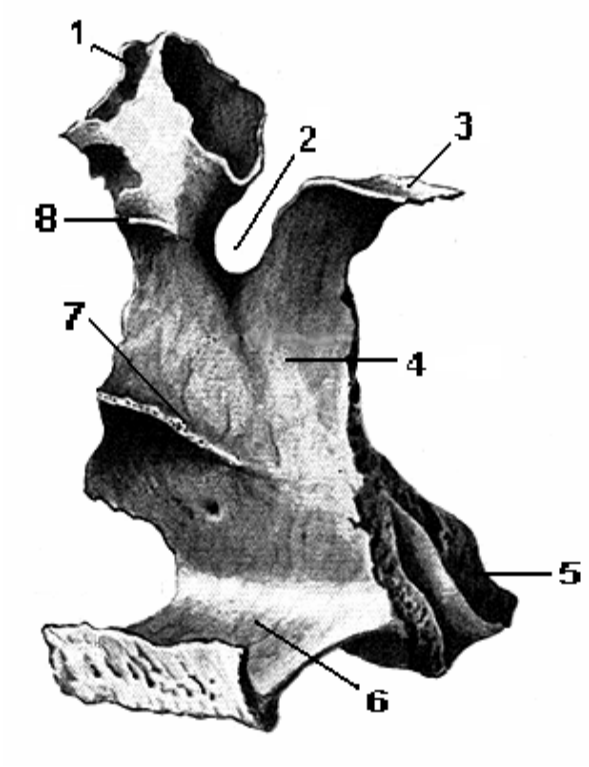
In newborns upper jaw is not developed fully so lower orbital edge is close to the alveolar process. In infants bones grow very fast especially the alveolar process, because teeth sockets appear.

The first childhood period increased body growth is noted. In the second childhood period because teethes change the upper jaw bone grow and the formation of air sinuses finishes. During puberty period sex and individual traits appear.

Lachrymal bone or tears (os lacrimale) - two little bones - thin, quadriangle plates, which form the anterior part by medial wall of orbits. On its outer surface we can see lachrymals groove (**sulcus lacrimalis**) and small depression for tear's sac (**fossa sacci lacrimalis).**

Nasal bone (os nasale) — two small bones form the bridge at the top of the nose. It is thin quadriangle bone, which is fussed with the nasal part of frontal bone in the upper edge, lateral edge is fussed with the frontal process of maxilla and lower edge is attached to the nasal cartilage.

Palatine bone (os palatinum) - pair bones, which form posterior part of the hard palate, the orbits, oral cavities, nasal cavity and the cavity



behind the nose (fig.33). It is consists of two plates - perpendicular and horizontal **(lamina perpendicularis and lamina horisontalis).**

Fig. 33 Palat bone;
inner view.
1- processus orbitalis;
2- incisura sphenopalatina;
3- processus sphenoidalis;
4- lamina perpendicularis;
5- processus pyramidalis;
6-lamina horizontalis;
7-cristaconchalis;
8-crista ethmoidalis.

The horizontal plates of palatine bones are fussed with palatine's process of maxilla and form hard palate, where two sutures pass - medially and horizontally.
The perpendicular plate is directed superiorly and forms the medial wall of **pterygopalatine fossa** and the lateral wall of the nasal cavity.
On its outer surface greater palatine grooves (**sulcus palatinus)** pass, which are fussed with the main grooves of maxilla, forming greater palatine canal (**canalis palatinus major**). On the medial surface of perpendicular plate there are two crests. One of it - is ethmoidal crest (**crista ethmoidalis**), other for the lower nasal conches (**crista conchalis).**
The palatine bone has 3 processes - pyramid-shaped, orbital, and wedge form. The pyramid-shaped process (**processus pyramidalis**) occupies the notch between the medial and lateral plates of pterygoid process, the orbital **(processus orbitalis)-** participate in the form the floor of orbital cavity and wedge form process (**processus sphenoidalis**) is fussed with the body of sphenoid bone and forming **sphenopalatine openings (foramen sphenopalatinum)**.

Lower nasal conchae (**concha nasalis inferior**) - little thin bone, which forms the lateral wall of nasal cavity and consists of 3 processes – lachrymal (**processus lacrimalis**), maxillar (**processus maxilaris**) and cribriform **(processus ethmoidalis**), which are fussed with same name bones.

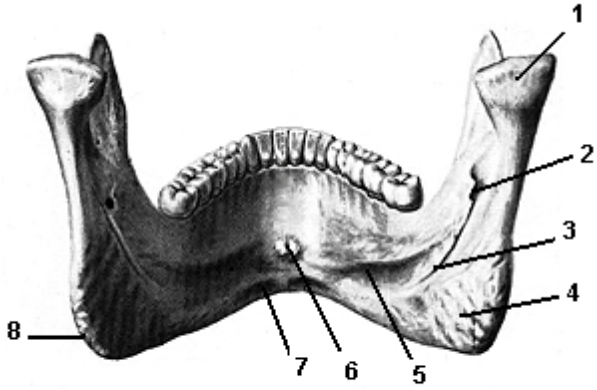


Fig. 34 Lower jaw;
inner view.
1 – processus condularis;
2 – foramen mandidulae;
3 – sulcus mylohyoideus;
4 – tuberositas pterygoidea;
5 – fovea submandibularis;
6 – spina mentalis;
7–fossa digastrica;
8 – angulus mandibulae.

Lower jaw bone (mandibula) is only one unfixed part of the skull, which attached to the skull with a hinge joint and can move up and down (fig. 34, 35).
It consists of body and two branches (**ramus mandibulae)**. Body (**corpus mandibulae**) is hour's shoe in form. It is divided into base **(basis mandibulae**) and alveolar arch (**arcus alveolaris**), where a tooth sockets **(alveoli dentalis**) are placed.
There are 16 sockets, into which teeth fits. In front surface we can see prominence under each tooth, which are called "**juga alveolaria**". In the middle outer face of the shaft protuberance is placed **(protuberantia mentalis**). On sides of it there is an opening - **foramen mentale,** where nerves and vessels pass. On the inner surface of the shaft there is a spine (**spina mentale**) with depression **(fossa digastrica**) on its sides. Mylohyoid line **(linea mylohyoidea**) is under the fossa and is directed obliquely up throughout the shaft. The branches of lower jaw (**ramus mandibulae**) form angle 100-110 ° with the shaft. On the outer surface of the angle there is tuberosity (**tuberositas masseterica**) where chewing muscle is attached.

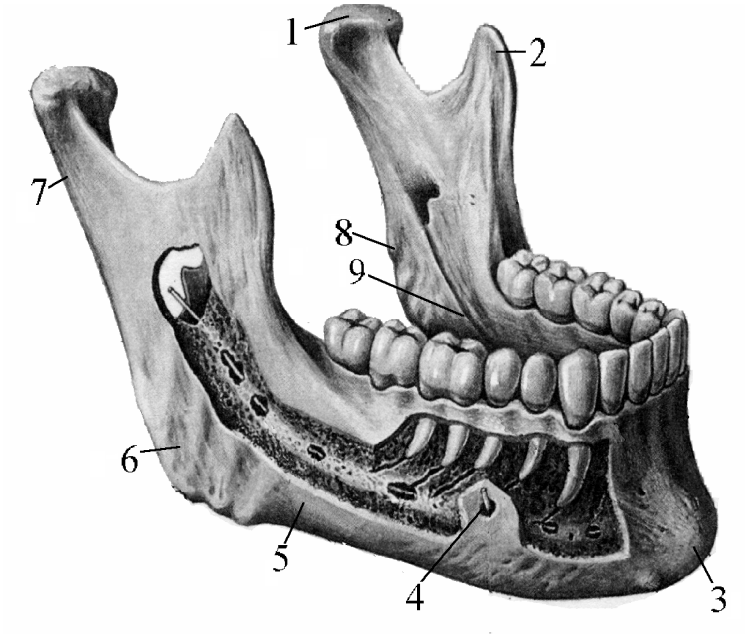


Fig. 35 Mandible bone; external view.
1—processus condylaris;
2—processus coronoideus;
3—protuberantia mentalis;
4- foramen mentale;
5- linea obliqua;
6- linea mylohyoidea;
7–tuberositas masseterica;
8-collum mandibulae;
9-tuberositas pterygoidea.

On the inner surface of the angle there is pterygoid tuberosity (**tuberositas pterygoidea**) where the same named muscle is attached. Lower jaw branches have two processes on the end: "**processus coronoideus**" and **"processus condularis**". Between them mandibullar notch (**incisura mandibulae)** is formed. The head (**caput mandibulae**) and the neck (**collum mandibulae**) are placed on the "processus condularis". In front of the neck we can see small depression - called **"fossa pterygoidea**". On the inner surface of branch there is a small process which called small tongue (**lingula mandibulae**), with the opening (**foramen mandibulae**) under it, which leads to the canal **- "canalis mandibularis**".

In newborns lower jaw is a paired bone. By the two years old it becomes fussed. After the incisors appear, alveolar part growth is noted. In early childhood period the widening of the bone is observed and the angle degree deceases. By the twenty years old the angle becomes about 90°, that's why the branch has vertical position.

Hyoid bone (os hyoideum) - unpaired hors- shoe form bone on the neck, between low jaw and the larynx. It is divided into body (**corpus hyoideum**) and pair greater (**cornua majora)** and lesser hornes (**cornua minora**). Greater hornes are laid up on the right and the left of the body, but lesser hornes directed on the upper and backward. Hyoid bone serves to attach the muscles.

Questions for self – study:

1. What is the structure of upper jaw bone?
2. What parts have upper jaw bone?
3. What surfaces have body of upper jaw bone?
4. What is the structure of upper jaw bon's processes?
5. What is the structure of lachrymal bone?
6. What is the structure of nasal bone?
7. What is the peculiarity of newborn's upper jaw bone?
8. What is the structure of palatine bone?
9. What is the peculiarity of palate in newborns?
10. What is the structure of lower jaw?
11. What is the peculiarity of lower jaw in newborns?
12. What is the structure of hyoid bone?

Lesson 13.

Orbital cavity, nasal cavity, temporal, infratemporal and pterygopalatine fosses.

The orbital cavity or bony orbit **(orbita)** is paired, look like four-side pyramid (fig. 36). Its base directed anteriorly, but apex - posteriorly and midline. Apex ends with the optic canal (**canalis opticus**) where the optic nerve enters the orbit. The orbit entrance is called **aditus orbitae**. The orbit has four walls: superior or roof, inferior or floor, the medial and lateral walls.

The roof **(paries superior**) is formed by the orbital plate of frontal bone and the lesser wing of the sphenoid bone. Near the front on the lateral angle of roof is situated the lachrymal's gland, which fills lachrymal fosse (**fossa glandulae lacrimalis).**

The medial wall (**paries medialis**) is formed by the frontal process of maxilla, the lachrymal, the ethmoid bones and the sphenoid bone's body. In front of medial angle of the orbit depression is located for lacrimal sack **(fossa saccus lacrimalis**), which is the upper dilated end of the **nasolacrimal duct.** There are the anterior and posterior ethmoidal openings (**foramen ethmoidalis anterior et posterior),** which communicated the orbit with the nasal cavity.

The floor (**paries inferior**) is formed by the orbital surface of the maxilla, the orbital surface of zygomatic bone and the orbital process of the palatine bone.

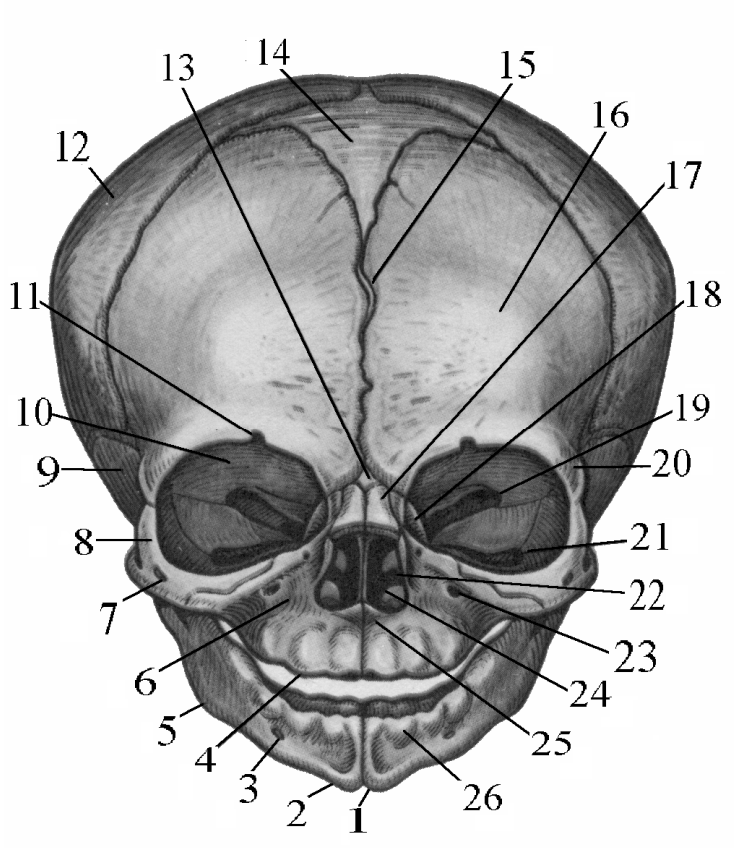


Fig. 36 Newborn's skull; anterior view.

1—symphysis mentalis; 2—tuberculum mentale; 3—foramen mentale; 4-maxilla; 5—angulus mandibulae; 6-fossa canina; 7-foramen zygomaticofaciale; 8-os zygomaticum; 9—pars squomosa ossis temporalis; 10—orbita; 11—incisura supraorbitalis; 12-os parietale; 13- nasal fonticulus ; 14—fonticulus anterior; 15-metopik suturae; 16-tuber frontale; 17-os nasale; 18-os lacrimale; 19-fissura orbitalis superior; 20-processus zygomaticus ; 21-fissura orbitalis inferior; 22-apertura piriformis nasi; 23-foramen infraorbitale; 24-septum nasi; 25-spina nasalis anterior; 26-alveoli dentales.

There are infraorbital groove (**sulcus infraorbitalis**) and infraorbital canal (**canalis infraorbitalis**) on the floor. Hear the infraorbital nerve and vessels transmit.

The lateral wall (**paries lateralis**) is formed by the orbital process of zygomatic bone and greater wing of the sphenoid bone. Also there is opening (**foramen zygomaticoorbitale**) where nerve passes.

Between superior wall and lateral superior orbital fissure (**fissura orbitalis superior**) is located. This fissure communicated the orbital cavity with the cranial cavity. Inferior orbital fissure (**fissura orbitalis inferior**) communicates with the infratemporal and pterygopalatine fosses and is bounded by the greater wing of the sphenoid bone above and the maxillary and palatine bones below.

In newborn's orbit is not developed. The orbit entrance is oval in form. Medial wall is almost absent that's why the orbital cavities are three-side pyramid. In the second childhood period the orbit is similar to adult's one.

Nasal cavity (**cavum nasi**) is located in the middle of the facial cranium. It is opened anteriorly on the face by pear-form opening (**apertura nasi piriformis**). Posteriorly it is communicated by the **choanae** with the nasopharinx. Nasal cavity is divided into right and left sides by the nasal septum (**septum nasi).** Each of sides has four walls.

The roof is formed by nasal bone, the nasal part of frontal bone, ethmoid bone's cribriform plate and inferior surface of the body sphenoid body.

The floor is formed by hard palatine and consists of the palatine process of maxilla and horizontal plate of the palatine bone.

The medial wall is formed by septum nasi, which consists of perpendicular plate of the ethmoid bone, vomer and the septal cartilage.

The lateral walls are compound and formed by the frontal process of maxilla, ethmoid labyrinths, perpendicular plate of palatine, the body of maxilla, medial plate of the pterygoid process of sphenoid bone and inferior nasal conches.

The nasal cavity is subdivided into superior, middle and inferior ways by superior middle and inferior conches. Superior and middle conches are cartilaginous, but inferior one is bony.

Superior way **(meatus nasi superior)** is between superior and middle conch and it's connected with the posterior ethmoidal air cells and sphenoid sinus which empties into sphenoethmoidal recess.

Middle way (**meatus nasi media**) is located between the superior and middle conch. Hear opening frontal sinus the middle and anterior ethmoidal air cells, maxillary sinus and sphenopalatine foramen drain to middle way.

Under inferior conch, between the inferior conch and hard palatine there is inferior way (**meatus nasi inferior**). The nasolacrimal duct (**canalis nasolacrimalis**) is opened hear.

In newborn nasal cavity is narrow and short (fig. 36). Entrance of the nasal cavity is irregular rhomb-shape. Choanes are the triangular in form and nasal septum is formed only by cartilages and usually is short and plane.

Newborns have four nasal conches: suprema, superior, middle and inferior, which divide the nasal cavity into four ways. The development of paranasal sinuses finish by the puberty period. In this time sex and individual traits occur.

On each side of the skull we can see three fosses: temporal, infratemporal and pterygopalatine.

The temporal fosse (**fossa temporalis**) is superficial to those areas of the frontal, parietal and squamous parts of the temporal bones and greater wing of sphenoid bone that are bounded superiorly and posteriorly by the temporal lines. It extends inferiorly by the zygomatic arch and annteriorly to the frontal process of the zygomatic bone. It is filled by temporal muscle.

Infratemporal fosse (fossa infratemporalis) is deep to the branch of mandible and the zygomatic arch. It is limited above by the infratemporal crest **(crista infratemporalis)** of the sphenoid, medially by the lateral pterygoid plate (**lamina lateralis processus pterygoidea)**, anteriorly by the maxilla and zygomatic arch and inferiorly by the alveolar borders of the maxilla.

Infratemporal fosse protrudes medially to the pterygopalatine fosse via the pterygomaxillary fissure. Also it is connected with the orbit through the inferior orbital fissure (**fissura orbitalis inferior).**

Pterygopalatine fossa (fossa pterygopalatina) is located between the maxilla and pterygoid process of sphenoid bone. It is bounded only by three sides: anterior, posterior and medial. Lateral wall is absent therefore

laterally it is opened and communicates laterally with the infratemporal fossa by the pterygomaxillary fissure.
Anterior wall is formed by posterior surface of the maxilla or "tuber maxillae". Posterior wall is form by pterygoid process and greater wing of the sphenoid bone, and medial wall is formed by perpendicular plate of the palatine bone.
Pterygopalatine fossa has five openings, which communicate with different cranial cavities:

1. With the orbit by the inferior orbital fissure.
2. With the nasal cavity by the sphenopalatine foramen.
3. With the oral cavity by the palatine canals and the greater and lesser palatine foramina.
4. With the middle cranial fossa by foramen rotundum.
5. With external skull's base by pterygoid canal.

The pterygoid canal is a canal that goes through the base of pterygoid process of the sphenoid bone that opens to the pterygopalatine fossa.
This fossa contains the terminal portion of the maxillary artery, the maxillary division of the trigeminal nerve, and the pterygopalatine parasymphatic ganglion.

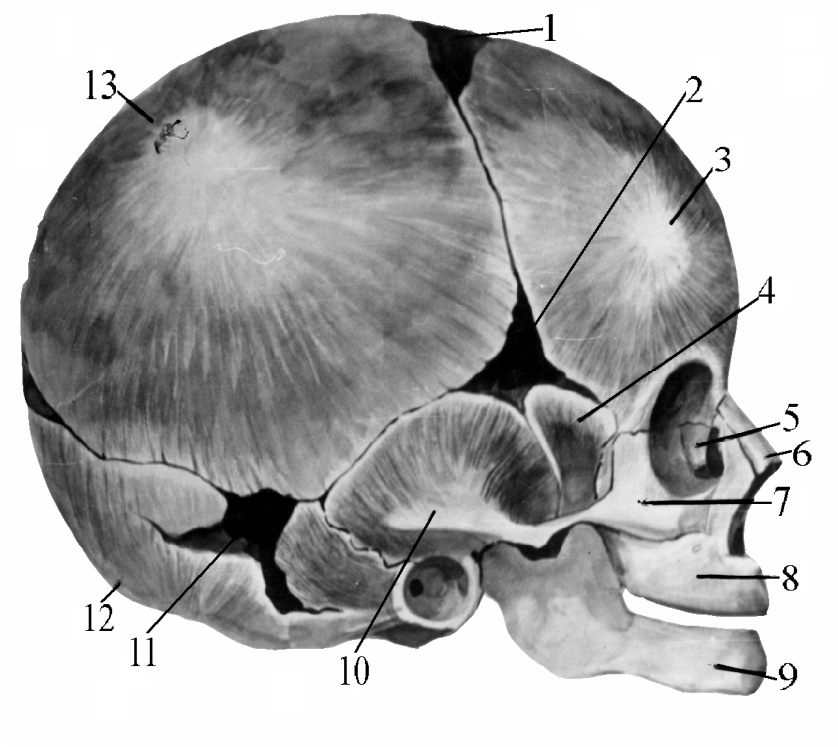


Fig. 37 Newborn's skull; lateral view. 1—os parietale; 2—os frontale; 3—os sphenoidale; 4—os lacrimale; 5-os nasale; 6-os zygomaticum; 7-maxilla; 8-mandibula; 9-os temporale; 10—os occipitale; 11—fonticulus anterior; 12—fonticulus sphenoidalis; 13—fonticulus mastoideus.

Lesson 14.

Newborn's skull and cranial cavity.

In newborn cranial part of the skull is correlated to facial part of the skull as 8:1 but in adult is 2:1. Also the bones are united by connective tissue or cartilage. The frontal and parietal tubers are more visible. If we look at the

newborn's skull superiorly we can see that the skull is in quadrangle in form. Frontal bones and mandible are paired.

The main characteristic of newborn's skull is the presence of fontanelles (**fonticuli) (**fig. 37**)**. There are the signs of membranous period in the development of the skull. They are six fontanelles: two unpaired (frontal and occipital), and two pair paired on the lateral side of the skull.

Frontal (in front of the skull) fontanella (**fonticulus anterior**) is in rhomb-shaped, placed between frontal and parietal bones, its length about two sm. and it is ossificates by two years of age.

Occipital (back) fontanella (**fonticulus posterior**) is triangular in form, lies between two parietal and occipital bones. It is ossificates by two or three months of age.

Anterolateral fontanella (**fonticulus sphenoidalis**) lies between the greater wings of the sphenoid bone and temporal and parietal bones, its ossificates by two or three months of age.

Posteriolateral fontanella (fonticulus mastoideus) lies between the squamous parts of temporal, parietal and occipital bones, ossificates by two or three months of age.

Cranial cavity.

The cranial cavity is formed by a roof (**calvaria)** and a floor **(base inner).**

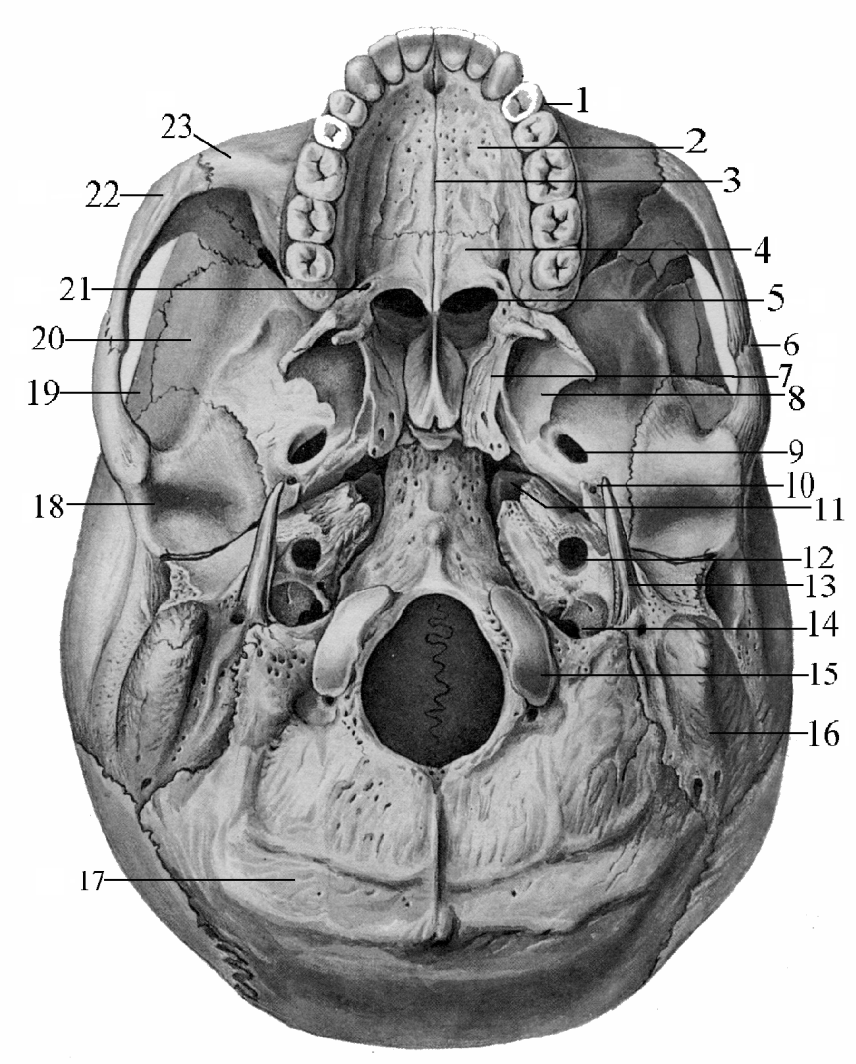


Fig. 38 Base of the skull;
(inner surface).

1-crista galli;
2-pars orbitalis ossis frontalis;
3-canalis opticus; 4-fossa hypophysialis; 5-foramen rotundum;
6-foramen ovale
7-foramen spinosum;
8-foramen lacerum; 9-porus acusticus internus;
10-foramen jugulare;
11-canalis n.hypoglossis; 12-pyramids; 13-crista occipitalis interna;
14-sulcus sinus transversus;

15-sulcus sinus sigmoideus.

The calvarium is formed by the single frontal and occipital bones, the paired parietal bones, portions of the greater wings of the sphenoid bone and the squamous parts of the temporal bones.Upperly the parietal bones are united by the sagittal suture and between parietal and frontal bones is formed coronal suture. Posteriorly the occipital and parietal bones are united at the lambdoidal suture.

The floor of the cranial cavity is divided into three fossae-anterior, middle, and posterior (fig. 38).

Anterior cranial fossa (**fossa cranii anterior**) is formed by the cribriform plate of ethmoid bone and the crista galli which in the centre lies. Laterally it is formed by the orbital plate of frontal bone and posteriorly- part of the body of the sphenoid bone and its lesser wings. Anterior cranial fossa communicates with frontal sinus anteriorly and inferiorly with nasal cavity, celluli ethmoidale, and the orbit.

Cribriform plate has many multiple openings where transmit the rootlets of the olfactory nerve into the superior nasal way. **Crista galli -** is the portion of the perpendicular plate of ethmoid bone which extending upward from the cribriform plate. In front of the crista galli is a small pit- **foramen cecum** where may transmit an emissary vein between the nasal cavity and superior sagittal sinus. The brims of lesser wings form the boundary between the anterior and middle cranial fosses. The anterior cranial fossa houses the frontal lobes of the brain and the olfactory bulbs and tracts.

Middle cranial fossa (fossa cranii media) has a central and two lateral parts. The central part is formed by the body of sphenoid bone and consists of the **sella turcica** and chiasmatic groove **(sulcus chiasmatis**). Hear the hypophysis and optic chiasm lies. This part of the fosse is related anteriorly to the sphenoid sinus and laterally to the cavernous sinus. In front of it we can see the optic canals which convey the optic nerves into the orbits. Between the lesser and greater wings of sphenoid bone, superior orbital fissure (f**issura orbitalis superior)** is forms. This fissure containing ophthalmic, oculomotor, trochlear and abducens nerves, and opens into the orbit. Turk's saddle is bounded anteriorly by the **tuberculum sellae** and posteriorly by the **dorsum sellae**. There are a number of openings in this fosse: **foramen rotundum** (containing the maxillar nerve) opens into the pterygopalatine fossa; **foramen ovale** (containing the mandibular nerve) and **foramen spinosum** where the middle meningeal artery pass. Both openings open into infratemporal fossa; **foramen lacerum** is an irregulary shaped opening at the apex of the pyramid. This opening is filled by fibrous tissue and is the floor of the carotid canal. Internal carotid artery and greater and deep petrosal nerves pass through it.

Posterior cranial fossa (fossa cranii posterior) is formed by the posterior part of the body of sphenoid bone, the posterior surface of pyramid of temporal bone and the occipital bone. The large single opening in this fossa is **foramen magnum**, transmits the spinal cord- brainstem junction and its coverings.

There are a number of openings: the **hypoglossal canal** transmits the hypoglossal nerve; the **jugular foramen** contains the glossopharyngeal, vagus, and accessory nerves and beginning of internal jugular vein;

condyloid foramen transmits condyloid emissary vein. On the posterior face of the petrous pyramid the **internal acoustic meatus** is located that transmits the facial and vestibulocochlear nerves and labyrinthine artery.

External base of skull (basis cranii externa) may subdivided into three parts (fig. 39).

The first part (**paries anterior**) includes the hard palate which is formed by palatine processes of the maxillae and the horizontal plate of the palatine bones. They are connected by two sutures-**sutura palatine media** and **sutura palatine transversa**. An incisive canal penetrates it and ends of **foramen incisive**. Posteriorly from the hard palate the greater and lesser palatine foramina lie (**foramina palatina major et minor**).

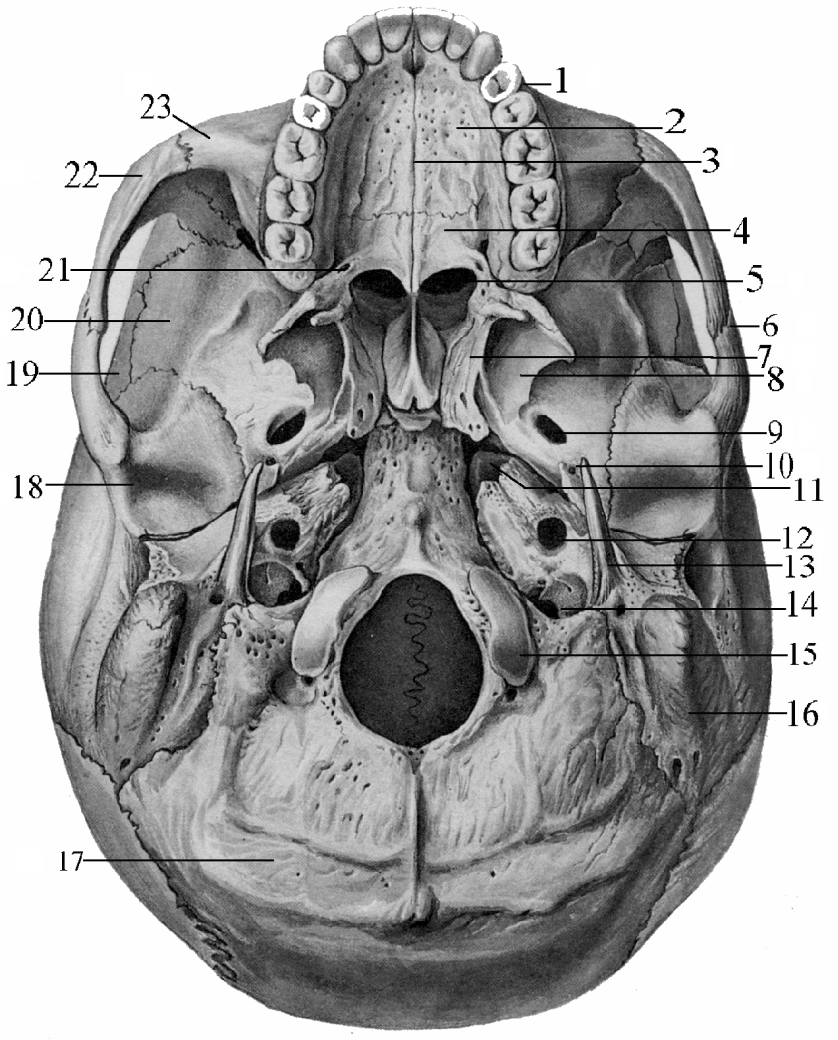


Fig. 39 Base of the skull; external surface.

1–maxilla; 2–processus palatinus; 3–sutura palatina media; 4–lamina horizontalis ossis palatini; 5–choanae; 6–arcus zygomaticus; 7 – lamina medialis processus pterygoidei; 8 – lamina lateralis processus pterygoidei; 9 – foramen ovale; 10 – foramen spinosum; 11 – foramen lacerum; 12 – foramen caroticum externum; 13 – processus styloideus; 14 – foramen jugulare; 15 – condylus occipitalis; 16 – processus mastoideus; 17 – os occipitale; 18 – os temporale; 19 – os parietale; 20 – os sphenoidale; 21–os palatinum; 22 – os zygomaticum; 23 – maxilla.

The second part (**paries media**) is located between the border of hard palate anteriorly and anterior margin of foramen magnum posteriorly. In the midline we can see **synchondrosis sphenooccipitalis** where the basilar part of occipital bone joins with the body of sphenoid bone.
There is **pharyngeal tubercle** where is pharynx attaches by pterygobasilar fascia. There are numerous openings on external base: **foramen ovale**, **foramen spinosum**, **foramen lacerum**, **foramen caroticum externum,**

canalis musculotubarius, foramen and fossa jugularis, foramen stylomastoideum between **processus mastoideus** and **processus styloideus**. Both lateral sides have **meatus acusticus externus.**

The third part of external base of skull (**paries posterior**) is forms only by occipital bone and directed from the anterior border of faramen magnum to upper occipital line. There are **occipital condoyle, fossa and canalis condylaris, hypoglossal canal, processus and incisura mastoideus,** occipital artery groove (**sulcus arteria occipitalis**) and **protuberentia occipitalis externa with the occipital lines** located.

Questions for self – study:

1. What is the structure of orbital cavity?
2. How many openings does orbit have?
3. What is the structure of nasal cavity?
4. What is the structure of nasal dividing wall?
5. What is the structure of nasal cavity in newborns?
6. Tell about the temporal fossa?
7. Tell about the infratemporal fossa?
8. Tell about the pterygopalatine fossa?
9. How many openings does pterygopalatine fossa have?
10. What is the structure of newborn's skull?
11. What kind of fontanelles does newborn have?
12. What is the structure of inner base of skull?
13. What is the structure of external base of skull?

Lesson 15.

Skull bones connections. Temporomandibular joint. Articulations of the body's bones.

An articulation, or joint, is a place where two bones come together. In terms of the amount of movement they allow, there are three types of joints: immovable, slightly movable and freely movable.

Synarthroses; The singular form of immovable joints **is synarthrosis**. In these joints, the bones come in very close contact and are separated only by a thin layer of fibrous connective tissue. The sutures in the skull are examples of immovable joints.

Amphiartroses; Slightly movable joints are called **amphiarthroses.** In this type of joint, the bones are connected by hyaline cartilage or fibrocartilage. The ribs connected to the sternum by costal cartilages are slightly movable joints; they are connected by hyaline cartilage.

The symphysis pubis is a slightly movable joint in which there is a fibrocartilage pad between the two bones. The joints between the vertebrae and the intervertebral disks are also of this type.

Diarthroses; Most joints in the adult body are **diarthroses,** or freely movable joints. In the singular form of this joint, the ends of the opposing bones are covered with hyaline cartilage, the articular cartilage, and they are separated by a space called the joint cavity. The components of the joints are enclosed in a dense fibrous joint capsule. The outer layer of the capsule consists of the ligaments that hold the bones together. The inner layer is the synovial membrane that secretes synovial fluid into the joint cavity for lubrication.

Because all of these joints have a synovial membrane, they are sometimes called synovial joints.

Also the **synovial joints** are classified according to axes of movement into plane, hinge, pivot, ellipsoidal, saddle, and ball and socket joints.

1**. Plane joints** have flat articular surfaces and limited in movement by the articular capsule, occur in the proximal tibiofibular, intercarpal, sternoclavicular and acromioclavicular joints.

2. **Hinge (ginglymus) joints** – resemble door hinges and allow movement around one axis at right angles to the bones. Movements here are only flexion and extension. Occur in the elbow, knee, ankle and interphalangeal joints.

3. **Pivot (trochoid) joints** –are formed by a central bony pivot turning within a bony ring.They allows movement around one longitudinal axis, allows only rotation. Occur in the atlantoaxial joint.

4**. Ellipsoidal (condyloid) joints** have reciprocal elliptical convex and concave articular surfaces; allow movement into directions at right angles to each other flexion and extension, abduction and adduction movements but no axial rotation. Occur in the wrist, atlanto-occipital and metacarpo-phalangeal joints.

5**. Saddle (sellar) joints** – resemble a saddle on a horse's back and allow movement in several directions and allow flexion and extension, abduction and adduction, and circumduction, but not axial rotation. Occur in the carpo-metacarpal joint of the thumb.

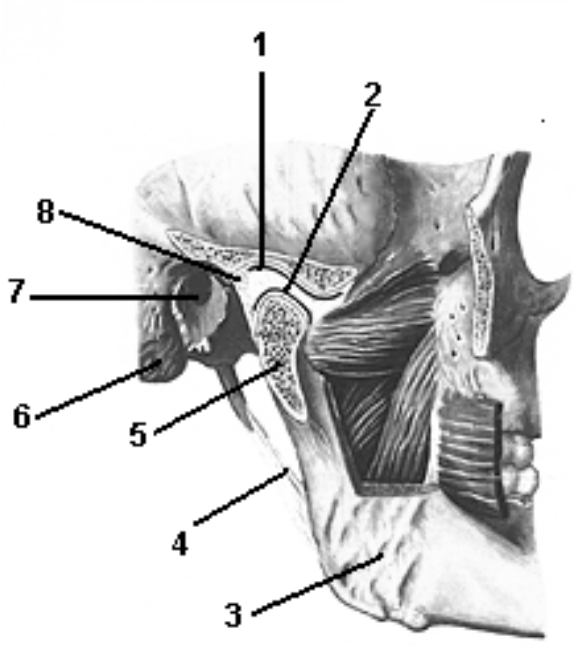
6**. Ball and socket (spheroidal) joints** are formed by the reception of a globular head into a cup-shaped cavity and allow movement in many directions. Occur in the shoulder and hip joints. Allow flexion, extension, abduction and adduction, medial and lateral rotation and circumduction.

Also the joints are classified according of movement directions into three types:

1) **uniaxial joints** – allow movement around one longitudinal axis;

2) **biaxial joints** – allow movement in two axis, which make at right angles to each other;

3) **multiaxial joints** – produce the movement in many directions.



Temporomandibular joint.

Fig.40 Temporo-mandibular joint; viewed from the right side.

1 - fossa mandibularis;
2 -discus articularis;
3–tuberositas masseterica;
4–lig. stylomandibulare;
5–caput mandibulae;
6– processus mastoideus;
7–porus acusticus externus;
8–capsula articularis.

Temporomandibular joint is a single synovial joint of the skull (fig. 40). The temporomandibular joint is formed between the articular tubercle and mandibles fosse of the temporal bone above and the condoyle or head of the mandible bellow. The articular surfaces are covered by fibrocartilage and are, separated by intraarticular disk. This disk separates the joint space into two synovial cavities (superior and interior).

The joint has an articular capsule that extends from articular tubercle and the margins of the mandibles fosse and attached to the neck of the mandible. This joint capsule is loose between the temporal bone and articular disk but tighter and stronger between the disk and mandibles condyle. The joint is reinforced by three ligaments:

1. T**he lateral temporomandibular ligament (ligamentum laterale)**, which extends from the tubercle of the zygomatic process to the neck of mandible. It directly reinforces the lateral aspect of the joint capsule;

2. **Sphenomandibular ligament (ligamentum sphenomandibulare**) extends from the spine of sphenoid bone to the lingula of the mandible.

3. **Stylomandibular ligament (ligamentum stylomandibulare)** extends between the styloid process of temporal bone and posterior border of the mandible branches, near the angle of the mandibles. These ligaments suspending the mandible as a sling and permitting the mandible's condoyles to move anteriorly and posteriorly.

Temporomandibular joint is a combined hinge and a gliding joint and has different types of movement:

1) Drop and raising mandible;
2) move the mandible anteriorly and posteriorly;
3) move the mandible right and left;
4) Circular movement of the lower jaw.

Other bones of skull are connected by fibrous connective tissue and formed sutures. Also sutures are subdivided into coronal, sagittal, squamous, lambdoid and plana.

Coronal suture lies between the frontal bone and two parietal bones.

Sagittal suture lies between the two parietal bones.

Squamous suture lies between the parietal bone and the squamous part of temporal bone.

Lambdoid suture lies between the two parietal bones and occipital bone.

Suture plana lies between the facial bones.

The vertebrae connections.

There are different joints of the vertebral column. Vertebrae are connected by bodies, arches and processes.

Connections of the bodies of vertebrae.

The bodies of vertebrae are bound together by the **intervertebral disks**, forming the cartilaginous joints (fig. 41). There are 23 disks which lie between the bodies of two vertebrae from axis to the sacrum. Each of them consists of a **central mucoid substance (nucleus pulposus**) which surrounds **fibrocartilagenous lamina- annulus fibrosus**. **Nucleus pulposus** consists of reticular and collagenous fibers embedded in the mucoid. It may protrude or extrude through the annulus fibrosus. Compressing the roots of the spinal nerve and functions as a shock – absorbing mechanism by equalising pressure. **Annulus fibrosus** consists

of concentric layers of fibrous tissue and fibrocartilage. It binds the vertebrae in column together, retains the nucleus and permits a small amount of movement as “nucleus pulpous” functions as a shock – absorbing mechanism.

The joints between the bodies of vertebra are reinforced by two ligaments.**Anterior longitudinal ligament (ligamentum longitudinale anterior**) runs from the skull to the sacrum on the anterior surface of the vertebral bodies and intervertebral disks. It is narrows at the upper end but widens as it descends.

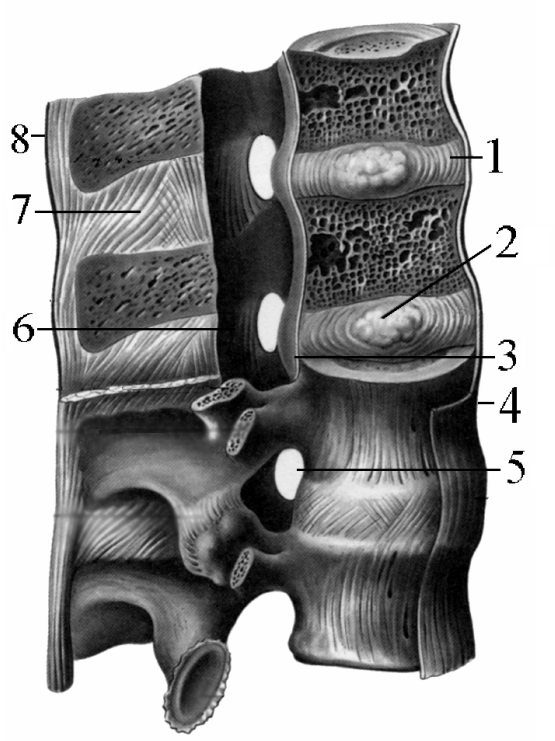


Fig. 41 Vertebrae connections.

1-discus intervertebralis;
2—nucleus pulposus;
3-lig. longitudinale posterius;
4-lig. longitudinale anterius;
5-foramen intervertebrale; 6-lig.flavum;
7-lig.interspinale; 8-lig. supraspinale.

This ligament limits extension of the vertebral column, and supports the “annulus fibrosus” anteriorly. It resists gravitational pull, preventing hyperextension of the vertebral column.

Posterior longitudinal ligament (ligamentum longitudinale posterior) interconnects the vertebral bodies posteriorly and narrows as it descends. It supports the vertebral column and also the annulus fibrosus posteriorly.

This ligament limits flexion of the vertebral column and resists gravitation pull,
preventing hyperflexion of the vertebral column.

Junction of the vertebrae arches. The arches of vertebrae join by **“ligamentum flavum**”, which connects the lamina (arch) of two adjacent vertebrae and functions to maintain the upright posture.

Junction of vertebrae processes. The pared “articular processes” of vertebra articulate with other articular processes of the arch above or below, forming synovial joints. These joints are plane and limited in movement joints, which are reinforced by **ligamentum interspinata,** between the spinous processes of vertebra, **ligamentum supraspinata**,

which passes above the spinous processes of vertebra from C_7 to L_5. Between the transverse processes lies **ligamentum intertransversale.**

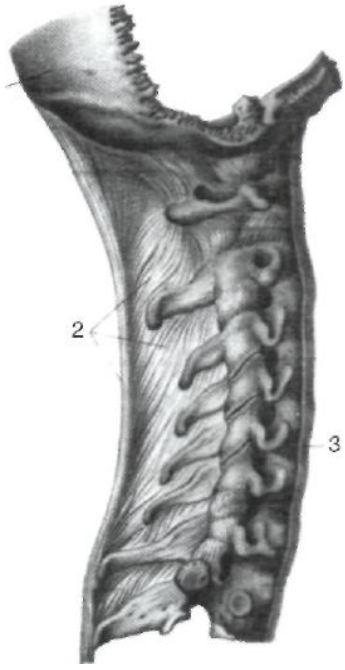


Fig. 42 The joints of the occiput and cervical spinae.

1-os occipitale;
2- lig. nuchae;
3-lig.longitudinale anterior.

Ligamentum nuchae (fig. 42**)** is formed of thickened supraspinous ligaments that extend from vertebra C_7 to the external occipital protuberance and crest. It is a triangular shaped median fibrous septum between the muscles on the sides of the posterior aspect of the neck which attach to the posterior tubercle of the atlas, external occipital crest and to the spinous processes of the other cervical vertebrae.

Atlanto-occipital joint is an ellipsoidal synovial joint. It is formed between the superior articular facets of the atlas and occipital condyles. This articulation is combined joint and it is involved primarily in flexion, extension and lateral bending of the head. This joint also reinforced by two membranes:

1. M**embrane atlanto-occipitale anterior** which extends from anterior border of the biggest opening of occipital bone (foramen magnum) to upper border of anterior arch of atlant.

2. Membrane atlanto-occipitale posterior extends between posterior border of foramen magnum and posterior arch of atlant.

Atlanto axial joints (fig. 43) are subdivided into three joints: two plane joints, which are formed between the superior and inferior articular facets of the atlas and axis and one pivot joint which is the median joint between the dens of the axis and the anterior arch of the atlas. Both of joints are involved in rotation of the head and reinforced by cruciform ligament, apical and allaria ligaments.

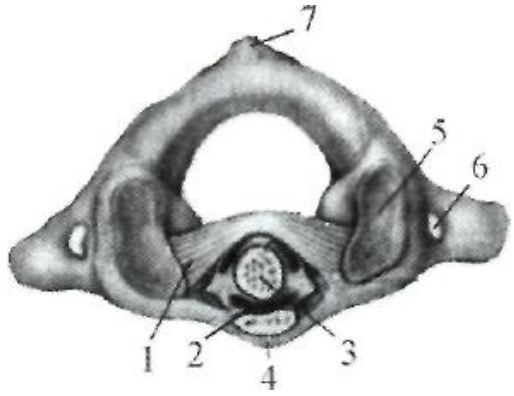
Cruciform ligament consist of two ligaments:

a) **transverse ligament (ligamentum transversus)**, which runs between the lateral masses of the atlas arching over the dens of the axis;

b) **longitudinal ligament** consists of two parts- **(ligamentum longitudinale anterior and posterior**) which extends from the dens of the axis to the anterior aspect of the foramen magnum and to the body of the axis.

Fig.43 Connection of atlas and dens;

lateral view.
1- lig.transversum; 2 - cavum articulare;
3-dentes axis; 4- tuberculum anterius;
5- fovea articularis superior;
6- foramen transversarium;
7-tuberculum posterius.



Apical ligament (ligamentum apices dentis) extends from the apex of the dens to the anterior aspect of the foramen magnum.

Alar ligaments (ligamentum allaria) extend from the both sides of the dens to the medial side of the occipital condoyle.

Sacrococcygeal joint (**Articulatio sacrococcygea**) is a cartilaginous joint between the sacrum and coccyx bones reinforced by the anterior, posterior and lateral sacrococcygeal ligaments.

Articulations of the body include the sternocostal, costovertebral and costotransversal joints.

The ribs are connected to the vertebrae by costovertebral, costotransversal joints and to the sternum via the costal cartilages.

Sternocostal joints are synchondroses in which the sternum articulates with the upper seven costal cartilages. These joints are reinforced by radiate ligaments **(lig. Sternocostalia radiate)**, and provide considerable flexibility so the ribs are free to move.

Costovertebral joint between vertebral body and head of rib and **costotransversal joint** between tubercle of rib and transverse process of vertebra are synovial joints. Small amounts of gliding motion occur at both of these joints and this motion is magnified anteriorly and laterally and thus permits considerable anterior and lateral enlargement of the thorax.

All the costovertebral joints besides I, XI and XII are reinforced by **ligamentum capitis costa intraarticulares**, which extends from crista

capitis costae to intervertebral disks insides the capsul, and radiate ligament **(ligamentum costa radiatum**) outside the articular capsule.

But the **costotransversal joints** are reinforced by single **costo-transversal ligament** outside.

Questions for self – study:

1. What do you know about joints structure?
2. What types of joints do you know?
3. What are the joints characteristics?
4. How are the joints classified?
5. How do the skull bones connect with each other?
6. What is the structure of Temporomandibular joint?
7. How do vertebrae join?
8. What is the structure of intervertebral disk?
9. What ligaments reinforce vertebrae connections?
10. What is the structure of Atlanto-axial joint?
11. What joints are formed between the first and second cervical vertebrae?
12. What is the structure of Atlanto-occipital joint?
13. What ligaments are reinforced by Atlanto-axial and Atlanto-occipital joints?
14. How do ribs connect to the breast bone?
15. How do ribs connect to vertebrae?

Lesson 16.

Units of the shoulder girdle bones and the shoulder joint.

The units of shoulder girdle bones consists of sternoclavicular and acromioclavicular joints.

Sternoclavicular joint (**articulationis sternoclavicularis**) is formed between the medial end of the clavicle and the clavicle's notch of the manubrium of sternal bones (fig. 44).

It is a saddle type synovial joint, but has the movements of a ball –and socket joint. The articular surface of the clavicle is much larger than that of the sternum, and is invested with a layer of cartilage, which is considerably thicker than that on the latter bone. The joint is separated by intraarticular disk in two synovial cavities.

This joint is reinforced by the articular capsule and ligaments. They are: the anterior and posterior sternoclavicular ligaments, costoclavicular and interclaviacular ligaments.

The anterior sternoclavicular ligament (ligamentum sternoclaviculare anterior) covering the anterior surface of the articulation; it is attached above to the upper and front part of the sternal end of the clavicle, and passes obliquely downward and medialward is attached below to the front of the upper part of the manubrium sterni.

The posterior sternoclavicular ligament (ligamentum sternoclaviculare posterior)- covers the posterior surface of the articulation; it is attached above to the upper and back part of the sternal end of the clavicle, and passes obliquely downward and medialward, is fixed below to the back of the upper part of manubrium sterni.

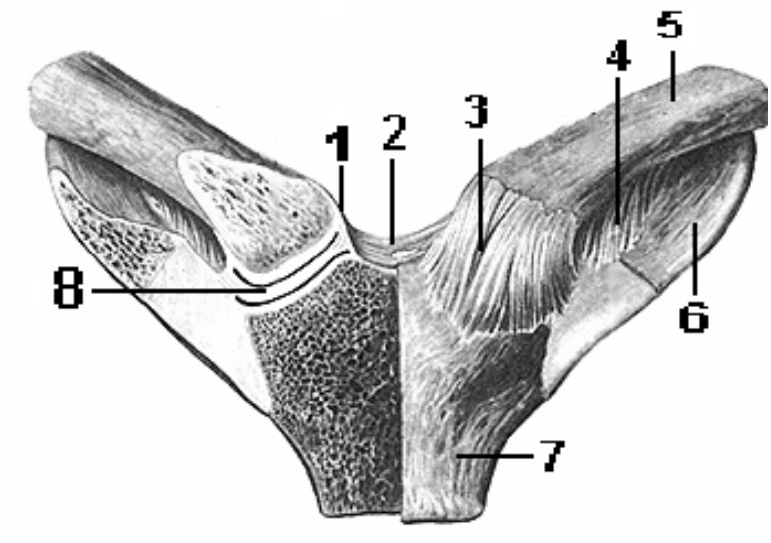


Fig.44. Sternoclavicular joint; view from the front.
1 - capsula articularis;
2 - lig. interclaviculare;
3- lig. sternoclaviculare anterius;
4 - lig costaclaviculare;
5 - claviculae;
6 - costae I;
7 - manibrum sterni;
8 - discus articularis;

The interclavicular ligament (ligamentum interclaviculare) – is a flattened band , which varies considerably in form and size in different individuals, it passes in a curved direction from the upper part of the sternal end of one clavicle to that of the other, and is also attached to the upper margin of the sternum (incisura jugularis).

The costoclavicular ligament (ligamentum costoclaviculare) – is short, flat, strong, and romboid in form. Attached below to the upper and medial part of the cartilage of the first rib, it passes obliquely backward and lateralward, and is fixed above to the costal tuberosity on the lower surface of the clavicle.

This articulation admits of a limited amount of motion in nearly every direction- upward, downward, backward, forward, as well as circumduction.

This joint therefore forms the center from which all movements of the supporting arch of the shoulder originate, and is the only point of connected the shoulder girdle with the trunk.

In newborns sternoclavicular joint is a ball-shaped. Intraarticular disk is two times as much than articular surfaces of bones. The joints capsule is thin, ligaments are not developed.

Acromioclavicular joint (articulatio acromioclavicularis)-is a plane joint between the acromial end of the clavicle and the medial margin of the acromion of scapula (fig. 45). Articular surfaces are covered by fibrous cartilages and concluded in capsule, which is reinforced by the superior and inferior acromioclavicular ligaments.

Ligamentum acromioclaviculare superior - covers the superior part of the articulation, and extends between the upper portions of the acromial end of the clavicle to the adjoining part of the upper surface of the acromion.

Ligamentum acromioclaviculare inferior is somewhat thinner than the preceding and covers the under part of the articulation. It is attached to the adjoining surfaces of the two bones.

Stability of this joint is provided by the coracoclavicular ligament **(ligamentum coracoclaviculare)** which consists of two parts, they are called the conoid and trapezoid ligaments **(ligamentum conoideum and ligamentum trapezoideum**).

They extend between the inferior aspect of the clavicle and the coracoid process of scapula. These two ligaments also maintain a rather constant relationship between the scapula and clavicle. This joint has important functions in the movements of the upper extremity.

Also the scapula has three ligaments which extend and attach on the scapula. They are **coracoacromial ligament, transverse scapula superior and inferior ligaments**. These are called the proper ligaments of the scapula.

Coracoacromial ligament (**ligamentum coracoacromiale**) extends from the coracoid process of the scapula to the acromion. This ligament, together with the coracoid process and acromion, forms a vault for the protection of the head of the humerus.

The transverse scapula superior ligament (ligamentum transversum scapulae superior) is a bridge above scapular notch. It is a thin and a flat ligament, which converts the scapular notch into foramen. The suprascapular nerve runs through this foramen; the transverse scapular vessels cross over the ligament. The ligament is sometimes ossified.

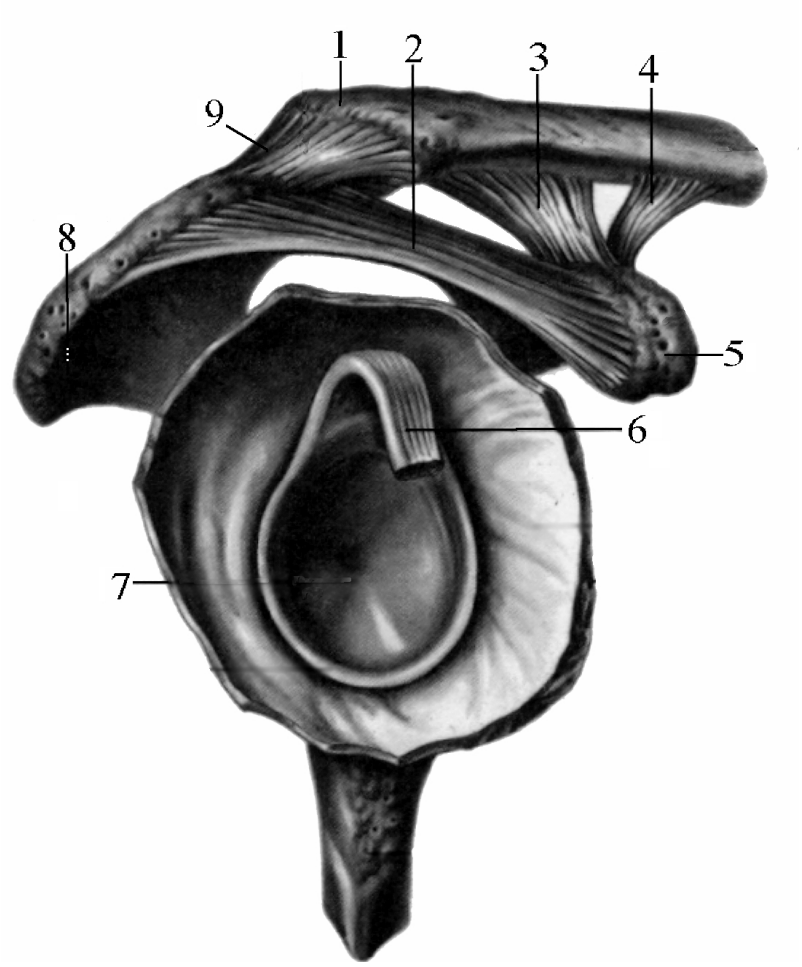


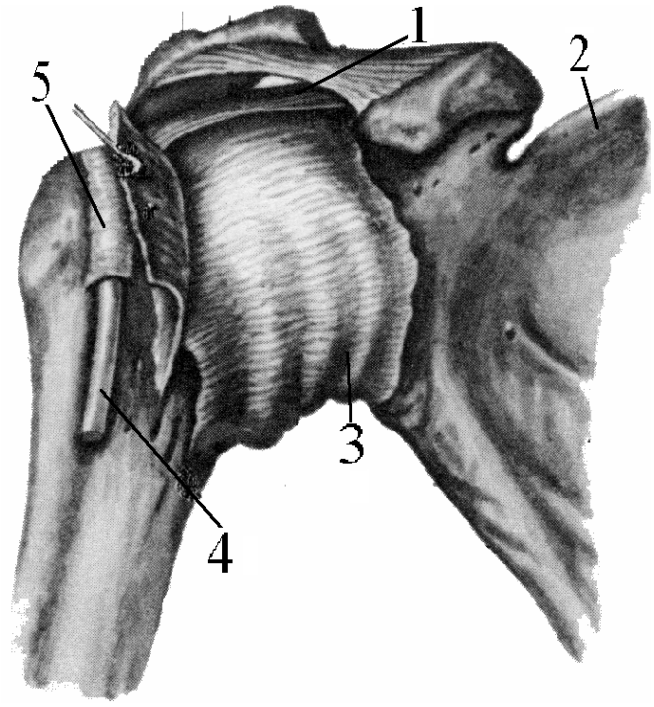
Fig.45 Acromioclavicular joint.

1 - clavicula;
2 - lig. coracoacromialis;
3 - lig. trapezoideum;
4 - lig. conoideum;
5 - processus coracoideus;
6 - cavitas glenoidalis;
7 - tendo m. bicepitis brachii;
8 - acromion;
9 - lig. acromioclaviculare.

The transverse scapula inferior ligament (**ligamentum transversum scapula inferior**) surrounds scapular neck and is stretching from the lateral border of the spine to the margin of the glenoid cavity. It forms an arch under which the transverse scapular vessels and suprascapular nerve enter into infraspinatous fossa.

Shoulder joint- (articulatio humeri), (glenohumeral joint) is a synovial, multiaxial, ball –and socket (spheroidal) joint between the glenoidal cavity of the scapula and the head of the humerus (fig. 46). The glenoid cavity is deepened around by the glenoid labrum (**labrum glenoidale)**, a fibrocartilaginous wedge that attaches to the periphery of the glenoid cavity. The joint capsule extends from the rim of the glenoid cavity and the glenoidal labrum to the anatomical neck of the humerus. The capsule is reinforced only by one coracohumeral ligament **(ligamentum coracohumerale**), which arises from the lateral border of the coracoid process and passes obliquely and lateralward to the greater tubercle of the humerus. The tendon of the long head of the biceps brachii muscle ascends through the intertubercular groove and then passes across the superior aspects of the humeral head and attached to the supraglenoid tubercle.Movements of the shoulder joint are free and about three axes.

Fig. 46 Shoulder (glenohumeral) joint.



1- lig. coracohumerale;
2-scapula; 3-capsula articularis;
4-tendo m. bicepitis brachii;
5-vagina synovialis intertubercularis

The movements which are called flexion and extension occur of sagital plane; abduction and adduction occur about coronal plane and medial and lateral rotation (axial rotation) about of horizontal plane. Since the joint has only one ligament this causes common sprains (dislocations) of the joint.

In newborn the joint surfaces are cartilageous, glenoid labrum is thin, and the capsule is strong: the only corocohumeral ligament is well developed, short, firm and is attached to the articular capsule, so the movement of the joint is limited. In the first childhood period the joint surfaces becomes like in adults.

Elbow joint (**articulatio cubiti)** is a composite joint. It is formed between the throchlea of the humerus and the semilunar trochlear notch of the ulna medially, and the capitulum of the humerus and the fovea of the head of the radius laterally (fig.47). A joint capsule encloses two portions of the elbow joint and also is included the proximal radio-ulnar joint. Therefore this composite joint consists of three simple joints – humeroulnar **(articulatio humeroulnaris**), humeroradial **(articulatio humeroradialis)** and radio-ulnar proximal **(articulatio radioulnaris proximales)**. The proximal radio-ulnar joint is formed by the radial head and the radial notch of the ulna and stabilized by the annular ligament. Elbow joint is reinforced by the following ligaments:

Annular ligament (**ligamentum annulare radii**) – is a strong fibrous band around the head of the radius, which is attached to the anterior and posterior margins of the radial notch of the ulna. A thickened band which extends from the inferior border of annular ligament below the

radial notch to the neck of the radius is known as the **quadrate ligament**. The superficial surface of the annular ligaments is strengthened by the radial collateral ligament of the elbow and blends with the articular capsule of the elbow joint.

The radial collateral ligament (liglamentum collaterale radiale) is a short and narrow fibrous band attached above, to the lateral epicondyle of the humerus; below, to the annular ligament, some of its most posterior fibers passing over that ligament to be inserted into the lateral margin of the ulna.

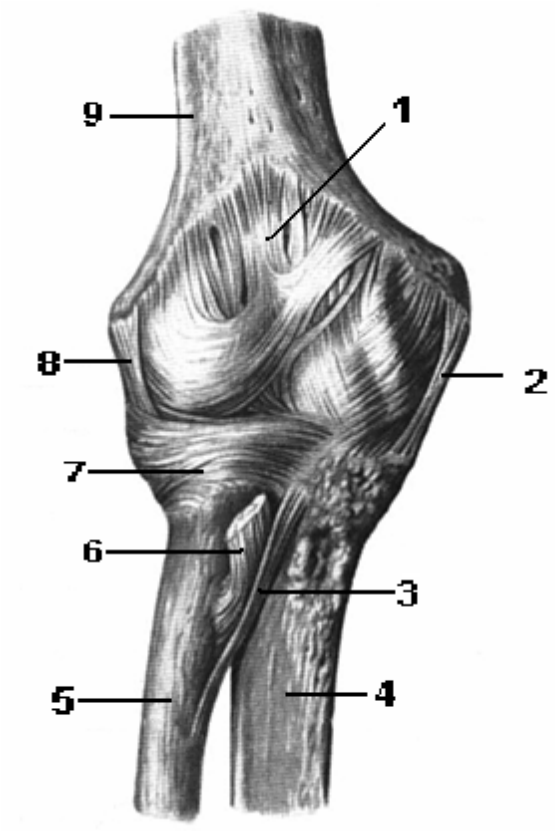


Fig. 47 Elbow joint;
viewed from the front.

1 – capsula articcularis;
2 – lig. collaterale ulnare;
3 – chorda oblique;
4 – ulna;
5 –radius;
6 – tendo m. bicepites brachii;
7 – lig. annullare radii;
8 – lig. collaterale radiale;
9 – humerus.

The motion permitted at this joint –flexion and extension which occurs between the humerus and ulna with those of pronation (palm dawn) and supination (palm up) of the hand, that occur between the radius and ulna.

When the hand is supinated, the two bones are parallel. All motions are produced primarily by the muscles.

Questions for self – study:

1. What is the structure of sternoclavicular joint?
2. What ligaments reinforce sternoclavicular joint?
3. What is the structure of acromioclavicular joint?
4. What is the structure of shoulder joint?
5. What are the peculiarities of shoulder joint of the children?
6. How the elbow joint is formed?

7. What is the structure of elbow joint?
8. What are the peculiarities of elbow joint in children?

Lesson 17.

Units of the forearm bones. Wrist joint and other joints of the hand.

The forearm bones ulna and radius are united with synovial joints both proximally and distally, and the shaft of radius and ulna are joined by a fibrous tissue – the interosseous membrane.

The proximal radio-ulnar joint (articulatio radioulnaris proximalis) is a pivot- joint between the circumference of the head of the radius and the ring formed by the radial notch on the proximal end of the ulna (fig. 48). The joint cavity and capsule are continued with that of the elbow joint.

Movements-The head of the radius rotates within and is retained by an annular ligament attached to the anterior and posterior margins of the radial notch.

The distal radio- ulnar joint (articulatio radioulnaris distalis) is a pivot-joint which is formed between the head of the ulna and the ulnar notch on the lower end of the radius and the fibrocartilaginous articular disc which unites the two bones. The apex of the triangular disc is attached to the styloid process of the ulna and its base to the ulnar notch on the radius. The distal end of the ulna therefore articulates with the fibrocartilaginous disc which separates the synovial cavity of the distal radio-ulnar joint from that of the wrist.

Distal radio-ulnar disc is triangular fibrocartilage which strongly reinforces the joint and permits the radius to rotate around the ulnar head. As the joint's capsule attaches to the intraarticular disc the synovial cavity is separated from that of the radio-carpal joint.

Movement in the distal radioulnar articulation is rotation of the lower end of the radius around an axis, which passes through the center of the head of the ulna.

Both the proximal and distal radio-ulnar joints form combination pivot (**throchoid**) joints. Movement of the forearm so that the palm is facing downward is called **pronation** and the reverse movement, the face of the palm upward, is called **supination.**

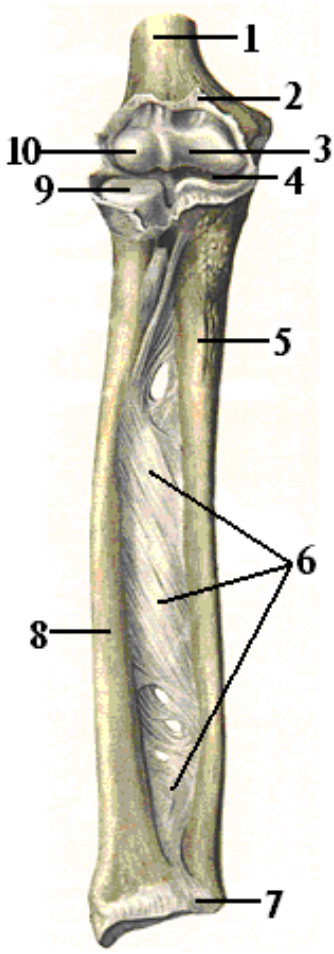


Fig. 48 Joints of the forearm bones (anterior view).

1–humerus;
2–capcula articularis;
3–trochlea humeri;
4–cavum articulare;
5–ulna;
6-membrana interossea antebrachii;
7- articulatio radioulnaris distalis;
8–radius;
9–fovea articularis;
10–capitulum humeri.

Wrist (**radio-carpal**) **joint** is a synovial ellipsoid (condyloid) joint (fig. 49). It is formed between the distal end of the radius and the articular disc superiorly and the proximal row of carpal bones (scaphoid, lunate, triquetral) inferiorly. The joint capsule is attached proximally around the articular margins of the distal ends of the radius and ulna; and distally to the proximal row of carpal bones. It is strengthened by radial and ulnar collateral ligaments and dorsal and palmar radiocarpal ligaments.

Also **interosseus ligaments** interconnect the adjacent bones with each of the carpal rows.

Radial collateral ligament (**ligamentum collaterale carpi radiale**) extends from the tip of the styloid process of the radius to the radial side of the scaphoid bone.

Ulnar collateral ligament (ligamentum collaterale carpi_ulnare) is attached above to the end of the styloid process of the ulna and divides below into two parts, one of which is attached to the medial side of the triquetral bone, the other to the pisiform bone.

Palmar radiocarpal ligament (ligamentum radiocarpeum palmare) starts from the front margin of joints surface on radius and is attached to the first row of carpal bones.

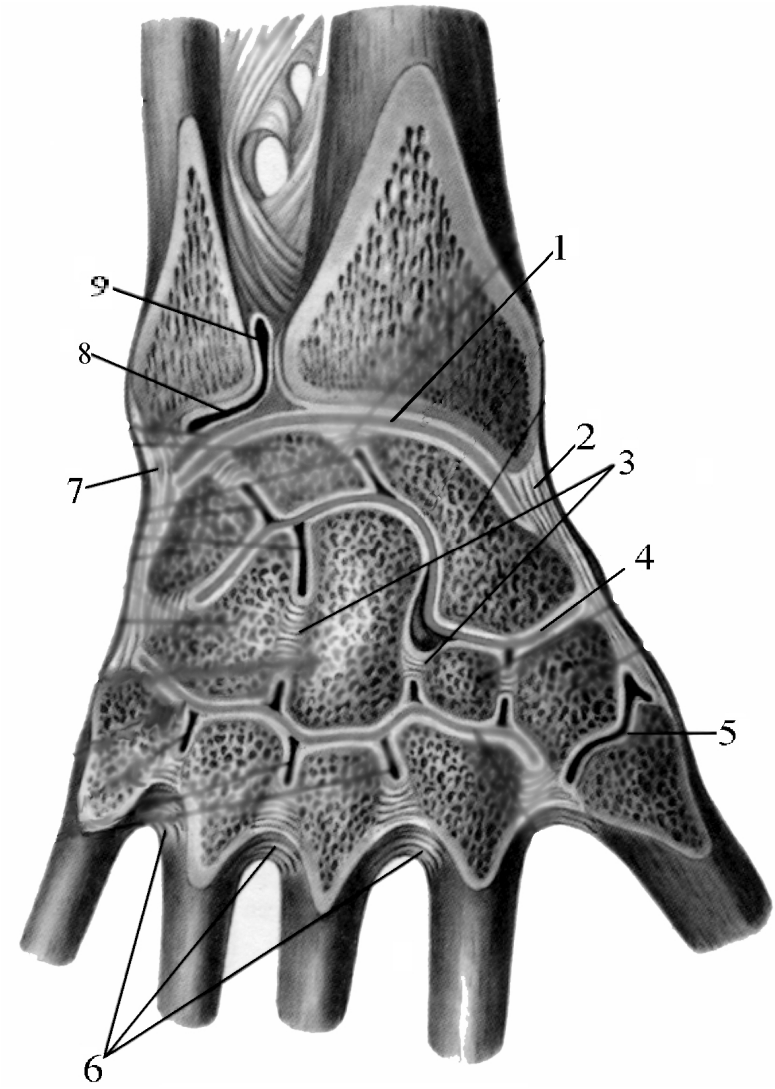


Fig. 49 Joints and ligaments of the hand.

1 - articulatio radiocarpea;
2 - lig.collaterale carpi radiale;
3 - articulatio mediocarpea;
4 - articulatio carpometacarpea;
5 - ligg. metacarpea interossea;
6 - lig. intercarpea;
7 - lig.collaterale carpi ulnare;
8 - discus articularis.
bones and capitate bone.

Dorsal radiocarpal ligament (ligamentum radiocarpeum dorsale) lies on the dorsal surface and is attached only to the first row bones.

Joints of the carpus

The mid-carpal joints are formed between the two rows of carpal bones (fig. 49.) Adjacent carpal bones articulate by plane synovial joints which enable small sliding movements to occur. Also these joints are called **intercarpal joints** and reinforced by **ligamentum carpi radiatum, ligamentum intercarpea palmaria, and ligamentum intercarpea dorsalia and ligamentum intercarpea interossea.**

Articulatio ossis pisiformis- is a joint between the triquetral and pisiform bones. This joint is reinforced by **ligamentum pisohamatum,** which connects the pisiform bone to the hamate and **ligamentum pisometacarpeum**, which joins the pisiform bone to the base of the fifth metacarpal bone**.** These ligaments are, in reality, prolongations of the tendon of **the flexor carpi ulnaris** muscle.
The movements at this joint complement those occurring at the wrist.

Carpometacarpal joints are formed between the distal row of carpal bones and the base of the second, third, fourth and fifth metacarpal bones (fig. 49).

Carpometacrpal joints consist of plane joints. The joints between carpal bones and the medial four metacarpal bones are reinforsed by dorsal, palmar, and interosseous ligaments.

Movements. The movements permitted in the carpometacarpal joints of the fingers are limited to slight gliding of the articular surfaces upon each other. The metacarpal bone of the little finger is more movable than that of the ring finger; the metacarpal bones of the index and middle fingers are almost immovable.

Articulation of the thumb (articulatio carpometacarpea pollicis). Also one saddle joint is formed between the trapezium bone and the base of the first metacarpal bone. The capsule is thick but loose. It is thickest laterally and dorsally, and is lined by synovial membrane.

Movements- In this articulation the movements permitted are: flexion and extension, abduction and adduction, circumduction, and opposition.

Metacarpophalangeal joints are ellipsoidal joints, which are formed between the head of metacarpal bones and the bases of proximal phalanges. These joints are supported by a palmar ligament and two collateral ligaments and permit flexion, extension, abduction, abduction, and circumduction.

Interphalangeal joints. Both the proximal interphalangeal and distal interphalangeal joints are synovial, hinge- joints, which are formed between the bases and heads of adjacent phalanges. Each of these joints is reinforced by the **collateral ligaments.** Their collateral ligaments are taut throughout the range of flexion and extension and no adduction or abduction is possible.

Movements are more extensive between the first and second phalanges, than between the second and the third one.

In newborn the capsule of radiocarpal joint is thin. Joint’s disk changes to cartilaginous on the distal end of radius. The movements are limited because of articulation surfaces incorespondence (incongruented). The wrist bones are cartilaginous and joints are cartilaginous too. The capsule is firm and ligaments are not well developed.

Questions for self – study:

1. How are the bones of forearm connected?
2. What is the structure of the wrist joint?
3. How are the bodies of forearm bones connected?
4. What is the structure of the mid-carpal joint?
5. What ligaments reinforce wrist joint?
6. What is the structure of carpometacarpal joint?
7. How is pisiform bone connected?
8. What is the structure of metacarpophalangeal joint?
9. What is the structure of interphalangeal joint?
10. What are the peculiarities of the hand's joints in newborn?

Lesson 18

Units of pelvic bones, hip and knee joints.

Pelvis is composed of two hip bones (as coxae) and the sacrum. These three bones are united by two sacroiliac joints and the single symphisis pubis forming the pelvis ring.

Sacroiliac joints (articulatio sacroiliaca) are formed by congruent articular ear shaped surfaces (**facies auricularis)** of the sacrum and ilium (fig. 50). These joints are plane synovial joints which are adapted to limit movement and permit weight-bearing.

The articular capsule is thicker and reinforced by strong ligaments in front of the joint (**ligamentum sacroiliaca ventrale),** and behind **(ligamentum sacroiliaca dorsale).** Also are presence interosseous **ligaments** which occupy the area between the two bones; and **iliolumbar ligaments** which extend from the transverse processes of two lower lumbar vertebrae to the crest of iliac bone.

Pubic symphysis (symphysis pubis) is a fibrocartilaginous joint, which is formed between the two pubic bones (between their symphysial surfaces). Each articular surface is covered by a hyaline cartilage plate. These plates are separated by a narrow slit. The bones are bound together by strong **superior pubic ligament** (**ligamentum pubicum superior)** above and an arcuate ligament (**ligamentum arcuate pubic)** below which spans the pubic arch.
The motions in this joint are very limited.

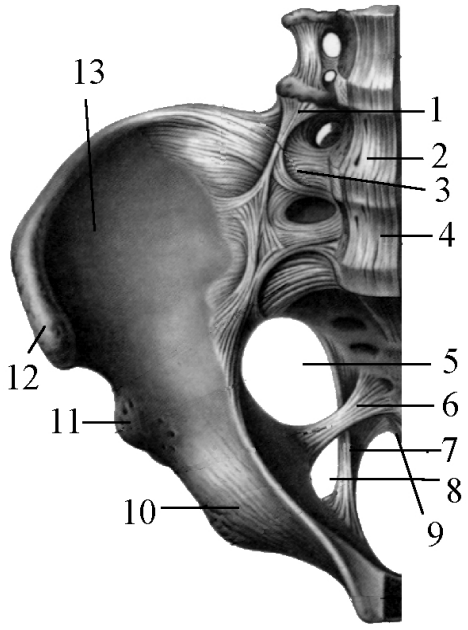


Fig. 50 Joints and ligaments of the pelvis.

1- lig. iliolumbale; 2 - lig. longitudinale anterius; 3 -lig. sacroiliaca ventralia; 4 - promontorium; 5- foramen ishiadicum majus; 6 - lig. sacrospinale; 7 - lig. sacrotuberale; 8 - foramen ischiadicum minus; 9 - lig. sacrococcygeum anterius; 10 - eminentia iliopubica; 11 - spina iliaca anterior inferior; 12- spina iliaca anterior superior; 13- fossa iliaca.

Bisides that the pelvis has two ligaments on the posterior aspect:

1) **sacrotuberal ligament** (**ligamentum sacrotuberale**) extends from the lateral border of sacrum to ischial tuberouse (fig. 50);

2**) sacrospinal ligament (ligamentum sacrospinale)**, which extends from sacrum to ischial spine (fig.50). These ligaments transform the greater and lesser sciatic notches to opening.

The bones of the pelvis are formed of the walls of both the pelvic and abdominal cavities. The horizontal plane of the pelvic inlet is divided pelvis into the greater or false and lesser or true pelvis.

False pelvis (pelvis major) is a part of abdominal cavity (fig. 51). It is an expanded portion of the bony pelvis above the pelvic brim. The pelvis inlet is bounded posteriorly by the sacral promontory, laterally by the arcuate line of the ilium, iliopectineal elevation and the superior aspect of the pubic bodies and symphysis pubic anteriorly.

The pelvis outlet is bounded posteriorly by the sacrum and coccyx, laterally by the ischial tuberosities and sacrotuberous ligaments, and anteriorly by the pubis simphysis, arcuate ligament, and rami of the pubis and ischium.

True pelvis (pelvis minor) is the cavity below the pelvic brim and above the pelvic outlet.

Dimensions of the false (or major) pelvis are:

1. The distance between the anterior superior spines of ilium is called "**distantio spinarum**" and is 25-27 cm.

2. The distance between the crests of ilium, which is called "**distantio cristarum**" is about 28-30cm.

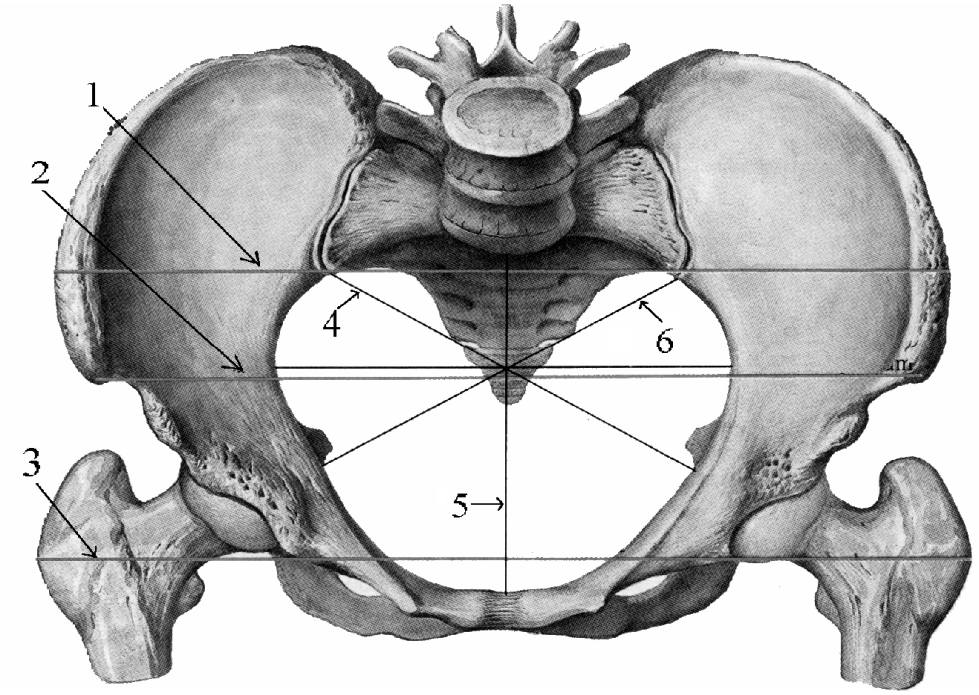


Fig. 51 Sizes of the pelvis.

1-distantia cristarum; 2-distantia spinarum; 3-distantia trochanterica; 4,5-diameter obliqae; 6—conjugata vera.

3. The distance between the greather brochanter of femur it is "**distantio trochanberica**" is about 30-32cm.

Dimensions of the true (or minor) pelvis are:

1. The distance between the sacral promontory and the upper aspect of the symphysis pubis is the "**conjugate vera**" (A. P. diameter) or true conjugate is 10,5-11 cm.

2. The **transverse diameter** of the inlet is the greatest distance between the arcuate lines is about 13 cm.

3. The **diagonal conjugate** is the distance between the promontory and the interior aspect of the symphisis pubis is 12 cm.

Differences between the female and male pelvis

The bones of the female pelvis are usually smaller, lighter, and thinner than those of the male.

In the female pelvis the transverse diameter exceeding the anteroposterior therefore the pelvis is wider.

The iliac wing flares superiorly and horizontally in female pelvis but in male pelvis iliac wing flares upper and vertically.

The inlet of true pelvis is oval in the female and heart-shaped in the male.

The subpubic angle or pubic arch is larger, (angle ≈ 90^0) the male pelvis subpubic arch is more acute ≈ 70-75^0.

The female sacrum is shorter and wider than the male sacrum.

The obturator foramen is oval or triangular in the female and round in the male.

The hip joint.

Hip joint (articulatio coxae) is formed between the articular surface of the acetabular fossa and the spherical articular surface on the head of the femur (fig. 52, 53).

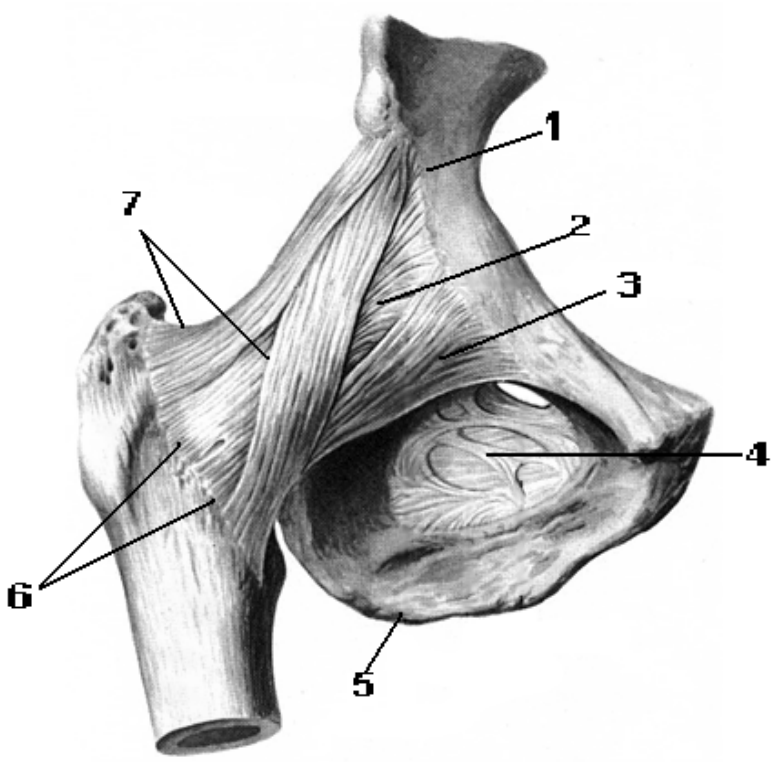


Fig. 52 Ligaments of the right hip joint.

1–os pubis;
2–capsula articularis;
3–lig. pubofemorale;
4– membrana obturatoria;
5 – tuber ishiadicum;
6 – linea intertrochanterica;
7 – lig. iliofemorale.

Hip joint is composite, multiaxial, ball-and-socket synovial joint. The articular surfaces of acetabulum and head of femur are incomplete (incongruent) because the head of the femur is slightly larger than a hemisphere surface of acetabule. The joint cavity is deepened by the acetabular rim or labrum.

This **fibrocartilaginous labrum (labrum acetabule)** attaches of the acetabulum border and bridges the acetabular notch where is formed the **transverse acetabular ligament (ligamentum transversum acetabule)**, which convert the acetabular notch into foramen where vessels and nerves passage.

The fovea of the head of the femur and the floor of acetabular fossa are connected by the intraarticular ligament-**ligamentum capitis femoris** (or ligamentum teres femoris) that conveys a blood vessel to the head of the femur.

Fibrous capsule is attached proximally to the border of the acetabulum and transverse ligament and distally to the neck of the femur as follows: anteriorly to the intertrochanteric line and the root of greater trochanter and posteriorly to the intertrochanteric crest and encloses part of the head and most of the neck of femur. These three extracapsular ligaments with the fibrous portion of the capsule support the joint.

1) **The liofemoral ligament (ligamentum iliofe-morale)** is the largest, reinforces the fibrous capsule anteriorly. It is attached to the anterior inferior iliac spine and intertrochanteric line and the front of the greater trochanter of the femur.

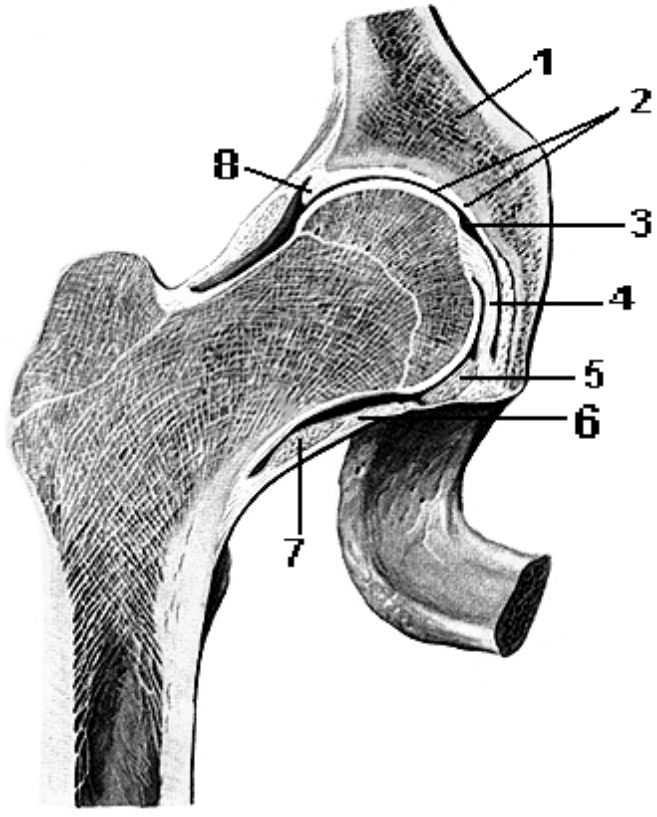


Fig. 53 Hip joint
(viewed from the frontal plane).

1 – os coxae;
2 – cartilage articularis;
3 – cavum articularis;
4 – lig. capitis femoris;
5- lig. transversum asetabuli;
6 - capsula articulare;
7 – zona orbicularis;
8 – labrum acetabulare.

This ligament strongly resists hyperextension at the hip joint.

2**) Ischiofemoral ligament (ligamentum ischiofemorale**) reinforces fibrous capsule posteriorly and extends from the ischial part of acetabular rim to the neck of the femur.

3) **Pubofemoral ligament (ligamentum pubofemorale**) extends from the pubic portion of the acetabular rim and superior pubic branch to the lower part of femurs neck.

The motions at the hip are: flexion, extension, abduction, adduction, external (lateral rotation), and internal (medial) rotation. They are made with help of the muscles.

The Knee joint

Knee joint (articulatio genus) is a compound hinge-type, synovial joint between condyles of the femur and relatively flat of tibia, and also includes a saddle joint between the femur and patella (fig. 54). All of articular surfaces are covered with articular hyaline cartilage. The articular surfaces of the femoral condyles and the tibial condyles are incongruency that is partially filled by two fibrocartilaginous disks or menisci.

Medial meniscus has a semicircle forms and is attached to the interarticular area of the tibia and medial collateral ligament.

Lateral meniscus is almost a complete circle and incompletely attached to the capsule and continuous with the posterior meniscofemoral ligament. As a result the lateral meniscus is relatively movable and presumable. Both of meniscuses joined with transverse ligament which binds the anterior parts of menisci.

The fibrous articular capsule is rather thin, weak and attached to the margins of the femoral condyles, to the patella and patellar ligament, and to the margins of the tibial condyles. The fibrous portion encloses the entire joint area and is composed of the quadriceps muscle tendon, patella and patellar ligament anteriorly; the patellar retinacula anteromedially and anterolaterally and the iliotibial tract laterally. The synovial lining encloses the articular surfaces but the intercondylar area is outside the joint space but within the fibrous capsule.

The ligaments of the knee joint can be divided into two groups: inner articulation capsule and outside. The inside ligaments are: the cruciate ligaments. They are two thick, rounded cords which lie centrally within the capsule.

The anterior cruciate ligament (**ligamentum cruciatum anterior)** is attached anteriorly to the upper aspect of the tibia and passes upward and backward to the inner aspect of the lateral femoral condyle. The posterior cruciat ligament (**ligamentum cruciatum posterior)** is attached to the posterior part of the upper surface of the tibia; it passes upward and forward to the inner aspect of the medial femoral condyle. The two ligaments therefore cross one another.

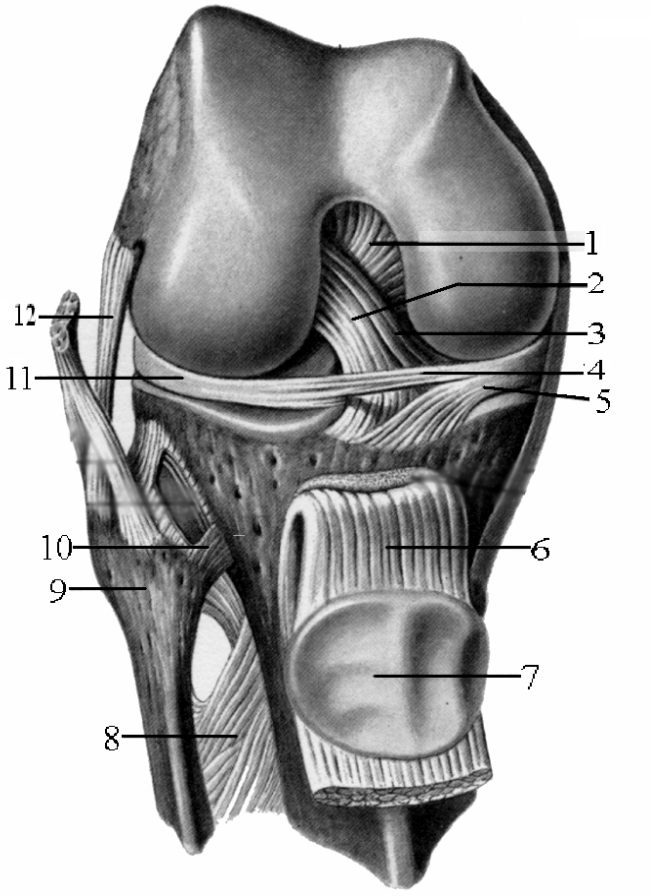


Fig. 54 Knee joint.

1–lig. cruciatum posterius;
2–lig. cruciatum anterius;
3–lig. meniscofemorale anterius;
4– lig. transversum genus;
5–meniscus medialis;
6–lig. patellae;
7–facies articularis;
8– membrana interossea cruris;
9–caput fibulae;
10–lig. capitis fibulae anterius;
11– meniscus lateralis;
12–lig. collaterale fibulare.

The outside ligaments are:

1. Medial collateral ligament (**ligamentum collaterale mediale**) extends between the medial epicondyle of the femur and the anteromedial part of tibia well below the medial tibial condyle. The medial meniscus is strongly attached to its inner aspect.

2. Lateral collateral ligament (**ligamentum collaterale laterale**) extends between the lateral femoral epicondyle and the head of the fibula. 3. Patellar ligament (**ligamentum patella**) is a strong flattened fibrous band that is the continuation of the **musculus quadriceps femoris** tendon and extends from the apex of the patella to tuberosity of the tibia.

4. Arcuate popliteal ligament **(ligamentum poplitea arcuatum)** arises from the head of fibula and passes upward and medially on the back of the capsule of knee joint.

5. Oblique popliteal ligament **(ligamentum poplitea oblique)** is an oblique expansion of the tendon the semimembraneous muscle passes upward obliquely across the posterior surface of the knee joint from the medial condyle of the tibia.

The movements at the knee joint make around two planes: frontal or coronal and sagital. They are extension, flexion, medial (internal) rotation, and lateral (external) rotation.

The knee joint capsule forms some burses. The important of them are:

1) **suprapatellar bursa** lies deep to the **quadriceps femoris muscle** and extends upper the patella, it is a major bursa communicating with knee joint cavity, and also may communicate with the semimembraneous bursa;
2) **prepatellar bursa** lies over the superficial surface of patella;
3) **infrapatellar bursa** consist of the subcutaneous infrapatellar bursa, which lies over the patellar ligament, and deep infrapatellar bursa, which lies deep to the patellar ligament.

Questions for self – study:

1. What is the structure of sacroiliac joint?
2. What ligaments reinforce sacroiliac joint?
3. What is the structure of pubic symphisis?
4. How are the large and the small pelvic cavities formed?
5. What dimensions of false pelvis do you know?
6. What dimensions of true pelvis do you know?
7. What are the differences of female and male pelvis?
8. What is the structure of hip joint?
9. What the peculiarities of the hip joint do you know?
10. What ligaments reinforce hip joint?
11. What are the peculiarities of hip joint in children?
12. What is the structure of the knee joint?
13. What ligaments reinforce knee joint?
14. What are the differences between the adult's and children's knee joints?

Lesson 19

Units of the leg and foot.

The unit of the leg bones consists of the proximal and distal tibiofibular joints.
Proximal tibiofibular joint is a plane synovial joint between the head of the fibula and articular surfaces of tibia. It is reinforced by two ligaments (**ligamentum capitis fibulae anterior** and **ligamentum capitis fibulae posterior**) anteriorly and posteriorly.The motions in this joint are limited.

Distal tibiofibular joint (syndesmosis tibiofibularis) is a fibrous joint between the distal ends of the shafts of the tibia and fibula. This joint is reinforced by anterior (**ligamentum tibiofibularia anterius**) and posterior (**ligamentum tibiofibularia posterius)** tibiofibular ligaments and little movement can occur.

These two bones are held firmly by the interosseous membrane **(membrana interossea cruris)**, which has upper and lower openings for nerves and vessels.

Ankle joint – Talocrural joint (articulatio talocruralis) is formed by the inferior ends of the tibia and fibula and the superior surface of the trochlea talus and the two malleoli lying on both side (fig. 55). It is a hinge –type (**ginglymus**), synovial joint in which dorsiflexion and plantar flexion are produced.

Articular capsule is a thin and attached around the articular margins of the tibia, fibula, and talus. The capsule is reinforced by strong lateral and medial ligaments.

Medial (deltoid) ligament (ligamentum deltoideum) is fan-shaped and has four parts: the tibionavicular, tibiocalcaneal, anterior tibiotalar and posterior tibiotalar ligaments which extend from the medial malleolus to the navicular, calcaneus and talus bones.

Lateral ligament (ligamentum laterale) consists of three parts: the anterior talofibular, posterior talofibular and calcanefibular ligaments.

The anterior talofibular ligament (ligamentum talofibulare anterior) is the most common injured ligament which is attached superiorly to the lateral malleolus and runs forward and medially to the neck of the talus. The posterior talofibular ligament (**ligamentum talofibulare posterior)** runs horizontally from the lateral malleolus to the posterior aspect of the talus.

The calcaneofibular part (ligamentum calcaneofibulare) runs downward and backward from the tip of malleolus to the lateral side of the calcaneus.

The motions of the ankle are plantar flexion, dorsiflexion, inversion of the foot and eversion.

The subtalar joint (**articulatio subtalaris**) is the synovial joint situated beneath the talus. It is formed between the articular surfaces of the talus and the calcaneus. The two sets of articular surfaces that form this joint are separated by a strong interosseous ligament which occupies the tarsal canal between the bones.

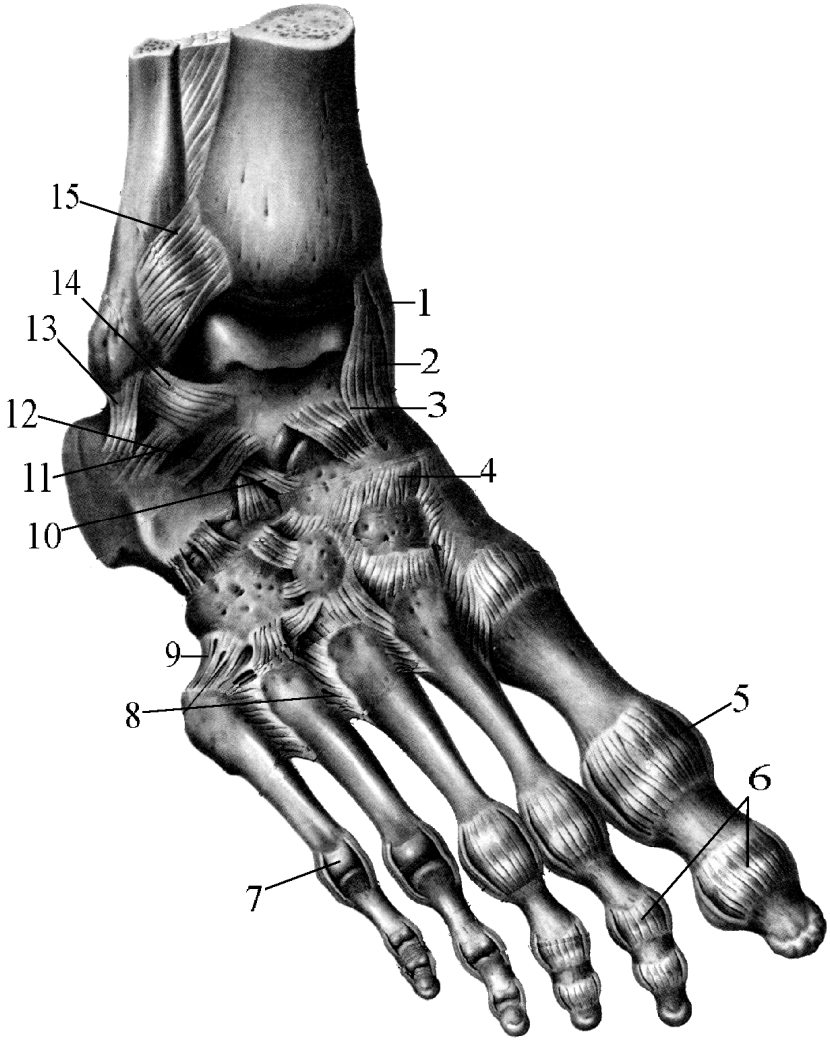


Fig. 55 Joints and ligaments of the foot.
1-articulatio talocruralis;
2-lig. mediale;
3-lig. talonaviculare;
4-ligg. cuneonavicularia dorsalia; 5-capsula art. metatarsophalangeae;
6-capsula articulatio interphalangeae;
7-aritculatio metatatrsophalangea;
8-ligg. metatarsea dorsalis;
9-ligg. tarsometatarsea dorsalis; 10-lig. bifurcatum;
11-lig. talocalcaneum laterale;
12-lig. talocalcaneum interosseum; 13—lig. calcaneofibulare;
14- lig. talofibulare anterius;
15- lig. tibiofibulare anterius

The movements are inversion and eversion of the foot.

Talo-calcaneo-navicular joint or the transverse tarsal joint (articulatio tarsi transversa) extends transversely across the foot and composes from two articulates.

The medial articulation is between the talus and navicular bones; the lateral between the calcaneus and the cuboid.

Articulatio talonaviculare is formed between the head of the talus and a socket formed by the concave posterior surface of the naviculare. This joint is supported by the spring (plantar calcaneonavicular) ligament.

Articulatio calcaneocuboidea is formed between the articular surfaces of calcaneus and cuboid bones. The articular capsule reinforced dorsally by the bifurcate ligament (**ligamentum bifurcatum**) and plantare by the short and long plantar ligaments (**ligamentum plantare breve et longum).**

The short plantar ligament fills the depression between the anterior tubercle of the calcaneus and the ridge on the plantar aspect of the cuboid bone.

The long plantar ligament extends from the undersurface of the calcaneus to the ridge on the cuboid and then forward over the tendon of peroneus longus to the bases of the second to fifth metatarsal bones.

The calcaneo-cuboid and talo-navicular joints together form a mid-tarsal joint which cross the foot transversely and called **"articulatio tarsi transverse"** or **"Shopar joint**". Both simple joints have one general ligament- **bifurcate ligament** (**ligamentum bifurcatum**) which starts from the upper margin of calcaneus and is divided into **ligamentum calcaneonaviculare and ligamentum calcaneocuboideum**, and attached to each of bones. This ligament also form the main bond between the two rows of tarsal bones therefore is it called **"Shopar joints key".** Movements in this joint are little during inversion and eversion.

Articulatio cuneonavicularis is the plane synovial joint and formed between three cuneiform and navicular bones. The joint capsule covered articular surfaces of all bones and reinforced by **ligamentum cuneonavicularia plantaria and dorsalia, ligamentum intercuneformia dorsalia and plantaria and interossea.**

Articulatio tarsometatarsea also called **Lisfrank's joints** and they are formed between cuneformia and cuboid bones above and metatarsal bones bellow. It consists of three simple joints. The first is formed between medial cuneiform bone and the first metatarsal bone. This joint is saddle and has proper articular capsule. The second joint is formed between the intermedial cuneiform bone and the second metatarsal bone, and the third joint is formed between the lateral cuneiform and third metatarsal bones. Both these simple joints are covered by one articular capsule.

Also cuboid bone joins with the fourth and fifth metatarsal bones which are covered one articular capsule. All these three joints are reinforced by **ligamentum tarsometatarsea dorsalia and plantaria and ligamentum cuneometatarsea interossea**.

Between the bases of metatarsal bones are formed intermetatarsal joints (**articulatio intermetatarsea**) which are reinforced by **ligamentum metatarsea dorsalia and plantaria and ligamentum metatarsea interossea**.

Ligament, which extends from the medial cuneiform bone to the second metatarsal bone, is called **"key of Lisfrank's joint"**

Articulatio metatarsophalangea is formed between the head of metatarsal bone and base of proximal phalanx. The articular capsule is the loose and thin, and reinforced by **ligamentum collateralia mediale and laterale**, and **ligamentum plantaria**. Also the heads of metatarsal bones are connected by **ligamentum metatarsea transversus profundum**.
These joints are biaxial that's why only flexion, extension and slightly abduction and adduction may be produced.

Articulatio interphalangea is very similar to their in the hand. They are throchlear joints which are reinforced in both side's **ligamentum collateralia** and lowerly **ligamentum plantaria.**

The adult foot shaped like a half-dome and has three supports points-tuber calcanei and the heads of the first and fifth metatarsal bones. Half-dome elevation on the foot is called **fornix pedis**. It is formed by helping the long and short plantar ligaments, the strong spring ligament and the muscles of the leg and their tendons.
A newborn baby's foot does not have an obvious arch. When the child begins to walk, toward the end of the first year the relatively large amount of fat in the sole of the foot regresses, and arch begins to appear.

Questions for self – study:

1. How the leg's bones are joining?
2. What is the structure of ankle joint (articulatio talocruralis)?
3. What ligaments reinforce ankle joint?
4. What do you know about the subtalar joint?
5. What is the structure of joint of Shopar's?
6. What is the key of Shopar's joint?
7. What are the structures of cuneonavicular joints?
8. What is the key of Lisfrank joints?
9. What is the structure of metatarsophalangeal joint?
10. What is the structure of interphalangeal joint?
11. What the peculiarities of baby's foot do you know?

Lesson 20.

The muscles of the thorax and diaphragm.

The muscles of the breast-cage (thorax) are divided into two groups: muscles of the pectoral area and the muscles of the thoracic wall.
The muscles of the pectoral area lie externally and influence the motion the upper limb. They are: the pectoralis major, pectoralis minor, subclavius, serratus anterior.

Pectoralis major (m. pectoralis major) – is a large radiated muscle, which consists of three parts: the clavicle, breast-ribs and the abdomen. The clavicle part (**pars clavicularis**) originat from the medial half of the clavicle; breast-ribs part (**pars sternocostalis**) – starts from manubrium and

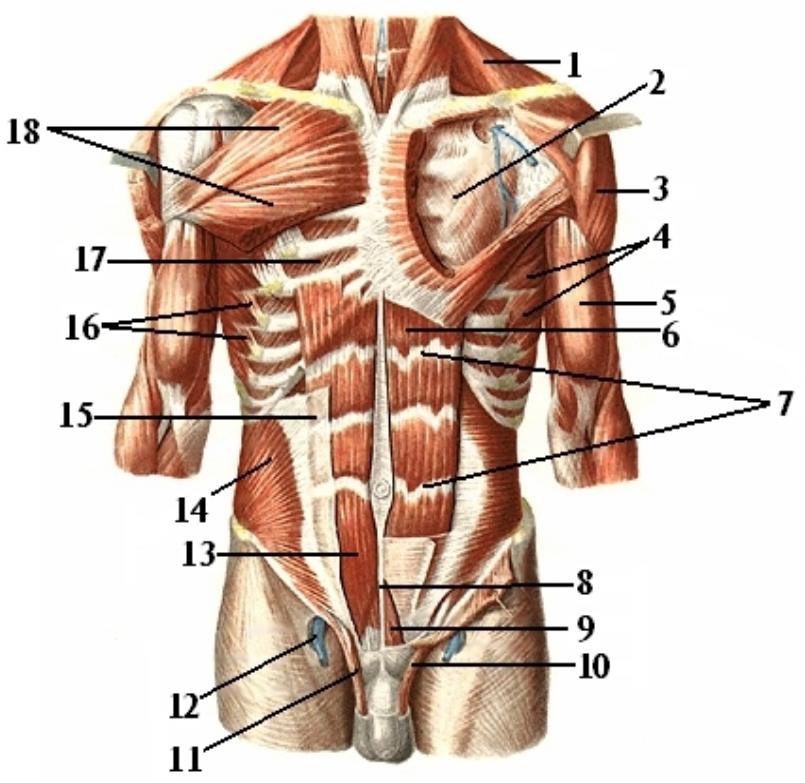


Fig 56. Muscles of the thoracic and abdominal walls.

1–trapezius; 2–fascia pectoralis (lamina profunda);
3–m. deltoideus;
4–m. serratus anterior;
5–m. biceps brachii,
6–m. rectus abdominis;
7–intersectiones tendineae; 8–linea alba;
9–m. pyramidalis; 10,11–funiculus spermaticus;
12–v.femoralis;
14–m.obliquus internus abdominis; 15–vagina m. recti abdominis (lamina anterior); 16–m. intercostalis externus; 17–m. intercostalis internus; 18–m. pectoralis major.

body of the sternum and the upper six costal cartilages, and the abdomen part (**pars abdominalis**) – startes from the vagina of the straight muscle. All this parts are united and inserted on the crest of the greater tubercle of the shoulder bone (**crista tuberculi majoris humeri**).

Action: the clavicular part can rotate the arm medially and flex it; the sternocostal part depresses the arm and shoulder. Its lower fibers can help extend the arm, when it is flexed. If the raised arm is fixed this muscle enlarges breast- cage. This muscle forms the anterior wall of the axillary's fossa.

Pectoral minor (m. pectoralis minor) – placed under the pectoralis major muscles arises from the external surfaces of the second to fifth ribs and is inserted into the coracoid process. It depresses the shoulder. This pectoral muscle forms the anterior wall of the axillary's fossa too.

Subclavius muscle (m. subclavius) – originates from the junction of the first rib and its cartilage and is inserted on the lower surface of the clavicle. It assists in depressing the lateral portion of the clavicle and reinforces the sternoclavicular joint.

Serratus anterior muscle (m. serratus anterior) - arises from the external surfaces of the upper eight ribs and is inserted on the medial border of the scapula. It rotates the scapula upward so that the inferior angle swings laterally, abducts the arm and elevates above horizontal position. If scapula is reinforced this muscle enlarges breast cage.

The muscles of thoracic wall (proper muscles) are: the external and internal intercostals, the subcostal and transversus thoracis. These muscles are called the proper (autochton) muscles because they originate and inserted only on the ribs and between them lies.

The intercostals muscles fill the intercostals spaces and consist of external and internal muscles.

External intercostals muscles (m.m. intercostales externi) – fill the intercostal's spaces, originated from the lower border of ribs above and inserted to the upper border of rib below. They elevate ribs in inspiration.

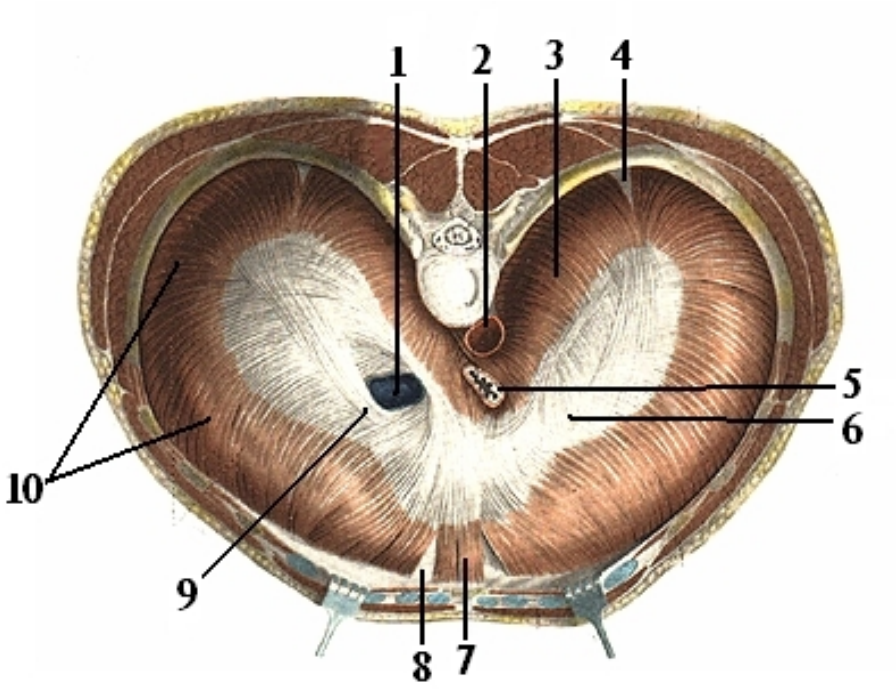
Internal intercostals muscles (m.m. intercostals interni) lay under external intercostals muscles, arise from upper border of ribs below and are inserted on the lower border of ribs above. They depress ribs and reinforce the sternocostal joints.

Subcostalis muscles (m. subcostales - originate from inner surface of lower ribs (from tenth to twelfth) near their angles extend over two or more intercostals spaces and are inserted to lower borders of two or three ribs above, near the rib's angles. They elevate ribs.

Transverse thoracic muscle (m. transverses thoracis) arises from the dorsal surface of the lower part of sternum and xiphoid process, extends from up in down to be inserted between second and the six costal cartilages. It depresses ribs.

Diaphragm (m. phrenicus) is a thin dome-shaped muscle between thorax and abdomen, which consists of radially oriented muscles fibers that arise from the inner aspect of the thoracic outlet and becomes the central tendon (fig. 57.). On the right its dome extends superiorly, to the fifth rib, and on the left to the fifth interspace.
Diaphragm consists of three parts: sternal, costal and lumbar.

Fig. 57. The Diaphragm; view below.



1–foramen venae cavae; 2–hiatus aorticus; 3–pars lumbalis diaphragmatis; 4–trigonum lumbocostale; 5–hiatus oesophageus; 6,9–centrum tendineum; 7–pars sternalis diaphagmatis; 8–trigonum sternocostale;10–pars costalis diaphagmatis.

Small sternal part (**pars sternalis**) attaches to the posterior aspect of the xiphoid process, costal part **(pars costalis**) arises from lower six costal cartilages and lumbar portion (**pars lumbalis)** that consists of the right and left legs which arise from anterior aspect of lumbar vertebra's body. Right leg **(crus dextrum**) is larger and longer that the left one. It originates from vertebrae L1-L4, but the left leg **(crus sinistrum**) originates from L1-L3 and splits to enclose esophagus. All three parts formed in the midline **centrum tendineum.**
Medial arcuate ligament **(lig. arcuatum mediale**) extends from the body of L1 to transverse process of L2 and passes over the psoas muscle and sympathetic trunk.
Lateral arcuat ligament (**lig. arcuatum laterale**) extends from the transverse process of L2 to twelfth rib and passes over quadratus lumborum muscle. Between two diaphragm legs at the level of Th12 aortic

hiatus **(hiatus aorticus)** lays where transmits aorta, thoracic duct, greater splanchnic nerve and azygos vein.
The esophageal hiatus **(hiatus esophageus)** is anteriorly to aortic hiatus at the level of Th_{10} and transmits esophagus with the anterior and posterior trunks of vagus nerves. On central tendon of diaphragm at the level of Th_8 the opening for vena cava inferior lays where vena cava inferior and the right phrenic nerve transmit.
Diaphragm descends when it contracts, causing an increase in thoracic volume by increasing the vertical length of thorax and thus resulting in decreased thoracic pressure. It is ascends when it relaxes causing a decrease in thoracic volume with increased thoracic pressure. Diaphragm is a respiratory muscle, then diaphragm contract make inspiration, but then its relax make expiration.

Questions for self – study:

1. Which muscles attach to the shoulder girdle and shoulder born?
2. Tell about m. psoas major and minor.
3. Tell about m. serratus anterior and m. subclavius.
4. Tell about intercostal externa and interna muscles.
5. Tell about m. subcostalis and m.transversus abdominis.
6. What is the structure of diaphragm?
7. What thoracic fascias do you know?

Lesson 21.

Topic: The muscles of the abdominal walls. Linea alba. The rectus muscles sheath, inguinal canal.

The interval between the inferior costal margin and the superior aspect of the pelvis is the anterior abdominal wall, which conyains four flat muscles (fig. 56, 58).
1.The most superficial muscle is the **m.external oblique abdominis** which arises from the external surface of lower eight ribs (5-12). Fibers are directed anteriorly, medially and inferiorly and inserts on the anterior half of iliac crest, anterior-superior iliac spine; pubic tubercle continues to the aponeuroses and formes linea alba.

Actions: compresses abdomen, flexes frunk.
The folded lower border of aponeurosis of the external oblique muscle forms the inguenal ligament, which extends between the anterior-superior iliac spine and the pubic tubercle. This is artificial ligament.
2. **M. obliquus internus abdominis**, originates from the lateral two-thirds of inguinal ligament; iliac crest; thorocolumbar fascia and incerted on lower four costal cartilages, pubic crest.The fibers are perpendicular to those of the external oblique muscles and to continue the wide aponeuroses, which passes to the linea alba. The lower margin fibers of internal oblique muscle formed c**remaster muscle**, which retracts testis.
Function of the internal oblique muscle is to compress abdomen and flex the frunk.

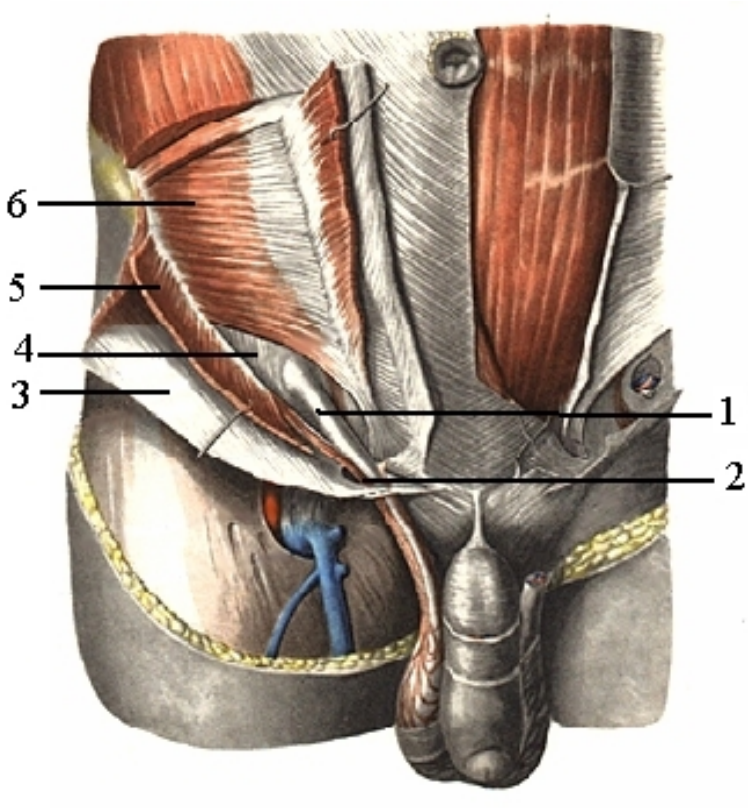


Fig. 58. Muscules of the abdominal wall.

1–anulus inguinalis superficialis;
2–funiculus spermaticus;
3–aponeurosus m. obliqui externi abdominis;
4–fascia transversalis;
5–m. obliquus internus abdominis;
6–m.transversus abdominis.

3. **Transversus abdominis muscle** oriented transversaly and starts from lateral one-third of inguinal ligament; iliac crest, thorocolumbar fascia; lower six costal cartilages directed anteriorly, continue to aponeuroses which insert pubic crest and linea alba.
Function: compresses abdomen, depresses ribs and participates to forme the abdominal press.
4. **Rectus abdominis muscle** is the vertically oriented, flat, dimshaped, long muscle, which lies laterally to linea alba. It extends between the superomedial aspect of the pubis and the medial parts of the costal

cartilages from 5th to7th and the xiphoid process.
Muscle fibers are divided by three or four intersections tendinous into some parts. Its tendinous intersections account for the "ripples" seen on the surface of the abdomen. The function of rectus abdominis is to depress ribs and flex the frunk.
5. **Pyramidal muscle**, is tringular-shaped, lying in lower part of rectus muscle; originates from pubic body and pubic crest. The fibers directed from below to upward and interfere in linea alba.

On the posterior abdominal wall single **m. quadratus lumborum** is found. This muscle extends between the twelfth rib, transverse processes of L_3-L_5, iliac crest and also is attached to the lumbar trasverse processes of L_1-L_3
Action: depress twelfth rib, flexes trunk laterally.

The white line (Linea alba).

Linea alba is a tendinous median raphe between the two rectus abdominis muscles, extending from the xiphoid process to the pubic symphysis.
This linea is formed by the fusion of the aponeuroses of all three flat muscle external oblique, internal oblique and transverse muscles of the abdomen. In upward its width (nearly 2,5sm) and below its narrows (nearly 1sm).

The rectus abdominis muscles sheath

The rectus muscles sheath is formed by fusion of the aponeuroses of the external oblique, internal oblique and transverse muscles of the abdominis. The sheath encloses the rectus abdominis and sometimes the pyramidal muscle.

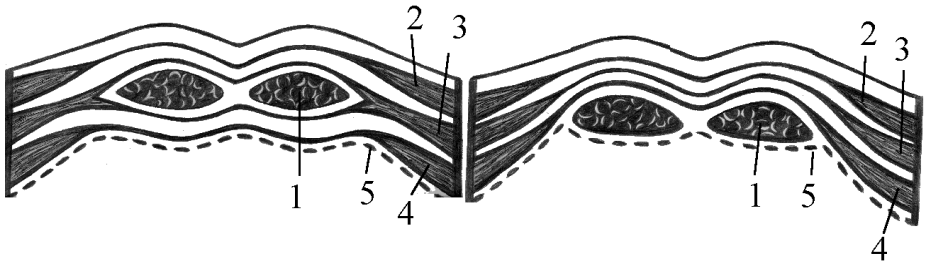


Fig. 59. Arrangement of the rectus bdominis muscle.

A – above the umbilicus;
B–below the umbilicus;
1–m. rectus abdominus; 2–m. obliquus abdominus externus; 3– m. obliquus abdominus internus; 4– m. obliquus abdominus transversus; 5–fascia transversa.

This sheath has two walls or layers- anterior and posterior, which are different in structure (fig. 59). Above the arcuate line the anterior wall of the rectus sheath is formed by aponeuroses of the external abdominal muscle and half aponeuroses internal oblique muscle; posterior wall of the rectus sheath is formed by half aponeuroses of internal oblique muscle and aponeuroses of transversal abdominis muscle. Lowerly the navel aponeuroses of all three flat abdominal muscles: external oblique, internal oblique and transverse lie on anterior wall but posterior layer of the rectus sheath is formed by only transversal's fascia and behind it peritoneum lies.

Inguinal canal

The inguinal canal is an obliquely oriented pathway throught the abdominal wall. It begins at the deep inguinal ring and ends at the superficial ring and directed interomedially just above the inguinal ligament. It is smaller in females than in the males and transmits the spermatic cord whith vesels and ilioinguinal nerve in male and round ligament of the uterus in female.

The general shape of this canal is that of a flattened cylinder. It can be described as having a floor and roof as well as anterior and posterior walls.

Anterior wall is formed by aponeuroses of the external oblique muscles, Posterior wall- the transversal's fascia. Superior wall (roof) is formed by arching fibers of the internal obliquer and transverse muscles and inferior wall (floor) is formed by the inguinal ligament.

Deep inguinal ring begins with sleeve of transversal's fascia. It is formed by embryonic extention of the processus vaginalis through the abdominal wall and subsequent passege of the testes through the transversalis fascia during their descent into the scrotum.

Superficial inguinal ring is a friangular opening in the apouneuroses of the external oblique muscle that lies just laterally to the pubic tubercle.

Superior edge of superficial ring is formed by medial crus external oblique aponeurosis, inferior edge is formed by lateral crus external oblique aponeurosis. Lateral edge is formed by intercrural fibers and medial edge by fibers that are called ligamentum reflexum. Above it covers with skin.

Questions for self - study

1. What groups are abdominal muscles divided into?
2. Tell about the externus obliquus abdominis muscle.

3. Tell about the internus obliquus abdominis muscle.
4. Tell about the transversus abdominis muscle.
5. Tell about the anterior group of abdominal muscles.
6. Tell about the posterior group of abdominal muscles.
7. How is the rectus abdominal sheath formed?
8. How is the linea alba formed?
9. What forms the walls of canalis inguinales?
10. What forms superficial ring of inguinal canal?

Lesson 22.

Muscles of the back.

Muscles of the back (mm.dorsi) are separated into superficial and deep group. The superficial muscles of the back interconnect the bones of the shoulder girdle and axial skeleton, and control scapular position and motion, they are also called the extrinsic muscles of the shoulder.
The deep or intrinsic muscles of the back consist of multiple groups of muscles that extend from occipital bone to the sacrum.

The superficial muscles of the back placed into three layers (fig. 60). There are muscles trapezius and latissimus dorsi in the first layer, and levator scapular, rhomboid major and minor and serratus, posterior superior and inferior.

First layer: 1. **Muscle trapezius** originates from external occipital protuberance, superior nuchae line, ligamentum nuchae and cervical and thoracis spinous processes and insert on spine of the scapula, acromion and lateral third of clavicle.
When all fibers of this muscle are abridged, scapula is adducted to vertebral column. The upper fibers can elevate and rotate the scapula so that the inferior angle swings forward and laterally but the latera angle swings upward and medially.
2. Muscles latissimus dorsi originate from iliac crest, sacrum , spines of lumbar and lower seven thoracic vertebrae, thoracolumbar fascia and are inserted on the medial lip of intertubercular groove of humerus or the crest of the lesser tubercle of the humerus. It extendes and rotates arm medially, depresses shoulder.
The second layer consists of the levator scapulae muscle, rhomboid major and minor.

1. Muscles levator scapulae originate from transverse processes of upper three or four cervical vertebrae and insertion on superior angle of scapula. It elevates scapula.

2. Rhomboid major and minor muscles: rhomboid minor originates from spinous processes of the lower cervical and first thoracic vertebrae but rhomboid mojor originates from spinous processesof the second to fifth thoracic vertebrae and both are inserted on medial border of scapulae. They act to adduct scapula

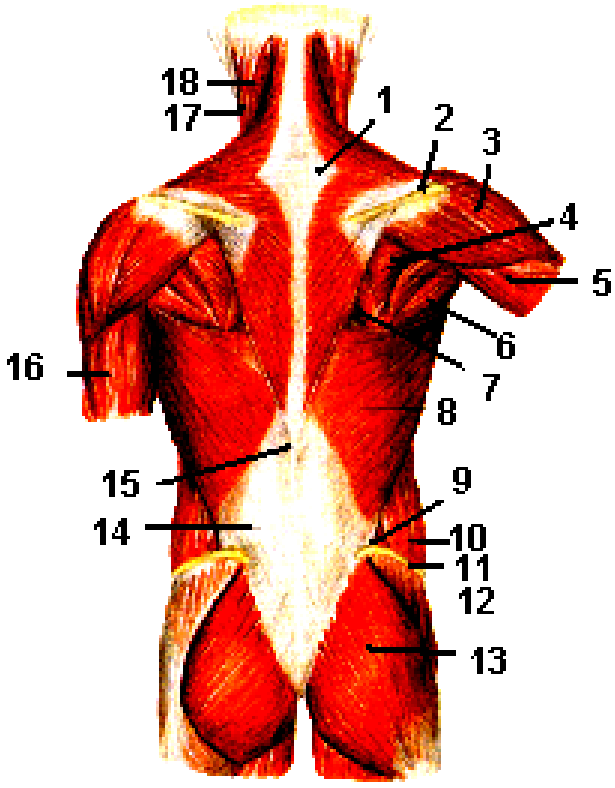


Fig. 60 Superficial muscles of the back.
1–m. trapezius;
2–spina scapulae;
3–m. deltoideus;
4– m. supraspinatus;
5–m. teres minor;
6–m. teres major;
7–m. romboideus maior; 8–m. latissimus dorsi; 9–trigonum lumbale; 10–m. obliquus abdominus internus; 11–crista iliaca; 12–m. gluteus medius;
13–m. gluteus maximus;
14– fascia thorocodorsalis;
15–processis spinosus 12-th thoracic vertebra;
16–m. triceps brachii;
17–m. sternoclleidomastoideus;
18–m. splenius capitis.

Third layer consists of serratus posterior superior and inferior muscles

1. Serratus posterior superior muscle originate from ligamentum nuchae, supraspinal ligament and spinous processes of lower cervical and three upper thoracic vertebrae and are inserted on the upper border and external surface of second to fifth ribs

2. Serratus posterior inferior -originates from supraspinous ligament and spinous processes of lower two thoracic and upper three lumbar vertebrae and is inserted on lower border of ninth to twelvth ribs. It depresses ribs.

The deep group muscles of the back consist of three layers superficial, midle and deep.

Superficial layer subdivided into**:** spinotransversal group, sacrospinal group and interspinal group.

Spinotransversal group:

1. m. splenium capitis originates from the spinosus processes of the lower cervical and upper three or four thoracic vertebrae and is inserted on the mastoid process and the superior nuchae line.Fibers of this muscle are directed upward and laterally. It rotates the head and neck toward the same side and extends the head and the frunk.

2. m. splenium cervicis originates is from the spinous processes of the three or four thoracic vertebrae and is insertes on base of skull and upper two or three cervical transverse processes. It acts to rotate the head and neck towards the same side too.

Sacrospinal group consists of the erector spinae muscle which lies between the sacrum and base of skull.

3. m. erector spinae originates from back surface of sacrum and iliac crest, ribs and spinous processes of lumbar and lower thoracic vertebrae and divided into three columns: lateral, medial and most medial.

a) Lateral column is called **muscle iliocostalis**, originates from the iliac crest and thorocolumbar fascia oriented upward and inserted on the ribs and cervical transverse processes. Iliocostalis muscle is divided into three parts: iliocostalis lumborum, iliocostalis thoracis, and iliocostalis cervicis.

b) Medial column is called **muscle longissimus** and divided into three parts: **1) musculus longissimus thoracis** originates from back surface of sacrum, transverse processes all lumbar and lower thoracic vertebrae and inserted on the lower nine ribs and the top of transverse processes thoracic vertebrae.

2) m. longissimus cervicis originates from the top of processus transverse upper five thoracic vertebra and inserted on cervical transverse processes from sixth to second.

3) m. longissimus capitis originates from the transverse processes upper three thoracic and lower four cervical vertebrae and inserted on the mastoid process.

c) most medial column called **muscle spinalis**. Its start from and inserts into the spinous processes and is divided into three parts:

1) m. spinalis thoracis originates from spinous processes of upper two lumbar and lower two thoracic vertebras and is inserted to spinous processes of eighth upper thoracic vertebra

2) m. spinalis cervicis originates from spinous processes of the lower cervical and two upper thorasic vertebra and ligament nuchae lower part and is inserted on spinous process of second or third cervical vertebra
3) m. spinalis capitis originates from spinous processes of the lower cervical and upper thoracic vertebrae oriented updawn and inserted on occipital bone near "protuberance occipitale". This muscle often is absent.
Muscles of the midle layer consists of m. transverso- spinalis, m. interspinales and m. intertranaversales.
1. m. transverso- spinalis consists of three parts which start from processes transverses of lower vertebrae and attached to processus spinosus of vertebra above.
a) m. semispinales overloop 4-6 vertebrae;
b) m. multifidi – passes through 2-4 vertebrae;
c) m. m. rotatoris - passes through one vertebra.
All these muscles function are rotation the trunk.
Muscles of the deep layer consists of m. interspinales and m. intertransversales.
1) **m. interspinales are** located between spinosus processus of adjacent vertebras. Function: extending spine.
2) **m. intertransversales** is located between transversal processus of adjacent vertebras. Its function flex spine in the same side.

Questions for self – study:

1. What groups are back muscles divided into?
2. What are the superficial muscles of the back?
3. Tell about the trapezius muscle.
4. Tell about the latissimus dorsi muscle.
5. Tell about the rhomboid and levator scapula muscles.
6. What are the deep muscles of the back?
7. Tell about splenius capitis and cervicis muscles.
8. Which parts is errector spinal muscle divided into?
9. Tell about m. iliocostalis.
10. Tell about m. longissimus.
11. Tell about m. spinalis.
12. Tell about m. transeverso-spinalis.
13. Which muscles form suboccipital group?
14. Tell about suboccipital muscles.

Lesson 23.

Muscles of the shoulder.

Primary muscles of the shoulder placed surround the shoulder joint and producing motion at the glenohumeral joint. Also they subdivided into two groups: muscles of the shoulder girdle and muscles of the arm.

Muscles of the shoulder girdle

1. Deltoid muscle (**m. deltoideus**) is placed superficially, subcutaneous and divided into three parts: clavicle, arcomion and scapular. The first clavicle part originates from lateral third of the clavicle, the second part originates from acromion process of the scapula and the third scapular part originates from the spine of the scapula. All these parts are united and inserted to deltoid tuberosity of humerus.

Its function is to abduct, adduct, flex, extend and rotate arm medially.

2. Supraspinatus muscle (m. supraspinatus) is placed on the back part of the scapula and originates from supraspinous fossa of the scapula to superior facet of greater tubercle of the humerus (fig. 61, 62).

Function: abducts arm and drag away the shoulder joint capsule.

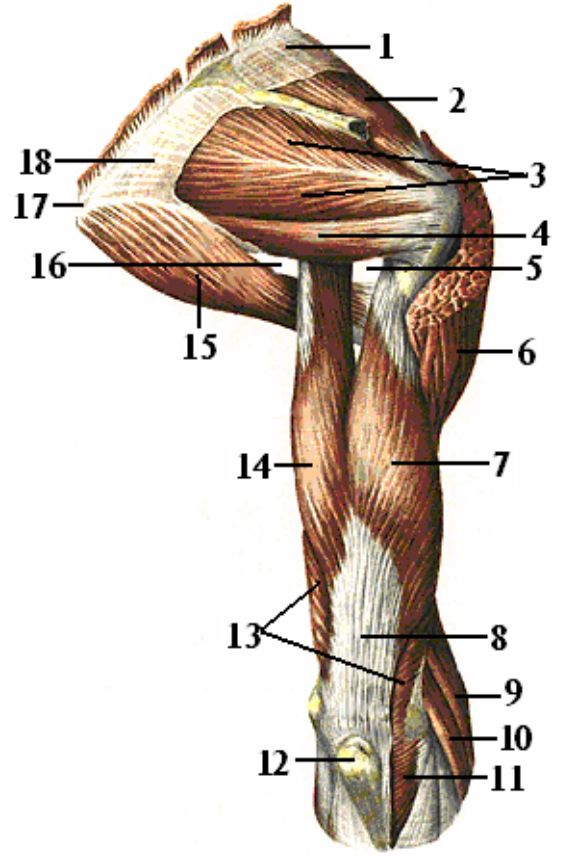


Fig. 61. Muscles of the shoulder and arm. (Posterior view).

1–fascia supraspinata; 2–m.supraspinatus; 3–m. infraspinatus; 4–m. teres minor; 5–foramen quadrilaterum; 6–m. deltoideus (отрезано) 7–caput laterale m. tricipitis brachii; 8–tendo m. tricipitis brachii; 9–m. brachioradialis; 10–m. extensor carpi radialis longus; 11–m. anconeus; 12–olecranon; 13–m. triceps brachii; 14–caput longum m. tricipitis brachii; 15–m. teres major; 16–foramen trilaterum; 17–angulus inferior scapulae; 18–fascia infraspinata;

3. Infraspinatus muscle (m. infraspinatus) originates from infraspinous fossa and is inserted on the middle facet of greater tubercle of the humerus.

Function: rotates the arm medially.

4. Subscapularis__muscle (m. subscapularis) is placed in subscapular fossa, starts from this fosse border and is inserted on the lesser tubercle of the humerus.

Function: rotates arm medially.

5. Teres minor muscle (m. teres minor) originates from the upper portion of lateral border of the scapula and is inserted on lower facet of greater tubercle of the humerus.

Function: rotates the arm laterally or **supinatoris** arm.

6. Teres major muscle (m. teres major) originates from the dorsal surface of inferior angle of the scapula and is inserted on the medial lip of intertubercular groove of the humerus or of the crests of the lesser tubercle of the humerus. Function: adducts and rotates arm medially. If the arm is immuvable this muscle pulls scapula's lower angle laterally.

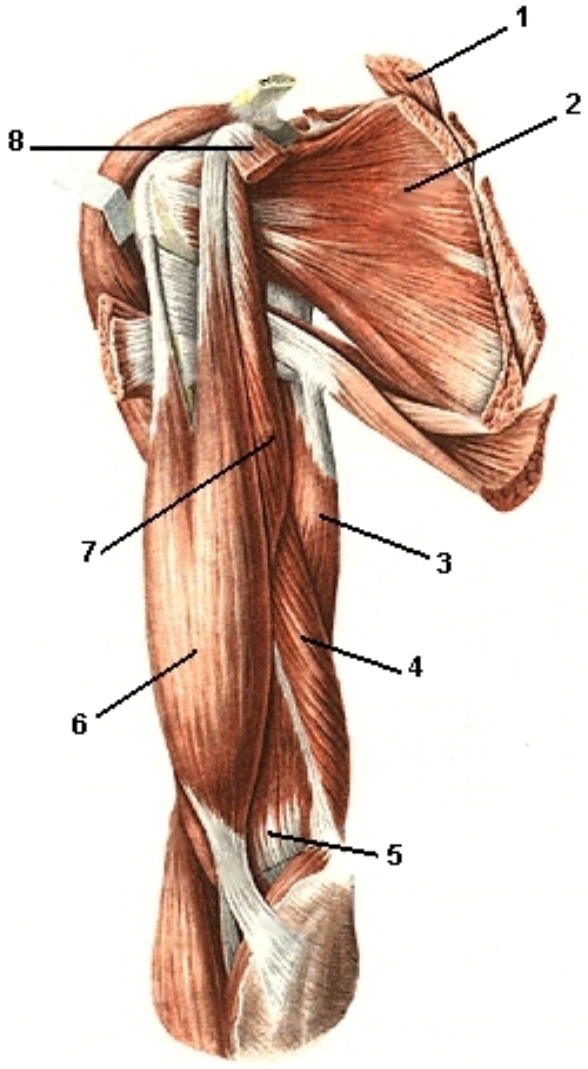


Fig. 62. Muscles of the shoulder and arm.
Anterior view.

1 – m. levator scapulae;
2 – m. subscapularis;
3 – caput longum m. triceps brachii;
4 - caput mediale m. triceps brachii;
5 – m. brachialis;
6 – m. biceps brachii;
7 – m.coracobrachialis;
8 – m. pectralis minor.

The muscles of the arm

The arm muscles are divided into anterior and posterior compartments by the medial and lateral intermuscular septa.

The muscles in the anterior compartment are: the biceps brachii, brachialis and coracobrachialis (fig. 62). These muscles produce flexion at the elbow and supination of the forearm.

1. Biceps brachii (**m. biceps brachii**) **muscle** has two heads: long and short; long head originates from supraglenoid tubercle, short head from coracoid process, and is inserted on tuberosity of the radius.

Function: It flexes arm and forearm, supinates forearm.

2. Muscle brachialis (m. brachialis) originates from lower anterior surface of the humerus and is inserted into coronoid process of the ulna and ulnar tuberosity.

Function: is to flex the forearm.

3. Corocobrachialis muscle (m. corocobrachialis) originates from corocoid process and is inserted into the middle third of medial surface of humerus.

Function: flexes and adducts arm. In the posterior compartment only the triceps brachii and anconeus muscles are found.

1. Triceps brachii muscles (**m. triceps brachii)** has three heads: long, lateral and medial. Each of the heads has different origin. The long head originates from infraglenoid tubercle of scapulae; lateral head originates from superiorly to radial groove of humerus and lateral intermuscular septa; medial head originates from inferiorly to radial groove and medial intermuscular septa. All these heads are united and inserted to posterior surface of olecranon process of the ulna.

Its action is to extend forearm.

2. Muscle anconeus (m. anconeus) originates from lateral epicondyle of humerus and is inserted to olecranon and upper part of posterior surface of the ulna.

Function: extends forearm.

Questions for self – study:

1.What are the muscles of the shoulder girdle?
2. Tell about the deltoid muscle.

3. Tell about m. supraspinatus and infraspinatus.
4. Tell about m. teres major and minor.
5. Show subscapular muscle in the illustration and tell about it.
6. Which muscles are the anterior compartments of brachial muscles?
7. Tell about m. biceps brachii.
8. Tell about m. coracobrachialis.
9. Which muscles are the posterior compartments of brachial muscles?
10. Tell about m. triceps brachii.

Lesson 24.

Muscles of the forearm.

The muscles of forearm are divided into anterior and posterior compartments by the medial and lateral intermuscular septum, which extends from the investing antebrachial fascia to the ulna and radius.

The muscles of both anterior and posterior compartments are divided into superficial and deep groups. The superficial group crosses the elbow and contributes to motion in that joint.

There are pronator teres, flexor carpi radialis, palmaris longus, flexor carpi ulnaris and flexor digitorum superficialis in superficial layer of the anterior compartment. Deep layer consists of flexor digitorum profundus, flexor policis longus, and pronator quadratus. They are called flexors.

Muscles of posterior compartment of the forearm are divided into superficial and deep layers too.

There are muscles brachioradialis, extensor carpi radialis longus, extensor carpi radialis brevis, extensor carpi ulnaris, extensor digitorum, extensor digiti minimi in the superficial layers are located.

Deep layer include muscles supinator, abductor pollicis longus, extensor pollicis brevis, extensor indicis. They are called extensors.

Muscle of the anterior forearm.

Superficial group:

1. M.Pronator teres originates from medial epicondyle and coranoid process of ulna, is inserted on lateral middle shaft of radius.
Its action is to pronate forearm.

2. M.Flexor carpi radialis – originates from medial epicondyle of humerus, is inserted on the anterior surface of the basis of the second and the third metacarpals bones.

Function: flexion of the forearm, flexion and abduction of the hand.

3. M.Palmaris longus – originates from medial epicondyle of shoulder bone and is inserted on palmar aponeurosis.

Function: tense the palmar aponeurose (wide fascia).

4. M.Flexor carpi ulnaris- originates with two heads. The first head originates from medial epicondyle of humerus; the second head originates from medial border of olecranon and posterior border of ulna. Both heads cling together and are inserted on pisiform bone, but don't end, because this muscle's tendon goes to hook of humatum bone and form **ligamentum pisohamatum,** and then continue to the base of the fifth metacarpal bone and form **ligamentum pisometacarpeum**.

Its action is to flex and adduct hand as well as to flex forearm.

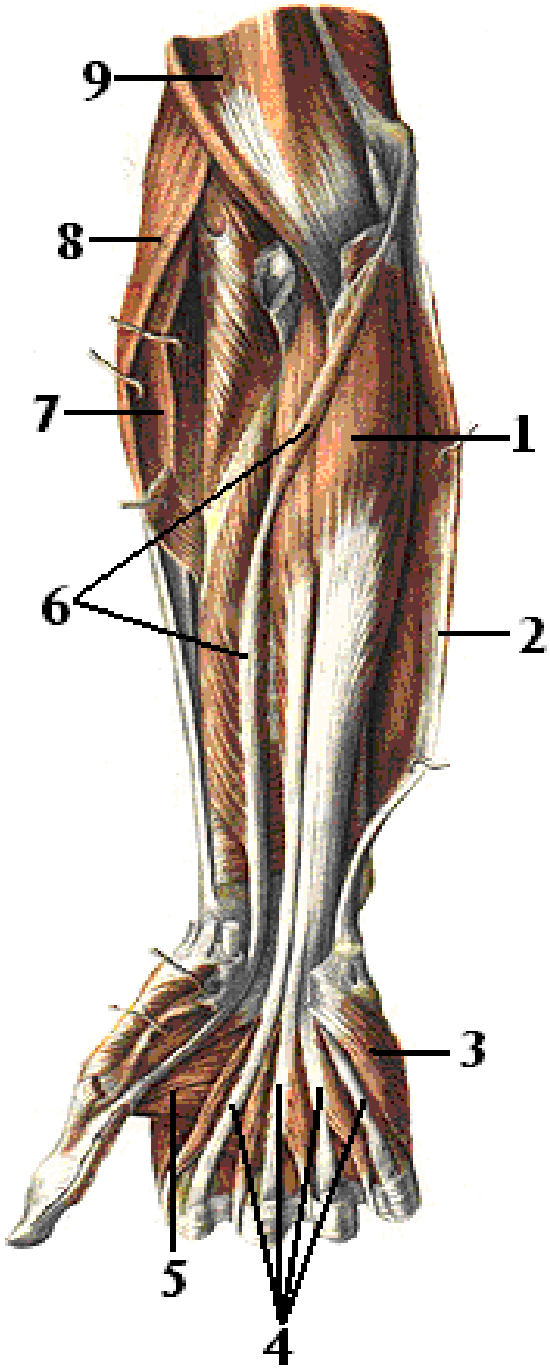


Fig. 63. Muscles of the anterior forearm. Third layer.

1–m. flexor digitorum profundus;

2–m. flexor carpi ulnaris;

3–m. opponens digiti minimi;

4–tendines m. flexoris digitorum profundi;

5 – m. adductor pollicis;

6–m. flexor pollicis longus;

7–m. extensor carpi radialis longus;

8–m. brachioradialis;

9 – m.brachialis.

5. M.Flexor digitorum superficialis originates from two heads. First of them (brachioulnar head) originates from medial

epicondyle of humerus and medial border of coronoid process of ulna. The second head (radial head) originates from oblique line of radius. Both heads cling together form general tendon which is subdivided into four tendons; each of them is inserted with two legs to anterior surface of base of middle phalanges of 2- 5 fingers.
Function is to flex in the proximal interphalangeal joints; to flex hand and forearm.

Deep group: 1. M.Flexor digitorum profundus originates from anteromedial surface of ulna, its proximal two-thirds and interosseous membrane and it is inserted by four tendons on the base of distal phalanges of 2 – 5 fingers (fig. 63).

Its action is to flex distal phalanges.

2. M.Flexor pollicis longus - originates from anterior surface of radius, interosseous membrane, and coronoid process and is inserted on the base of distal phalanx of the thumb. (fig.63).
Function: flexes the thumb.

3. M.Pronator quadratus – originates from anterior surface on distal part of ulna and is inserted on the anterior surface of distal part of radius.
Its action is to pronate forearm.

Muscles of the posterior forearm

Superficial group: (fig. 64).

1. Muscle brachioradialis – originates from lateral supracondylar ridge of the humerus and is inserted on the base of radial styloid process.
Function: It flexes forearm. (fig. 64).

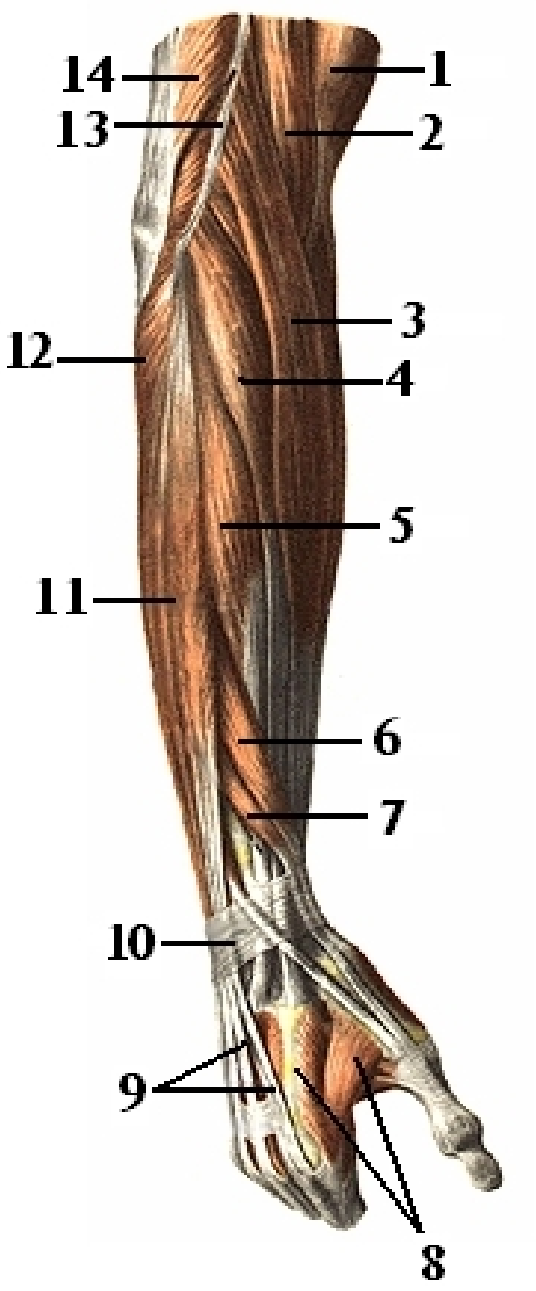
2. M.Extensor carpi radialis longus – originates from lateral epicondyle of the humerus, is inserted on back (posterior) surface of the second metacarpal's bone base. Its action is to extend and abduct hand.

3. M.Extensor carpi radialis brevis - originates from lateral epicondyle of the humerus, is inserted on the posterior surface of third metacarpal's bone base.
Its action is to extend and abduct hand.

4. M.Extensor digitorum - originates from lateral epicondyle of the humerus, is inserted on extensor expansion of four digits and base of the middle and distal phalanges. Its action is to extend from second to fourth fingers.

5. M.Extensor digiti minimi – originates from lateral epicondyle of the humerus and is inserted into extensor's aponeurous of little finger and basis of middle and distal phalanges.
Its function is to extend little finger.

Fig. 64 Muscles of the right forearm.



Lateral view.

1– m. biceps brachii; 2–m. brachialis;

3–m. brachioradialis; 4– m. extensor carpi radialis longus; 5–m. extensor carpi radialis brevis; 6 – m. abductor pollicis longus; 7–m. extensor pollicis brevis;

8–m.interosseus; 9–tendines m. extensoris digitorum; 10–retenaculum extensorum; 11–m. extensor digitorum; 12–m. anconeus; 13 – septum intermusculare brachii laterale; 14 – m. triceps brachii.

6. M.Extensor carpi ulnaris (fig.64) - originates from lateral epicondyle and posterior surface of ulna, is inserted on dorsamedial surface of the fifth metacarpal bone base. Its action is to extend and adduct the hand.

Deep group:

1. Muscle supinator - originates from lateral epicondyle of the humerus radial collateral and annular ligaments and crista supinatoris of ulna, is inserted on the lateral side of upper part of the radius.
Function is supinates forearm.

2. M.Abductor pollicis longus - originates from interosseous membrane, middle third of posterior surfaces of the radius and ulna, is inserted on the lateral surface of the first metacarpal's bone base.

Action is to abduct thumb and hand.

3. M.Extensor pollicis longus – originates from the middle third of the posterior surface of the ulna and interosseous membrane and is inserted on the base of distal phalanx of the thumb. It extends distal phalanx of the thumb and abduct the hand.

4. M.Extensor pollicis brevis - originates like that mentioned above from the middle third of the posterior surface of the ulna and interosseous membrane and is inserted on the base of the proximal phalanx of the thumb.

Its action is extends proximal phalanx of the thumb and abducts the hand.

5. M.Extensor indicis - originates from the posterior surface of the ulna and interoseous membrane and is inserted on extensor tendons of index finger.

Action is to extend index finger.

Questions for self – study:

1. What muscles on the first layer of anterior forearm are located?
2. Tell about m. pronator teres and m. flexor carpi radialis.
3. Tell about m. palmaris longus and m. flexor carpi ulnaris.
4. What muscles are included the second layer of anterior forearm.
5. Tell about of third layer of anterior forearm muscles.
6. Tell about muscles, which are located on the fourth layer of anterior forearm.
7. What muscles are included into the lateral group of forearm?
8. What groups of muscles is the posterior forearm divided into?
9. Tell about superficial group of posterior forearm muscles.
10. Tell about deep group of posterior forearm muscles.

Lesson 25.

Muscles of the hand.

Muscles of the hand are divided into three groups**: thenar muscles, hypothenar and** midpalmar or **mesothenar muscles.**

Thenar muscles.

Thenar muscles or thumb group consist of abductor pollicis brevis, flexor pollicis brevis, opponens pollicis and adductor pollicis. (fig.65).

1. Muscle Abductor pollicis brevis (m. abductor pollicis brevis) starts from **retinaculum flexorum**, scaphoid and trapezium bones and is attached to lateral side of the base of proximal phalanx of thumb.

Function - abduct the thumb.

2. Muscle Flexor pollicis brevis (m. flexor pollicis brevis) has two heads: superficial and profundus. Superficial head starts from retinaculum flexorum, deep head starts from trapezium and trapezoideum bones, and both heads connect and are attached to the base of proximal phalanx of thumb. Function- flexes thumb.

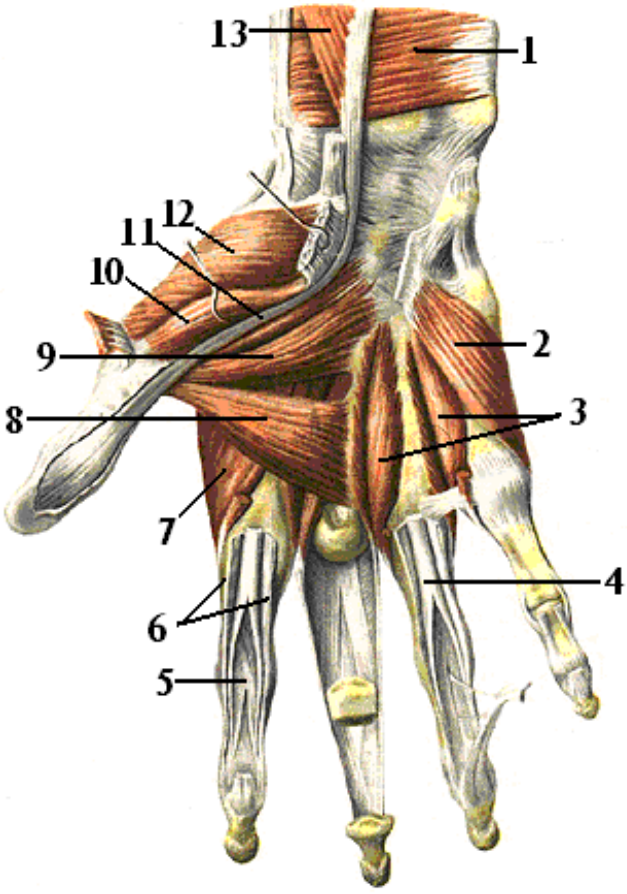


Fig. 65 Muscles of the right hand; Palm surface.

1–m. pronator quadratus; 2–m. opponens digiti minimi; 3–mm. interossei palmares; 4–tendo m. flexoris digitorum superficialis; 5–chiasma tendineum; 6–vagina fibrosa digitorum manus; 7–m. interosseus dorsalis I; 8–caput trasversum m. adductor pollicis; 9–caput obliquum m. adductor pollicis;.10–m.flexor pollicis brevis; 11–tendo m. flexoris pollicis longi; 12–m. opponens pollicis; 13–m. flexor pollicis longus.

3. Muscle Opponens pollicis (m. opponens pollicis) starts from retinaculum flexorum and trapezium bone, is attached to lateral side of the first metacarpal bone.

Action- opposes thumb to other digits.

4. Muscle Adductor pollicis (**m. adductor pollicis**) has two heads: oblique and transverse. Oblique head starts from capitate bone and the base of second and third metacarpal bones, transverse head starts from palmar surface of third metacarpal bone and both heads come together and

form one tendon which is attached to medial side of base of proximal phalanx of thumb.

Function- adducts the thumb.

Hypothenar muscles.

Hypothenar muscles or little finger group include palmaris brevis, abductor digiti minimi, flexor digiti minimi brevis and opponens digiti minimi muscles..

1. Muscle Palmaris brevis (m. palmaris brevis) originates from medial side of retinaculum flexorum and palmar aponeurosis and is attached to skin of medial side of palm.

Function- wrinkles skin on the medial side of palm.

2. Muscle Abductor digiti minimi (m. abductor digiti minimi) starts from pisiform bone and tendon of flexor carpi ulnaris muscle and is attached to medial side of base of proximal phalanx of little finger.

Function- abducts little finger.

3. Muscle Flexor digiti minimi brevis (m. flexor digiti minimi brevis) starts from retinaculum flexorum and hook of hamate bone, is attached to medial side of base of proximal phalanx of little finger.

Function- flexes proximal phalanx of little finger. (fig.65).

4. Muscle Opponens digiti minimi (m. opponens digiti minimi) originates from retinaculum flexorum and hook of hamate bone, is attached to medial side of fifth metacarpal bone.

Action- opposes little finger.

Midlpalmar or mesothenar muscles.

Mesothenar muscles are located between thenar and hypothenar muscles and consist of lumbricals and interossei palmaris and interossei dorsalis muscles.

1. **Muscles lumbricals (m.m. lumbricales).** There are four lumbrical muscles: two medial and two laterals. Each of these muscles starts from tendons of flexor digitorum profundus: the first and second (two medial lumbricals) starts from lateral side of flexor digitorum profundus tendons that is attached to proximal phalanx of index and middle fingers, third lumbrical muscle starts from adjacent sides of tendons which goes to middle and ring fingers and fourth starts from adjacent sides of flexor digitorum profundus tendons that is attached to ring and little fingers. All

those muscles pass downward and are attached to lateral side of extensor expansion.

Action- flexes proximal phalanx of second to fifth fingers and extends medial and distal phalanx.

2. **Palmar interossei muscles (m.m. interossei palmares)**. (fig.65). There are three muscles which are between the second to the fifth metacarpal bones. First muscle starts from medial side of second metacarpals and is attached to the base of proximal phalanx of index finger. Second and third start from lateral side of the fourth and the fifth metacarpal bones and are attached to the back side of proximal phalanx of ring and little fingers.

Function- when all these muscles contract fingers came to middle finger (fingers adduct).

3. **Dorsal interossei muscles (m.m. interossei dorsales)**. There are four muscles which start from adjacent sides of metacarpal bones and are attached to lateral side of the bases of proximal phalanges; tendon of the first muscle is attached to lateral side of proximal phalanx of index, second is attached to lateral side of proximal phalanx of middle finger, third is attached to medial side of middle fingers proximal phalanx and fourth is attached to the medial side of proximal phalanx of ring finger.

Function – fingers abduct.

Questions for self – study:

1. What groups of muscles is inner surface of the hand divided into?
2. What muscles are included into the thenar group?
3. Which muscles form hypothenar group?
4. What muscles are included into the mesothenar group?
5. What synovial sheaths of tendons are located on the palmar surface of the hand?
6. What sheaths of tendons are located on the dorsal surface of the hand.
7. What is the structure of axillary’s fosse?
8. What are the borders of triangle opening?
9. What are the borders of quadrangle opening?
10. What is the structure of cubital fosse?
11. What formations are there on the anterior surface of the forearm?

Lesson 26.

Muscles of the gluteal region and the thigh.

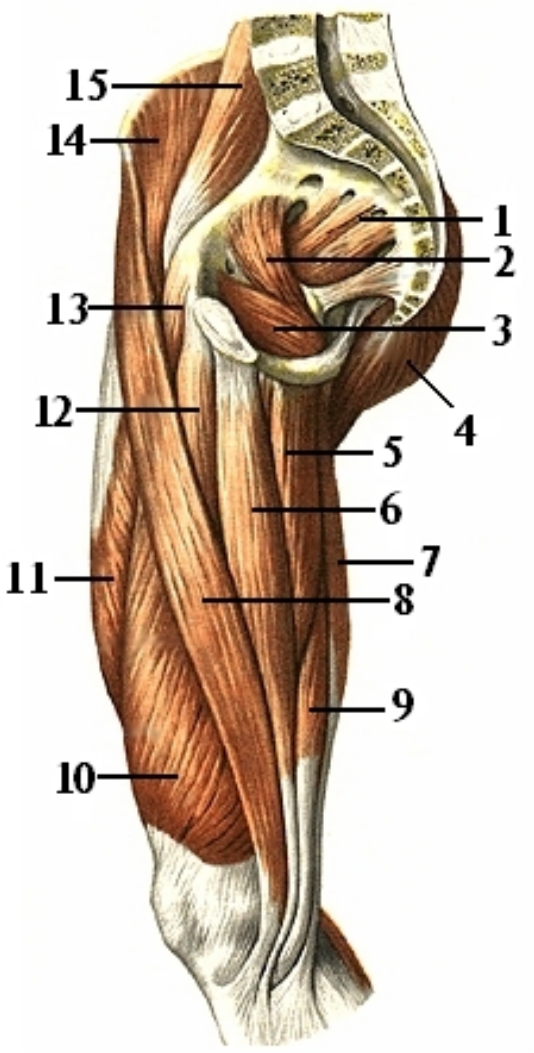
Muscles of the gluteal region are subdivided into two groups; anterior (inner) and posterior (outer).

Anterior muscles of the gluteal region

Anterior group consists of: iliopsoas, psoas major and minor, obturatorius internus, gemellus superior and inferior, and piriformis muscles.

1. Muscle Iliopsoas (m. iliopsoas) consists of two muscles- muscle psoas major and muscule iliacus.

Muscle Psoas major starts from transverse processes and bodies of lower thoracic and upper five lumbar vertebrae and is attached to lesser trochanter of the femur (fig.66).



Muscle iliacus starts from the border of iliac fossa connects with psoas major and formed one tendon which passes under ligamentum inguinale through muscl's lacuna and is attached to lesser trochanter of the femur (fig.66).

Function- flexes thigh and trunk.

Fig. 66. Muscles of gluteal region; inner group. Thigh muscles;anterior

1–m. piriformis; 2– m. obturatorius internus; 3– m. obturatorius externus; 4–m. gluteus maximus; 5 – m. adductor magnus; 6–m. gracilis; 7–m. semitendinosus; 8–m. sartoriussemitendinosus; 9–m. semimembranosus; 10–m. vastus medialis; 11–m.rectus femoris; 12–m. adductor longus; 13–m. pectineus; 14–m.iliacus; 15–m psoas major.

2. **Muscle psoas minor (m. psoas minor**), in 40% of adults it may be absent, starts from bodies and intervertebral disks of lower thoracic and upper lumbar vertebrae and is attached to iliac fascia and pectinal line and eminence.

Function – tenses the iliac fascia and aids in flexion of the trunk.

3**. Muscle obturator internus (m. obturatorius internus**) starts from margin of obturator hole and inner surface of obturator membrane, passes through foramen sciatic minor out of the pelvic cavity and is attached to greater trochanter's fossa of femur.

Function- abducts thigh and rotates laterally.

4**. Superior gemelli** and **inferior gemelli muscles (m.gemellus superior et inferior**).

Gemelli superior starts from ischial spine (spina ischiadica), gemelli inferior starts from ischial tuberosity (tuber ischi). Both muscles pass through foramen ischiadica minor and together with tendon muscle obturator internus are attached to trochanteric fossa.

Function- rotates thigh laterally.

5**. Muscle Piriformis** starts from pelvic surface of the sacrum near foramina sacralia pelvina and sacrotuberous ligament, passes through foramen ischiadica major and is attached to upper end of greater trochanter. Function- rotates the thigh laterally

Above and lower this muscles tendon two holes: foramina suprapiriforme et infrapiriforme are formed, where the nerves and vessels pass out of the pelvic cavity.

They are called foramen suprapiriformis and infrapiriformis.

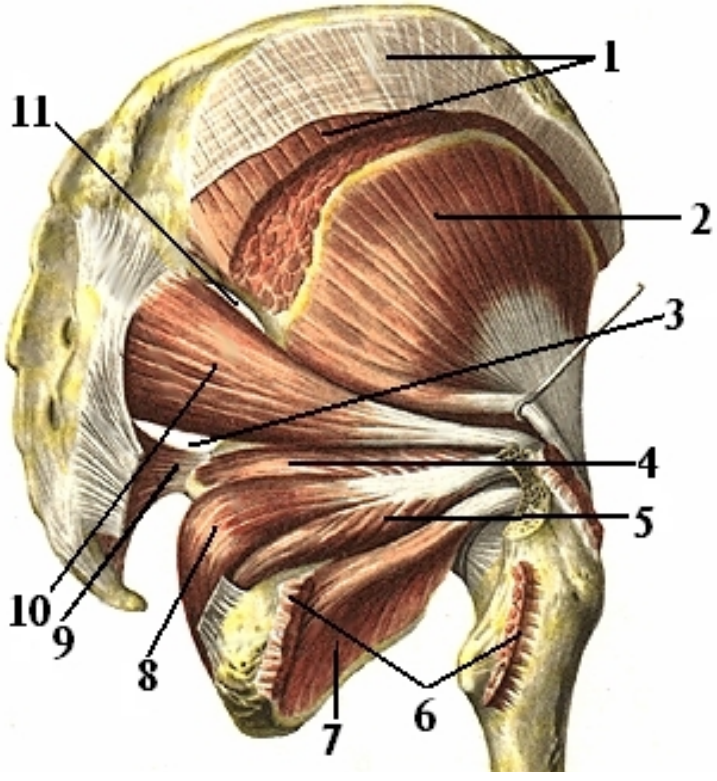


Fig.67. Muscles of gluteal region; deep layer.
1–m gluteus medius
2–m. gluteus minimus;
3–foramen infrapiriforme;
4–m gemellus superior;
5–m.gemellus inferior;
6–m duadratus femoris;
7–m. obturatorius externus;
8–m. obturatorius internus;
9–lig. sacrospinale;
10–m piriformis;

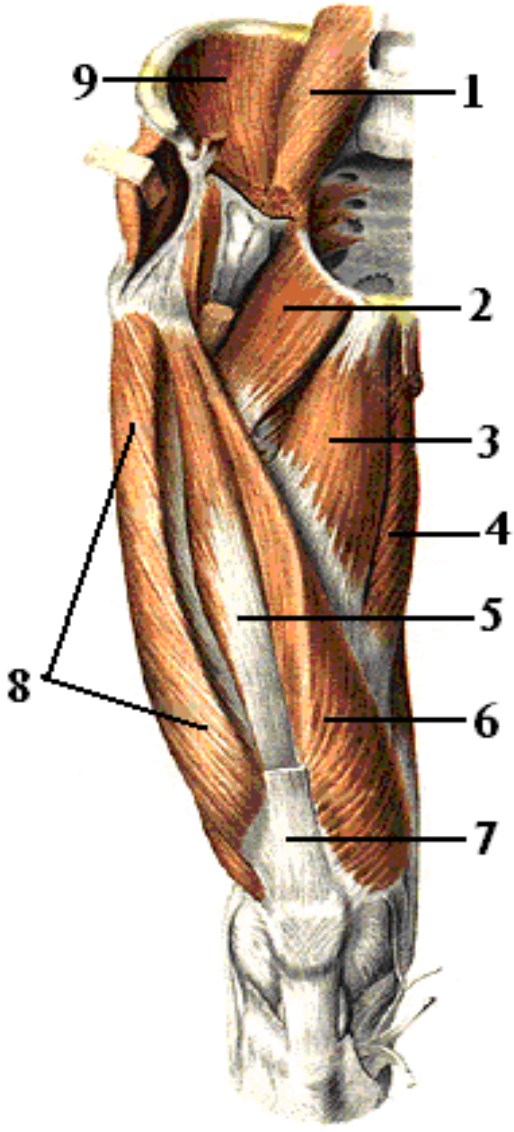
11–foramen suprapiriforme.

Posterior muscles of gluteal region

1. Muscle gluteus maximus (m. gluteus maximus) starts from posterior line of iliac wing, posterior surface of the sacrum and coccyx, sacrotuberous ligament and is inserted to gluteal tuberosity of the femur.
Function- extends and rotates the thigh laterally.

2. **Muscle gluteus medius (m. gluteus medius**) starts from iliac wing, between anterior and posterior gluteal lines and is attached to greater trochanter of the femur.
Function- abducts and rotates the thigh medially.

3. **Muscle gluteus minimus (m. gluteus minimus)** – lies under muscle gluteus medius, starts from iliac wing between anterior and inferior gluteal lines and margin of the greater sciatic notch, passes downward and is attached to greater trochanter of the femur.
Its function is the same as of gluteus medius.



4**. Muscle tensor fasciae latae** (**m. tensor fascia latae)** starts from anterior superior iliac spine and is inserted to iliotibial tract.
Function- tenses iliotibial tract and flexes the thigh.

Fig. 68 Muscles of right side of pelvis and right thigh; medial view.

1–m. psoas major;

2–m. pectineus;

3 – m. adductor longus;

4 – m. adductor magnus;

5 – m. vastus intermedius;

6– m. vastus medialis;

8– m. vastus lateralis;

9– m. iliacus.

5. **Muscle quadratus femoris** (**m. quadratus femoris**) - is a flat quadriangle muscle that starts from ischial tuberosity and is attached to intertrochanteric crest.
Function- rotates the thigh laterally.

6. **Muscle obturator externus** (**m. obturatorius externus**) is triangular in form, starts from margins of obturator membrane and obturator hole, branch of ischial bone and is attached to intertrochanteric fossa of the femur.
Function- rotates the thigh laterally.

Muscles of the thigh.

Muscles of the thigh are divided into three groups: anterior, posterior and medial.

Anterior group.

1. Muscle Sartorius (m. sartorius) starts from anterior superior iliac spine and is attached to upper part of medial surface of the tibia.
Function- flexes and rotates the thigh laterally and flexes the leg.

2. Muscle Quadriceps femoris (m. quadriceps femoris) is the largest muscle of the human body. It is subdivided into four muscles:

a) **Rectus femoris**- starts from anterior inferior iliac spine and superior rim of acetabulum,is attached to the base of the patella and connects with tendons of other parts of quadriceps muscle forms ligamentum patella which is attached to tibial tuberosity.

b) **Vastus medialis** starts from intertrochanteric line, linea aspera and medial intermuscular septum, is attached to medial side of the patella and continues to tibial tuberosity.

c) **Vastus intermedius** starts from upper two-third of the femur shaft, lower part of lateral intermuscular septum and is attached to upper border of the patella and tibial tuberosity.

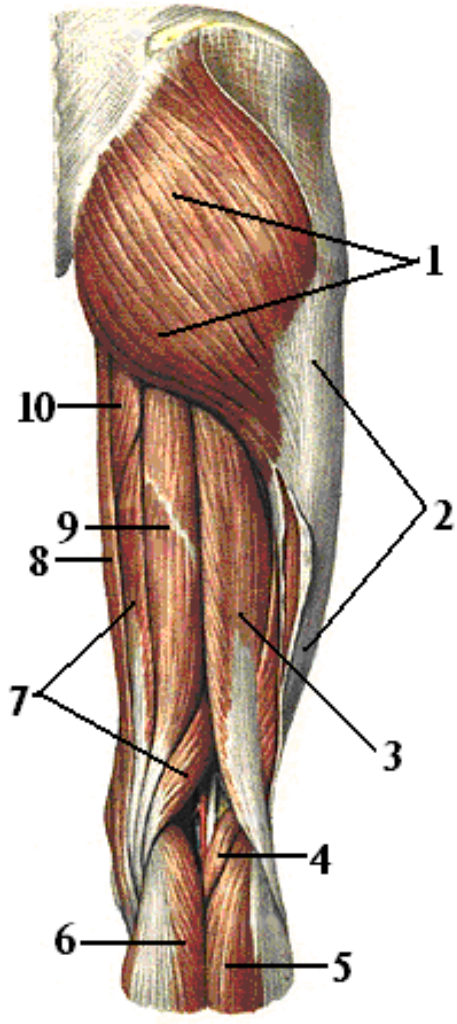
d) **Vastus lateralis** starts from intertrochanteric line, lower part of greater trochanter, linea aspera, gluteal tuberosity, lateral intermuscular septum and is attached to lateral side of the patella and tibial tuberosity.

Function: Quadriceps muscle extends the leg.

Posterior muscles of the thigh

There are only three muscles in this group.

1. Muscle Biceps femoris (m. biceps femoris) has two heads: long and short (fig.69).



Long head starts from tuber ischi, short head from labium laterale linea aspera and lateral intermuscular septum. Both heads are joined together and form one tendon which is attached to the head of the fibula.
Function: extends the thigh; flexes and rotates the leg laterally.

Fig. 69. Muscles of right side of pelvis and right thigh; posterior view.

1–m. gluteus maximus; 2–tractus iliotibialis; 3–m.biceps femoris; 4-m. plantaris; 5–caput laterale m. gastrocnemius; 6–caput mediale m. gastrocnemius;7–m.semimembranosus; 8–m.gracilis; 9–m. semitendinosus; 10–m. adductor magnus.

2. Muscle semitendinosus (m. semitendinosus) starts from tuber ischii, and in the middle half of femur's shaft, form a long tendon which is attached to medial surface of the upper part of the tibia (fig.69).
Function: extends the thigh, flexes and rotates the leg medially.

3. Semimembranosus muscle (m. semimembranosus) starts from tuber ischii as membrane which in the half part of femur's shaft converts into muscle and is attached to the posterior surface of the medial condyle of the tibia (fig.69).
Function is the same as mentioned above.

Medial muscles of the thigh

1. **Muscle gracilis** (**m. gracilis)** extends from the body and inferior pubic branch, is attached to the medial surface of the upper part of the tibia.
Function is to adduct and flex the thigh and to flex and rotate the leg medially.

2. **Pectineus muscle (m. pectineus)** starts from pectineal line of pubis and is attached to pectineal line of the femur.
Function: adducts and flexes the thigh.

3. Adductor longus (m. adductor longus) starts from the body and outer surface of the superior pubis branch is attached to the middle third of linea aspera, on the medial lip.
Function is the same -adducts and flexes the thigh.

4. Adductor brevis (m. adductor brevis) starts from the body and inferior pubis branch and is attached to the upper part of the linea aspera.
Function: adducts and flexes the thigh.

5. **Adductor magnus** (m. adductor magnus) is the biggest of adductors – starts from tuber ischii, inferior pubis and ischial branches, is attached to medial lip of linea aspera along its length.
Function: adducts and flexes the thigh.

Anatomical fibrous structures of the anterior surface of thigh and popliteal fossa.

Inguinal ligament separates abdominal wall from the thigh. Under this ligament are formed two passages: for muscles and for vessels.

The first is called **lacuna musculorum** and located laterally, is bounded by inguinal ligament superiorly and anteriorly, by iliac bone posteriorly and iliopectineal arch medially.
Through **lacuna musculorum** tendon muscle iliopsoas and femoral nerve pass.
The second passage is called **lacuna vasorum,** lies medially and is bounded by inguinal ligament anteriorly, by ligamentum pectinaty posteriorly and inferiorly, by iliopectineal arch laterally, and medially by ligamentum lacunare.
Through **lacuna vasorum** femoral artery, femoral vein and lymphatic vessels is passing.

Femoral triangle (trigonum femorale) – Scarp's triangle is formed on the anterior surface of the thigh. It is superiorly bounded by the

unguinal ligament, laterally by muscle sartorius and medially by adductor longus muscle.
Femoral triangle contains the femoral nerve and vessels.

Femoral ring (annulus femoralis) is the abdominal opening of the femoral canal. Also it is presence in the inner angle of lacuna vasorum. It is bounded by the inguinal ligament anteriorly, the femoral vein laterally, the lacunar ligament medially, and the pectineal ligament posteriorly.

Adductor canal (canalis adductorius). From lower angle of femoral triangle starts canalis adductorius which connected the anterior surface of thigh with the popliteal fossa. Through this canal femoral artery, veins and nerves pass.

Adductor canal (gunterov canal) begins at the apex of femoral triangle and ends at the adductor hiatus or hiatus tendineus. This canal lies between the adductor magnus medially, adductor longus laterally, and vastus medialis anteriorly. It is covered by the sartorius muscle and fascia. Through its femoral vessels, saphenous nerve and the nerve to the vastus medialis muscle pass**.**

Adductor hiatus (hiatus tendineus) is the aperture in the tendon of insertion of the adductor magnus. It allows the passage of the femoral vessels into the popliteal fossa.

Femoral canal located medially to the femoral vein in the femoral sheath. In normal organism femoral canal is absent. It is visible only in the presence of femoral hernia and has three walls.
Anterior wall is formed by superficial layer of **fascia lata**, posterior wall is deep layer of **fascia lata** and lateral wall is femoral vein. Femoral canal contains fat, areolar connective tissue and lymph nodes. It is a potential weak area and a site of femoral herniation.

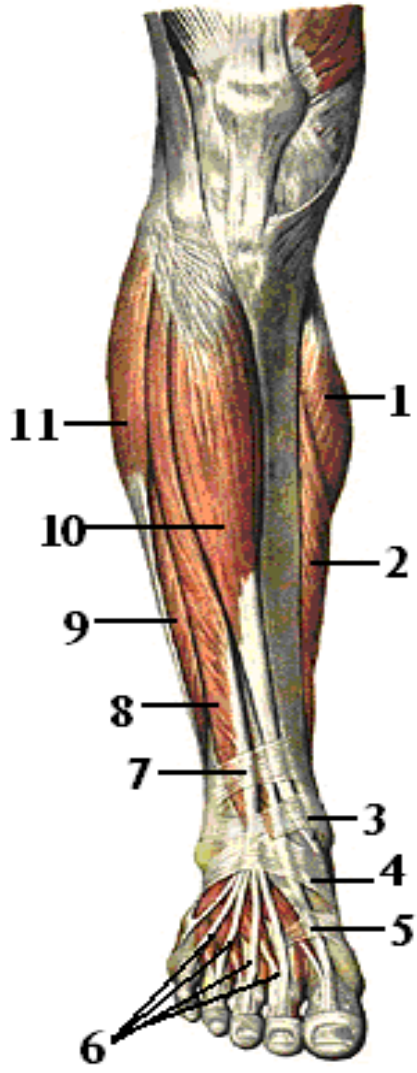
Popliteal fossa (fossa poplitea) is quadriangle as romb in shaped, behind knee joint lies. It is bounded superomedially by the semitendinosus and semimembranosus muscles and superolaterally by the biceps femoris muscle. Inferiorly it is bounded by the lateral head of gastrocnemius muscle laterally and by the medial head of the gastrocnemius muscle medially. Floor of this fossa is composed of the femur, the oblique popliteal ligament, and popliteus muscle.
Fossa poplitea contains the popliteal vessels, the common peroneal and tibial nerves, and the small saphenous vein.

Questions for self – study:

1. What muscles are included into the anterior group of the pelvis?
2. Tell about m. piriformis, m. obturatorius internus and m. gemelli.
3. Tell about of the gluteal region muscles.
4. Tell about m. obturatorius externus, m. tensor fascia lata and m. quadratus femoris.
5. Tell about m. quadriceps femoris.
6. Show m. sartorius in the illustration and tell about it.
7. Which muscles are in the posterior compartments of the thigh?
8. What muscles are located on the medial surface of the thigh?
9. Tell about m. pectineus and m. gracilis.
10. Tell about adductor muscles.
11. What do you know about pelvic and thigh fascias?

Lesson 27.

Muscles of the leg and foot.



Muscles of the leg divided into three groups: anterior, posterior and lateral.

Anterior group

1. Tibialis anterior muscle (m. tibialis anterior) starts from lateral tibia's condoyle; lateral surface of tibia's shaft and interosseous membrane and attached to first cuneiform and base of first metatarsal bones.

Function is dorsiflexes and inverts foot.

Fig. 70. Muscles of the leg and foot; anterior view.

1–caput mediale m. gastrocnemius; 2–m. soleus; 3, 4–retinaculum mm. extensorum inferius; 5–tendo m. extensoris hallicis longi; 6–tendines m.extensoris digitorum longi; 7–retinaculum mm. extensorum superius; 8– m.extensor digitorum longus; 9–m. peroneus drevis; 10 – m . tibialis anterior; 11–m. peroneus longus.

2. Extensor hallucis longus (m. extensor hallicis longus) starts from middle half of anterior surface of fibula and interosseous membrane attaches to base of distal phalanx of big toe. Function: extend big toe.

3. Extensor digitorum longus (m. extensor digitorum longus) starts from lateral tibia's condyle, upper two-thirds of fibula and interosseous membrane directed lower and above ankle joint subdivided into four tendon; each of them also divided into two parts, which attached to base of middle and distal phalanges.

Function: extend all foot's fingers except big toe.

Lateral group

1. Peroneus longus muscle (m. peroneus longus) starts from head and upper lateral side of fibula directed downward passing on the posterior surface of lateral malleolus on the undersurface of foot, where passed obliquely and attached to base of first and second metatarsal and medial cuneiform bones. Function is averts and plantar flexes foot.

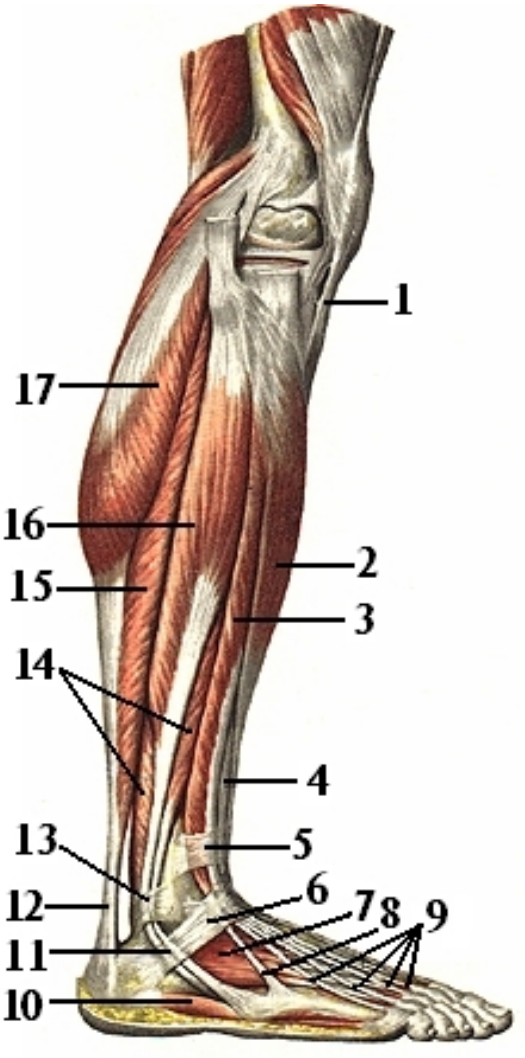


Fig.71 Muscles of the leg; lateral view.

1–lig. patellae; 2–m tibialis anterior;

3 – m. extensor digitorum longus; 4–m. extensor hallicis longus; 5–retinaculum mm. extensorum superius; 6–retinaculum mm. extensorum inferius; 7–m extensor digitorum brevis;

8–m. peroneus tertius; 9–tendines mm. extensorum digitorum longi;

10–m.abductor digiti minimi;

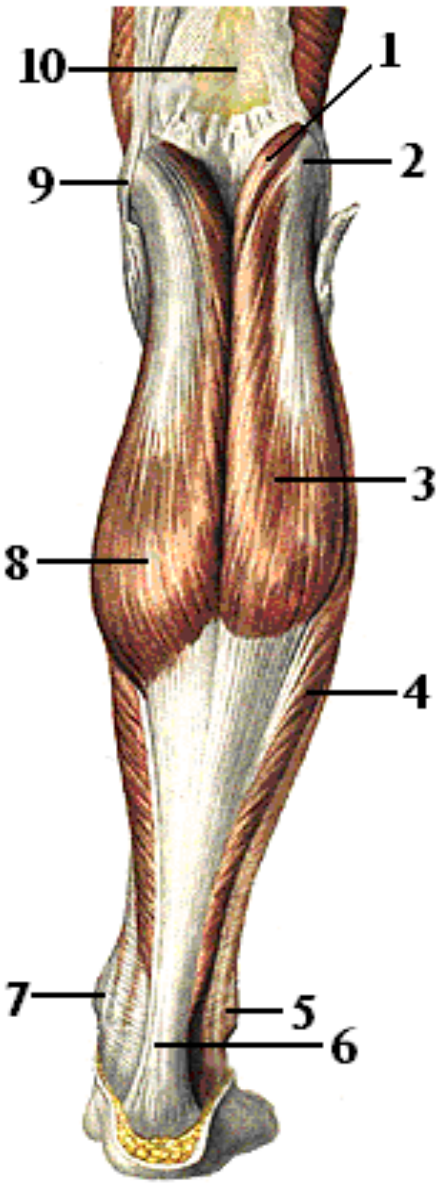
11–retinaculum mm. peroneorum inferius; 12–tendo calcaneus;

13–retinaculum mm. peroneorum superius; 14–m. peroneus brevis;

15–m. soleus; 16–m. peroneus longus; 17–m. gastrocnemius.

2. Peroneus brevis muscle (m. peroneus brevis) starts from lower lateral side of fibula and intermuscular septa and attached to base of fifth metatarsal bone.

Function: averts and plantar flexes of foot.



Posterior group

Subdivided into two layers supeficial and deep superficial includes triceps and plantar muscles.

1. Muscle triceps sure consists of two muscles: gastrocnemius and soleus

Fig.72 Muscles of the leg;

Posterior group, superficial layer.

1–m. plantaris;

2–epicondylus lateralis femoris;

3–caput laterale m. gastrocnemius;

4–m soleus;

5–malleolus lateralis;

6–tendo calcaneus;

7–malleolus medialis;

8–caput mediale m. gastrocnemius;

9–epicondylus medialis femoris;

10–fascies popliteus.

a) Gastrocnemius (m. gastrocnemius) has two heads-lateral and medial (fig. 72).

Lateral head start from lateral femoral's condyle and medial head from posterior surface of medial femoral's condyle.

In half of tibia's shaft two heads connect and formed one tendon, which join with tendon muscle soleus to forming tendo calcaneus (Achilies) and attached to posterior part of tuber calcanei.

Function: flexes knee and make plantar flexes of foot.

b) Muscle soleus (m. soleus) thin and flat muscle, starts from linea musculi solii with tendon muscle gastrocnemius formed tendo calcaneus or

tendo Achilii and attached to tuber calcaneus.
Function is plantar flexes of foot.
2. M.plantaris has short body and long tendon, starts from posterior surface of lateral femoral condyle form long tendo which passes between the astrocnemius and soleus muscles and attached together with these muscles tendon to tuber calcaneus.
Function is flextion and rotation leg medially.
Deep group separated from superficial group with deep fascia and included:
1) Popliteus muscle starts from lateral surface of lateral femur's condyle attached to upper posterior side of tibia.
Flexes and rotates leg medially and tenses knee joint capsule.
2) Flexor digitorum longus starts from middle posterior surface of tibia below linea musculi solei passes under medial malleolus and of its divided into two legs and attached to bases of distal phalanges second to fifth toes.
Function is flextion lateral four toes.
3) Flexor hallucis longus starts from lower two-thirds of fibula and interosseous membrane passes under sustentaculi tali in sulcus as this muscle name and attached to base of distal phalanx of big toe.
Function is flexes distal phalanx of big toe.
4) Muscle tibialis posterior starts from upper posterior parts of tibia and fibula and interosseus membrane formed tendon which passes under medial malleolus and attached to toberosity of navicular, three cuneiforms and bases of second to fourth metatarsal bones.
Function - plantar flexes and inverts foot.

Muscles of the foot.

Muscles of the foot divided into upper dorsal and plantar- sole muscles.
On the upper or dorsal surface two muscles lie.
1) M. Extensor digitorum brevis- starts from dorsal surface of calcaneus and divided into three tendons attached with the tendos of extensor digitorum longus and goes to distal and medial phalanges of second to fourth toes.
Function is extends toes
2) M. Extensor hallicis brevis extends of dorsal surface of calcaneus directed medially and attached to base of proximal phalanx of big toe. This muscle extends big toe.
Muscles of sole of foot. Under surface of foot subdivided into three

groups muscles: medial, intermedial and laeral (fig.73).

Medial group:

1) M. Abductor hallucis brevis starts of medial tubercle of calcaneus and attached to base of proximal phalanx of big toe.

Function is abducting big toe.

2) M. Flexor hallicis brevis starts from cuboid bone and third cuneiform bones and subdivided into two parts: one of them attached to proximal phalanx of big toe, the second part fixes to medial sesamoid bone.

Function: flexes big toe.

3) Muscle adductor hallicis consists of two heads: oblique and transversa.

a) Oblique head starts from cuboid bone, lateral cuneiform and bases of metatarsal from second to fourth and goes anterior and medially.

b) Transverse head starts from capsules of lateral four metatarso-phalangeal joints. Both heads cames together and form one tendon which is attached to base of proximal phalanx of big toe and lateral sesamoid bone.

Function: adducts big toe.

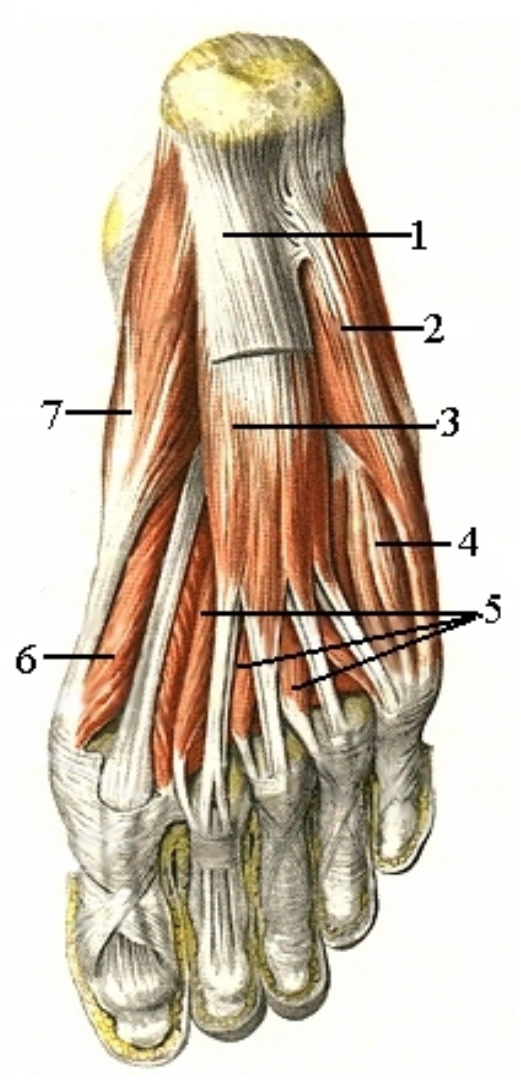


Fig. 73 Muscles of sole of foot.

1–aponeurosis plantaris;

2– m. abductor digiti minimi;

3–m. flexor digitorum brevis;

4 – m. flexor digiti minimi brevis;

5 – mm. lumbricales;

6 – m. flexor hallicis brevis;

7 – m. abductor hallucis.

Lateral group: form eminence of little toe and consists of two muscles.

1) M. Abductor digiti minimi - starts from under surface of mediall and lateral calcaneus tubercles and plantar aponeurosis and attaches to lateral part of base of proximal phalanx of little toe.

Function as same as name.

2) M. Flexor digiti minimi brevis - starts from under surface of fifth metatarsal bone and ligamentum plantare longus and attached to proximal phalanx of little toe. Function as same as name

Intermediate group.

1) M. Flexor digitorum brevis - starts from anterior part of tuber calcaneus and aponeurosis plantaris and subdivided into four tendons which passes anteriorly and near proximal phalanges also subdivided into two legs and attached to medial phalanges of second to fifth toes.Between those muscles tendons goes tendos of flexor digitorum longus muscle.
Function is flexion middle phalanges and reinforces fornix pedis.

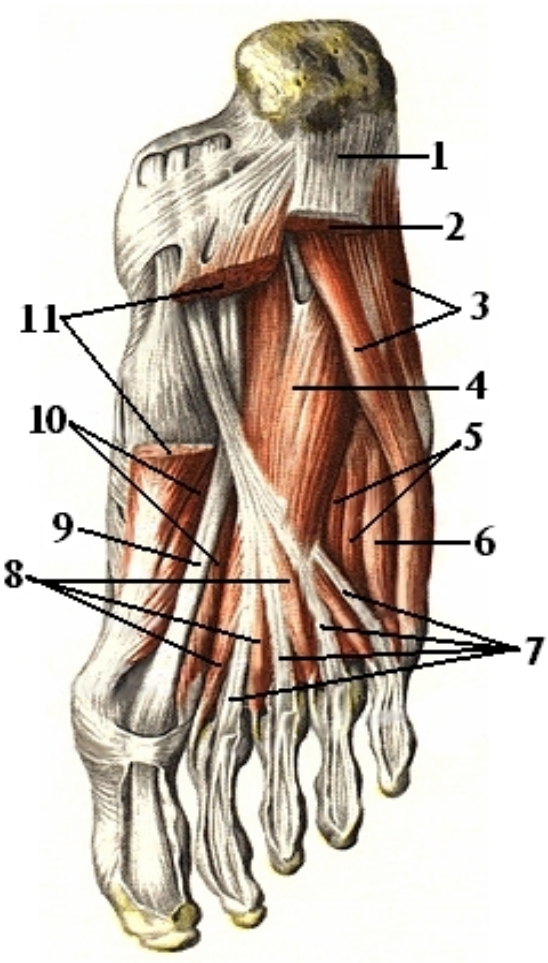


Fig. 74 Muscles of right foot.

Sole surface.

1–aponeurosis plantaris (cutting of);
2–m. flexor digitorum brevis;

3–m. abductor digiti minimi;

4–m. quadratus plantae;

5–mm. interosei plantares;

6–m. flexor digiti minimi;

7–tendines m.flexoris digitorum longi;

8–m. lumbricales;

9–tendo m. flexoris hallicis longi;
10–m. flexor hallicis brevis;

11–m. abductor hallicis.

2) M. Quadratus plantae - starts from sole surface of tuber calcanei and lig.plantare longus and is attached to tendos of flexor digitorum longus muscle (fig.74).
Function is aids in flexing toes.

3) Muscles lumbricals. There are four muscles. Three lateral muscles starts from tendons of flexor digitorum longus (adjacent) surface, the medial lumbrical starts from medial surface of adjasent tendon (vorm like goes) and attached to medial parts proximal phalanges second to fifth toes.

Function- flexes metatarsophalangeal joints and extends interphalangeal joints.

4) Plantar interossei muscles. There are three muscles, which start from base and medial sides of metatarsals third to fifth and attached to medial sides of base of proximal phalanges third to fifth toes.

Action - adduct toes, flex proximal and extend distal phalanges.

5) Dorsal interossei muscles. There are four muscles, which starts from adjacent shafts of metatarsals and attached to proximal phalanges of second toes(medial and lateral sides) and third and fourth toes(lateral sides)

Action-abduct toes; flex proximal and extend distal phalanges.

Plantar aponeurosis is a thick fascia investing the plantar muscles. Starts from the calcanei tuberosity (tuber calcanei) directed toward the toes and gives attachement to the short flexor muscles of the toes.

Questions for self – study:

1. Tell about the anterior group of the leg muscles.
2. Tell about the lateral group of the leg muscles.
3. What muscles are included in superficial layer of the posterior group of the leg?
4. Tell about the deep layer muscles of the posterior group of the leg.
5. What muscles are included into the dorsal group of the foot?
6. Tell about the medial group of plantar muscles of the foot.
7. Tell about the lateral group of plantar muscles of the foot.
8. Tell about the intermedial group of the plantar muscles of the foot.
9. What do you know about the leg fascias?
10. What formations are there on the anterior surface of the thigh?
11. What is the structure of “canalis femoralis”?
12. What is the structure of “fossa poplitea”?
13. What formations are there on the leg, tell about them?

Lesson 28.

Head and neck muscles.

Head muscles are divided into facial muscles which called mimic muscles and mastication. Facial muscles expressions are found in the subcutaneous

tissue of the face and scalp.

They have not fascia and attached to skin, therefore their function is to move the skin and regulate the shapes of the openings on the face. Most of these muscles are located in surrounding the mouth, eyes, nose, ears and scalp.

Scalp is covered by **muscle occipitofrontalis** (fig.75), which starts from superior nuchae line and upper orbital margin and insertion to aponeurosis epicranialis.

Function: elevates eye-brows, wrinkles forehead (surprise).

Most part of this muscle transformed to aponeurosis epicranialis is a fibrous sheet that covers the vault of the skull and unites the occipitalis and frontalis muscles (galla aponeurotica) and only in front of and backward there are rudimental muscles-venter frontalis and venter occipitalis muscle epicranius are located.

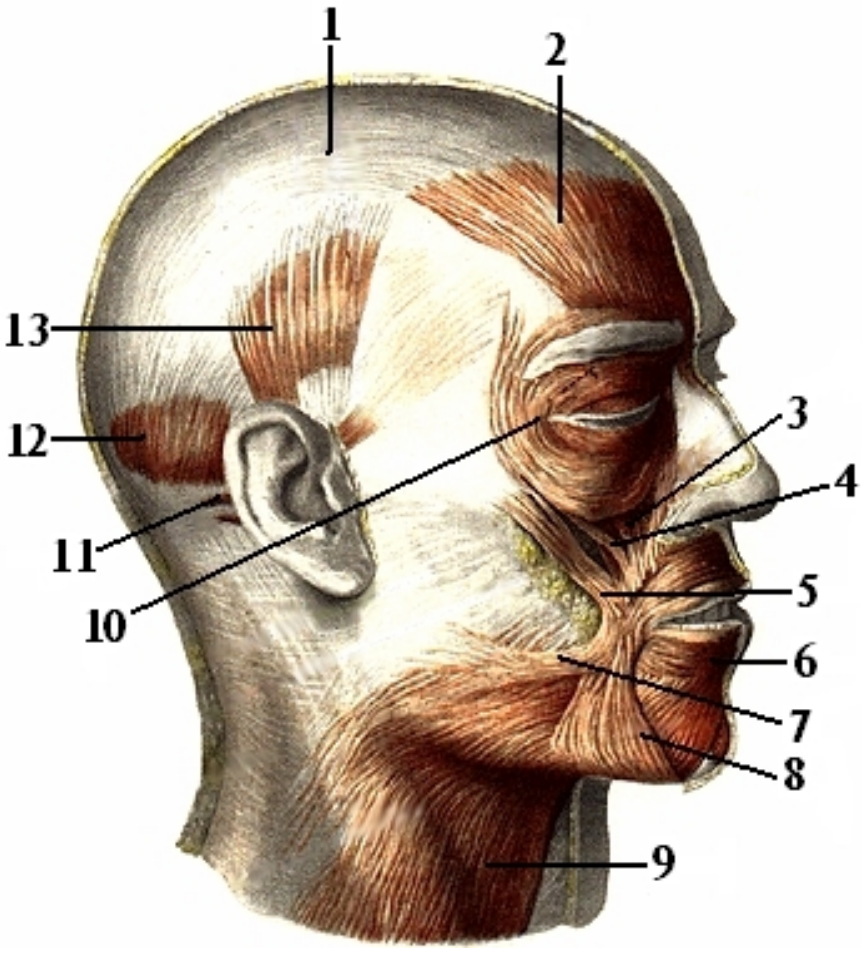


Fig.75. Muscles of the head and neck; right side view.

1– galea aponeurotica;
2– venter frontalis m. occipito- frontalis;
3– m. levator labi superior;
4– m. zygomaticus minor;
5– m.zygomaticus major;
6 – m. depressor labii inferioris;
7 – m. risorius;
8–m. depressor anguli oris;
9–m. platysma;
10–m. orbicularis oculi;
11- m.auricularis posterior;
12 – Venter occipitalis m. occipitofrontalis;
13– m. auricularis superior.

M. Corrugator supercilii - starts from medial supraorbital margin insertion to skin of medial eyebrow.

Function: draws eyebrows downward medially. (Angerfrowning)

M. Orbicularis oculi (fig.75), extraorbital muscle consist of three parts: pars orbitalis, pars lacrimalis and pars palpebralis.
Pars palpebralis starts from medial orbital margin and medial palpebral ligament: pars lacrimalis - from lacrimal bone and pars orbitalis starts from frontal bone and processus frontalis maxillar bone. All these parts are attached to skin rim of orbit.
Function: closes eyelids (squinting).

Muscles surrounding the nose.

1. M. Procerus-starts from nasal bone attached to skin betwenen eyebrows. Function- wrinkles skin over bones (sadnes)
2. M. Nasalis -starts from maxilla, goes laterally to incisive fossa, attaches to ala of nose.
Function- draws ala of nose toward septum.
3. M. Depressor septi nose - starts from incisive fossa of maxilla, attaches to ala and nasal septum. It constricts nares.
4. M. Levator labii superioris and alaeque nasi -starts from frontal process of maxilla attaches to skin of upper lips.
Function - elevates ala of nose and upper lip.

Muscles surrounding the mouth.

1. M. Orbicularis oris (fig.75), it is the lips, which are muscular folds which covered externally by skin and internally by mucous membrane.
There are superior and inferior lips. They connect and form angles of lips. Then these muscles contract lips closes
2. M. Levator anguli oris - starts from canine fossa of maxilla, attached to angle of mouth.
Function: elevates angle of mouth medially (disgust)
3. M. levator labii superioris - starts from maxilla above infraorbital foramen and attaches to skin of upper lip.
Function: elevates upper lip, dilates nares (disgust)
4. M.m. zygomaticus major and minor lie side by side. Both muscles start from zygomatic arch and attached to angle of mouth.
Function: draws angle of mouth backward and upward (smile).
5. M. Depressor labii inferioris starts from mandible below mental foramen inserting to orbicularis oris muscle and skin of lower lip.

Function: is the same as the name.
6. M. Depressor anguli oris starts from oblique line of mandible and attaches to angle of mouth.
Function: is the same as the name.
7. M. Risorius starts from fascia, over masseter and attaches to angle of mouth. Function: is to retract angle of mouth (falce smile).
8. M. Buccinator - thin, quadriangle by form, starts from oblique line of mandible, alveolar process of maxilla, pterygomandibular raphe, attaches to angle of mouth and inserting to upper and lower lips.
Function: is to press cheek in order keep it taut.
9. Mentalis muscle - starts from incisive fossa of mandible and attaches to skin of chin. Function: elevates and protrudes lower lip.

Muscles surrounding the ear.

They are situated around ear cartilage (fig**.**75).
1. M.m.Auricularis anterior, superior and posterior start from temporal fascia, epicranial aponeurosis and mastoid process attached to anterior, superior and posterior sides of auricle.
Function: is to retract and elevate the ear.
Mimic muscles are differ from others, because they attach to skin, have no fascia and also located surrounding the holes of face.

Muscles of mastication or chewing muscles.

Muscles of mastication are the masseter, temporalis and the medial and lateral pterygoids. They are found both in the temporal and infratemporal fossae as well as superficial to the ramus of the mandible(fig**.**76).
1**. M. Masseter (m. masseter**) starts from lower border of zygomatic arch and is attached to lateral surface of ramus and angle of mandible.
Function: elevates and retracts mandible.
2**. M. Temporalis (m. temporalis**) strarts from border of temporal fossa, and attached to coronoid process of mandible.
Function is the same as the masseter.
3. **Lateral pterygoid muscle (m. pterygoideus lateralis**) subdivided into two heads. Superior head starts from infratemporal surface of sphenoid bone. Inferior head starts from lateral surface of lateral pterygoid plate of sphenoid bone (**lamina lateralis processus pterygoideus**). Two heads

comes together and attached to neck of mandible; intraarticular disk and capsule of temporomandibular joint.
Function is to protrude and depress mandible. (Deviation to opposite side)

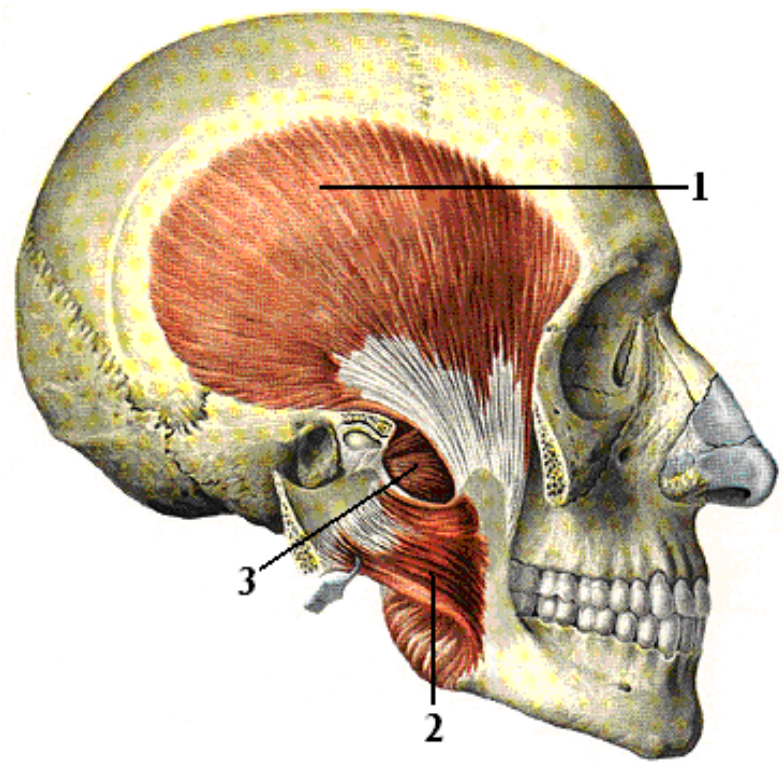


Fig.76. Muscles of mastication (chewing muscles); right side view.

1–m. temporalis;

2–m. pterygoideus lateralis;
3–m.pterigoideus medialis;

4– discus articularis.

4**. Medial ptorygoid muscle (m. pterygoideus medialis**) starts from tuber maxilla; medial surface of lateral pterygoid plate, attaches to medial surface of angle and ramus of mandible.
Function is to protrude and elevate mandible.
The jaws are opened by the lateral pterygoid muscles contract and are closed by the temporalis, masseter and medial pterygoid muscles contract.

Questions for self – study:

1. What groups of muscles is the head divided into?
2. What muscles do calvaria include?
3. What muscles are included into the group, which surrounds the eyes?
4. What muscles are included into the group surrounding the nose?
5. What muscles are included into the group surrounding the mouth?
6. What muscles are located around ear?
7. What muscles are included into the jaw group?
8. Tell about the head fascias.

Lesson 29.

Muscles of the neck

Muscles of the neck divided into three layers: superficial, middle and deep.

Cervical superficial muscles:

1**. M. platysma (m. platysma**) – thin muscles fibers, lie under skin start from superficial thoracic fascia over upper part of deltoid and pectoralis major muscles and attached to margin of mandible and the skin over mandible and angle of the mouth.
Function: depresses lower jaw and lip; wrinkles skin of neck.
2. **M. sternocleidomastoideus (m. sternocleidomastoideus**) – starts from manubrium sterni and medial one-third of the clavicle, attached to mastoid process.
Singly contract turns face toward opposite side; both sides contract flex head, raise thorax**.**

Muscles of middle layer:

Middle layer are subdivided into two groups: suprahyoid muscles and infrahyoid(fig**.**77).
Suprahyoid muscles:
1. **M. digastricus (m. digastricus**) has two bellies which separated by intermediate tendon.
Anterior belly (venter anterior) starts from digastric fossa of mandible and directed downward, attached to the body of hyoid bone with intermediate tendon.
Posterior belly (venter posterior) is continuation from hyoid bone to mastoid notch.
Function: Elevates hyoid, depresses mandible.
2. **Stylohyoid muscle (m. stylohyoideus**) originates from styloid process of temporal bone and insertion of the body of hyoid bone.
Its function is elevates hyoid bone.
3**. Mylohyoid muscle (m. mylohyoideus**) starts from mylohyoid line of the mandible. Both sides' muscles come together and form median raphe, attached to the body of hyoid bone. These muscles form the bottom of the

mouth cavity (diaphragma oris). Function: Elevates hyoid bone, depresses mandible.

4**. Geniohyoid muscle (m. geniohyoideus**) – starts from spina mentale of mandible and attached to the body of hyoid bone.

Function: elevates hyoid bone and tongue.

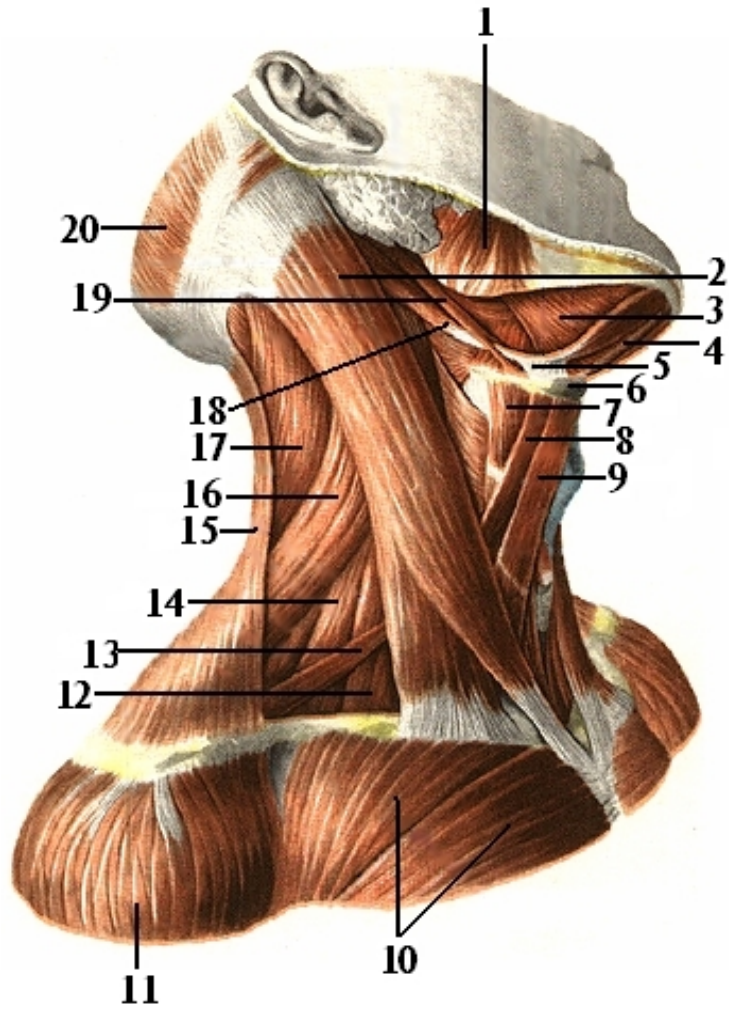


Fig. 77 Muscles of the neck; lateral view.
1–m.masseter;
2–m. sternocleidomastoideus;
3 – m mylohyoideus;
4–m.digastricus (venter anterior); 5–tendo m. digastricus; 6–os hyoideum;
7–m. thyrohyoideus;
8–m.omohyoideus (venter superior);
9–m. sternohyoideus;
10–m. pectoralis major;
11–m. deltoideus;
12–m.scalenus anterior;
13–m.omohyoideus (venter posterior); 14–m. scalenus medius; 15–m. trapezius;
16–m. levator scapulae;
17–m.splenius capitis;
18– m.digastricus (venter posterior);
19–m.stylohyoideus; 20–venter occipitalis m. occipitofrontalis.

Infrahyoid muscles:

1. **Sternohyoid muscle (m. sternohyoideus**) – starts from manubrium sterni and medial end of the clavicle and attached to the body of hyoid bone.

Its function is depresses hyoid bone and larynx.

2. **Sternothyroid muscle (m. sternothyroideus**) – starts from posterior surface of manubrium sterni and first costal cartilage and attached to oblique line of thyroid cartilage.

Function: depresses thyroid cartilage and larynx.

3. **Thyrohyoid muscle (m. thyrohyoideus**) – starts from oblique line of thyroid cartilage and attached to the body and greater horn of hyoid bone.
Function: depresses and retracts hyoid bone and larynx.
4. **Omohyoid muscle (m. omohyoideus**) – has two bellies, which are separated by intermediate tendon.
Inferior belly (venter inferior) starts from medial margin of suprascapular notch and suprascapular ligament goes upward to intermediate tendon, then continues to belly above.
Superior belly (venter superior) lies from intermediate tendon and the body of hyoid bone.
Function: depresses and retracts hyoid bone and larynx.

Deep layer muscles of the neck

Deep layer muscles of the neck subdivided into external and prevertebral muscles.

External group

External group contain three scalene muscles.
1**. M. scalenus anterior (m. scalenus anterior)** - starts from transverse processes of cervical vertebrae C_3- C_6 and insertion to scalene tubercle of the first rib.
Function: elevates first rib and bends neck.
2. **M. scalenus media (m. scalenus medius**) - starts from transverse processes of C_2- C_7 and attached to upper surface of the first rib.
Function as same as muscle above.
3. **M. scalenus posterior (m. scalenus posterior)** - starts from transverse processes of C_4 - C_6 and attached to outer surface of the second rib.
Function as same as prevent muscle.

Prevertebral group

1. **M. longus colli (m. longus colli**) starts from processes transverses of C_3 – C_6 and bodies of upper three thoracic and lower three cervix vertebrae and attached to tubercle anterior of transverse processes of C_2 – C_4 and tubercle anterior of atlas.
Function: flex and rotates head.
2. M. longus capitis (m. longus capitis) starts from transverse processes

of C_3 - C_6 and attached to the basilar part of occipital bone.
Function as same as muscle above.
3. M. rectus capitis anterior (m. rectus capitis anterior) starts from anterior arch and lateral mass of atlas and attached to outer surface of base of occipital bone.
Function: flex and rotates head.
4. M. rectus capitis lateralis (m. rectus capitis lateralis) starts from transverse processes of atlas and attached to jugular process of occipital bone.
Function: flexes head laterally.

Questions for self – study:

1. What groups of muscles is the neck divided into?
2. What muscles are included into the superficial layer of the neck?
3. What muscles are located above hyoid bone?
4. What muscles are located under hyoid bone?
5. What muscles does the deep layer of the neck include?
6. What muscles are included into the prevertebral group?

Lesson 30.

Cervical fascias and triangles.

Cervical fascias.

1. **Fascia colli superficialis** - splits to enclose the sternocleidomastoideus and trapezius muscles and make sheats for them. It attached superiorly along the mandible, mastoid process, external occipital protuberence and superior nuchae line of the occipital bone; inferiorly- is attached along the acromion, spine of the scapula; clavicle and manubrium sterni.
2**. Pretracheal layer of deep cervical fascia.** This fascia lies between posterior part of manubrium sterni, posterior surface of clavicle and hyoid bone. It is invest the larynx and trachea, enclosing the thyroid gland and formation of the carotid sheath.
Carotid sheath contains the common and internal carotid arteries, internal

jugular vein and vagus nerve, but does not contain the sympathetic trunk.
Carotid sheath blends with the prevertebral pretracheal and superficial layers and also attaches to the base of the skull

3. **Prevertebral layer of deep cervical fasci**a. This layer formed sheath for lower hyoid bone muscles.

It is cylindrical and encloses the vertebral column and its associated muscles attaches to the external occipital protuberance and the basilar part of the occipital bone and becames continuous with the endothoracic fascia

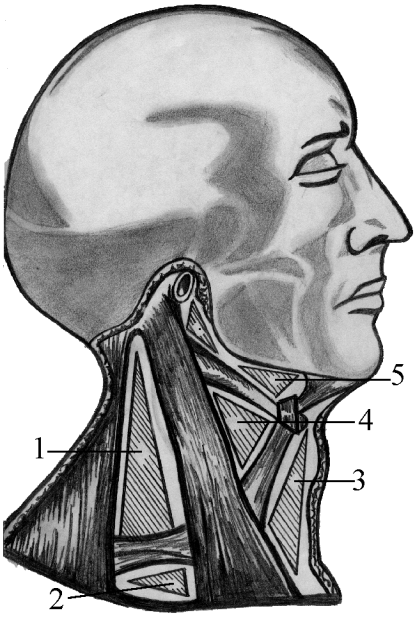
Cervical triangles.

Neck region also subdivided into several triangles, which are impotent for surgical.

1. **Trigonum colli laterale** is bounded by posterior border of the sternocleidomastoid muscle, the anterior border of the trapezius muscle and lower the clavicle.

2. **Trigonum colli mediale** or anterior triangle is bounded by the anterior border of the sternocleidomastoideus muscle and median line of the neck, and the inferior border of the mandible.

Trigonum colli lateralis is divided by inferior (posterior) belly of the omohyoideus muscle into Trigonum omotrapezoideum and Trigonum omoclaviculare.



3. **Trigonum omotrapezoideum** is bounded anteriorly by sternocleidomastoid muscle, posteriorly by anterior border of the trapezius muscle and lower- by inferior belly of omohyoideus muscle.

Fig.78. Subdivisions of the cervical triangle.

1–trigonum omotrapezoideum;
2–trigonum omoclaviculare;
3–trigonum omotracheale;
4–trigonum caroticum;
5–trigonum submandibulare.

4**. Trigonum omoclaviculare** - is bounded anteriorly by sternocleidomastoideus muscle, the upper border by inferior belly of the omohyoid muscle and lower clavicle.

5. **Trigonum coroticum** is bounded posteriorly by sternocleidomastoideus, upperly by posterior belly of digastric muscle and anteriorly by superior belly of omohyoid muscle.
6. **Trigonum omotracheale** - posteroinferiorly is bounded by sternocleidomastoideus muscle, posterosuperiorly by superior belly of omohyoid muscle and anteriorly by trachea.
7. **Trigonum submandibulare** - is bounded upperly by inferior border of the mandible and both bellies of digastric muscle. Here submandibular gland lies.
8. **Trigonum Pirogovi** - anteriorly is bounded by posterior border of m. mylohyoideus, posteroinferiorly by posterior belly of digastric muscle and above by hypoglossal nerve. In this triangle a. lingualis lies.
9. **Trigonum retromandibulare –** behind mandible's angle is lies.

Questions for self – study:

1. What groups of muscles is the neck divided into?
2. Tell about the neck fascias.
3. Tell about the neck topography.
4. Name the neck triangles.
5. What formations are there on the lateral surface of the neck?
6. Explane the Pirogove's triangle.
7. Explane the trigonum coroticum.
8. In what triangles are subdivided trigonum colli medialis?

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