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**Atlas of Human Anatomy**

# Sobotta

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**Edited by R. Putz and R. Pabst**  
in collaboration with Renate Putz

13th, revised Edition  
Translated by Dr. M. Lutz, K. Kopsieker  
With the assistance of Michael Budowick, Sarah Dietz,  
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Addresses of the editors:

Professor Dr. med. R. Putz  
Vorstand des Anatomischen Instituts  
Ludwig-Maximilians-Universität  
Pettenkoferstraße 11  
80336 München, Germany

Professor Dr. med. R. Pabst  
Leiter der Abteilung für Funktionelle und  
Angewandte Anatomie  
Medizinische Hochschule, Hannover  
Carl-Neuberg-Straße 8  
30625 Hannover, Germany

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Translation: Dr. M. Lutz  
K. Kopsieker  
Editorial staff at Dr. med. Dorothea Hennessen  
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Producer: Renate Hausdorf  
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# Preface

Following the extremely good illustrations in the last edition of the Atlas which was brought into being by J. Sobotta in 1903, the editors and publishers asked themselves what could be improved upon in such a classic work. It became clear from the many letters and discussions with students and colleagues that the concept obviously still fits into the panorama of study, and that the macroscopic anatomy remains without question, together with other basic sciences, one of the fundaments of medicine. Although the Atlas is primarily directed at those studying pre-clinical medicine, it has nevertheless as "The Book for life as a doctor" all that is necessary to be a companion through the clinical studies and a reference book during working life. In accordance with the most important/urgent wishes, the new edition has a series of alterations.

In the new edition we have

- a total of 133 new illustrations drawn based on original dissections, e.g. the series of sections of the brain and thorax,
- replaced the black and white illustrations,
- brought illustrations of clinical application up to date according to the development of the technique, e.g. endoscopy or X-ray,
- introduced the schematic of joint strain and
- revised the tables of muscles completely.

As the second important goal we have improved the readability by

- the introduction of conspicuous colours for the chapters,
- colour coding the labelling of topographic illustrations,
- the consistent addition of orientation sketches to the cross sections and line of vision,
- the revision and new arrangement of the tried and tested tables and by
- the introduction of small "wind mills" drawing your attention to the surrounding illustrations.

Of course, the new nomenclature (*Terminologia Anatomica*), which has been valid since October 1998, has been included. The glossary aids those interested in the background of our specialist language.

The division of the revision of the chapters, apart from the common discussions over the concept and the mutual correction, was retained and is as follows:

R. Putz: General anatomy, upper limb, brain, eye, ear, back, lower limb;

R. Pabst: Head, neck, thoracic wall, abdominal wall, thorax, abdomen, pelvis.

The following artists have earned our thanks for the many new drawings which they have produced in their already proven manner: Ulrike Brugger, Rüdiger Himmelhan, Sonja Klebe, and Horst Ruß. It is due to their efforts that the tried and tested "Sobotta Style" has been maintained. The free electronic processing of the photographs as well as the production of the prints was carried out by Michael Budowick. We are also grateful to our colleagues in the various clinics who put the illustrations at our disposal for this edition as well (see Acknowledgements).

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Many innovations in this atlas are based on the critic and suggestions made by students and colleagues. The editors were and are extremely thankful for these and would ask the users of this edition not to shy away from sending us their comments.

Munich and Hannover, September 1999  
R. Putz and R. Pabst



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# General terms of direction and position in the body

The following terms indicate the relative location of organs and parts of the body to each other, partly without taking into consideration the position of the body in space as well as the location and direction to the extremities. This concept is not only acceptable for human anatomy but also for practical medicine and the comparative anatomy.

## General terms

*anterior* - *posterior* = from the front - from the back (e.g. Arteriae tibiales anterior et posterior)  
*ventralis* - *dorsalis* = lying ventral - dorsal  
*superior* - *inferior* = above - below (e.g. Conchae nasales superior et inferior)  
*cranialis* - *caudalis* = lying cranial - caudal  
*dexter* - *sinister* = right - left (e.g. Arteriae iliacae communes dextra et sinistra)  
*internus* - *externus* = internal - external  
*superficialis* - *profundus* = superficial - deep  
*medius*, *intermedius* = lying in the middle between two other things (the Concha nasalis media lies in the middle between the Concha nasalis superior and inferior)  
*medianus* = lying on the middle line (Fissura mediana anterior of the spinal cord). By making a median sagittal section the body is divided into two mirror images.  
*medialis* - *lateralis* = lying towards the middle of the body, lying towards the side (e.g. Fossae inguinales medialis et lateralis)  
*frontalis* = relating to the plane of the forehead (frontal plane), (e.g. Processus frontalis of the maxilla)

*longitudinalis* = running lengthways (e.g. Musculus longitudinalis superior of the tongue)  
*sagittalis* = lying on a sagittal plane  
*transversalis* = lying on a transversal/transverse plane  
*transversus* = running transversely (e.g. Processus transversus of the thoracic vertebrae)

## Terms of direction and position for the extremities

*proximalis* - *distalis* = at the base of the extremity - at the end of the extremity (e.g. Articulationes radioulnares proximalis et distalis)

For the upper limbs:

*radialis* - *ulnaris* = relating to the radial - relating to the ulnar side (e.g. Arteriae radialis et ulnaris)

For the hand:

*palmaris* - *dorsalis* = relating to the palm - relating to the back of the hand (e.g. Aponeurosis palmaris, Musculus interosseus dorsalis)

For the lower limbs:

*tibialis* - *fibularis* = relating to the tibial side - relating to the fibular side (Arteria tibialis anterior)

For the foot:

*plantaris* - *dorsalis* = relating to the sole of the foot - relating to the back of the foot (instep) (e.g. Arteriae plantares lateralis et medialis, Arteria dorsalis pedis)

# References to the coloured illustration plates

The multi-coloured illustrations of this book are based on didactic observations: The contrasts should be emphasized. Where it is difficult to differentiate between structures, they should be made easily recognizable. The colours used for the different kinds of tissue (such as tendons, cartilage, bone and muscles) and the tracts (such as arteries, veins, lymphatic vessels, nerves) are different from those found in a living, dead or preserved body. Here, arteries are red, veins are blue, nerves yellow, lymphatic vessels and glands are generally represented as green. In addition to the artists who created the basis for the complete collection of illustrations with Prof. Sobotta and the following editors Prof. Becher, Prof. Ferner and Prof. Staubesand (K. Hajek, Prof. E. Lepier, F. Batke, H. v. Eickstedt, K. Endtresser, J. Kosanke, J. v. Marchtaler, J. Dimes, U. Brugger, N. Lechenbauer, L. Schnellbächer, and K. Schuhmacher), the following also drew for the current edition: Ulrike Brugger, Rüdiger Himmelhan, Sonja Klebe, and Horst Ruß. A series of original photographs were worked over electronically by Michael Budowick. A number of computer diagrams were produced by Henriette Rintelen.

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*superficialis - profundus* = superficial - deep  
*medius, intermedius* = lying in the middle between two other things (the Concha nasalis media lies in the middle between the Concha nasalis superior and inferior)  
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(figs. 906, 949a, b, 959, 1086)

Prof. Pfeifer, Radiology Department of the Surgical Clinic, University of Munich  
(figs. 306, 319, 321, 748-751, 789-792, 1199, 1230, 1231, 1260, 1261)

Assistent Prof. Rau, Department of Radiology, University of Freiburg  
(figs. 875, 886, 887)

Prof. Ravelli, Institute of Anatomy, University of Innsbruck,  
(fig. 746)

Prof. Reich, Clinic for Facio-Maxillary Surgery, University of Bonn  
(figs. 133, 134)

Prof. Reiser & Dr. Glaser, Institute of Clinical Radiology, University of Munich  
(figs. 307, 578-582, 705a, b, 771, 1369, 1371, 1373, 1377)

Prof. Rudzki-Janson, Polyclinic for Orthodontics, University of Munich  
(figs. 80, 81)

Dr. Scheibe, Department of Surgery, Rosman Hospital, Breisach  
(figs. 1233a-c)

Prof. Schillinger, Gynaecological Clinic, University of Freiburg  
(figs. 1072-1074)

Dr. Dr. Schliephake, Facio-Maxillary Surgery, University of Medicine, Hannover  
(figs. 167, 212, 213)

Prof. Schlößer, Gynaecology Centre, University of Medicine, Hannover  
(figs. 1071a, b, 1080, 1082, 1083, 1130)

Prof. Schuhmacher, Neuroradiology, Department of Radiology, University of Freiburg  
(figs. 448a, b)

Dr. Sommer & Assistent Prof. Bauer, Radiologists, Munich  
(figs. 650, 1234-1236)

Prof. Stotz, Orthopaedic Polyclinic, University of Munich  
(fig. 1193)

Prof. Vogl, Polyclinic for Radiology, University of Munich  
(figs. 440, 442, 631, 632)

Prof. Vollrath, ENT Clinic, Mönchengladbach  
(figs. 246-248)

Prof. Wagner (dec.), Diagnostical Radiology II, University of Medicine, Hannover  
(figs. 914, 1014, 1017, 1020, 1023, 1090)

Prof. Wenz, Department of Radiology, University of Freiburg  
(fig. 747)

Dr. Willführ, Department for Abdominal and Transplantation Surgery, University of Medicine, Hannover  
(fig. 1001)

Assistent Prof. Wimmer, Department of Radiology, University of Freiburg  
(fig. 778)

Additional illustrations were taken from the following books:

Birkner, R: The typical X-ray of the skeleton, Urban & Schwarzenberg, Munich-Vienna-Baltimore 1990  
(fig. 1200)

Welsch, U. (Editor): Sobotta - Histology, 5th Edition, Urban & Schwarzenberg, Munich-Vienna-Baltimore 1985  
(figs. 635, 646)

Wicke, L.: Atlas of X-ray Anatomy, 3rd Edition, Urban & Schwarzenberg, Munich-Vienna-Baltimore 1985  
(figs. 905a, b, 1076)

Wilhelm, K., R. Putz, R. Hierner, R.E. Giunta: Plastic surgery of the hand, Urban & Schwarzenberg, Munich-Vienna-Baltimore 1997  
(fig. 58)

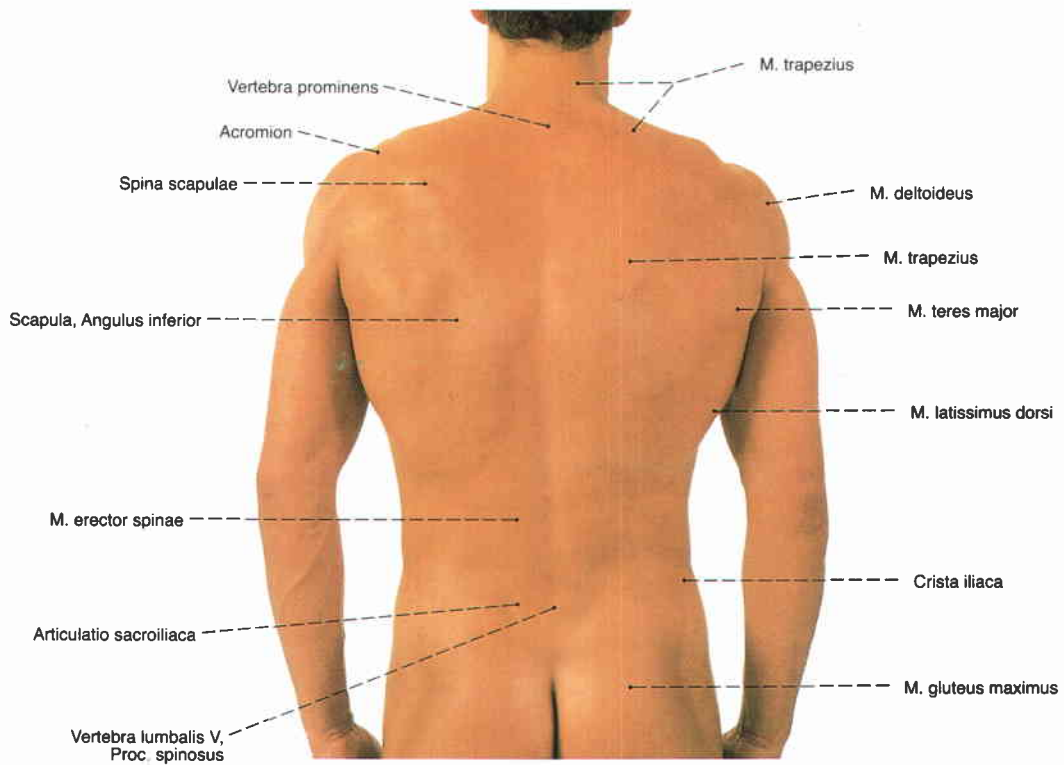


Fig. 706 The back, Dorsum; surface anatomy.

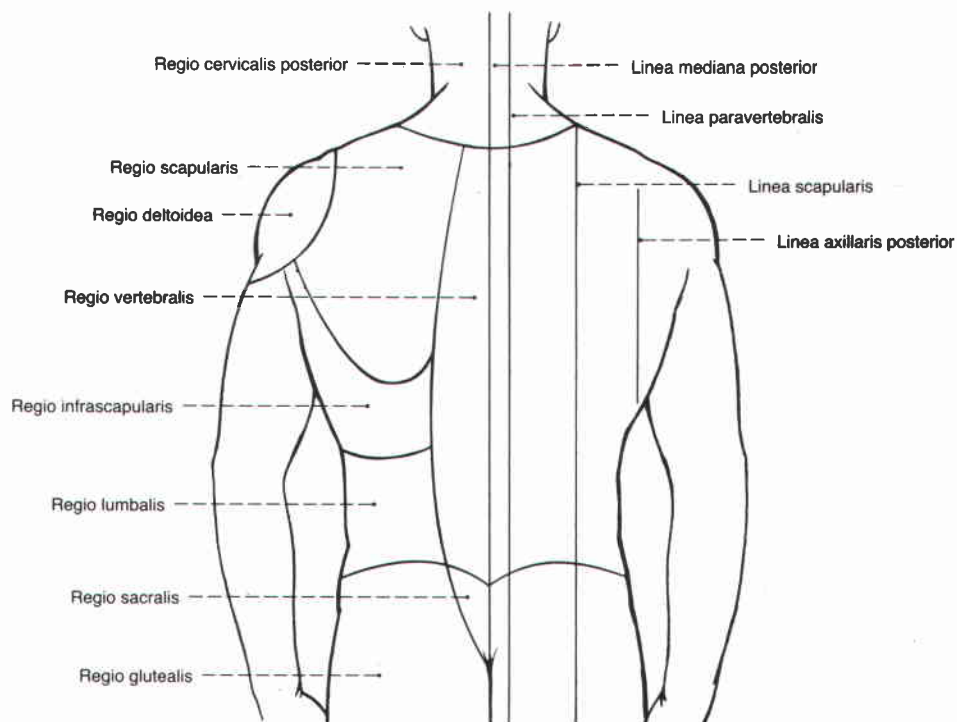
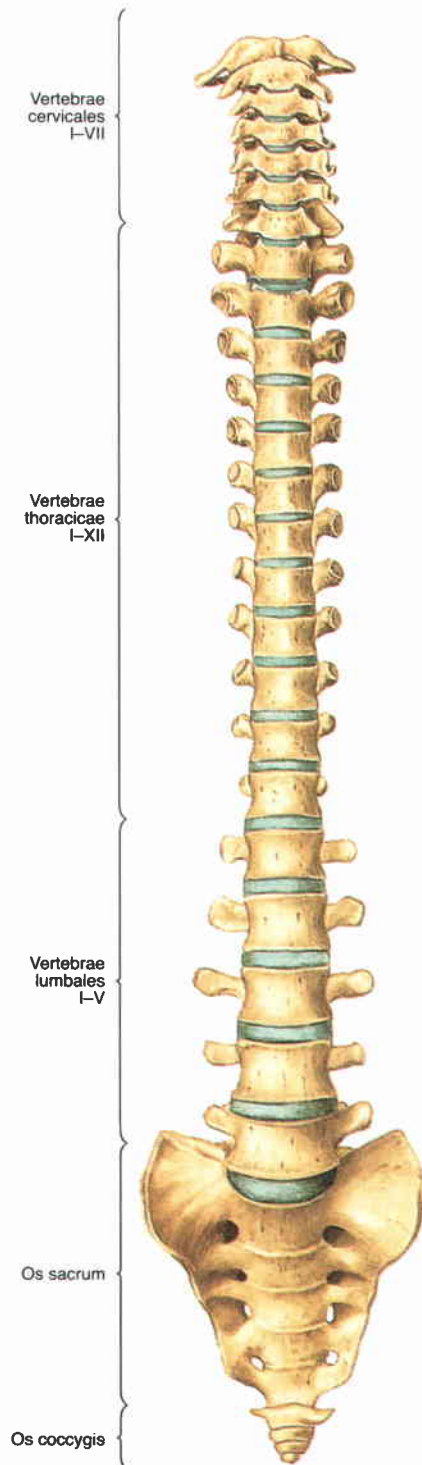


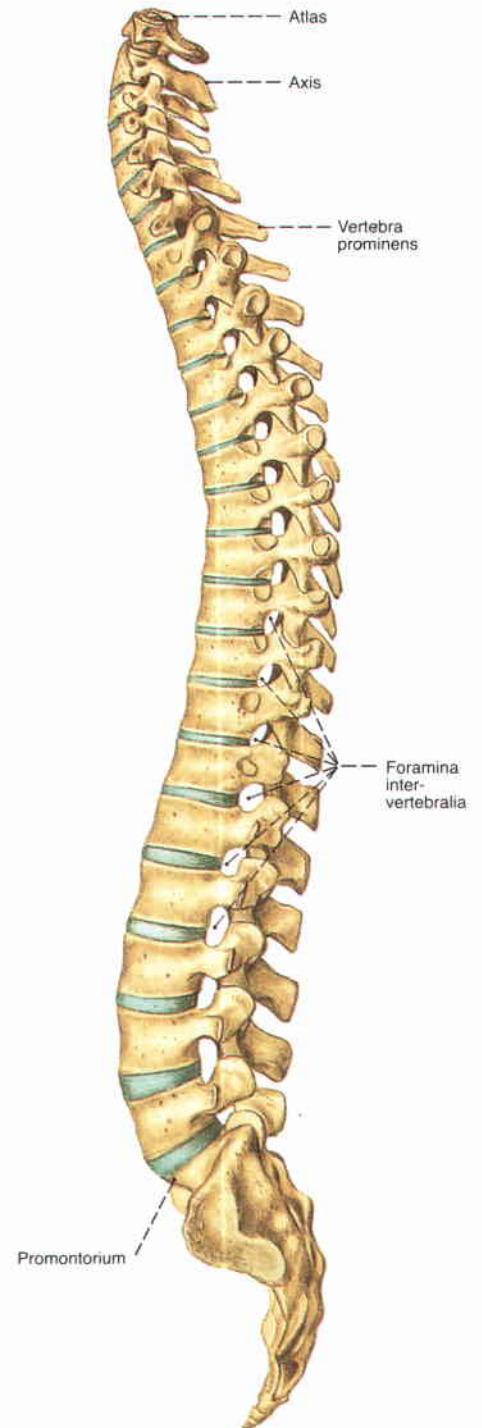
Fig. 707 Regions and orientation lines on the back.



**Fig. 708** Vertebral column, Columna vertebralis; the intervertebral discs are indicated in blue; ventral view (30%).



**Fig. 709** Vertebral column, Columna vertebralis; dorsal view (30%).



**Fig. 710** Vertebral column, Columna vertebralis; the intervertebral discs are indicated in blue; left lateral view (30%).



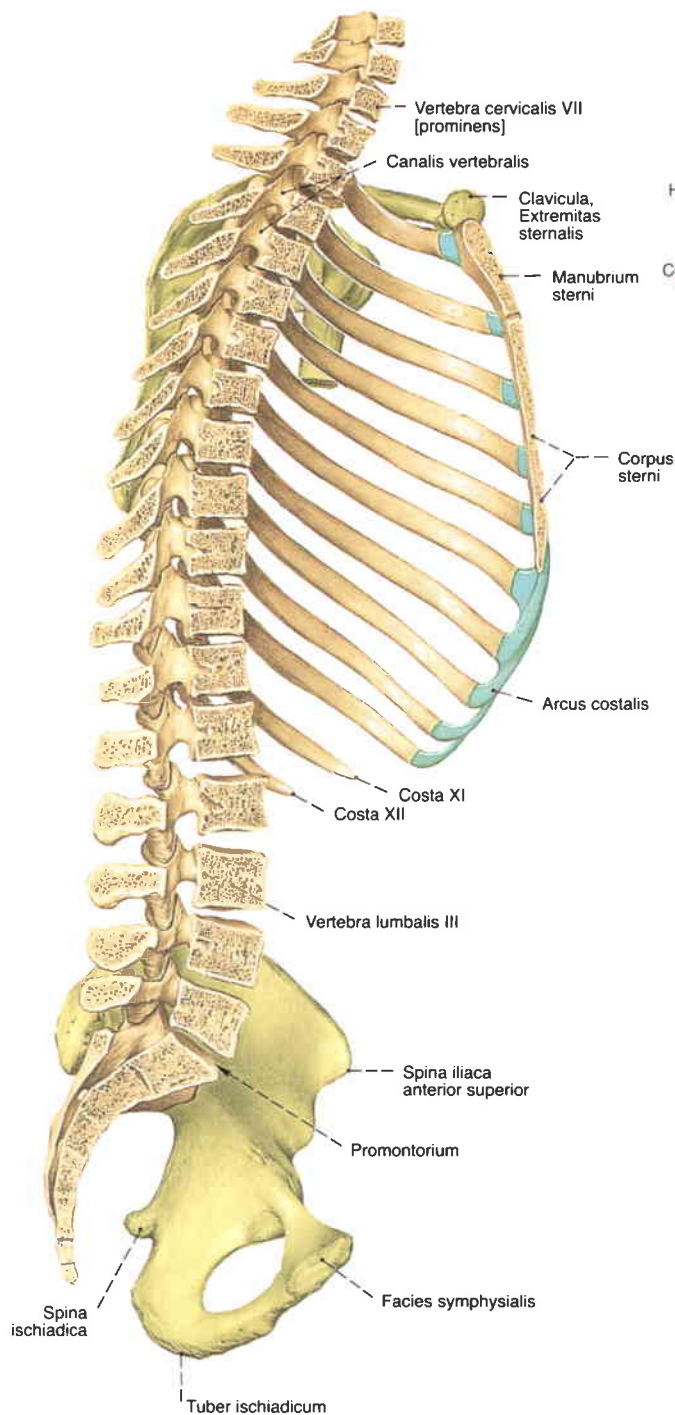


Fig. 711 Vertebral column, Columna vertebralis; shoulder girdle, Cingulum pectorale; pelvic girdle, Cingulum pelvium; the vertebral column has been sectioned in the median plane; left medial view (25%).

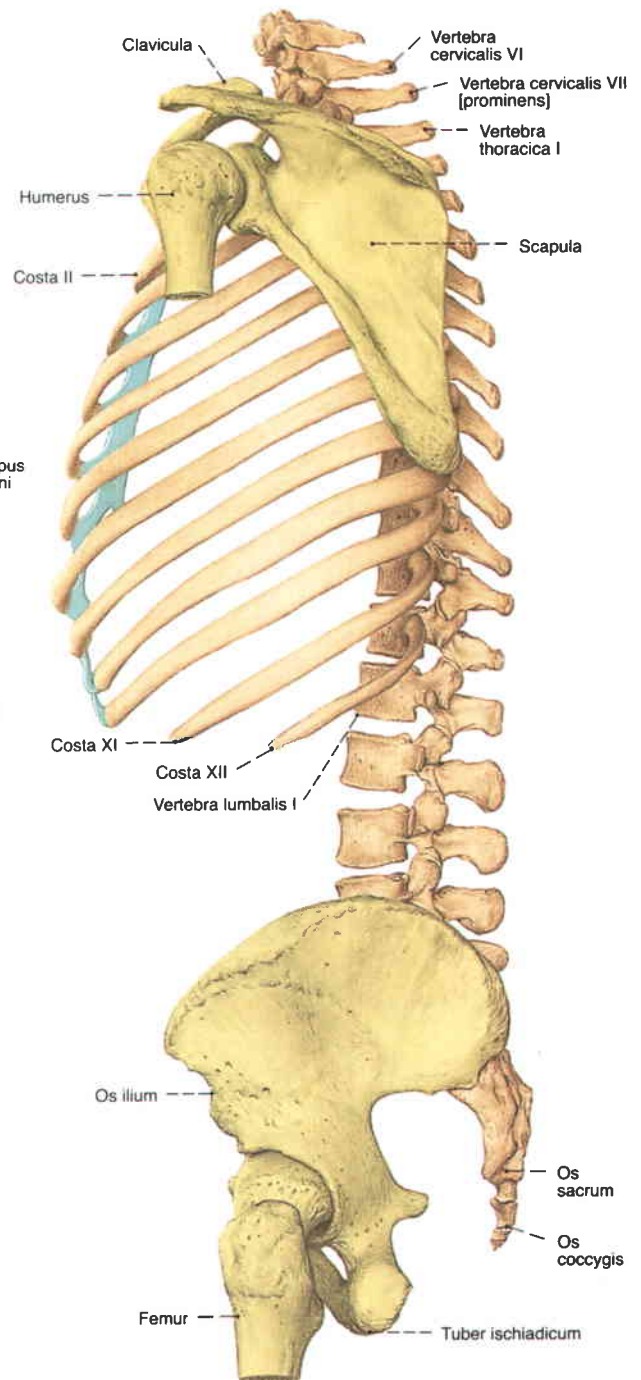
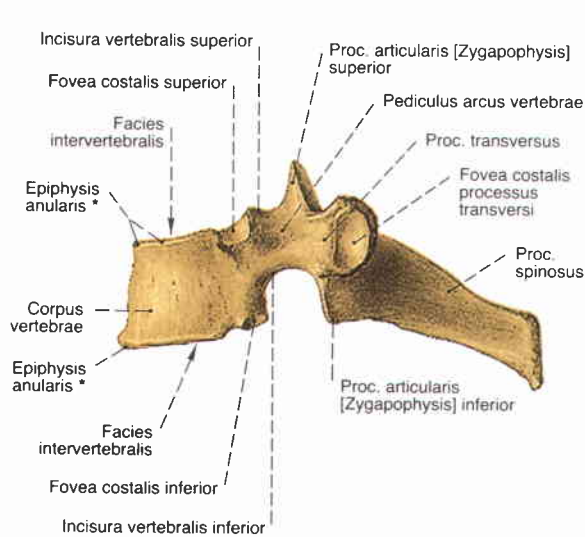
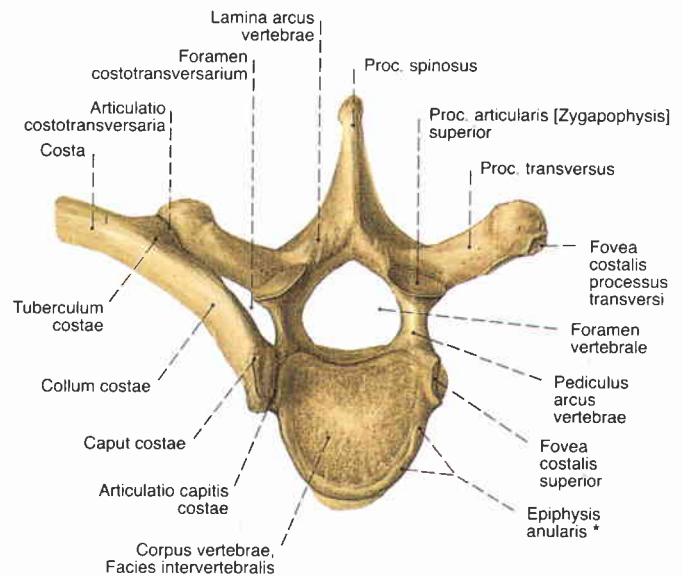


Fig. 712 Vertebral column, Columna vertebralis; shoulder girdle, Cingulum pectorale; pelvic girdle, Cingulum pelvium; the vertebral column has been sectioned in the median plane; left lateral view (25%).



**Fig. 713** Vertebra, Vertebra; the fifth thoracic vertebra is shown as an example with the typical structure; lateral view (80%).

\* also, rim of vertebral body

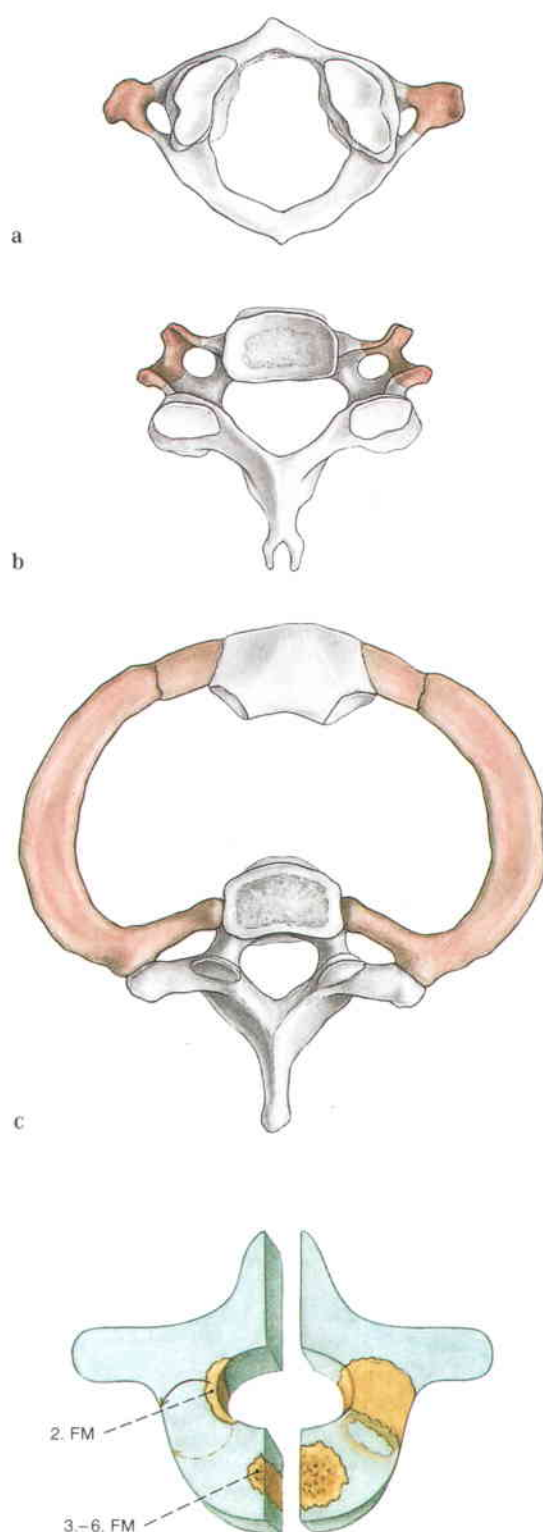


**Fig. 714** Vertebra, Vertebra; the fifth thoracic vertebra is shown as an example with the typical structure; superior view (80%).

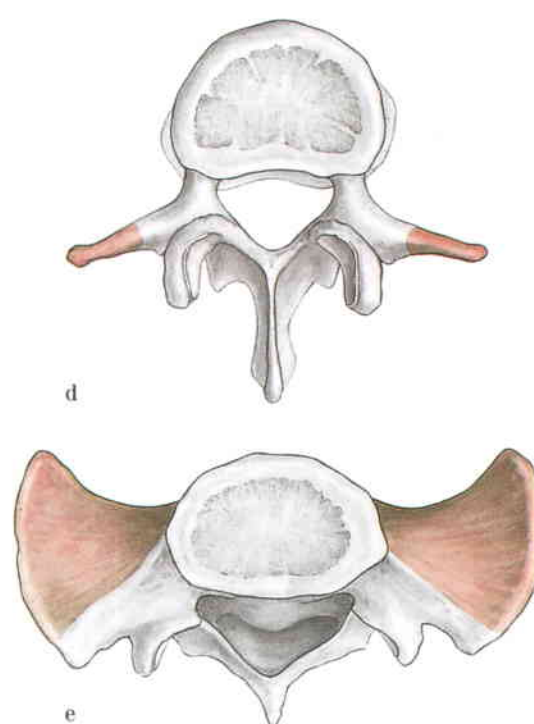
\* also, rim of vertebral body

### Structural characteristics of vertebrae (Atlas and Axis excluded)

	7 cervical vertebrae, Vertebrae cervicales I–VII	12 thoracic vertebrae, Vertebrae thoracicae I–XII	5 lumbar vertebrae, Vertebrae lumbales I–V	Sacral bone, Os sacrum formed by 5 vertebrae [Vertebrae sacrales I–V]
Upper and lower surfaces of the vertebral body	Rectangular, small, with Unci corporum on the upper surfaces	Triangular, becoming rounder caudally	Large, bean-shaped	
Vertebral foramen, Foramen vertebrale	Large, triangular cross section	Round cross section	Small, triangular cross section	Sacral canal, Canalis sacralis, oval cross section
Articular surfaces, Procc. articulares [Zygapophyses]	Oblique slope towards dorsal	Frontal position, slope towards dorsal	Lateral part: sagittal position; medial part: frontal position	Fused to the Crista sacralis medialis
Procc. transversi	Contain a Tuberculum anterior, a Tuberculum posterius, a Sulcus nervi spinalis and a Foramen transversarium	Club-shaped, with Foveae costales	Procc. mamillares et accessorii	Fused to the Crista sacralis lateralis
Procc. spinosi	Horizontal, short, bifurcated	Inclination towards caudal varies	Horizontal, laterally flattened, massive	Fused to the Crista sacralis mediana
Rudiments of ribs	Ventral part of the Proc. transversus and Tuberculum dorsale	None, because the ribs are developed	Procc. costales	Partes laterales
Characteristic feature	Foramen transversarium	Foveae costales superior et inferior	Procc. mamillares et accessorii	Synostosis of vertebrae

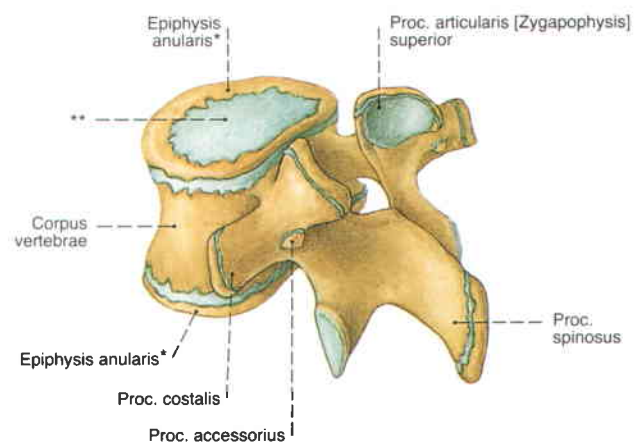


**Fig. 716** Vertebral development. Appearance of the primary ossification centres (Pedicle, second fetal month; body, 3rd to 6th fetal months), as exemplified in a lumbar vertebra. The synostosis of the ossification centres of the vertebral arch with those of the body occurs between the 3rd and 6th years of life.



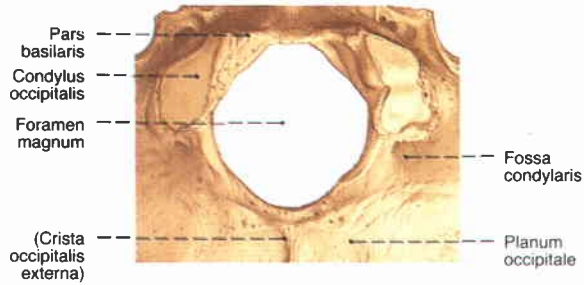
**Figs. 715 a-e** Regional characteristics of the vertebrae. Only in the thoracic region of the vertebral column do the lateral parts (coloured red) remain separated and form ribs.

- a first cervical vertebra, Atlas
- b fourth cervical vertebra, Vertebra cervicalis IV
- c first thoracic vertebra, Vertebra thoracica I, shown with the adjacent ribs, Costae; and the sternum, Sternum
- d third lumbar vertebra, Vertebra lumbalis III
- e sacral bone, Os sacrum

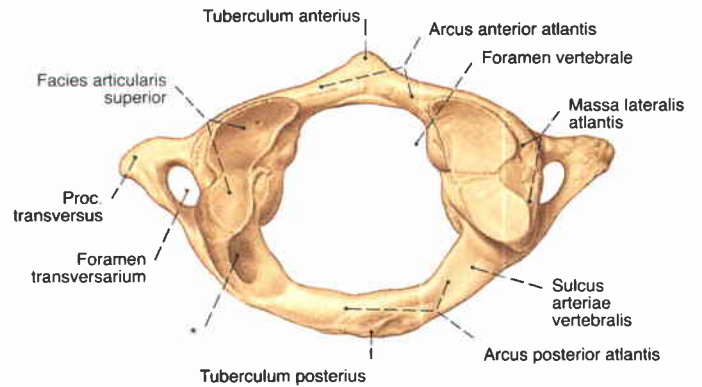


**Fig. 717** Vertebral development. Ring-shaped ossification centres (\*rims) appear in the vertebral bodies during the 8th year of life. They fuse with the vertebral bodies until the 18th year of life. The central parts of the epiphysis remain cartilaginous laminae \*\* throughout life. Secondary ossification centres (apophyses) appear in the processes of the vertebra.



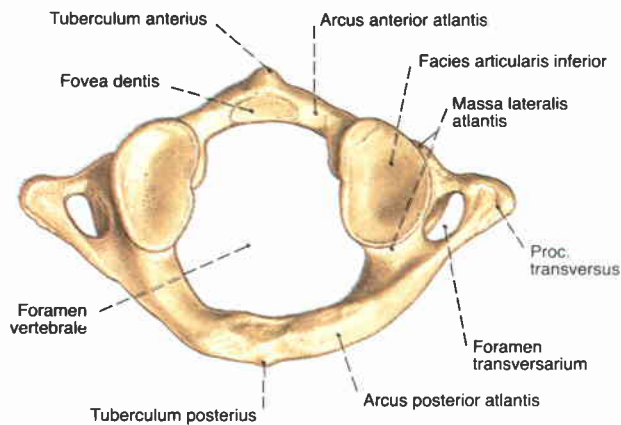


**Fig. 718** The occipital bone, *Os occipitale*; Segment showing the foramen magnum and the articular surfaces of the atlanto-occipital joint; inferior view (80%).

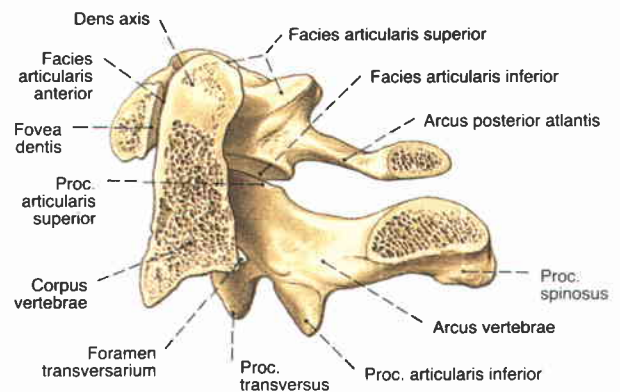


**Fig. 719** First cervical vertebra, *Atlas*; superior view (85%). The superior articular surfaces of the atlas are frequently divided.

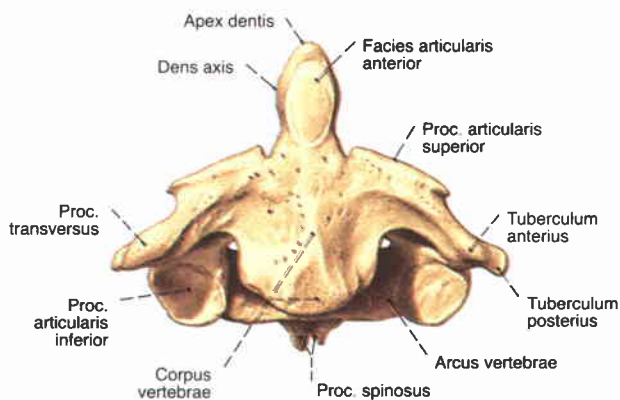
\* *Canalis arteriae vertebralis* as a variation



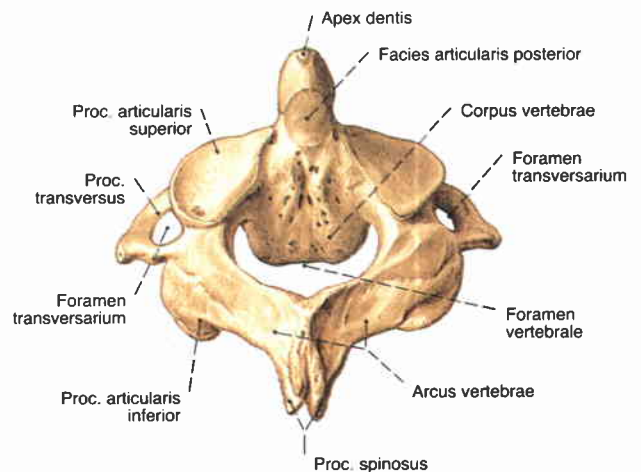
**Fig. 720** First cervical vertebra, *Atlas*; inferior view (85%).



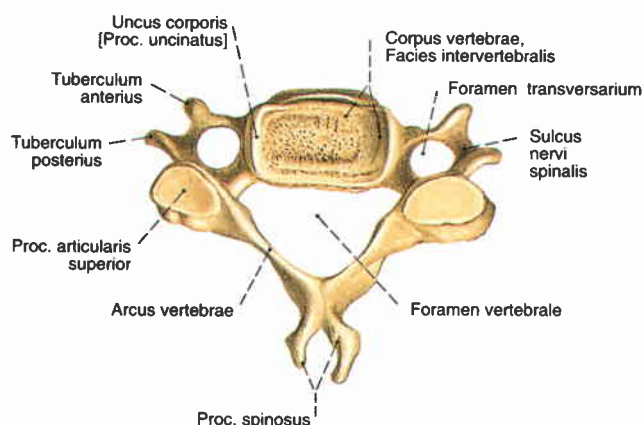
**Fig. 721** First and second cervical vertebrae, *Atlas* and *Axis*; median section; medial view (90%).



**Fig. 722** Second cervical vertebra, *Axis*; ventral view (90%).

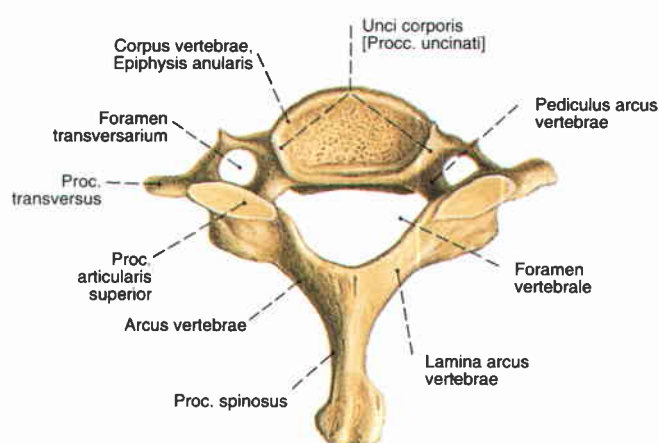


**Fig. 723** Second cervical vertebra, *Axis*; dorsosuperior view (90%).



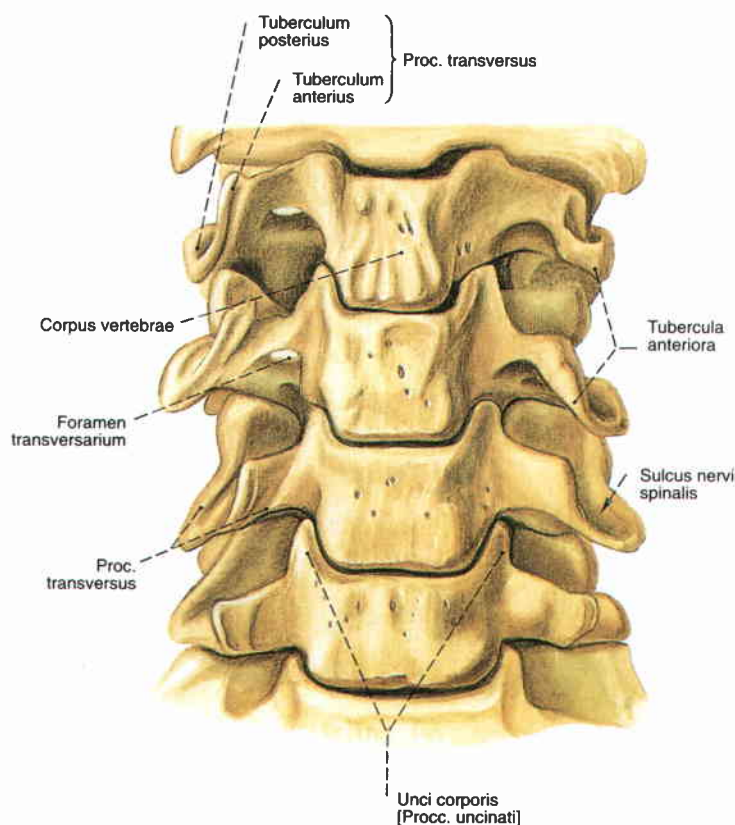
**Fig. 724** Fifth cervical vertebra, *Vertebra cervicalis V*; superior view (100%).

The spinous processes of the 2nd to 6th cervical vertebrae are usually split.

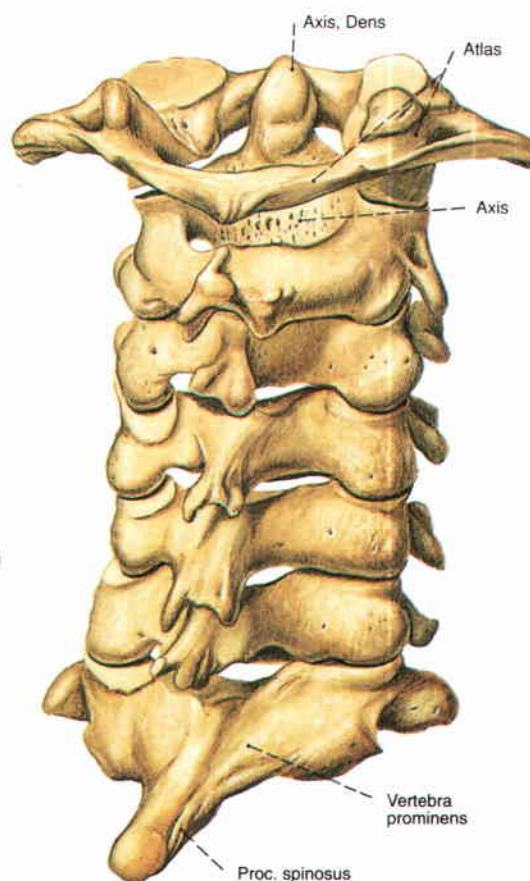


**Fig. 725** 7th cervical vertebra, *Vertebra cervicalis VII*; superior view (100%).

The 7th cervical vertebra can easily be identified by its prominent spinous process and is therefore also called the prominent vertebra, *Vertebra prominens*. However, the spinous process of the first thoracic vertebra often protrudes even further.



**Fig. 726** Second to seventh cervical vertebrae, *Vertebrae cervicales II-VII*; ventral view (120%).



**Fig. 727** Fifth to seventh cervical vertebrae, *Vertebrae cervicales I-VII*; dorsolateral view (110%).

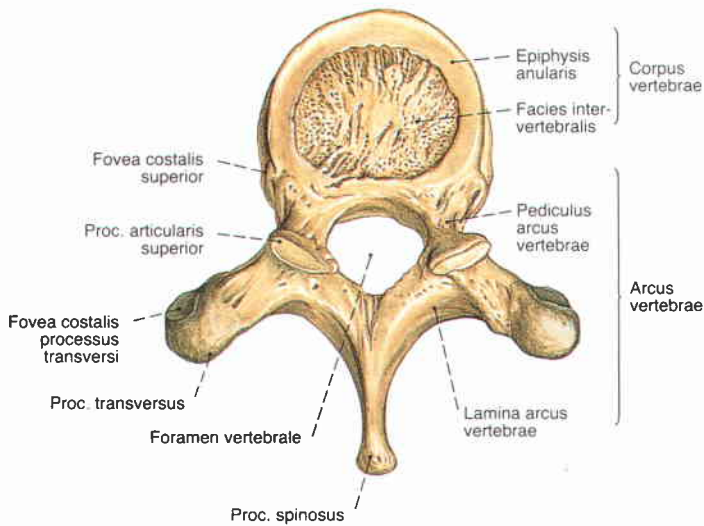


Fig. 728 Tenth thoracic vertebra, Vertebra thoracica X; superior view (90%).

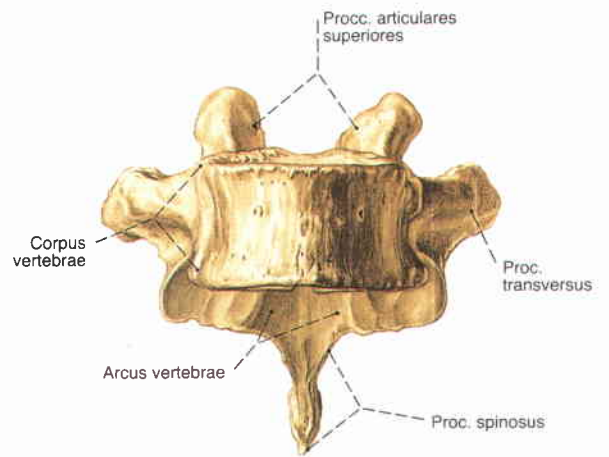


Fig. 729 Tenth thoracic vertebra, Vertebra thoracica X; ventral view (90%).

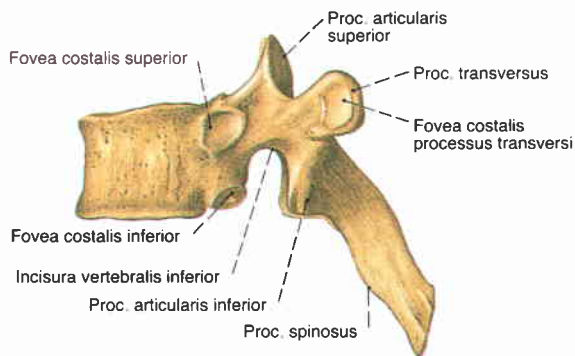


Fig. 730 Sixth thoracic vertebra, Vertebra thoracica VI; left lateral view (90%).

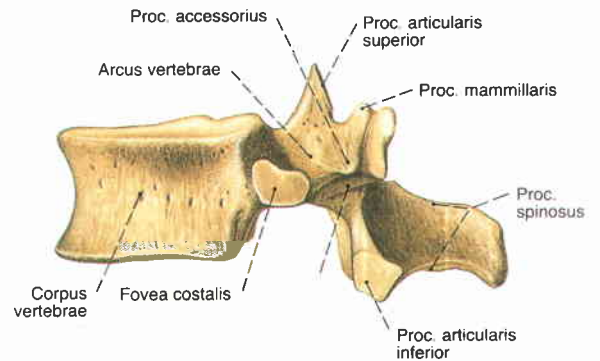


Fig. 731 Twelfth thoracic vertebra, Vertebra thoracica XII; left lateral view (80%).

\* part of the vertebral arch between the superior and inferior articular process (so-called isthmus = interarticular portion)

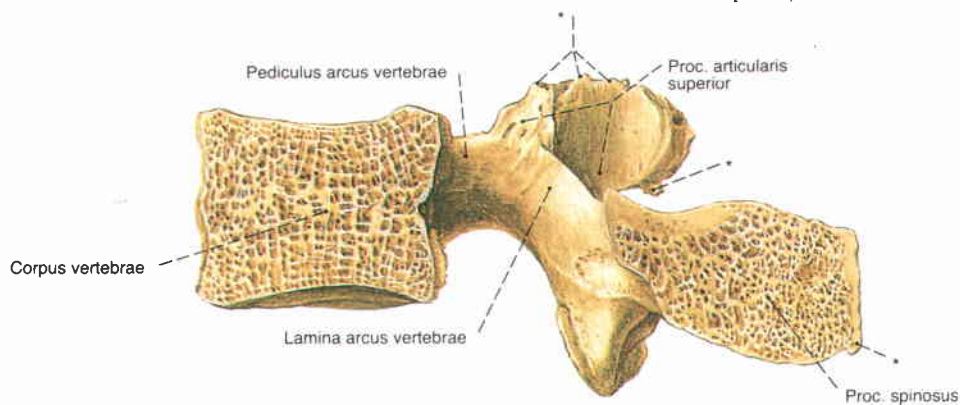


Fig. 732 Third lumbar vertebra, Vertebra lumbalis III; medial view of a median section (110%). Specimen from an elderly person.

\* ossification of ligamentous insertions



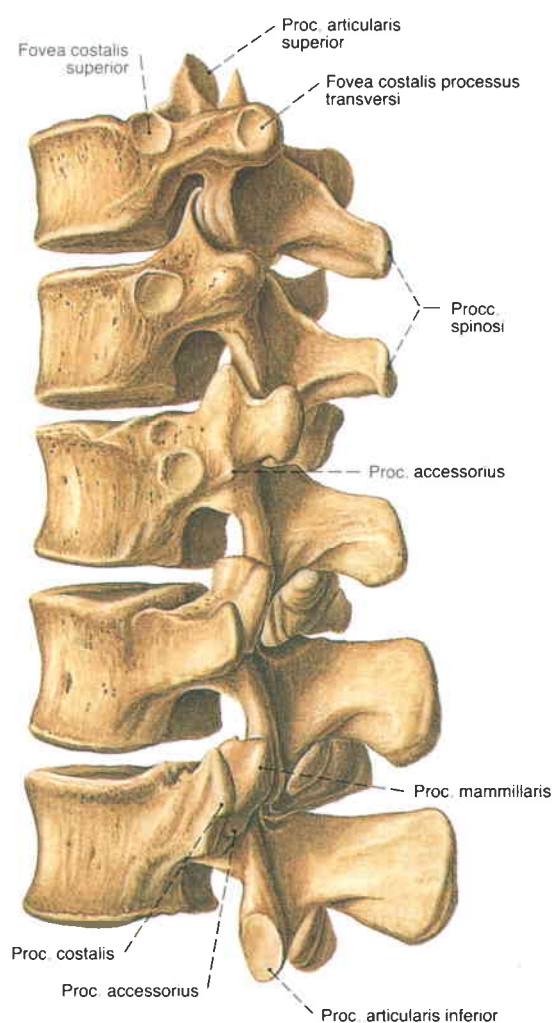


Fig. 733 Tenth to twelfth thoracic vertebrae, *Vertebrae thoracicae X–XII*, and first and second lumbar vertebrae, *Vertebrae lumbales I–II*; dorsolateral view (70%).

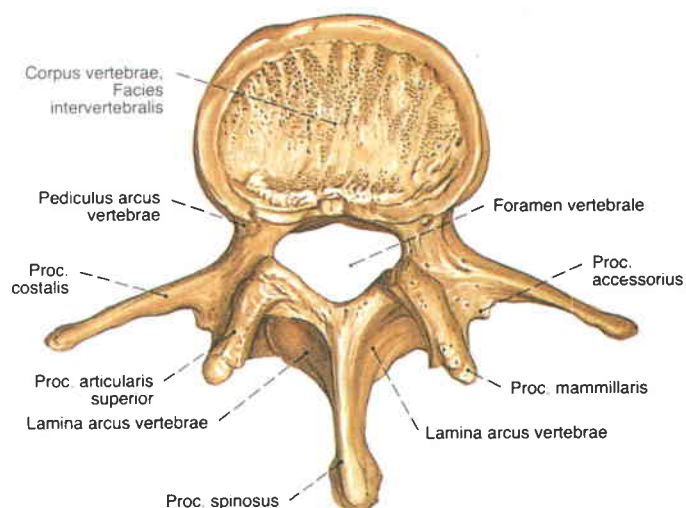


Fig. 734 Fourth lumbar vertebra, *Vertebra lumbalis IV*; superior view (100%).

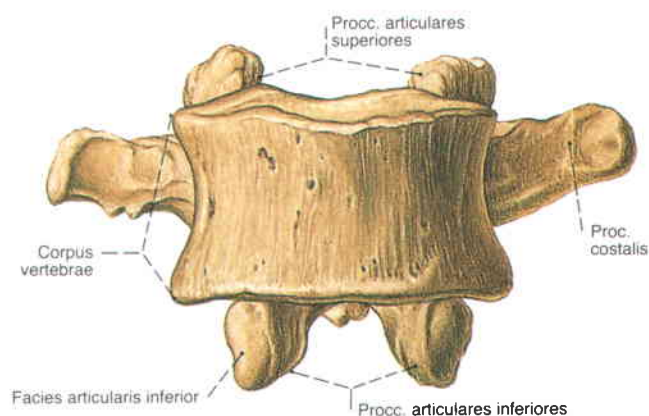


Fig. 735 Fourth lumbar vertebra, *Vertebra lumbalis IV*; ventral view (100%).

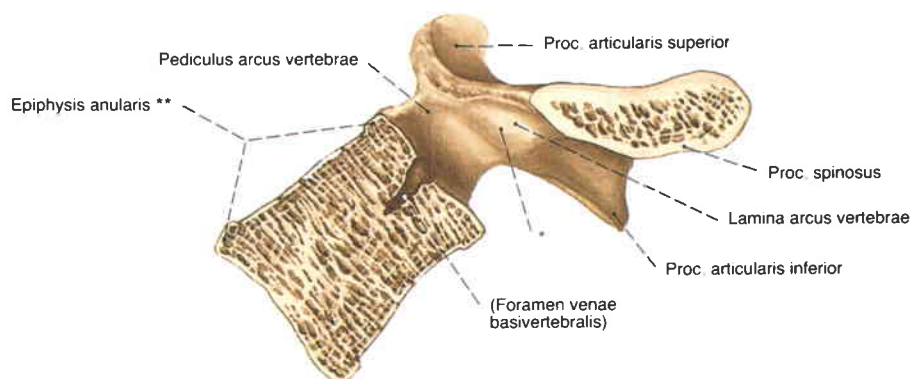


Fig. 736 Fifth lumbar vertebra, *Vertebra lumbalis V*; medial view of a median section (110%). Note the characteristic wedge shape of the body of the fifth lumbar vertebra.

- \* the region of the vertebral arch between superior and inferior articular processes. Here in the fifth and less frequently in the fourth lumbar vertebra a cleft, bridged by connective tissue (spondylolysis) can be formed. This is probably caused by local bending stress. As a consequence the superior vertebra may slip (olisthesis) onto the inferior vertebra (spondylolisthesis).
- \*\* In this specimen the anterior rim is pathologically oblique.

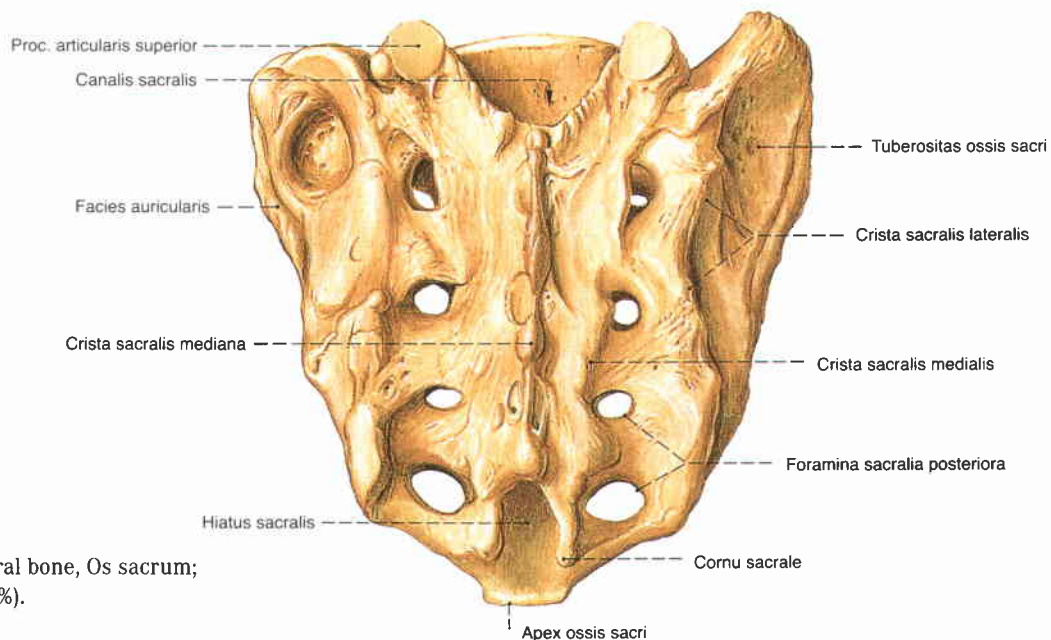


Fig. 737 Sacral bone, Os sacrum;  
dorsal view (60%).

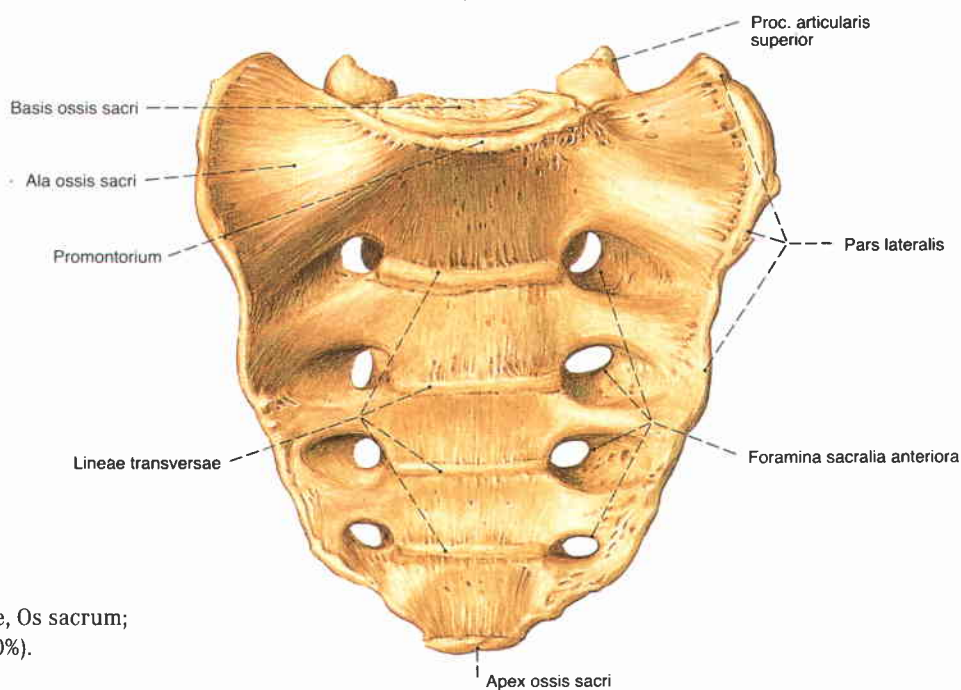


Fig. 738 Sacral bone, Os sacrum;  
ventroinferior view (60%).

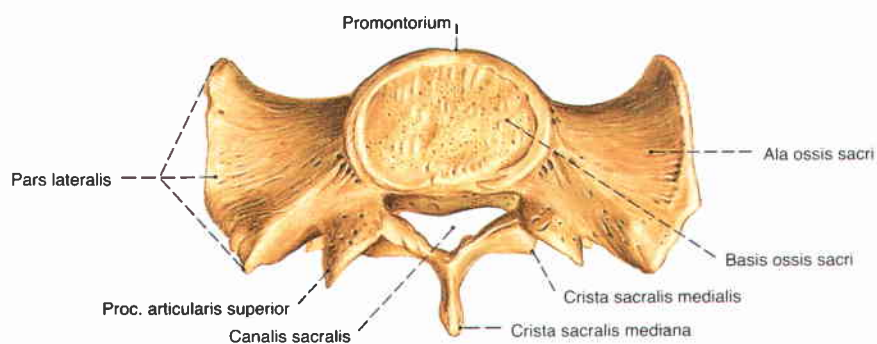
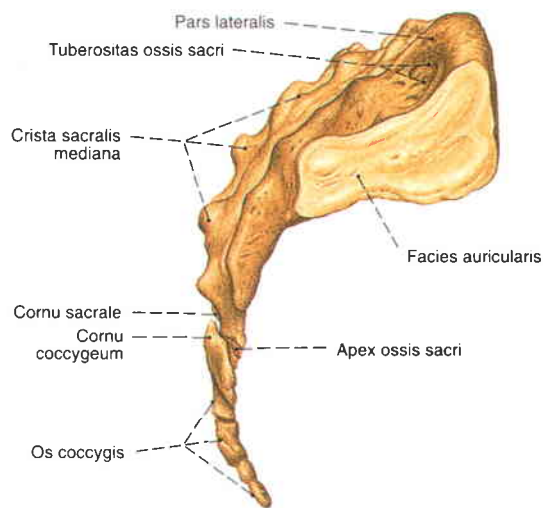
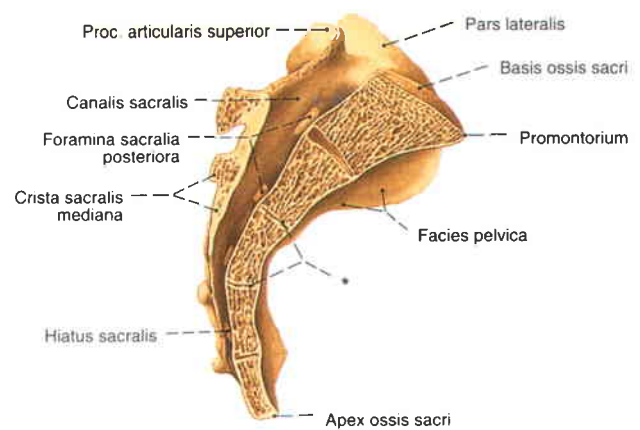


Fig. 739 Sacral bone, Os sacrum;  
the bone has been sectioned at the level  
of the second sacral vertebra; superior view (55%).

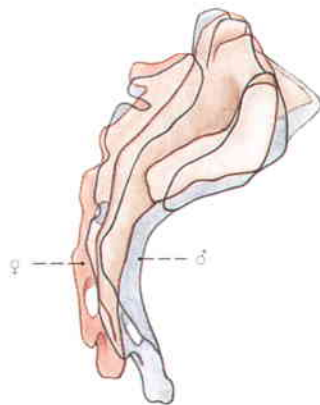


**Fig. 740** Sacral bone, Os sacrum; lateral view from the right (45%).

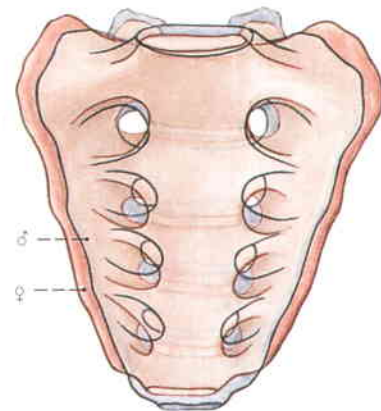


**Fig. 741** Sacral bone, Os sacrum; medial view of a median section (45%).

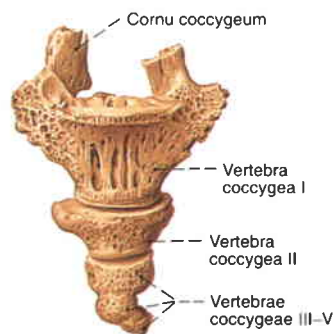
\* Even in adults, remnants of intervertebral disc tissue persists.



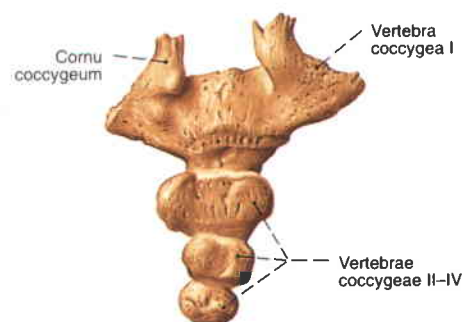
**Fig. 742** Sacral bone, Os sacrum; gender differences, lateral view.



**Fig. 743** Sacral bone, Os sacrum; gender differences, ventral view.

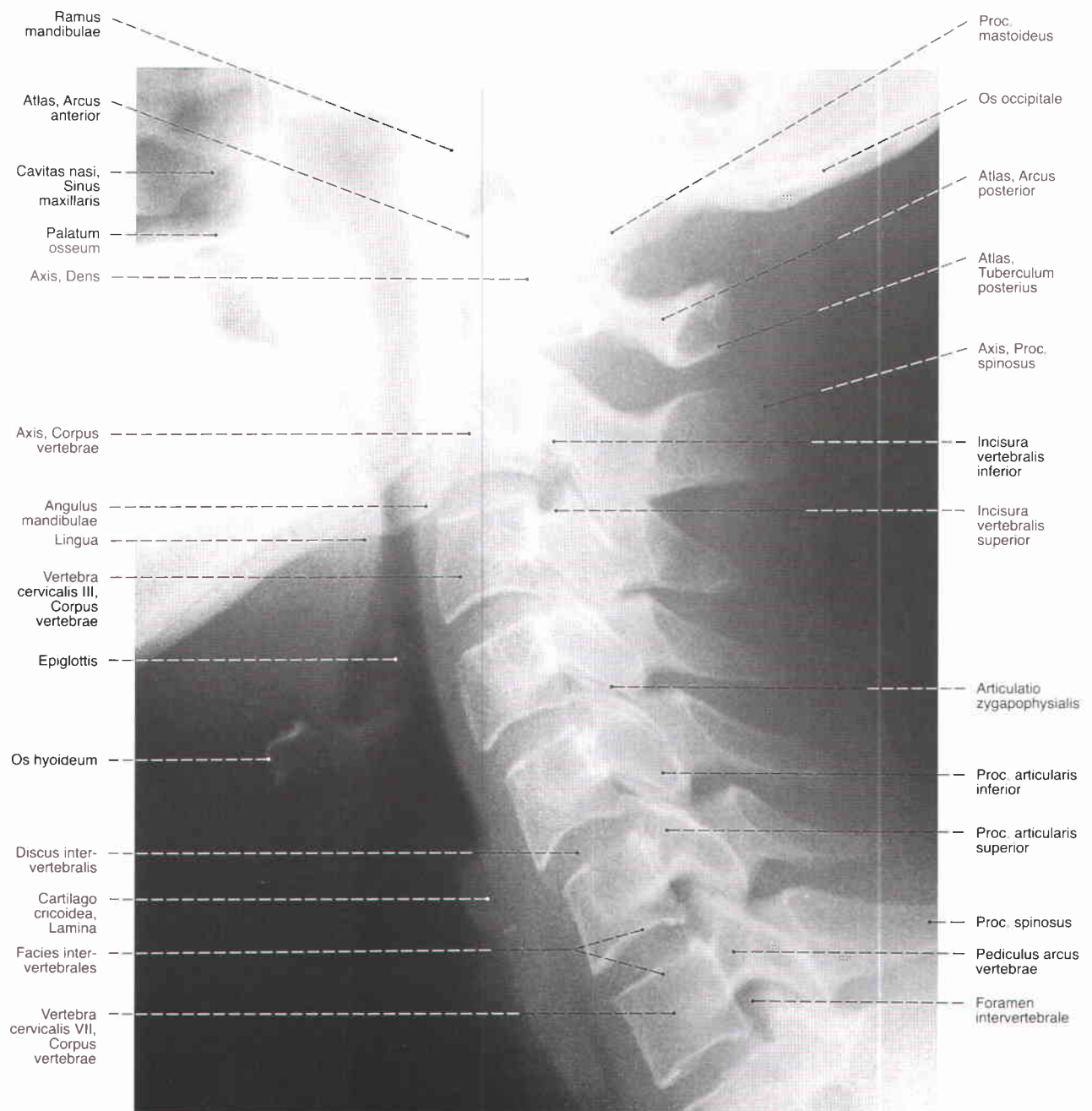


**Fig. 744** Coccyx, Os coccygis; ventrosuperior view (105%).  
Despite variations in the form of the intervertebral discs, all postsacral vertebrae are jointly termed the coccyx.



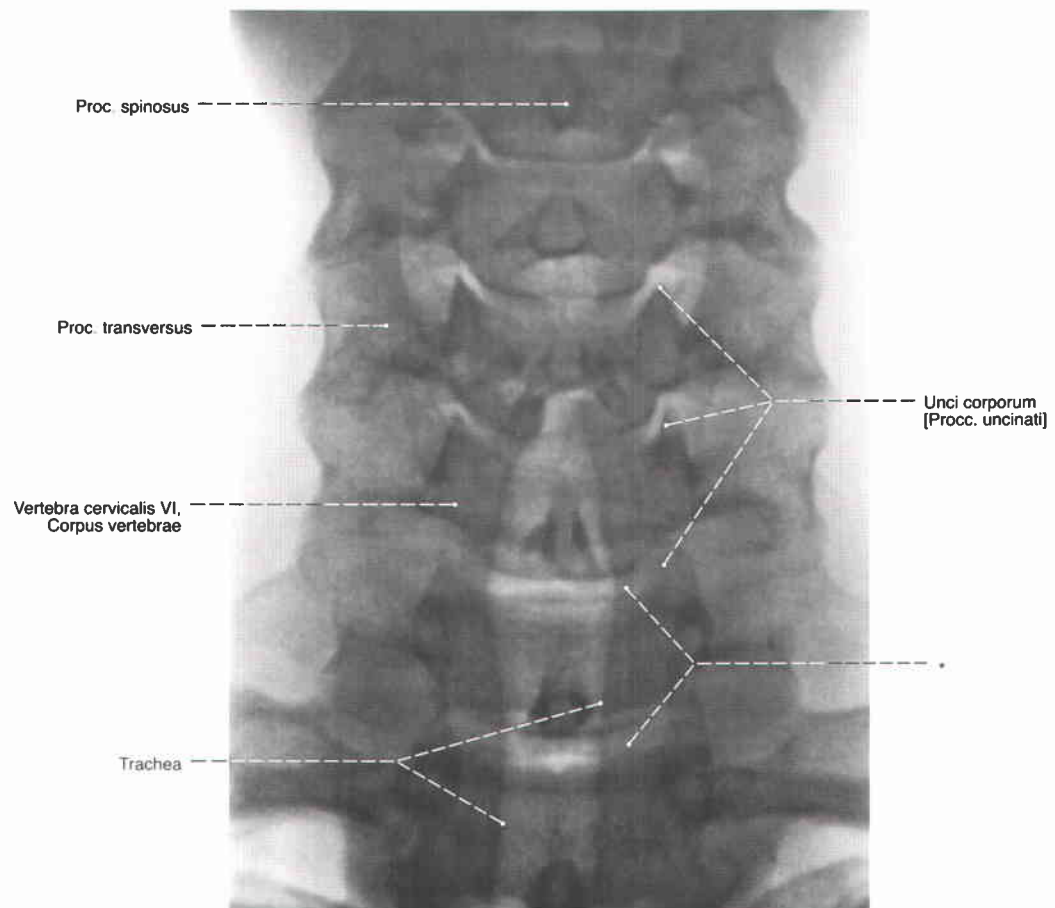
**Fig. 745** Coccyx, Os coccygis; dorsoinferior view (105%).





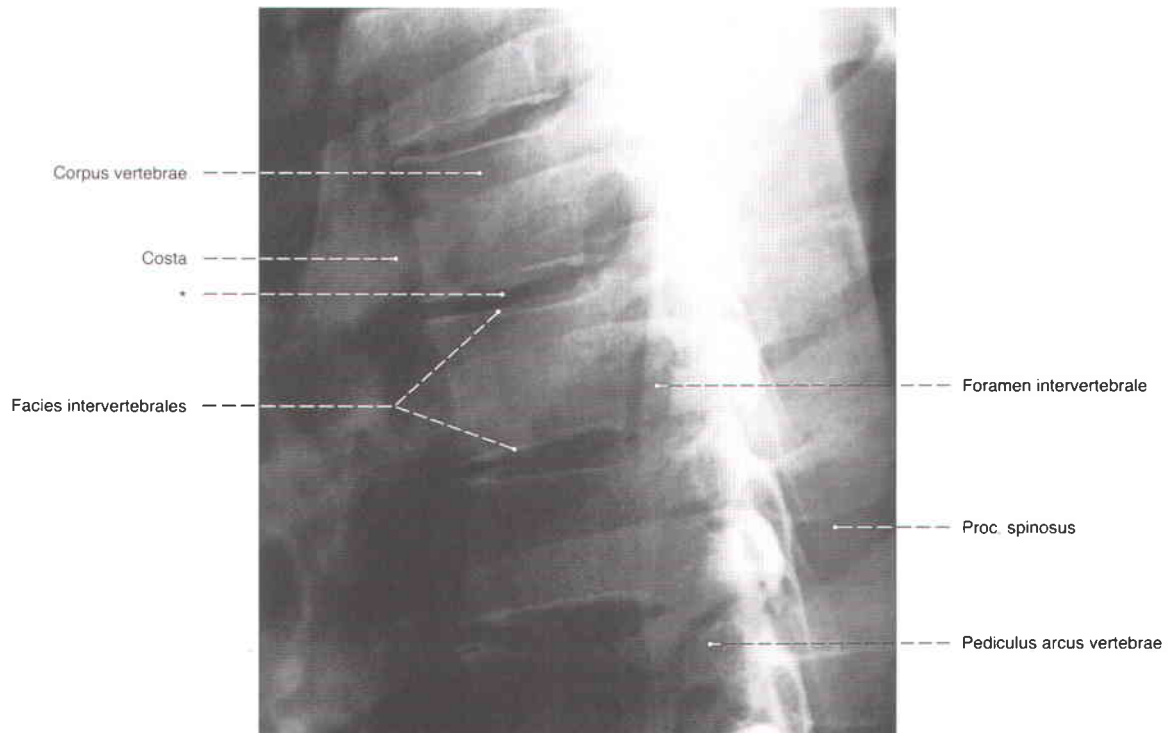
**Fig. 746** Cervical vertebrae, Vertebrae cervicales; a lateral radiograph of the cervical vertebral column in the upright position. The beam is directed at the 3rd cervical vertebra; shoulders are retracted inferiorly.





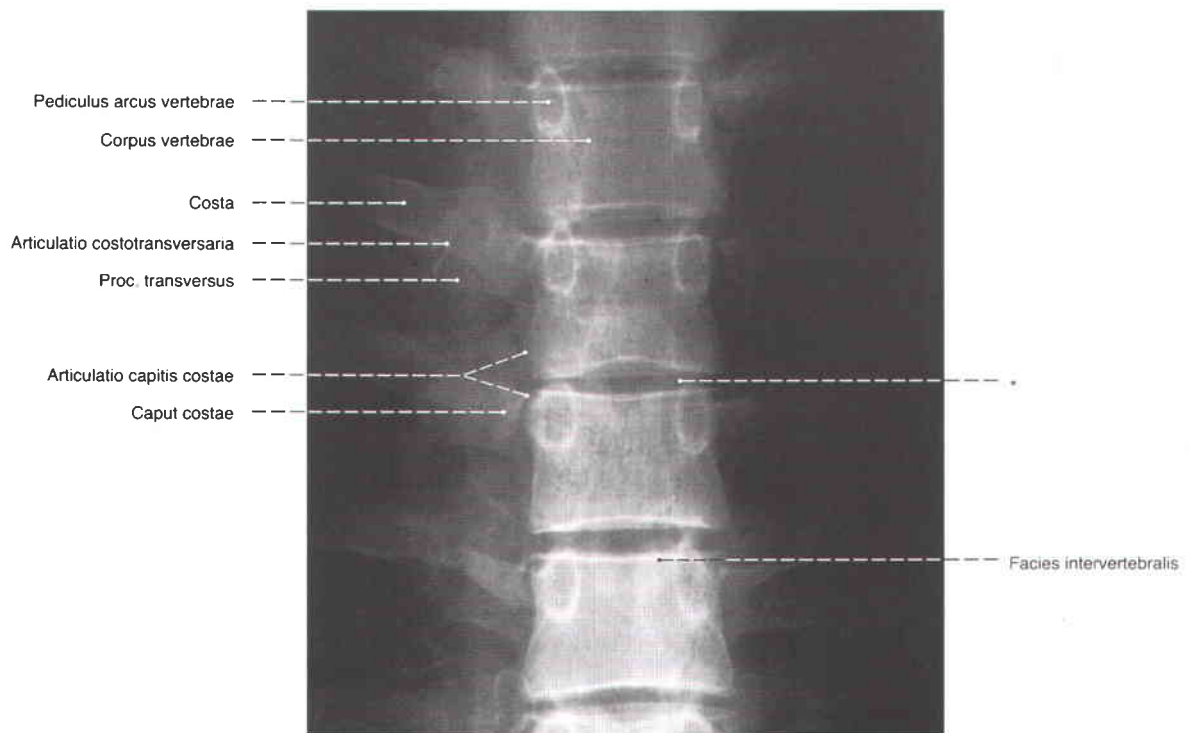
**Fig. 747** Cervical vertebrae, Vertebrae cervicales;  
AP-radiograph in an upright position; the beam is focused  
on the 3rd cervical vertebra.

\* spaces of the intervertebral discs



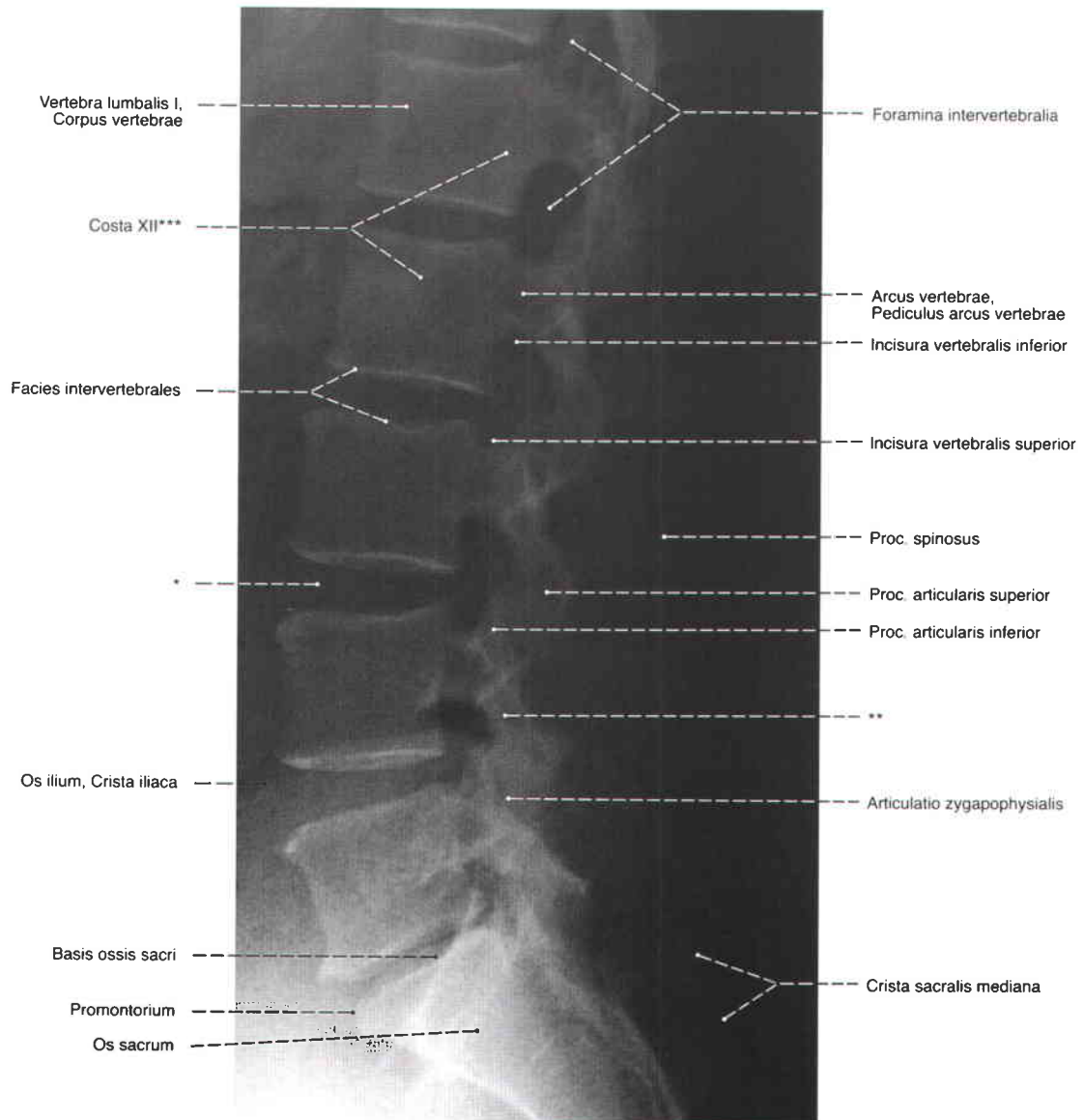
**Fig. 748** Thoracic vertebrae, *Vertebrae thoracicae*; lateral radiograph in an upright position; the beam is focused on the sixth thoracic vertebra.

\* space of an intervertebral disc



**Fig. 749** Thoracic vertebrae, *Vertebrae thoracicae*; AP-radiograph in an upright position; the beam is focused on the sixth thoracic vertebra.

\* space of an intervertebral disc

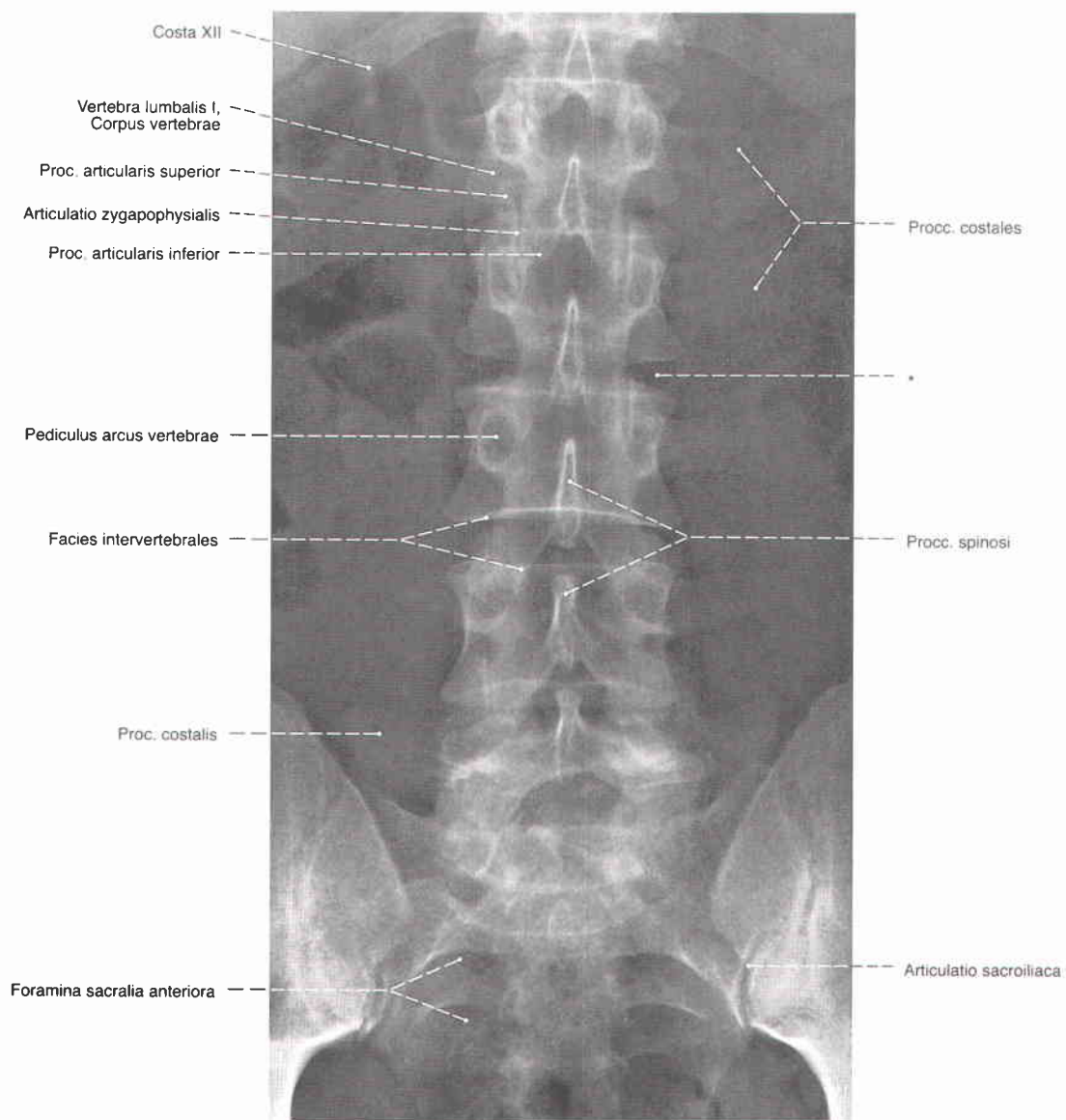


**Fig. 750** Lumbar vertebrae, *Vertebrae lumbales*; lateral radiograph in an upright position; the beam is focused on the second lumbar vertebra. The oblique anterior rims of the lower lumbar vertebrae are a pathological alteration.

\* space of an intervertebral disc

\*\* the region of the vertebral arch between the superior and inferior articular processes (so-called isthmus = interarticular portion)

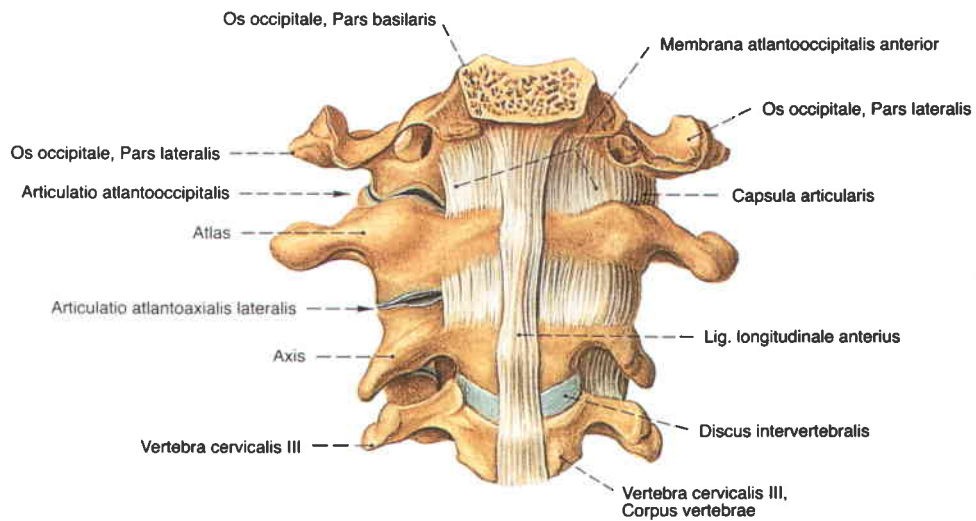
\*\*\* here the course of the 12th rib can faintly be seen



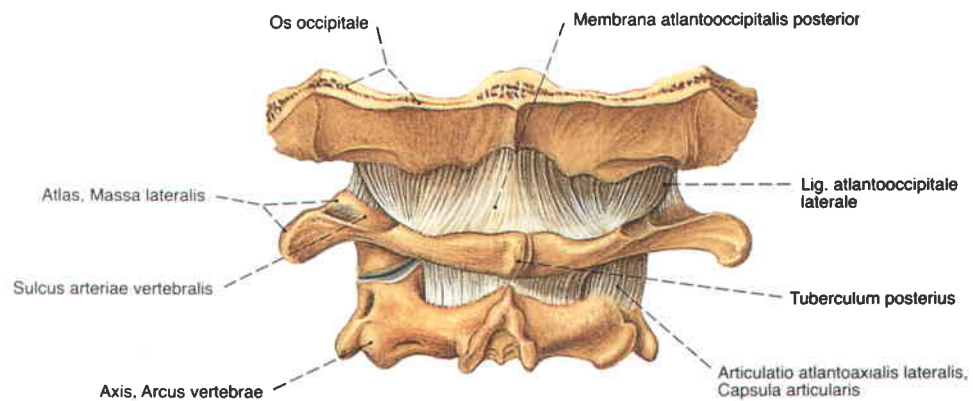
**Fig. 751** Lumbar vertebrae, Vertebrae lumbales;  
AP-radiograph in an upright position; the beam is focused  
on the second lumbar vertebra.

\* space of an intervertebral disc

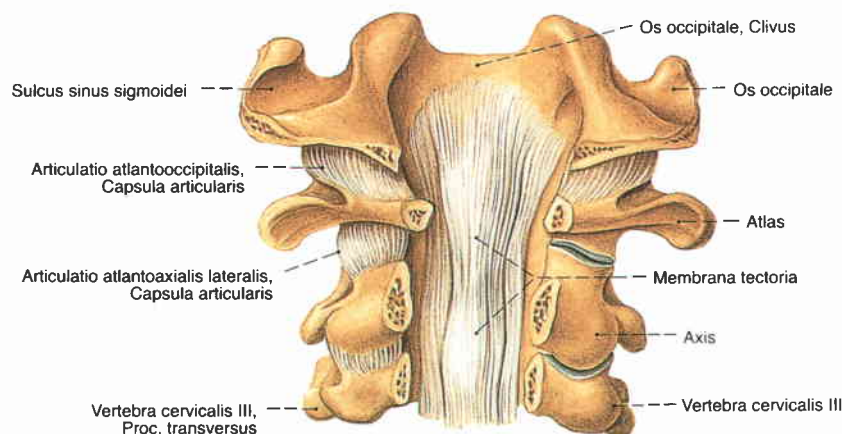




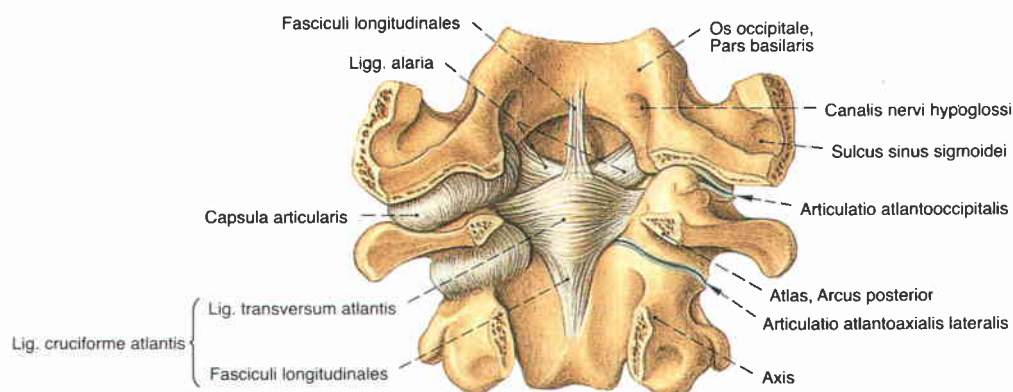
**Fig. 752** Articulations of the head and upper vertebral column; articular capsules have been removed on the right; ventral view.



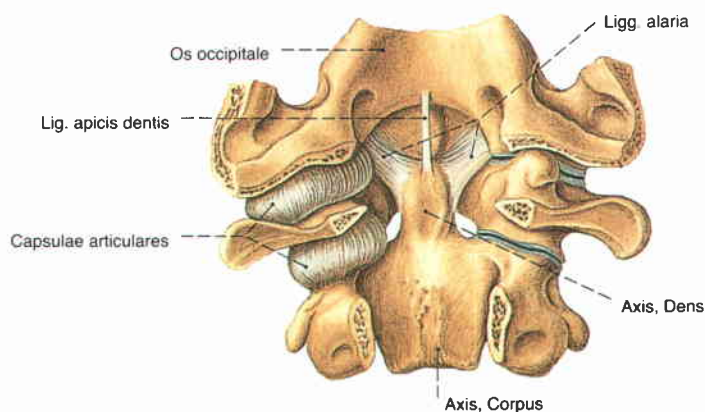
**Fig. 753** Articulations of the head; the articular capsule of the atlanto-axial joint, Articulatio atlanto-axialis lateralis, has been removed on the left; dorsal view.



**Fig. 754** Articulations of the head; the foramen magnum and vertebral canal have been opened to expose the deep ligaments. The articular capsules on the right have been partially removed; dorsal view.



**Fig. 755** Articulations of the head; the foramen magnum and vertebral canal have been opened to expose the deep ligaments. The articular capsules on the right have been partially removed; dorsal view.



**Fig. 756** Articulations of the head; the foramen magnum and vertebral canal have been opened to expose the deep ligaments. The articular capsules on the right have been removed; dorsal view.

The alar ligaments, Ligg. alaria, often insert on the lateral masses of the atlas as well.

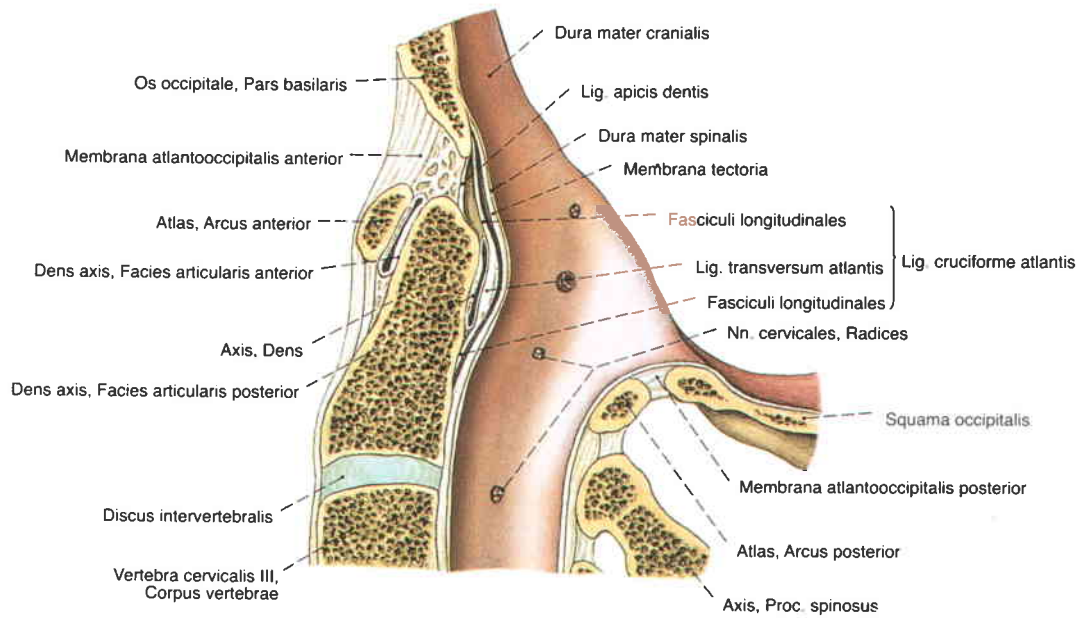


Fig. 757 Articulations of the head; median section; medial view.

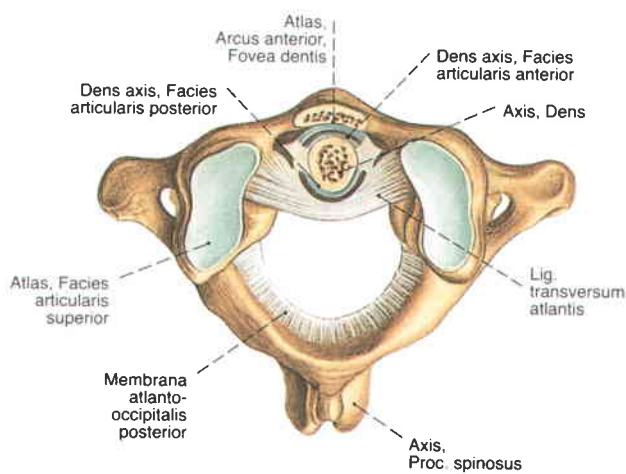


Fig. 758 Articulations of the head; the occipital bone has been removed; superior view.

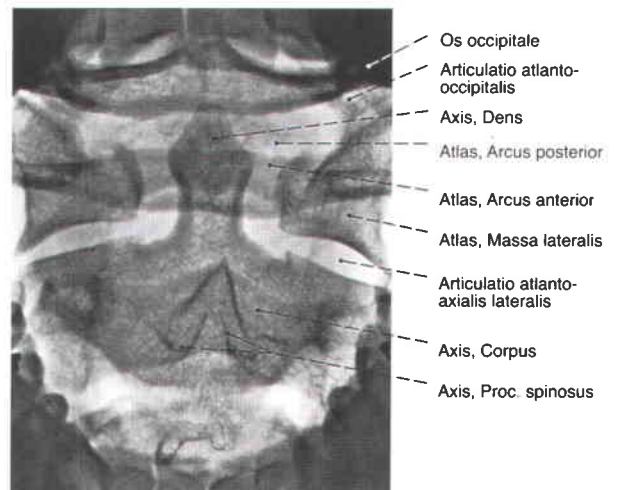
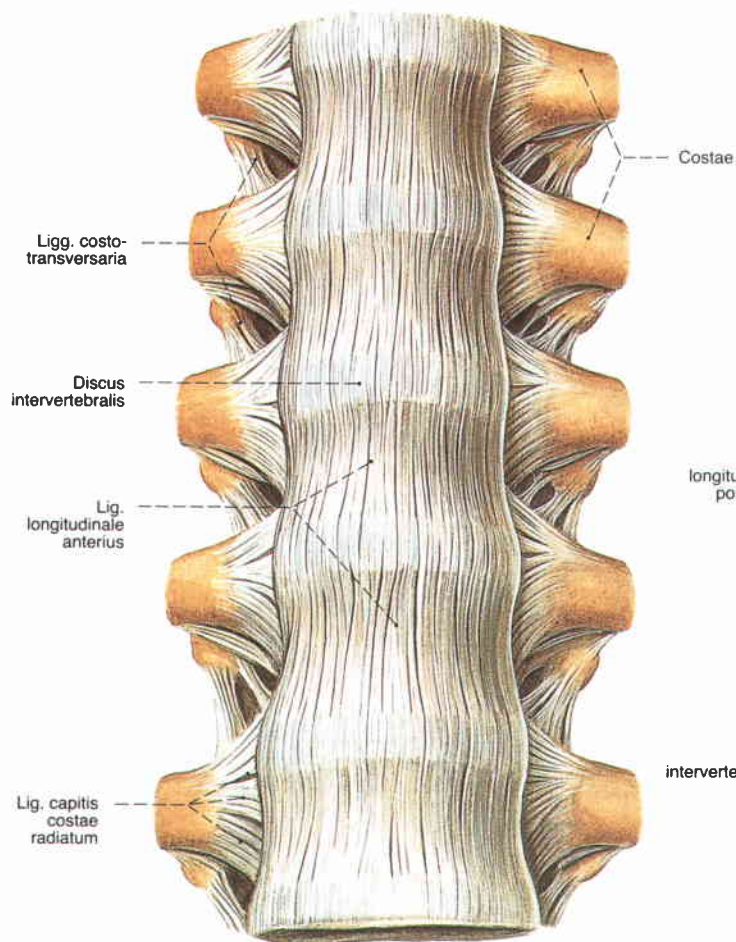
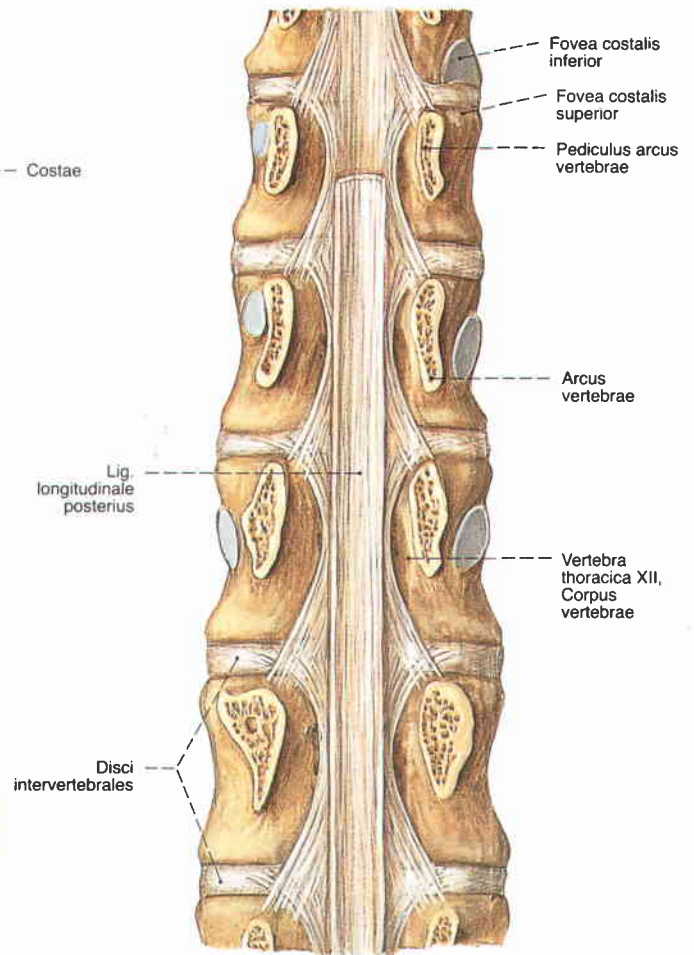


Fig. 759 Articulations of the head; AP-radiograph, taken through the open mouth.

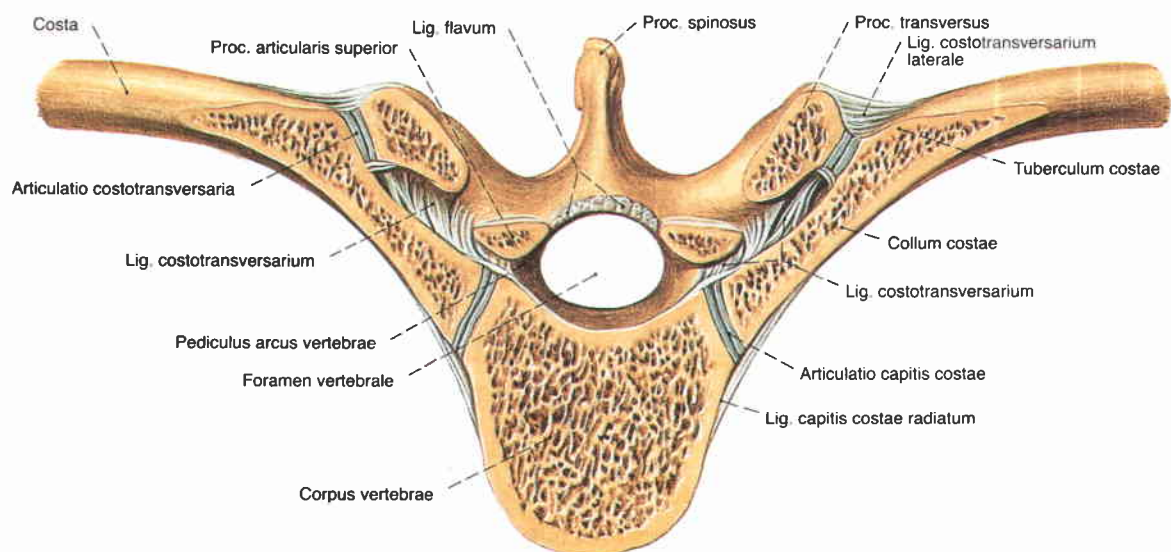




**Fig. 760** Ligaments of the vertebral column in the lower thoracic region; ventral view.



**Fig. 761** Ligaments of the vertebral column in the lower thoracic and upper lumbar regions; the vertebral canal has been exposed by a frontal section through the pedicles, Pediculi; dorsal view.



**Fig. 762** Costovertebral articulations, Articulationes costo-vertebrales;

a cross section through the lower part of the costovertebral articulation at the head of a rib; superior view.



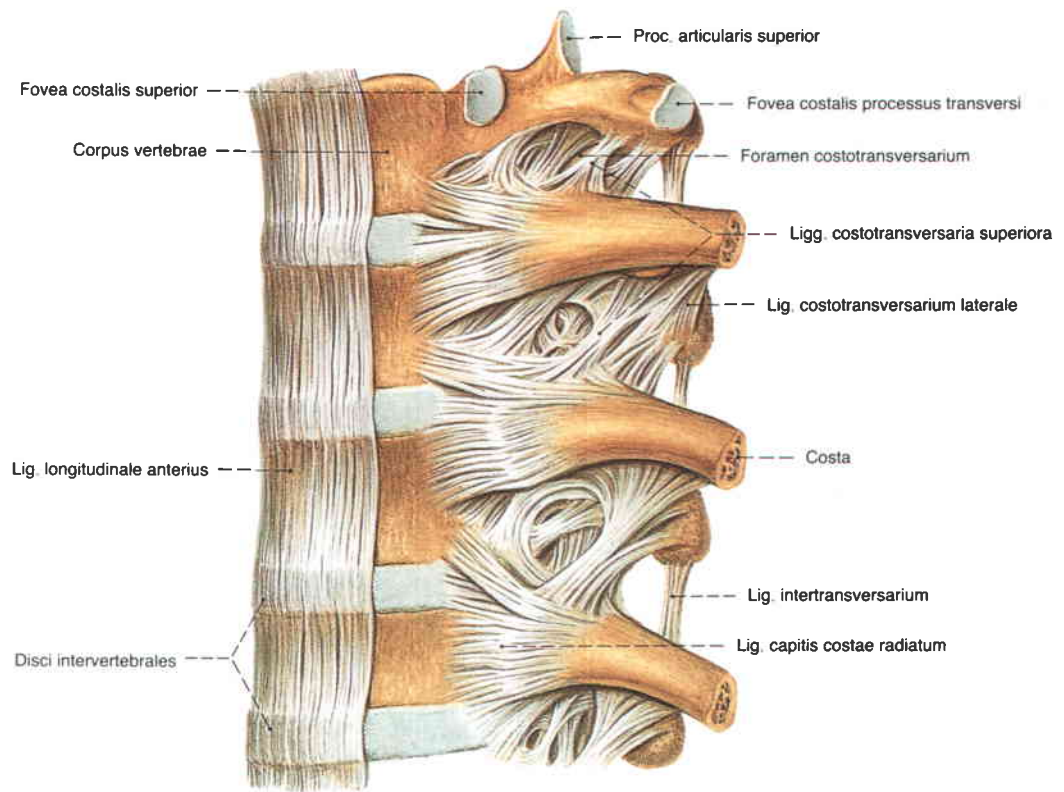


Fig. 763 Ligaments of the vertebral column and the costovertebral articulations;

the lateral part of the anterior longitudinal ligament has been removed; left lateral view.

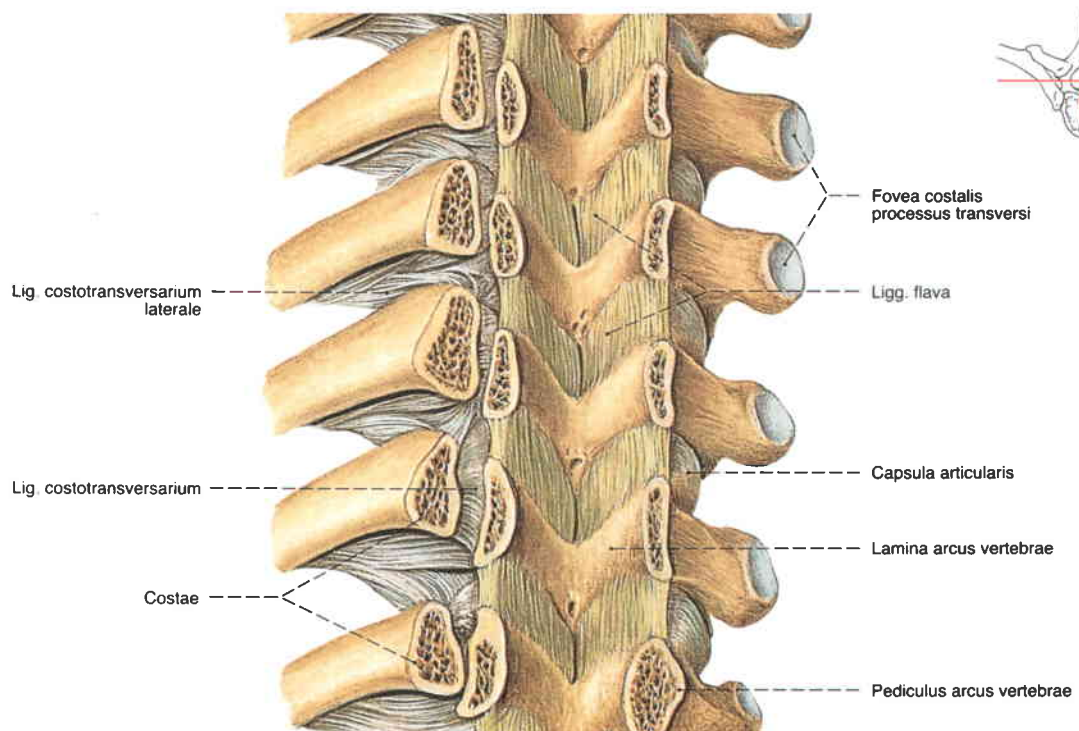
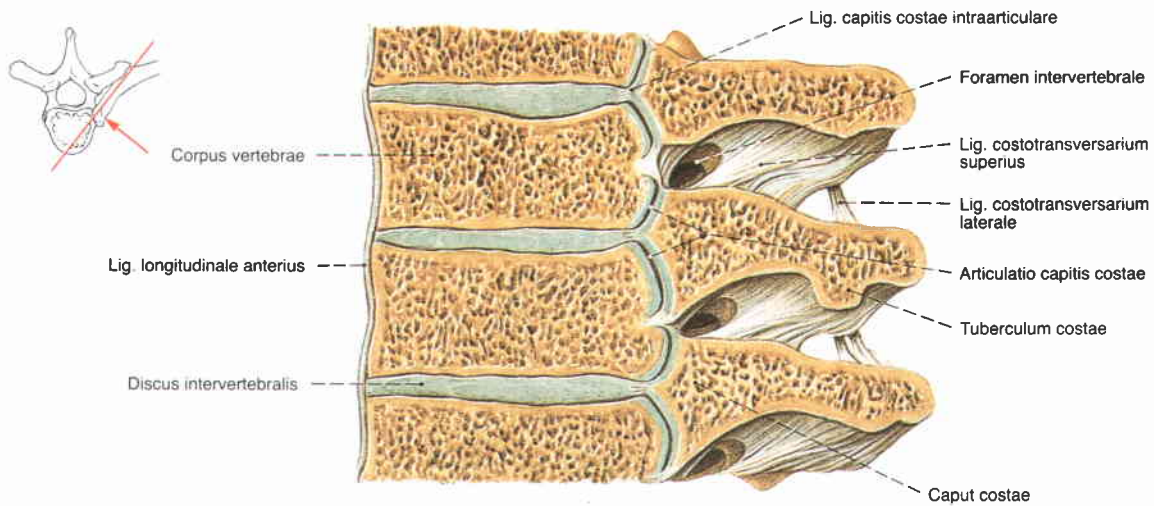
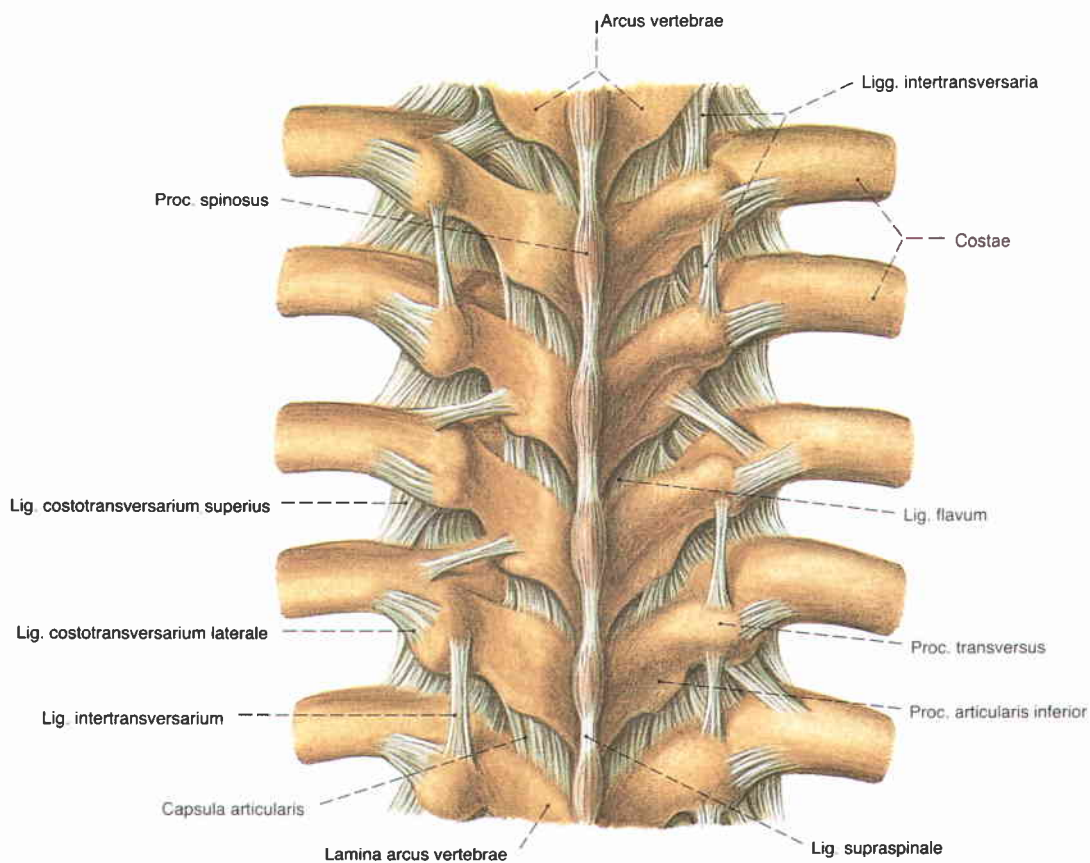


Fig. 764 Ligaments of the vertebral arches; the vertebral canal has been opened by a frontal section through the pedicles; ventral view.

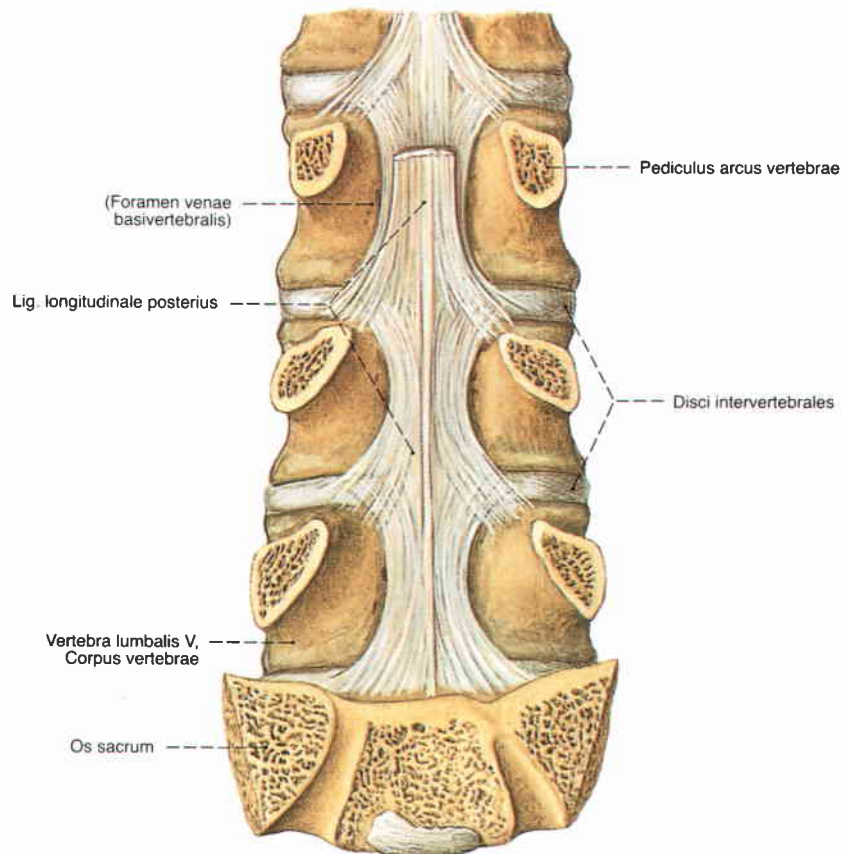
The ligamenta flava of the lumbar vertebral column surround the vertebral articulations ventrally as well and thereby form the posterior wall of the intervertebral foramina.



**Fig. 765** Costovertebral articulations, *Articulationes costovertebrales*; oblique vertical section through the joints at the heads of the ribs (costovertebral articulations); left lateral view.

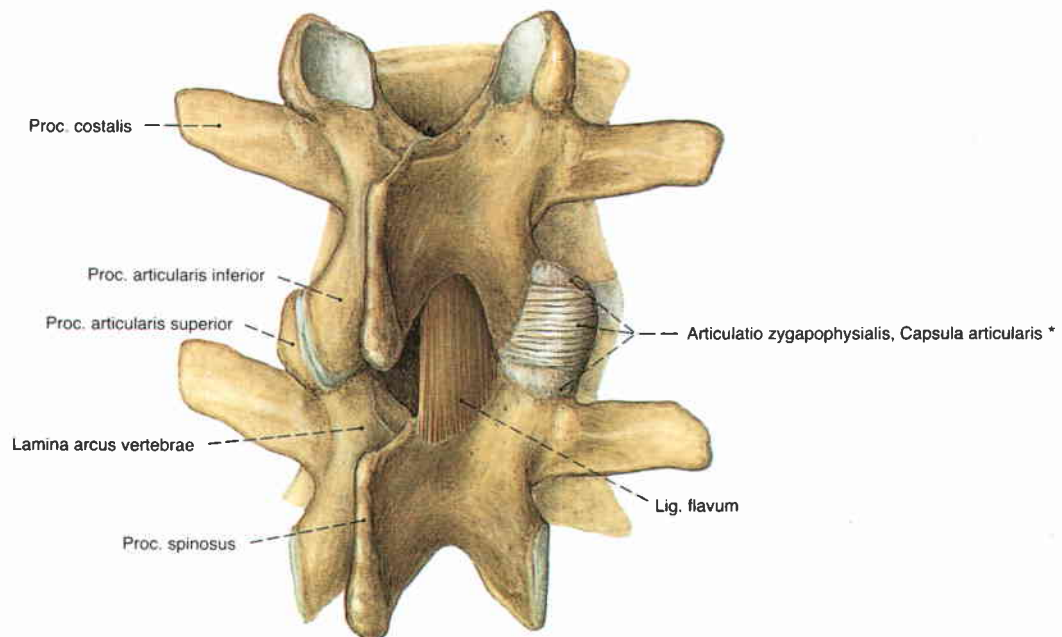


**Fig. 766** Ligaments of the vertebral arches and costovertebral articulations, *Articulationes costovertebrales*; dorsal view.



**Fig. 767** Ligaments of the lumbar vertebral column; the vertebral canal has been opened; dorsal view.

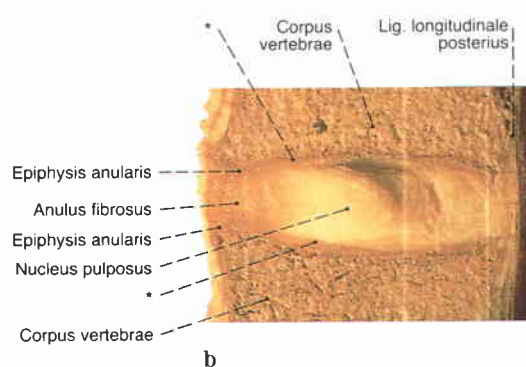
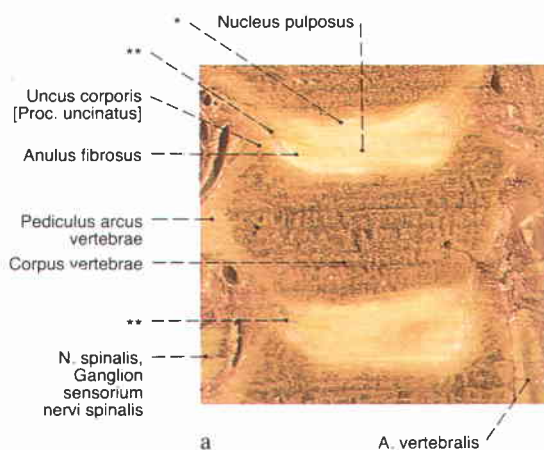
Below the second or third lumbar vertebrae, the superficial layer of the posterior longitudinal ligament becomes a thin strand. The deep layer inserts laterally on the fibrous ring of the intervertebral disc.



**Fig. 768** Articulations between the articular processes of the lumbar vertebral column, *Articulationes zygapophysiales lumbales*; the ligamenta flava have been removed on the left; right dorsal view.

\* Only in the lumbar vertebral column are the zygapophysial joints reinforced by strong, transverse fibre bundles ("transverse ligaments").





Figs. 769 a, b Intervertebral discs, Disci intervertebrales.

a cervical intervertebral discs, Disci intervertebrales cervicales; frontal section through the middle of the vertebral body; ventral view (115%)

b lumbar intervertebral disc, Discus intervertebralis lumbalis, median section (115%)

\* Hyaline cartilaginous covering of the end plates of the vertebral bodies, a nonossified portion of its epiphyses.

\*\* Within the first decade of life the so-called uncovertebral clefts appear in the lateral zones of the cervical intervertebral discs. Their progress medially in the following decades varies considerably between individuals.

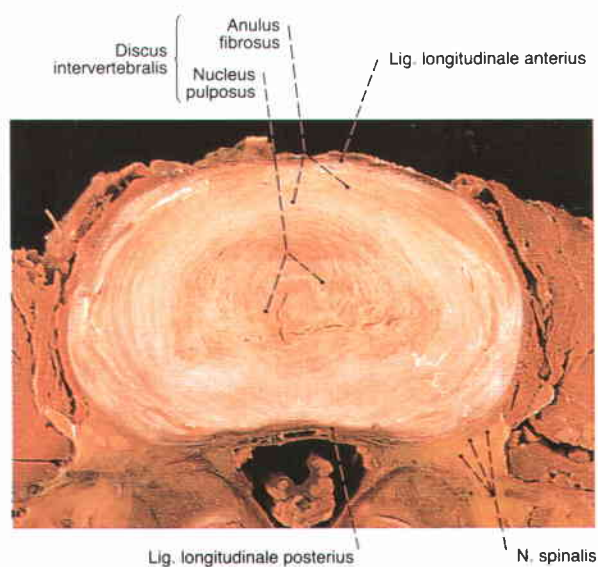


Fig. 770 Lumbar intervertebral disc, Discus intervertebralis lumbalis; ventrosuperior view (115%).

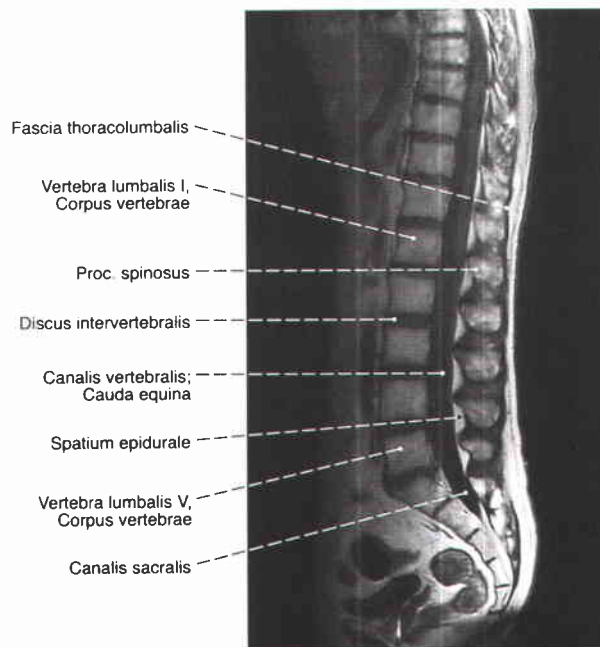
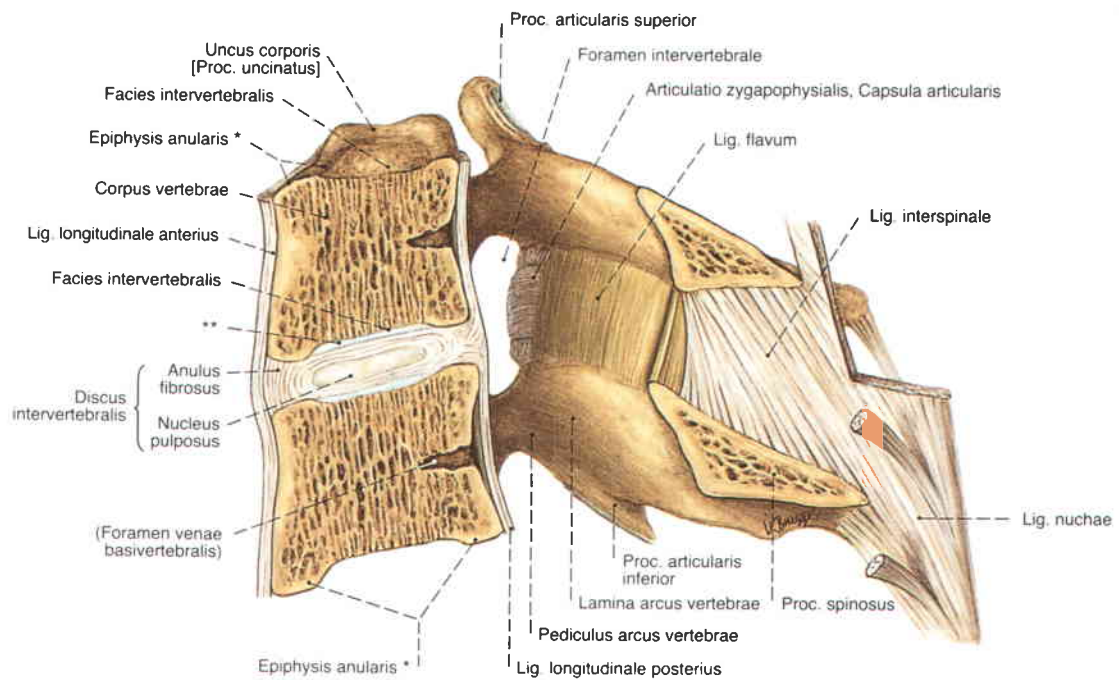


Fig. 771 Lumbar vertebral column; magnetic resonance tomography (MRT) in the median plane.

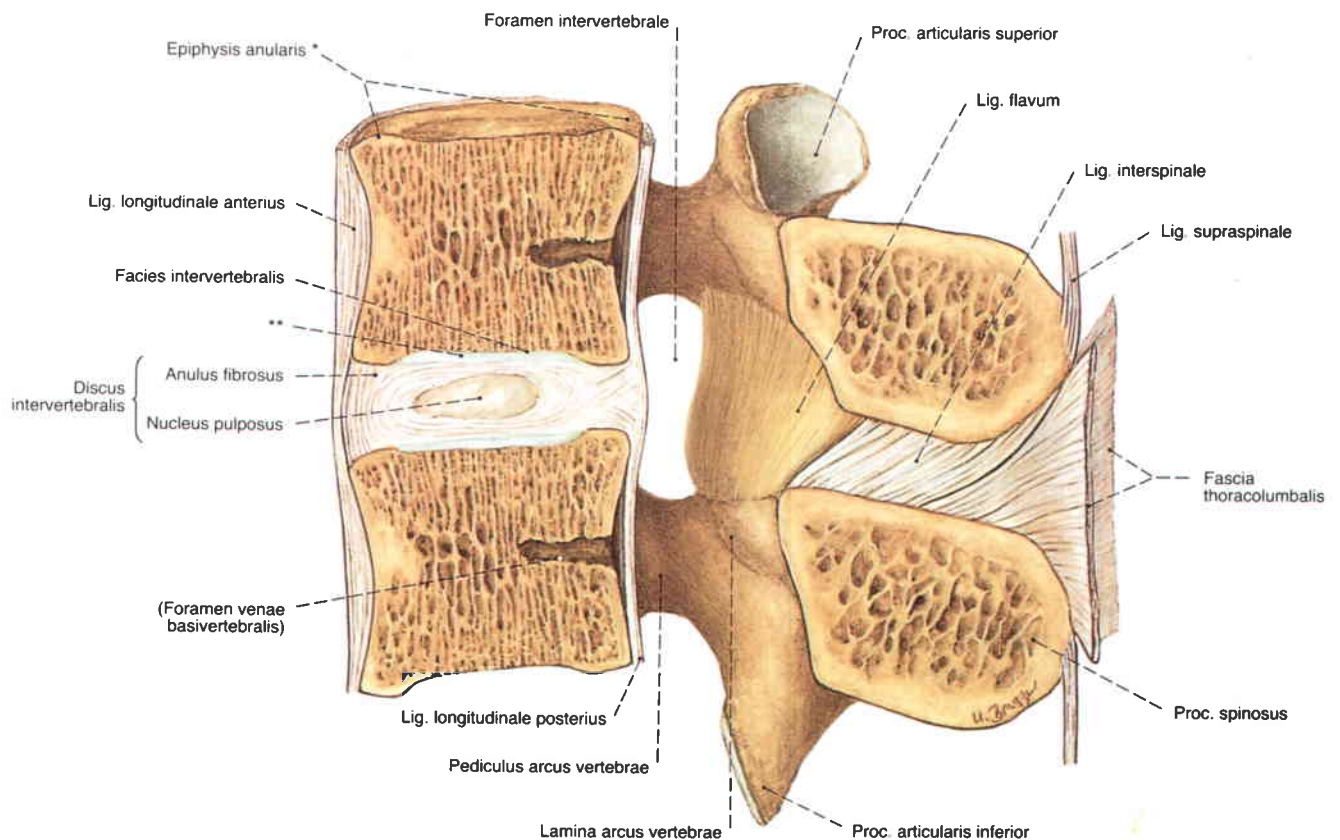




**Fig. 772** Cervical segment of movement; schematic, median section (160%).

\* Rim of vertebral body.

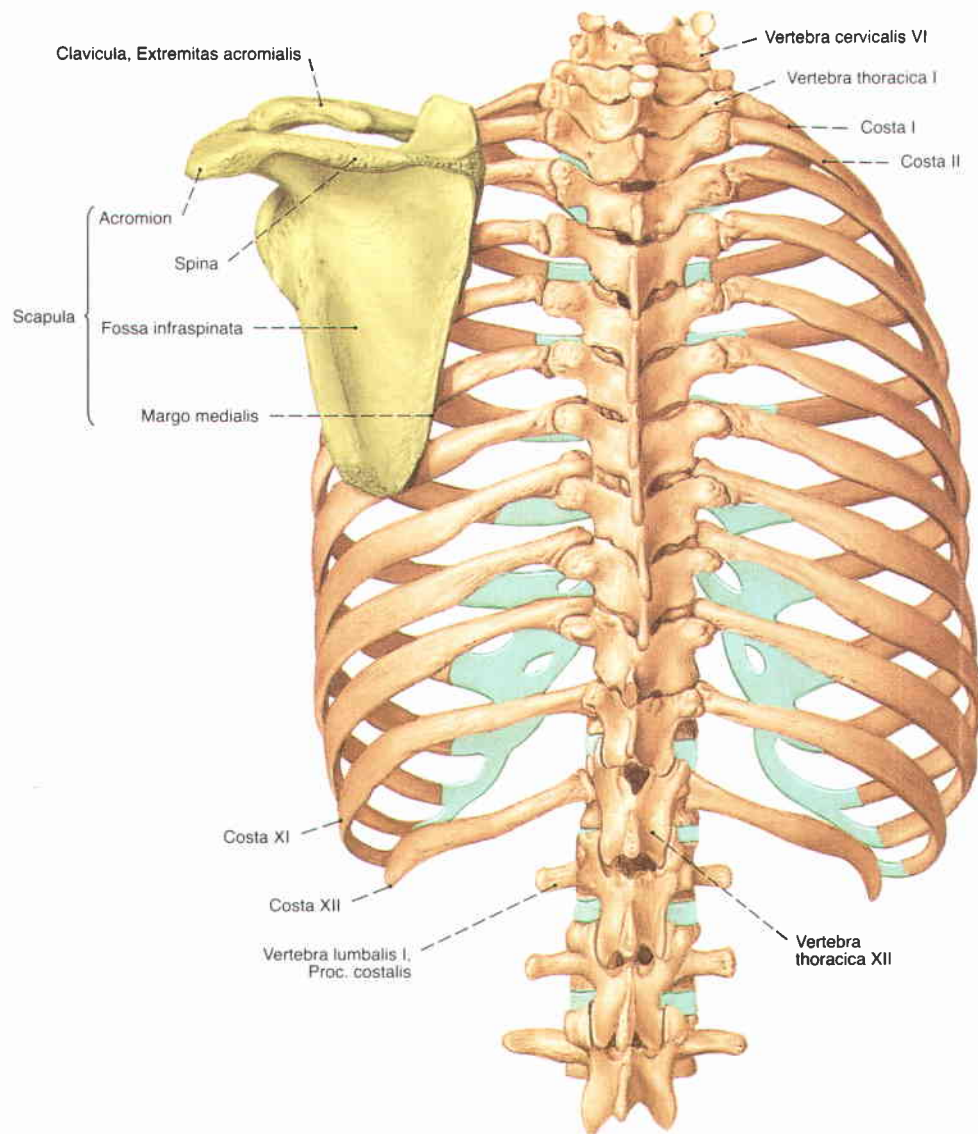
\*\* Hyaline cartilaginous covering of the end plate of the vertebral body, a nonossified portion of its epiphysis.



**Fig. 773** Lumbar segment of movement; schematic, median section (120%).

\* Rim of vertebral body.

\*\* Hyaline cartilaginous covering of the end plate of the vertebral body, a nonossified portion of its epiphysis.



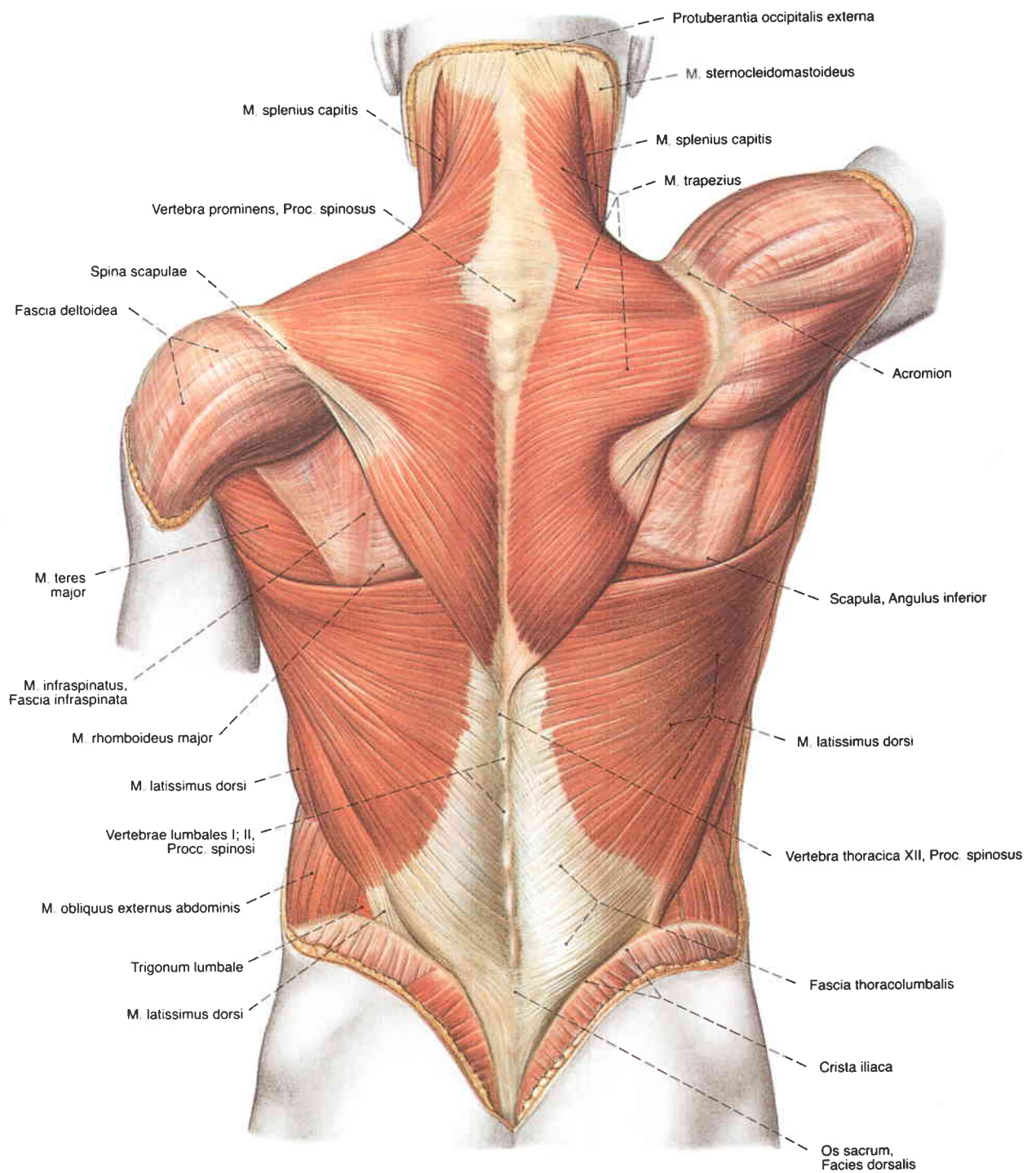
**Fig. 774** Thoracic cage, Cavea thoracis, and left shoulder girdle, Cingulum pectorale; dorsal view.

### Trunk-shoulder girdle muscles (Figs. 775, 776)

The dorsal muscles of this group, *M. trapezius*, *M. levator scapulae*, *M. rhomboideus major*, and *M. rhomboideus minor*, belong, according to their location to the superficial layer of the muscles of the back. According to their origin and innervation, they are described as derived muscles of the back. *M. serratus anterior* lays on the lateral thorax and passes dorsally, covered by the scapula. *M. pectoralis minor* and *M. subclavius* arise on the front of the thorax. They will be described within the group of ventral muscles of the shoulder.

Muscle Innervation	Origin	Insertion	Function
1. <b>M. trapezius</b> <i>N. accessorius [XI] and small branches of the cervical plexus</i>	<b>Pars descendens:</b> Squama ossis occipitalis (between Linea nuchalis suprema and superior), Procc. spinosi of the upper cervical vertebrae (by Lig. nuchae) <b>Pars transversa:</b> Procc. spinosi of the lower cervical and upper thoracic vertebrae <b>Pars ascendens:</b> Procc. spinosi of the medial and lower thoracic vertebrae	<b>Pars descendens:</b> Clavicula, acromial third <b>Pars transversa:</b> Acromion <b>Pars ascendens:</b> Spina scapulae  <b>Vertebral column:</b> acting bilaterally Pars transversa and Pars ascendens together flatten the kyphosis of the thoracic vertebral column.	<b>Shoulder girdle:</b> <b>Pars descendens:</b> Stabilizes the shoulder girdle and the arm (when carrying), elevates the scapula (during inspiration), rotates the scapula upward (raising the arm above the horizontal - assisting the <i>M. serratus anterior</i> ); when the shoulder is stable: rotation of the head to the opposite side; <b>Pars transversa:</b> Adducts the scapula. <b>Pars ascendens:</b> Depresses and rotates the scapula downward.





**Fig. 775** Muscles of the back, Mm. dorsi; superficial muscles connecting the trunk with the shoulder girdle and the upper arm; dorsal view.

## Trunk-shoulder girdle muscles (continuation)

Muscle Innervation	Origin	Insertion	Function
<b>2. M. levator scapulae</b> <i>Direct branches of the Plexus cervicalis and N. dorsalis scapulae (Plexus brachialis)</i>	Tubercula posteriora of the Processus transversi of the upper 4 cervical vertebrae	Angulus superior and immediate adjacent region of the scapula	<b>Shoulder girdle:</b> Depresses and rotates the scapula upwards
<b>3. M. rhomboideus major</b> <i>N. dorsalis scapulae (Plexus brachialis, Pars supraclavicularis)</i>	Procc. spinosi of the upper 4 thoracic vertebrae	Medial border of the scapula, (caudal to the Spina scapulae)	<b>Shoulder girdle:</b> With M. rhomboideus minor: adduction and elevation of the scapula With M. serratus anterior: hold scapula to the trunk
<b>4. M. rhomboideus minor</b> <i>N. dorsalis scapulae (Plexus brachialis, Pars supraclavicularis)</i>	Procc. spinosi of the 6th and 7th thoracic vertebrae	Medial border of the scapula (cranial to the Spina scapulae)	<b>Shoulder girdle:</b> With M. rhomboideus major: adduction and elevation of the scapula With M. serratus anterior: hold scapula to the trunk
<b>5. M. serratus anterior</b> <i>N. thoracicus longus (Plexus brachialis, Pars supraclavicularis)</i>	<b>Pars superior:</b> 1st and 2nd ribs (moderately convergent) <b>Pars media:</b> 2nd to 4th ribs (divergent) <b>Pars inferior:</b> 5th to (8th) 9th ribs (very convergent). Interdigitates with the origin of M. obliquus abdominis externus	<b>Pars superior:</b> Angulus superior of the scapula <b>Pars media:</b> Margo medialis of the scapula <b>Pars inferior:</b> Angulus inferior of the scapula	<b>Shoulder girdle:</b> <u>All parts:</u> adduction of the scapula; with Mm. rhomboidei holding the scapula to the trunk (Scapula alata: when one of the antagonists does not function) <u>Pars superior:</u> elevation <u>Pars media:</u> depression <u>Pars inferior:</u> depression, exterior rotation (elevation of the arm above the horizontal) <b>Thorax:</b> When the scapula is stabilized: elevation of the ribs (inspiration)

## Trunk-arm muscles (Fig. 775)

M. latissimus dorsi and M. pectoralis major belong to this group. Both arise on the trunk and pass to the arm. Based on the location of most of its mass, the M. latissimus dorsi is included in the group of superficial muscles of the back, and like those muscles, it also derives from ventral. M. pectoralis major arises from the chestwall and is described in the group of ventral muscles of the shoulder.

Muscle Innervation	Origin	Insertion	Function
<b>M. latissimus dorsi</b> <i>N. thoracodorsalis (Plexus brachialis, Pars supraclavicularis)</i>	Procc. spinosi of the 6 lower thoracic vertebrae, of the lumbar vertebrae (by Fascia thoracolumbalis), Facies dorsalis of the Os sacrum, Labium externum of the Crista iliaca (dorsal third), ribs (9) 10 to 12; frequently from the Angulus inferior of the scapula	Crista tuberculi minoris (by a flat tendon spiraling around the M. teres major; in between Bursa subtendinea musculi latissimi dorsi)	<b>Shoulder joint:</b> Adduction and medial rotation, retroversion <b>Shoulder girdle:</b> Adducts and depresses the scapula

## Spinocostal muscles (Fig. 776)

The spinocostal muscles, M. serratus posterior superior and M. serratus posterior inferior, are located on top of the autochthonous muscles of the back.

Muscle Innervation	Origin	Insertion	Function
<b>1. M. serratus posterior superior</b> <i>Ventral branches of N. cervicalis [C6] to N. thoracicus [T2]</i>	Procc. spinosi of the 6th and 7th cervical vertebrae and 1st and 2nd thoracic vertebrae	2nd to 5th ribs (lateral of the Angulus costae)	Elevation of 2nd to 5th ribs (inspiration)
<b>2. M. serratus posterior inferior</b> <i>Ventral branches of N. thoracicus [T11] to N. lumbalis [L2]</i>	Procc. spinosi of the 11th and 12th thoracic vertebrae and 1st and 2nd lumbar vertebrae	9th to 12th ribs (inferior rim)	Pulls ribs 9 to 12 caudally (expiration). As an antagonist to the pulling forces of the diaphragma, it is also active during forced inspiration.



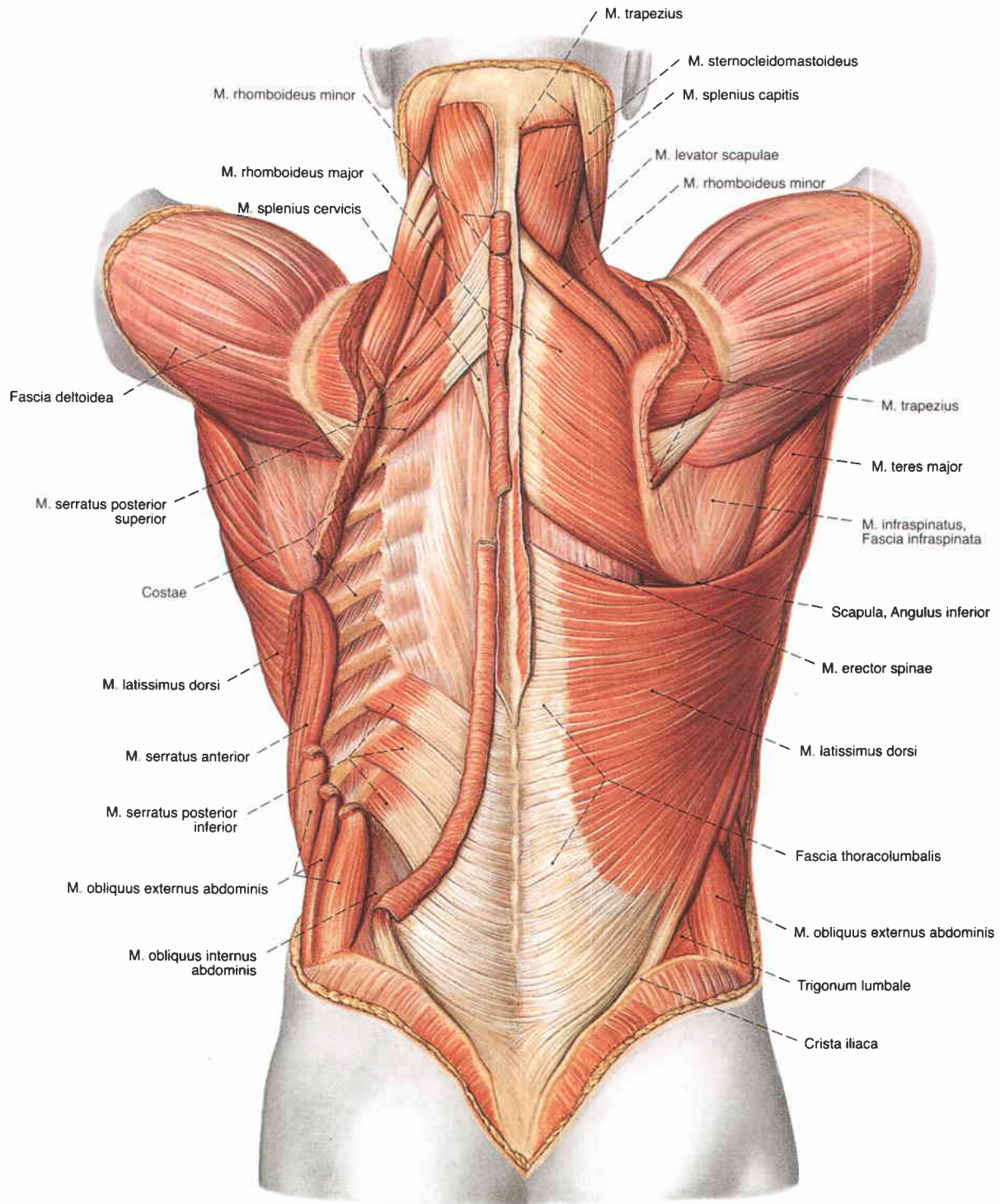
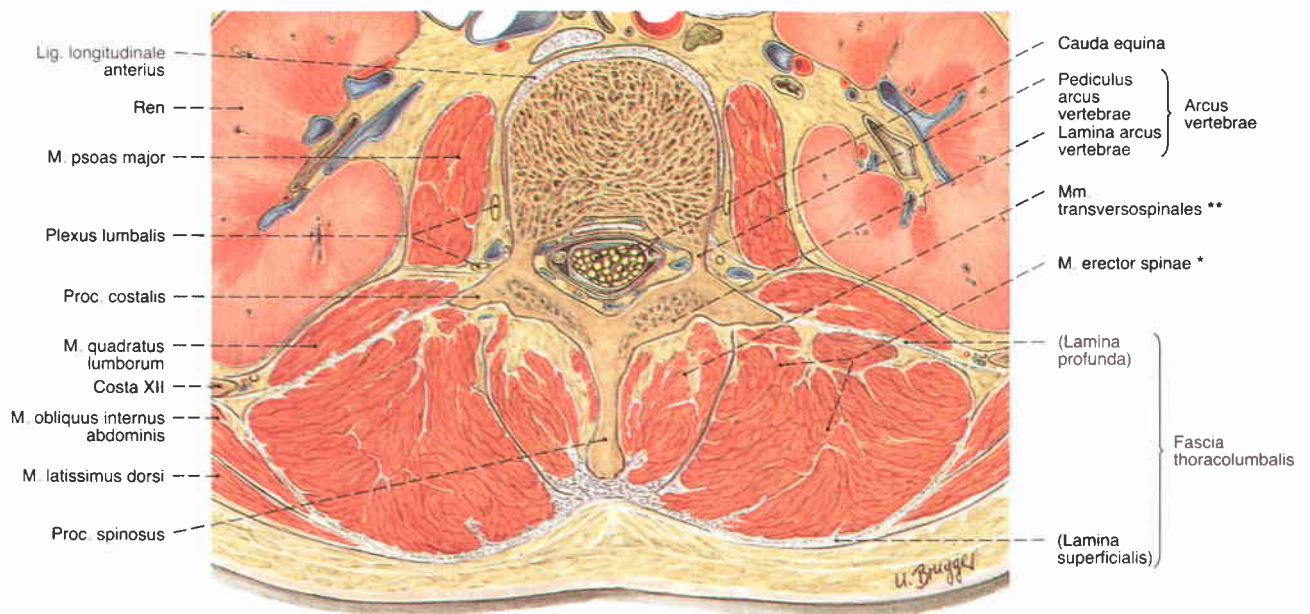
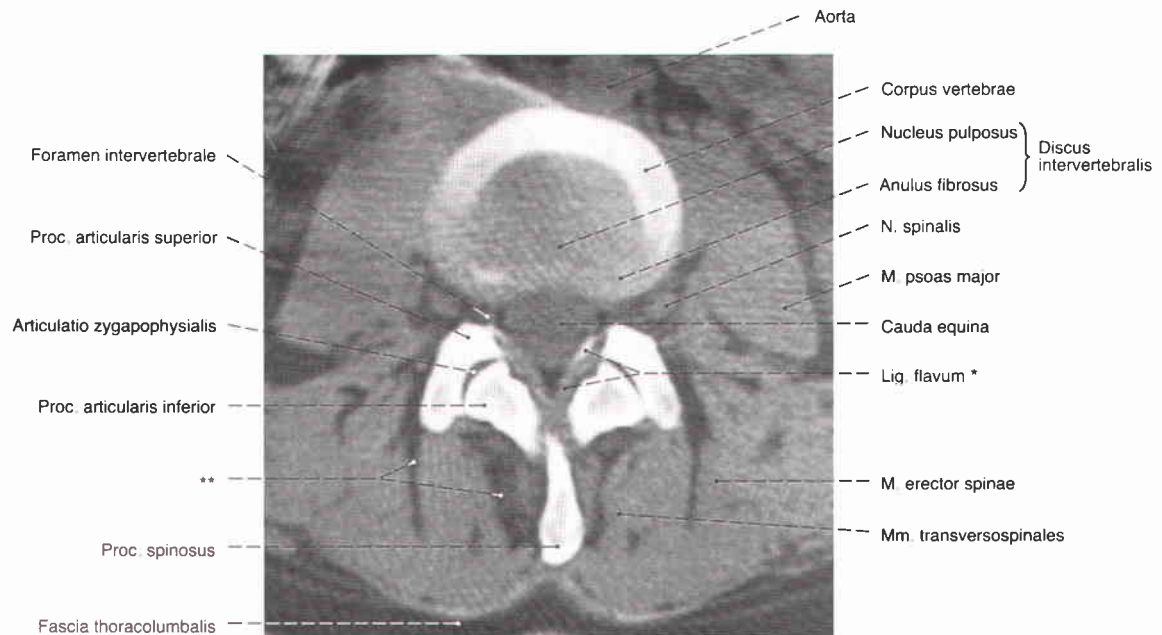


Fig. 776 Muscles of the back, *Mm. dorsi*; the deep muscles connecting the trunk with the shoulder girdle and the upper arm have been exposed by removing most of the superficial muscles on the left side; dorsal view.



**Fig. 777** Muscles of the back, Mm. dorsi; cross section through the second lumbar vertebra; inferior view.

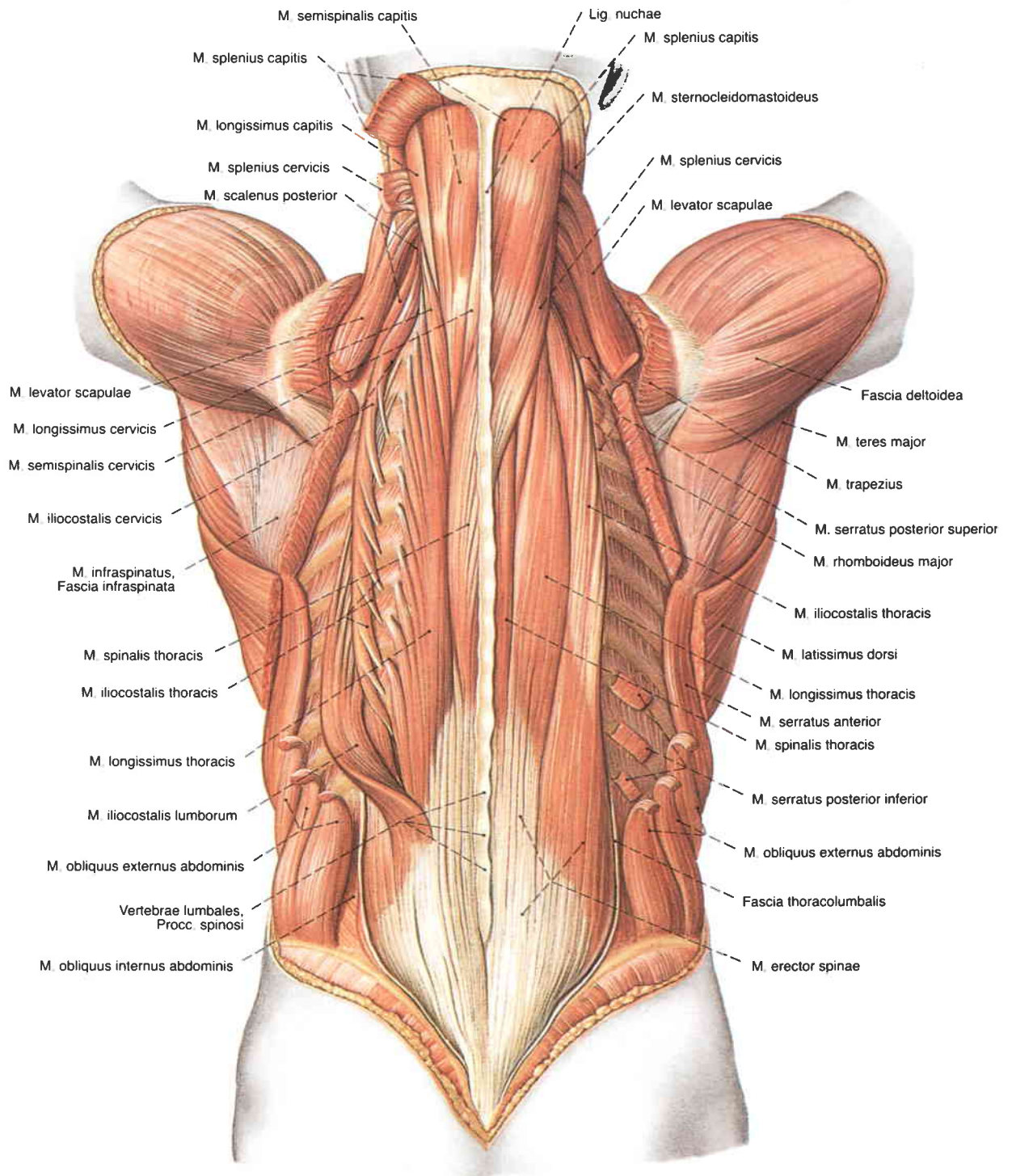
The deep muscles of the back lie within an osteofibrous tube which is formed by the dorsal parts of the vertebrae and the surrounding aponeurotic thoracolumbar fascia. The muscles are divided into a \*lateral tract and a \*\*medial tract.



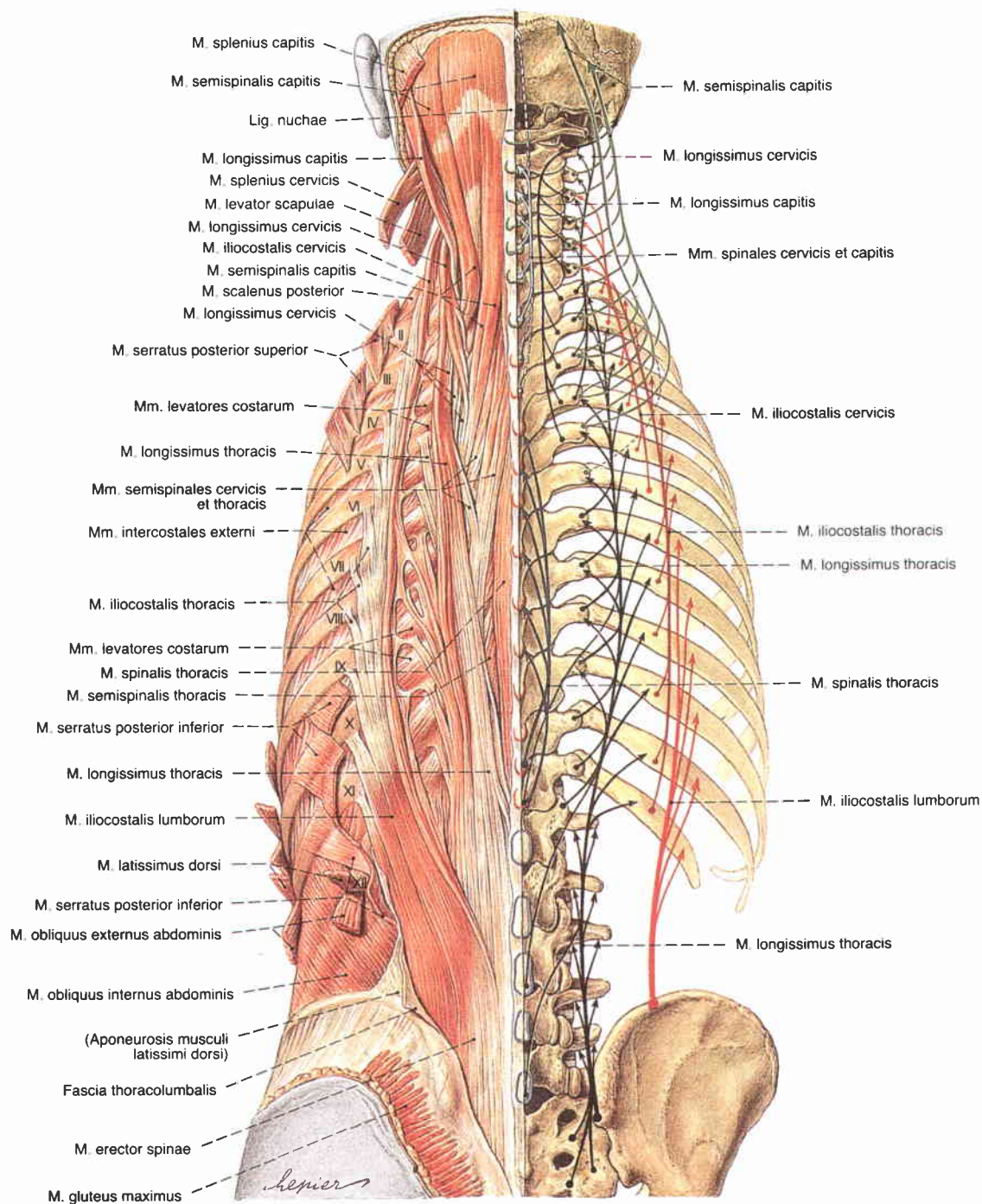
**Fig. 778** Muscles of the back, Mm. dorsi; computed tomography (CT) at the level of the intervertebral disc between the 3rd and 4th lumbar vertebrae, inferior view.

\* The area where the ligamenta flava insert is often calcified or ossified, even in younger individuals.  
\*\* adipose deposits





**Fig. 779** Muscles of the back, *Mm. dorsi*; the superficial layer of the autochthonous muscles has been exposed by removal of the thoracolumbar fascia and the overlying muscles which connect the trunk with the upper arm and the shoulder girdle; dorsal view.



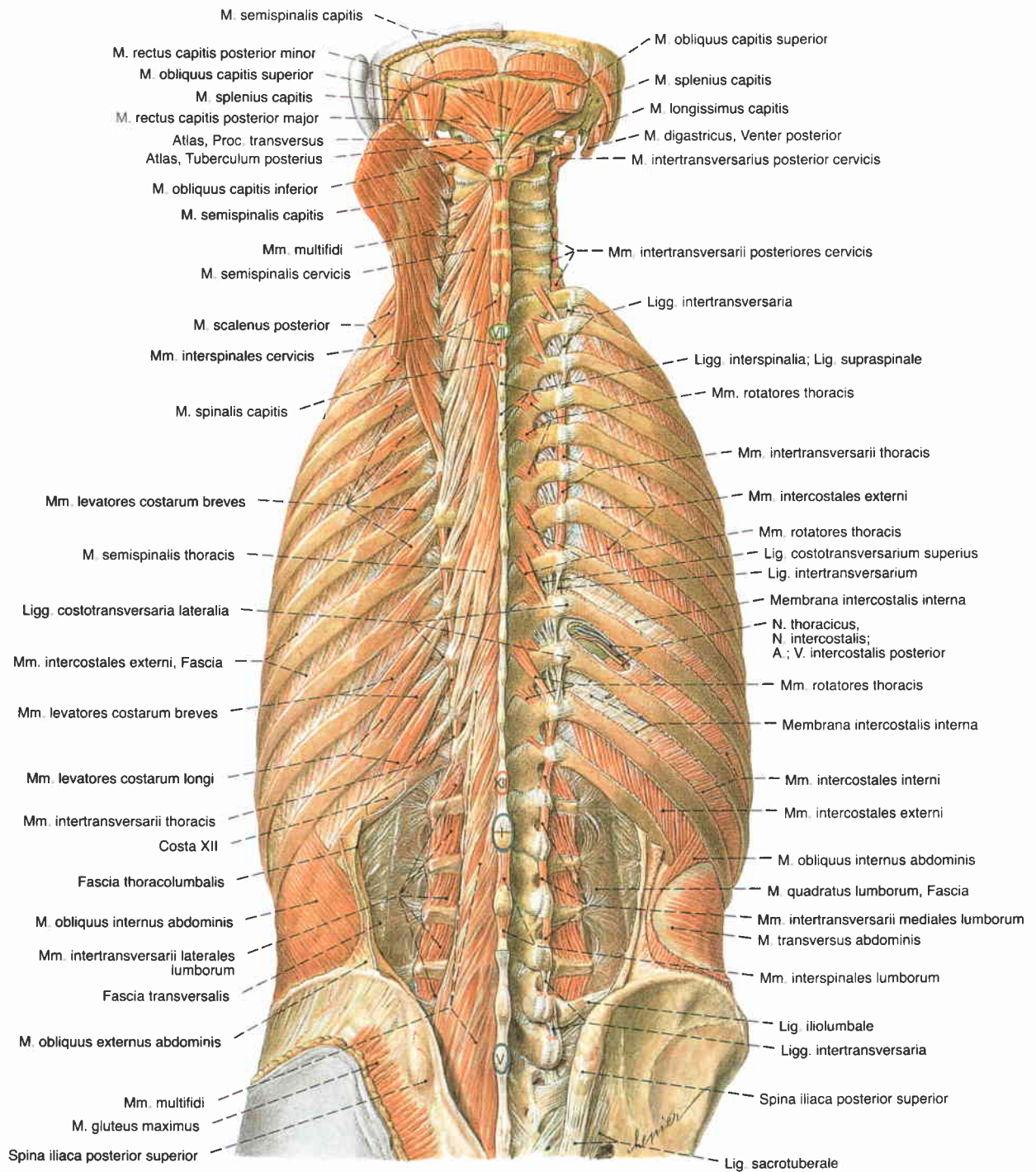
**Fig. 780** Muscles of the back, Mm. dorsi; the long fibres of the autochthonous muscles can be seen after the removal of the thoracolumbar fascia and the overlying muscles which connect the trunk with the upper arm and the shoulder girdle; on the right a diagram shows their course; the spinous processes of the cervical vertebrae are outlined in green, those of the thoracic vertebrae in red, and those of the lumbar vertebrae in blue. II-XII = ribs; dorsal view.



**Lateral autochthonous layer of the muscles of the back, Musculi dorsi (Figs. 779, 780)**

The lateral tract of the autochthonous muscles of the back covers the medial tract and is therefore also called the superficial portion of the autochthonous muscles of the back. Included herein are the muscles whose fibres take a straight (upward) course: M. iliocostalis, the M. longissimus and the Mm. intertransversarii. The Mm. splenii run oblique, diverging cranially (spinotransversal). The Mm. levatores costarum take a caudo-oblique course to the ribs.

Muscle/Innervation	Origin	Insertion	Function
<b>1. M. iliocostalis lumborum</b> <i>Rr. posteriores of the Nn. lumbales</i>	Together with M. longissimus thoracis from the Procc. spinosi of the lumbar vertebrae, Facies dorsalis of the Os sacrum, Crista iliaca (dorsal third), Fascia thoracolumbalis	Anguli of the ribs 5 to 12	
<b>2. M. iliocostalis thoracis</b> <i>Rr. posteriores of the Nn. thoracici</i>	12th to 7th ribs (medial to the Angulus costae)	Anguli of the ribs (6) 7 to 1.	
<b>3. M. iliocostalis cervicis</b> <i>Rr. posteriores of the Nn. cervicales</i>	7th to (4th) 3rd ribs (medial to the Angulus costae)	Tubercula posteriora of the Procc. transversi of the 6th to (4th) 3rd cervical vertebrae	
<b>4. M. longissimus thoracis</b> <i>Rr. posteriores of the Nn. spinales</i>  Blends with M. longissimus cervicis and M. spinalis	Together with M. iliocostalis lumborum from the Procc. spinosi of the lumbar vertebrae, Facies dorsalis of the Os sacrum; often from the Proc. mammillaris of the 2nd and 1st lumbar vertebrae and Procc. transversi of the 12th to 6th thoracic vertebrae	Medial part: Proc. mammillaris of 5th lumbar vertebra, Procc. accessorii of 4th to 1st lumbar vertebrae, Procc. transversi of the thoracic vertebrae; Lateral part: Procc. costales of 4th to 1st lumbar vertebrae, Fascia thoracolumbalis (deep layer), 12th to 2nd ribs (medial to the Angulus costae)	Acting unilaterally: Lateral flexion of the Columna vertebralis to this side Acting bilaterally: Extension of the Columna vertebralis
<b>5. M. longissimus cervicis</b> <i>Rr. posteriores of the Nn. spinales</i>	Procc. transversi of the 6th to 1st thoracic vertebrae and 7th to 3rd cervical vertebrae	Tuberculum posterius of Procc. transversi of the 5th to 2nd cervical vertebrae	
<b>6. M. longissimus capitis</b> <i>Rr. posteriores of the Nn. spinales</i>	Procc. transversi of the 3rd thoracic to the 3rd cervical vertebrae	Proc. mastoideus, posterior margin	
<b>7. Mm. intertransversarii laterales lumborum</b> <i>Rr. posteriores and anteriores of the Nn. spinales</i>	Tuberositas iliaca, Procc. costalis and accessorius of 5th to 1st lumbar vertebrae, Proc. transversus of the 12th thoracic vertebra	Proc. costalis of the 5th lumbar vertebra, Procc. transversus of the 1st thoracic vertebra	
<b>8. Mm. intertransversarii mediales lumborum</b> <i>(cf. to No. 7)</i>	Proc. accessorius of the 4th to 1st lumbar vertebrae	Proc. mammillaris of the 4th to 2nd lumbar vertebrae	
<b>9. Mm. intertransversarii thoracis</b> <i>(cf. to No. 7)</i>	Procc. transversi of 12th to 10th thoracic vertebrae	Procc. accessorius and mammillaris of the 1st lumbar vertebra to Proc. transversus of the 11th thoracic vertebra	
<b>10. Mm. intertransversarii posteriores cervicis</b> <i>(cf. to No. 7)</i>	Tuberculum posterius of Procc. transversi of the 6th to 1st cervical vertebrae	Tuberculum posterius of Procc. transversi of the 7th to 2nd cervical vertebrae	
<b>11. Mm. intertransversarii anteriores cervicis</b> <i>(cf. to No. 7)</i>	Tuberculum anterius of Procc. transversi of the 6th to 1st cervical vertebrae	Tuberculum anterius of Procc. transversi of the 7th to 2nd cervical vertebrae	
<b>12. M. splenius cervicis</b> <i>Rr. posteriores of the Nn. cervicales</i>	Procc. spinosi of the 3rd thoracic to 7th cervical vertebrae, Lig. nuchae (from 3rd cervical vertebra)	Tuberculum posterius of the Procc. transversi of the (3rd) 2nd to 1st cervical vertebrae	Acting unilaterally: Lateral flexion, rotation of the cervical spine and head to the same side
<b>13. M. splenius capitis</b> <i>Rr. posteriores of the Nn. cervicales</i>	Procc. spinosi of the 6th to 3rd cervical vertebrae, Lig. supraspinale	Proc. mastoideus, Linea nuchalis superior	Acting bilaterally: Extension of the cervical spine
<b>14. Mm. levatores costarum</b> <i>Rr. posteriores of the N. cervicalis [C8] and Nn. thoracici</i> Mm. levatores costarum longi are absent in the middle thoracic region	Procc. transversi of the 11th thoracic to 7th cervical vertebrae (Mm. levatores costarum longi: every other caudal rib, Mm. levatores breves: to the nearest caudal rib)	12th to 1st ribs (lateral of Angulus costae)	Elevation of the ribs; lateral flexion and rotation of the Columna vertebralis



**Fig. 781** Muscles of the back, Mm. dorsi, and suboccipital muscles, Mm. suboccipitales; after the removal of all superficial muscles and the thoracolumbar fascia the deepest layer is exposed.

Dorsal view.

The 9th intercostal space has been partly opened.

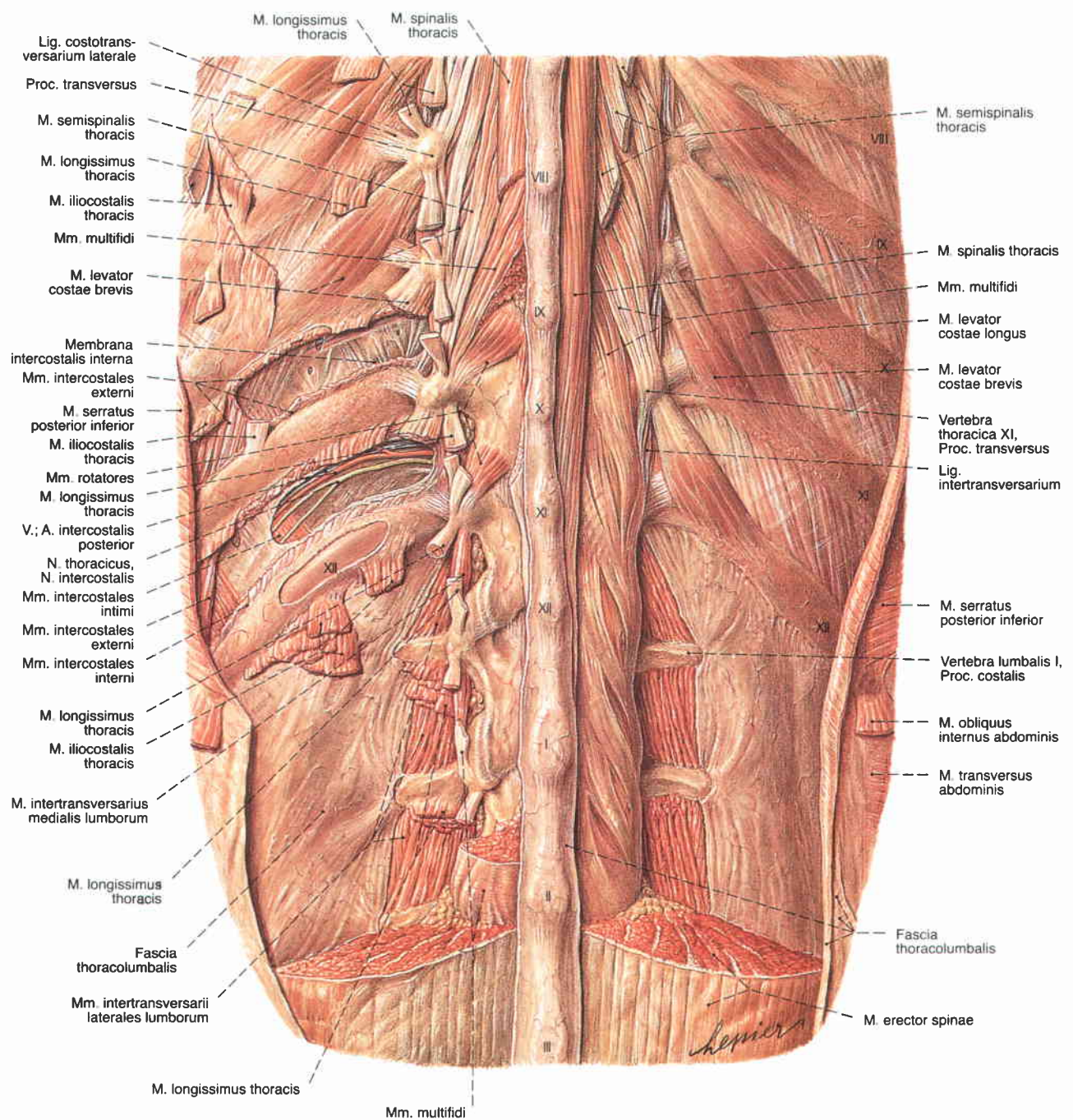
The Roman numerals indicate the spinous processes of the respective vertebrae.



**Medial autochthonous muscles of the back, Musculi dorsi (Figs. 780, 781)**

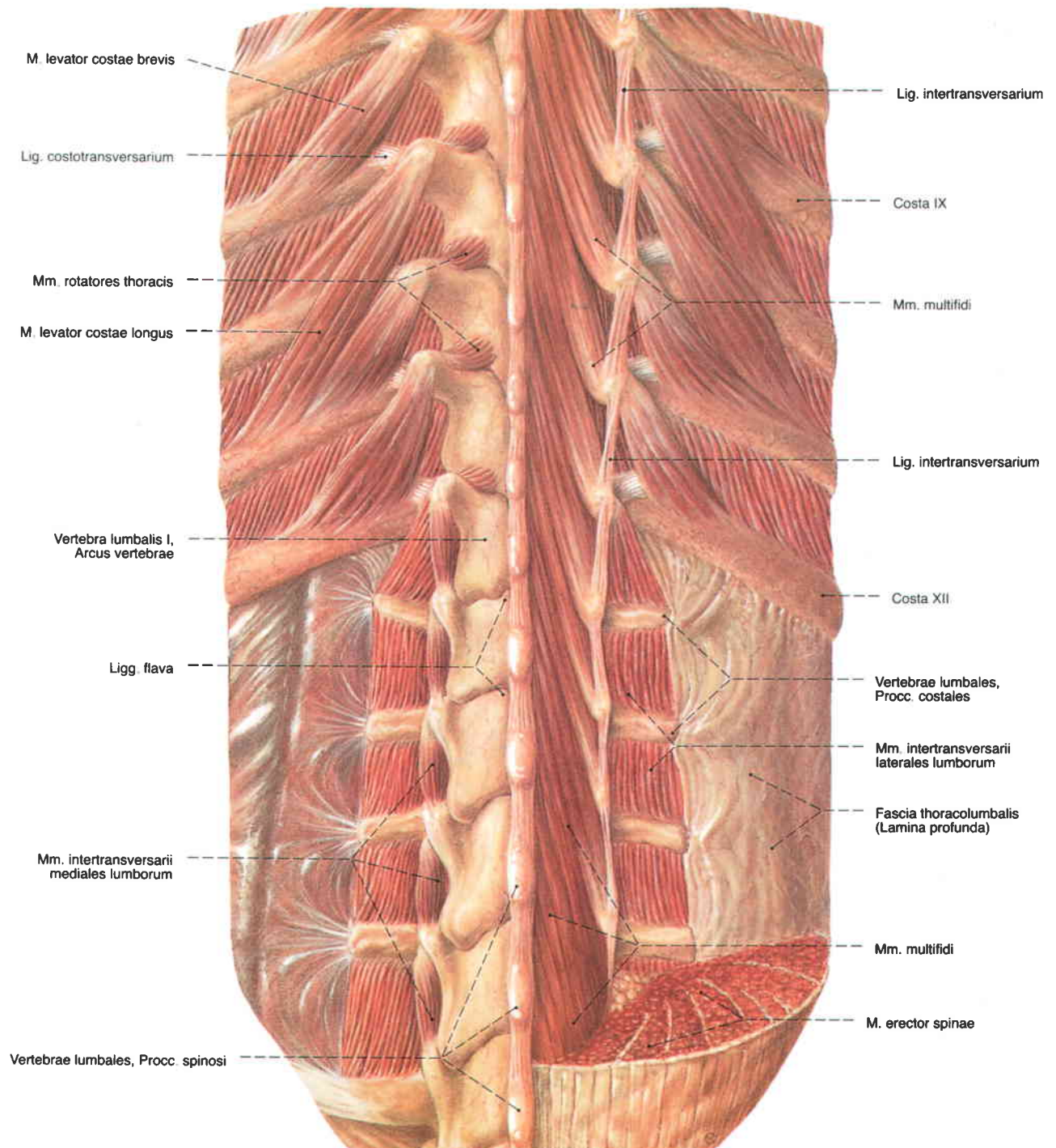
The medial tract of the autochthonous muscles of the back is covered by the lateral tract and is therefore also called the deep layer of the autochthonous muscles of the back. Included herein are the muscles whose fibres take a straight upward course: Mm. interspinales and the M. spinalis. The Mm. rotatores, Mm. multifidi and the M. semispinalis run oblique, converging cranially (transversospinal).

Muscle Innervation	Origin	Insertion	Function
<b>1. Mm. interspinales lumborum</b> <i>Rr. posteriores of the Nn. spinales</i>	Procc. spinosi of the 5th to 1st lumbar vertebrae	Crista sacralis mediana (superior rim), Procc. spinosi of the 5th to 2nd lumbar vertebrae	Segmental extension of the Columna vertebralis
<b>2. Mm. interspinales thoracis</b> <i>Rr. posteriores of the Nn. spinales</i>	Procc. spinosi of the (12th) 11th to 2nd (1st) thoracic vertebrae	Procc. spinosi of the (1st lumbar vertebra) 12th to 3rd (2nd) thoracic vertebrae	
<b>3. Mm. interspinales cervicis</b> <i>Rr. posteriores of the Nn. spinales</i>	Procc. spinosi of the 7th to 2nd cervical vertebrae	Procc. spinosi of the 1st thoracic to the 3rd cervical vertebrae	
<b>4. M. spinalis thoracis</b> <i>Rr. posteriores of the Nn. spinales</i>	Procc. spinosi of the (3rd) 2nd, 1st lumbar vertebrae, and the 12th to 10th thoracic vertebrae (closely correlated with M. latissimus thoracis)	Procc. spinosi of the (10th) 9th to 2nd thoracic vertebrae (closely correlated with Mm. multifidi)	Acting unilaterally: Lateral flexion of the spine to the same side Acting bilaterally: Extension of the spine
<b>5. M. spinalis cervicis</b> <i>Rr. posteriores of the Nn. spinales</i>	Procc. spinosi of the (4th) 3rd to 1st thoracic vertebrae, and 7th to 6th cervical vertebrae	Procc. spinosi of the (6th) 5th to 2nd cervical vertebrae	
<b>6. M. spinalis capitis</b> <i>Rr. posteriores of the Nn. spinales</i> (inconstant)	Procc. spinosi of the 3rd to 1st thoracic vertebrae, and 7th to 6th cervical vertebrae	Squama ossis occipitalis (between Lineae nuchales suprema and superior, close to Protuberantia occipitalis externa; associated with M. semispinalis capitis)	
<b>7. Mm. rotatores</b> <i>Rr. posteriores of the Nn. spinales</i> To the Mm. rotatores belong: Mm. rotatores cervicis, Mm. rotatores thoracis and Mm. rotatores lumborum (inconstant)	Procc. mamillares of the lumbar vertebrae, Procc. transversi of the thoracic vertebrae, Procc. articulares inferiores of the cervical vertebrae (Mm. rotatores breves run to the adjacent higher vertebrae; Mm. rotatores longi skip every other vertebra)	Procc. spinosi (roots) of the 3rd to 1st lumbar vertebrae, 12th to 1st thoracic vertebrae and 7th to 2nd cervical vertebrae	Acting unilaterally: Lateral flexion of the spine to the same side, rotation Acting bilaterally: Extension of the spine
<b>8. Mm. multifidi</b> <i>Rr. posteriores of the Nn. spinales</i>	Facies dorsalis of the Os sacrum, Lig. sacroiliacum posterius, Crista iliaca (dorsal part), Procc. mamillares of the lumbar vertebrae, Procc. transversi of the thoracic vertebrae, Proc. articularis inferior of the 7th to 4th cervical vertebrae (The fibres skip 2 to 4 vertebrae.)	Procc. spinosi of the 5th to 1st lumbar vertebrae, 12th to 1st thoracic vertebrae and 7th to 2nd cervical vertebrae	
<b>9. M. semispinalis thoracis</b> <i>Rr. posteriores of the Nn. spinales</i>	Procc. transversi of (12th) 11th to 7th (6th) thoracic vertebrae	Procc. spinosi of the (4th) 3rd thoracic to 6th cervical vertebrae	Muscles on one side acting alone: Rotation of the spine and head to the other side Muscles on both sides acting together: Extension of the spine
<b>10. M. semispinalis cervicis</b> <i>Rr. posteriores of the Nn. spinales</i>	Procc. transversi of (7th) 6th thoracic to 7th cervical vertebrae	Procc. spinosi of the 6th to 2nd cervical vertebrae	
<b>11. M. semispinalis capitis</b> <i>Rr. posteriores of the Nn. spinales</i>	Procc. transversi of (8th) 7th thoracic to 3rd cervical vertebrae	Squama ossis occipitalis (between Linea nuchalis suprema and Linea nuchalis superior, medial part)	

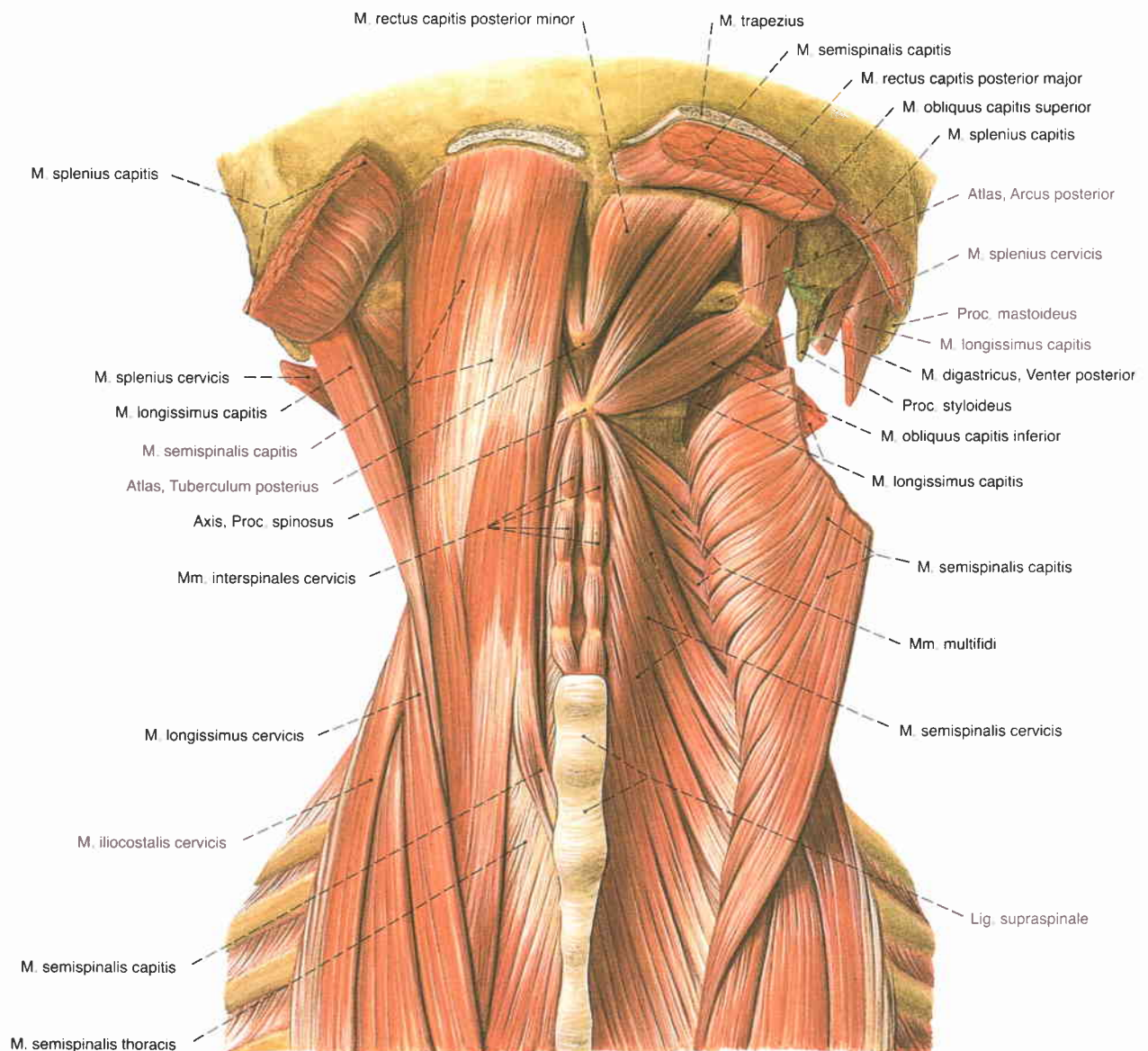


**Fig. 782** Muscles of the back, Mm. dorsi; the layer of autochthonous muscles and the thoracic muscles are shown here between the 8th and 12th thoracic vertebrae (VIII to XII) and between the 1st and 3rd lumbar vertebrae (I to III); the 11th intercostal space has been partly opened; dorsal view.



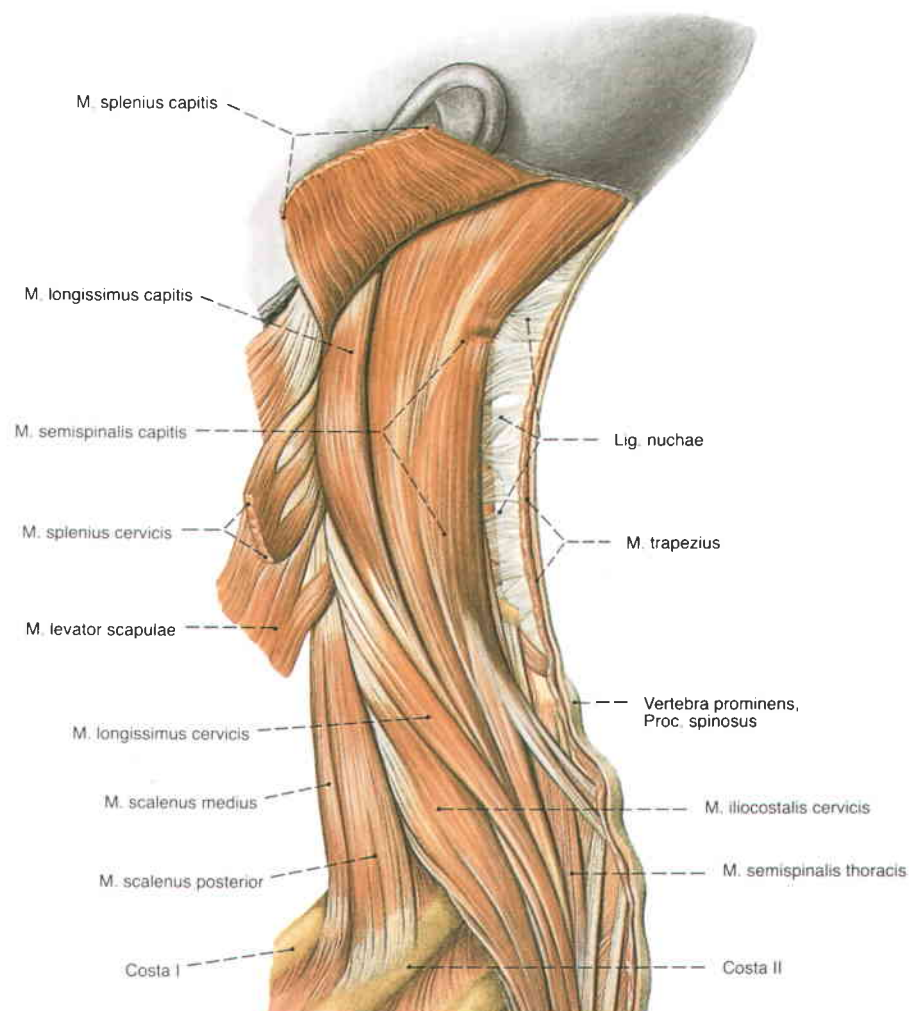


**Fig. 783** Muscles of the back, *Mm. dorsi*; the deepest layer is exposed here in the region of the lower thoracic and the lumbar vertebral column; the thoracolumbar fascia has been removed; dorsal view.



**Fig. 784** Muscles of the back, Mm. dorsi, and suboccipital muscles, Mm. suboccipitales; various superficial muscles have been removed; dorsal view.





**Fig. 785** Muscles of the back, Mm. dorsi, and muscles of the neck, Mm. colli; the superficial muscles of the back have been removed; left lateral view.

### The deep autochthonous muscles of the neck (Figs. 784, 786)

Mm. recti capitis posterior minor and major and Mm. obliqui capitis superior and inferior belong to the medial tract of the autochthonous muscles of the back, while M. rectus capitis lateralis belongs to the lateral tract.

Muscle/Innervation	Origin	Insertion	Function
<b>1. M. rectus capitis posterior major</b> <i>Suboccipital n. (dorsal division of 1st cervical n. [C1])</i>	Proc. spinosus of the axis	Inferior nuchal line (middle third)	Acting in concert during subtle positioning and kinematics of the head
<b>2. M. rectus capitis posterior minor</b> <i>Suboccipital n. (cf. to No. 1)</i>	Atlas, Arcus posterior, Tuberculum posterius	Inferior nuchal line (medial third)	
<b>3. M. obliquus capitis superior</b> <i>Suboccipital n. (cf. to No. 1)</i>	Atlas, Proc. transversus, Tuberculum posterius	Inferior nuchal line (lateral third)	
<b>4. M. obliquus capitis inferior</b> <i>Suboccipital n. (cf. to No. 1)</i>	Axis, Proc. spinosus	Atlas (posterior rim), Proc. transversus	
<b>5. M. rectus capitis lateralis</b> <i>N. cervicalis (ventral divisions of 1st cervical n. [C1]) (cf. to No. 1)</i>	Atlas (anterior rim), Proc. transversus	Os occipitale, Proc. jugularis	

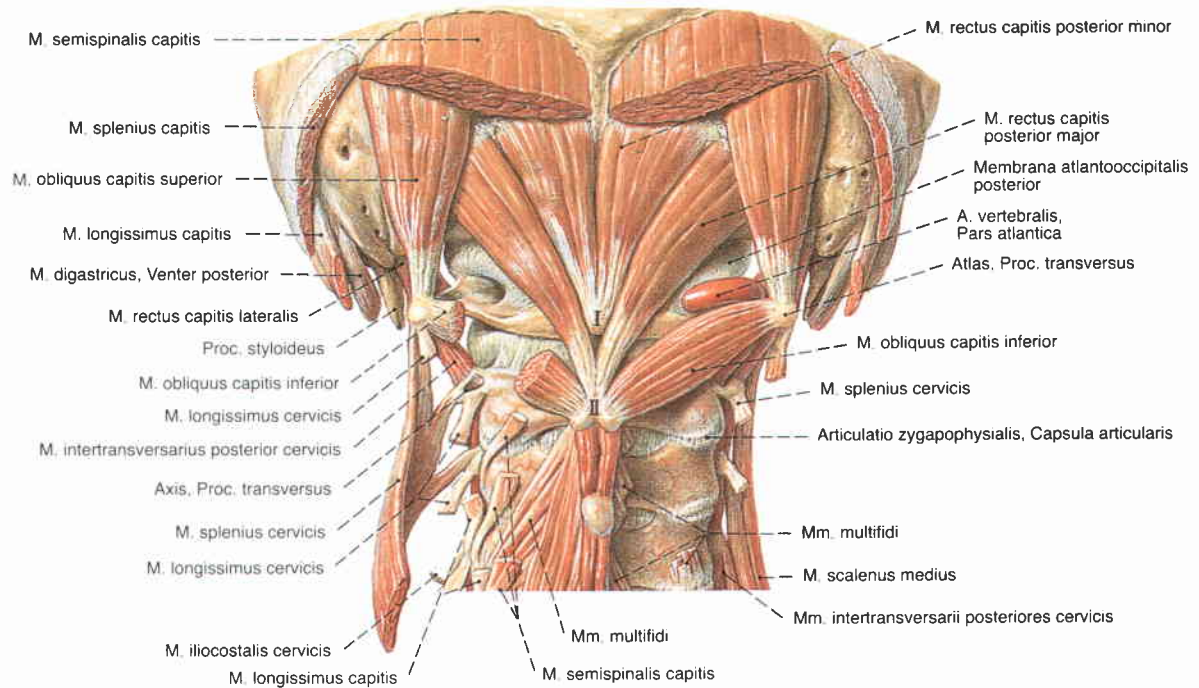


Fig. 786 Suboccipital muscles, Mm. suboccipitales; dorsal view.

I = posterior tubercles of the atlas

II = spinous process of the axis

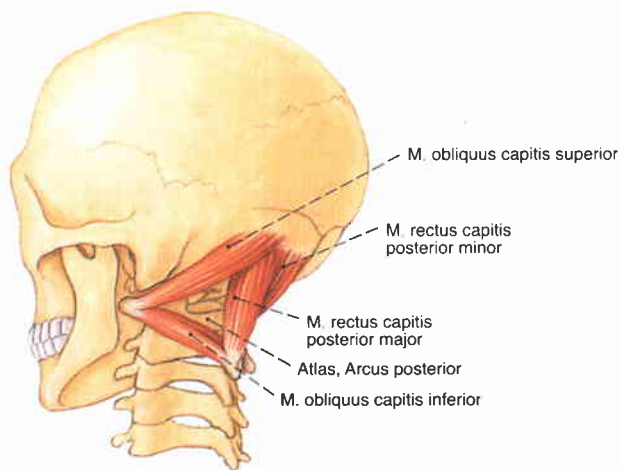
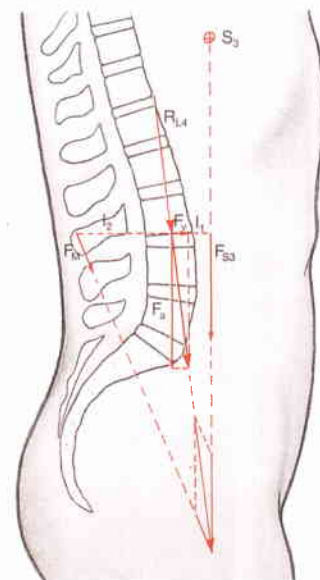


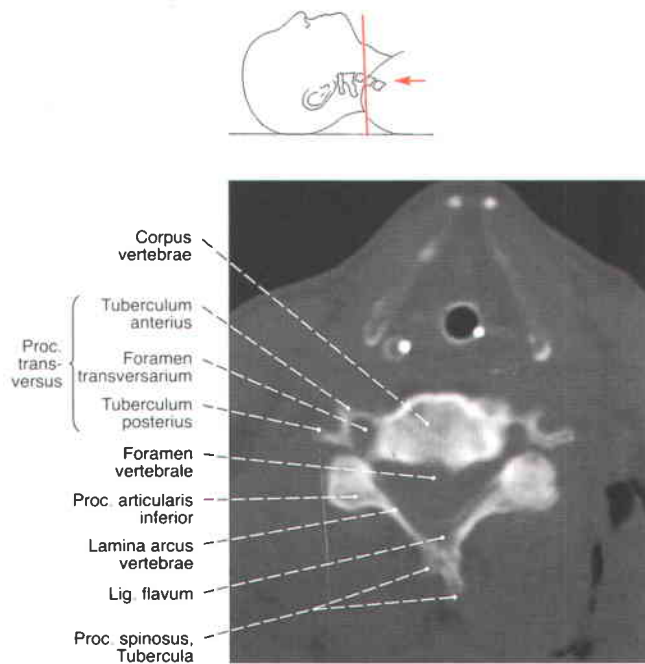
Fig. 787 Suboccipital muscles, Mm. suboccipitales, semischematic drawing, left dorsolateral view.



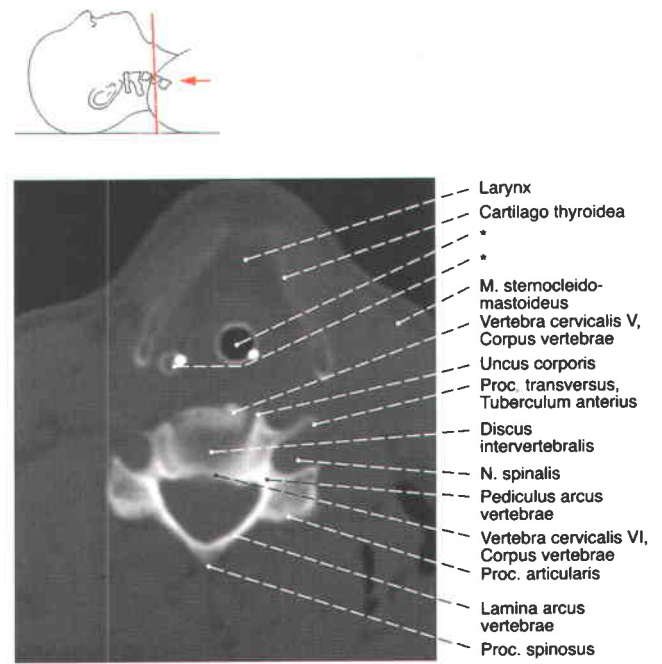
- $S_3$  Centre of gravity for 3/6 of the body weight
- $F_{S3}$  Force of body weight on the affected portion of the lumbar vertebral column
- $R_{L4}$  Resulting force on the segment of movement
- $F_m$  Force of the back muscles
- $F_v$  Ventral component of shearing stress that has to be absorbed by the vertebral joints
- $F_a$  Pressure that has to be absorbed by intervertebral discs and vertebral column
- $I_1$  Lever arm of the bodies weights on the vertebral column in the upright position
- $I_2$  Lever arm of the muscles of the back

Fig. 788 Stress on the lumbar vertebral column in the upright position.



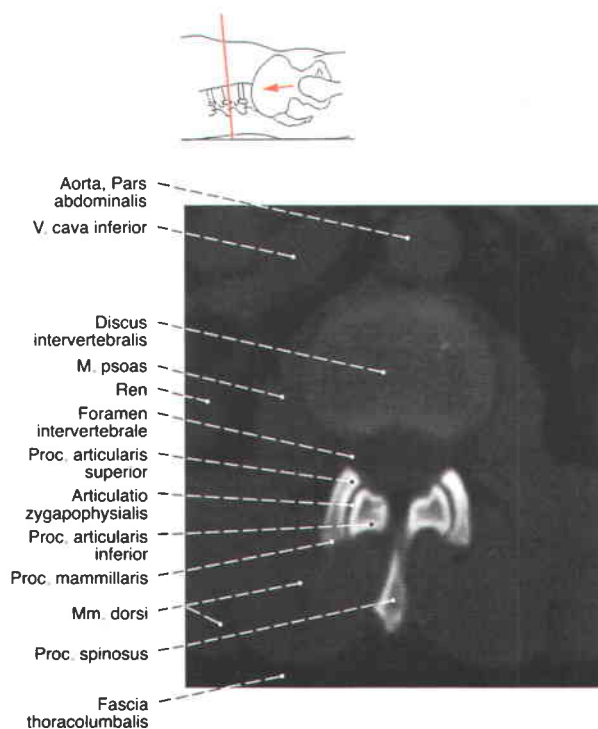


**Fig. 789** Cervical vertebral column; computed tomography (CT) at the level of the intervertebral disc between the 4th and 5th cervical vertebrae; inferior view.

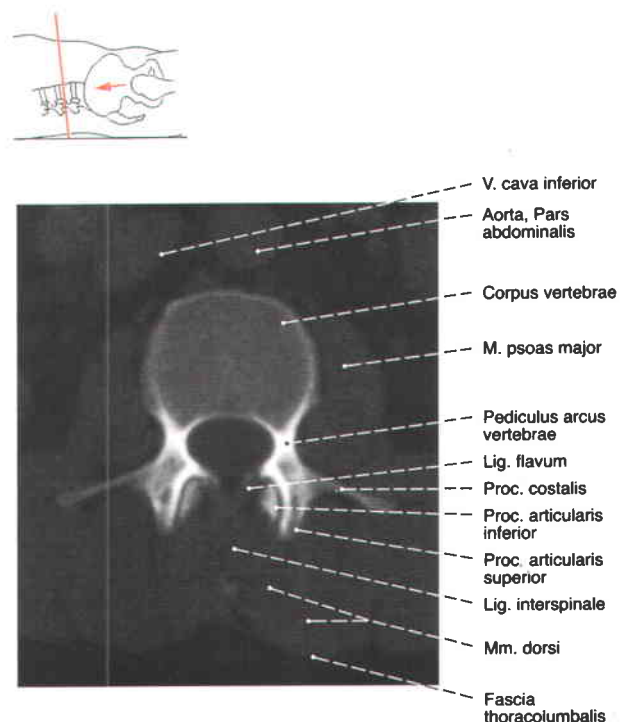


**Fig. 790** Cervical vertebral column; computed tomography (CT) at the level of the intervertebral disc between the 5th and 6th cervical vertebrae; inferior view.

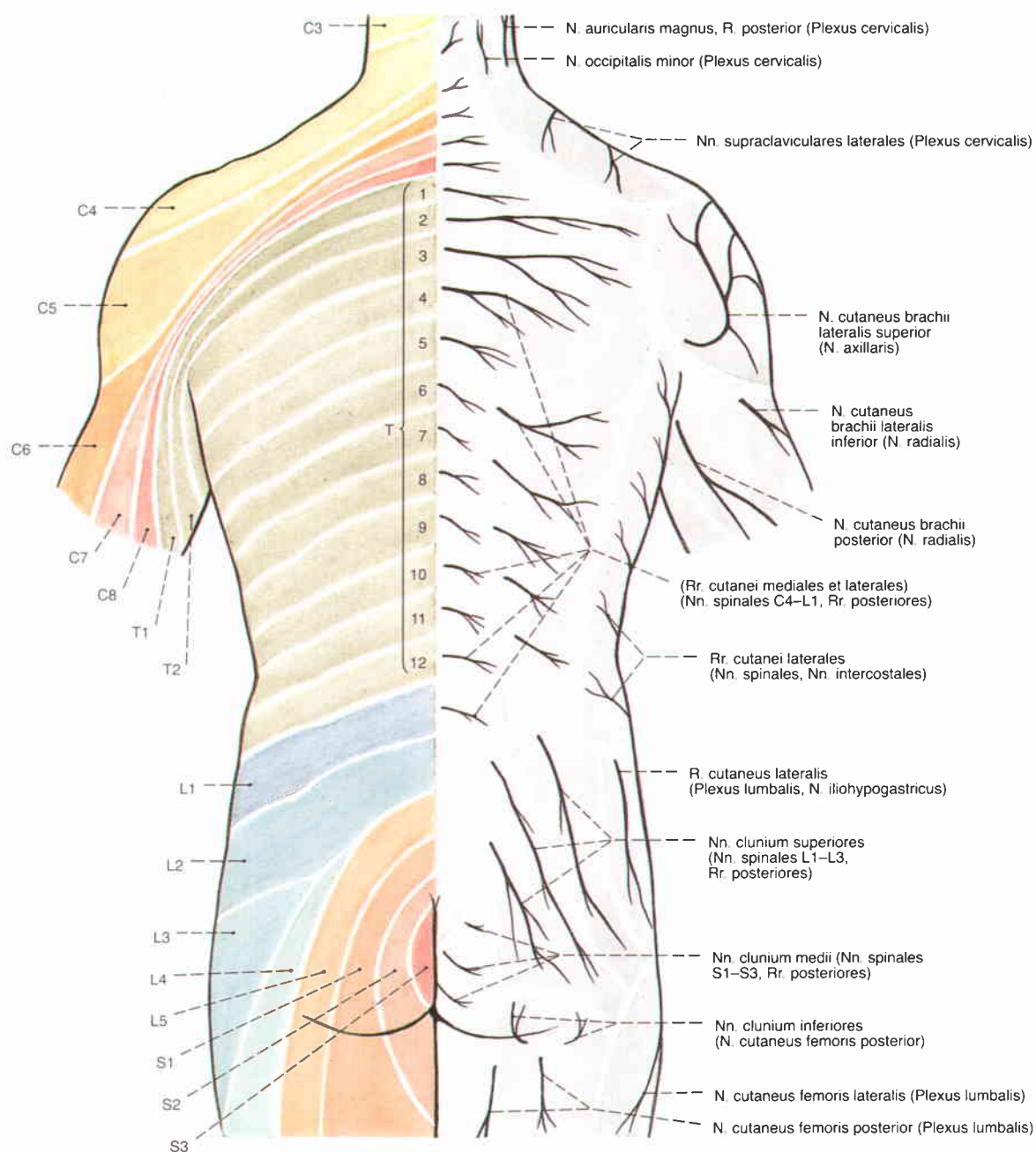
\* Intubation tube and endoscopic instrument



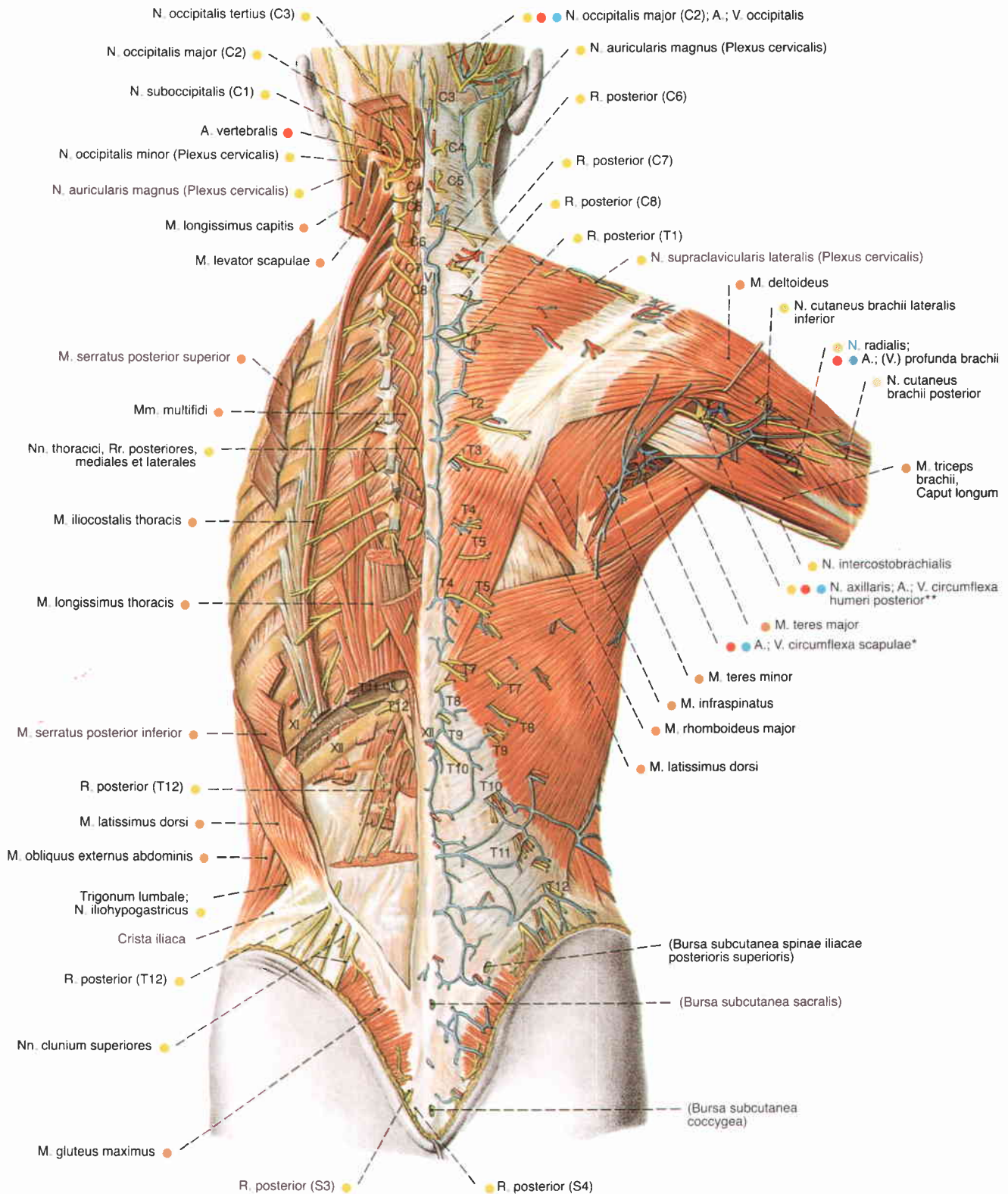
**Fig. 791** Lumbar vertebral column; computed tomography (CT) at the level of the intervertebral disc between the 2nd and 3rd lumbar vertebrae; inferior view.



**Fig. 792** Lumbar vertebral column; computed tomography (CT) at the level of the pedicle of the 3rd lumbar vertebra; inferior view.



**Fig. 793** Segmental cutaneous innervation (dermatomes) and cutaneous nerves of the back; dorsal view.

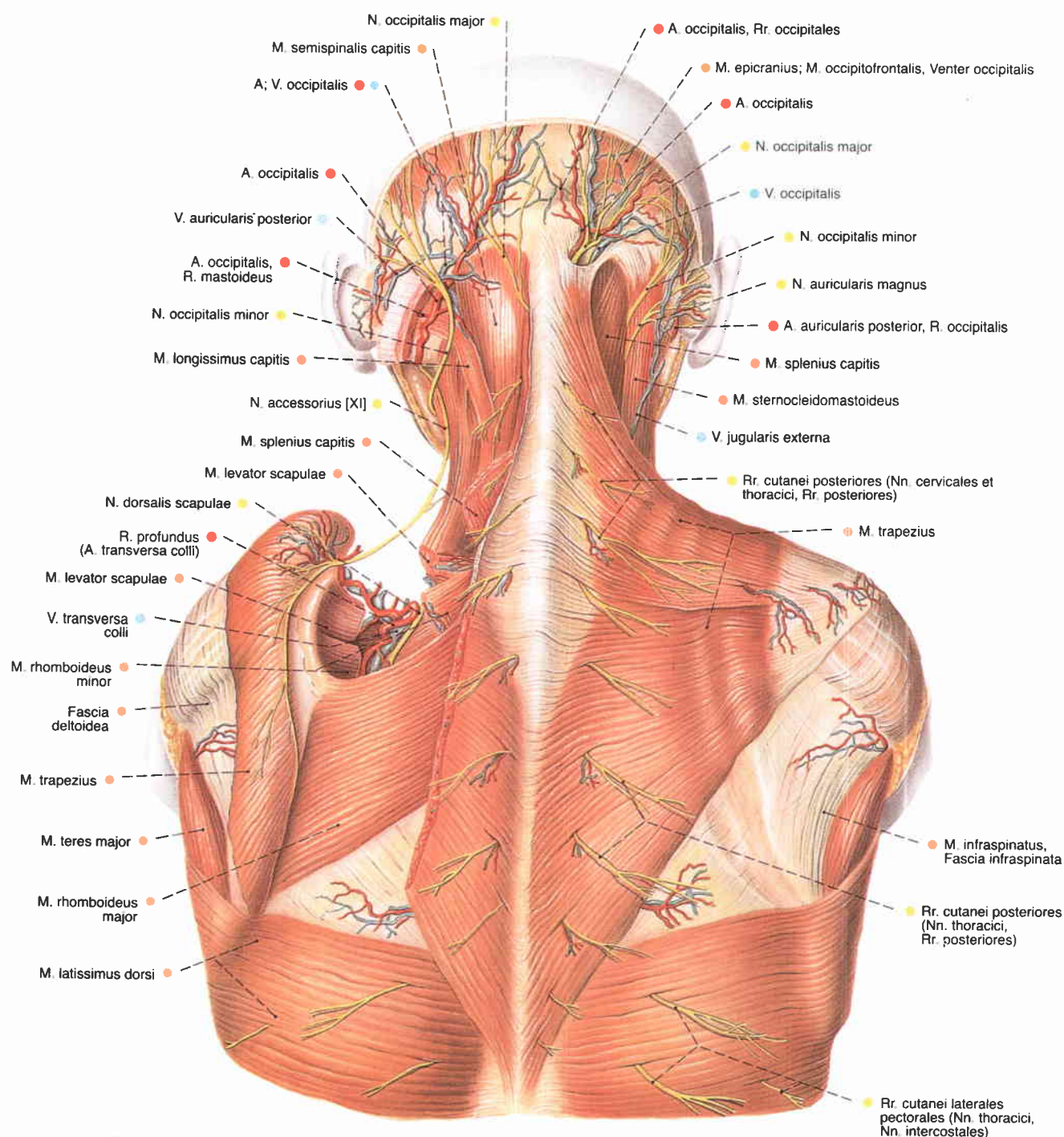


**Fig. 794** Blood vessels and nerves of the back; the superficial muscles and the shoulder girdle have been removed on the left side; dorsal view.

\* Blood vessels and nerves of the triangular space

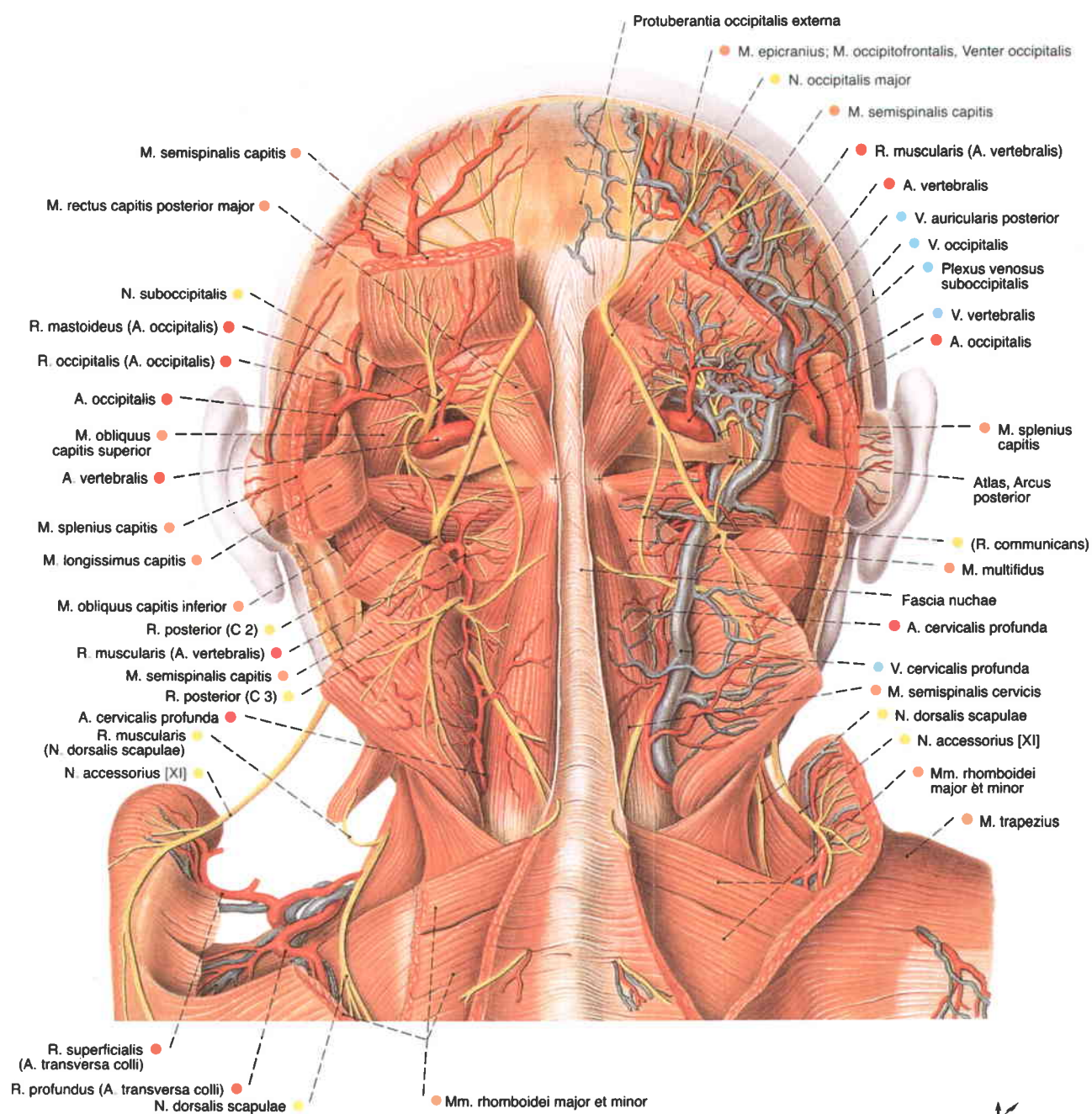
\*\* Blood vessels and nerves of the quadrangular space





796

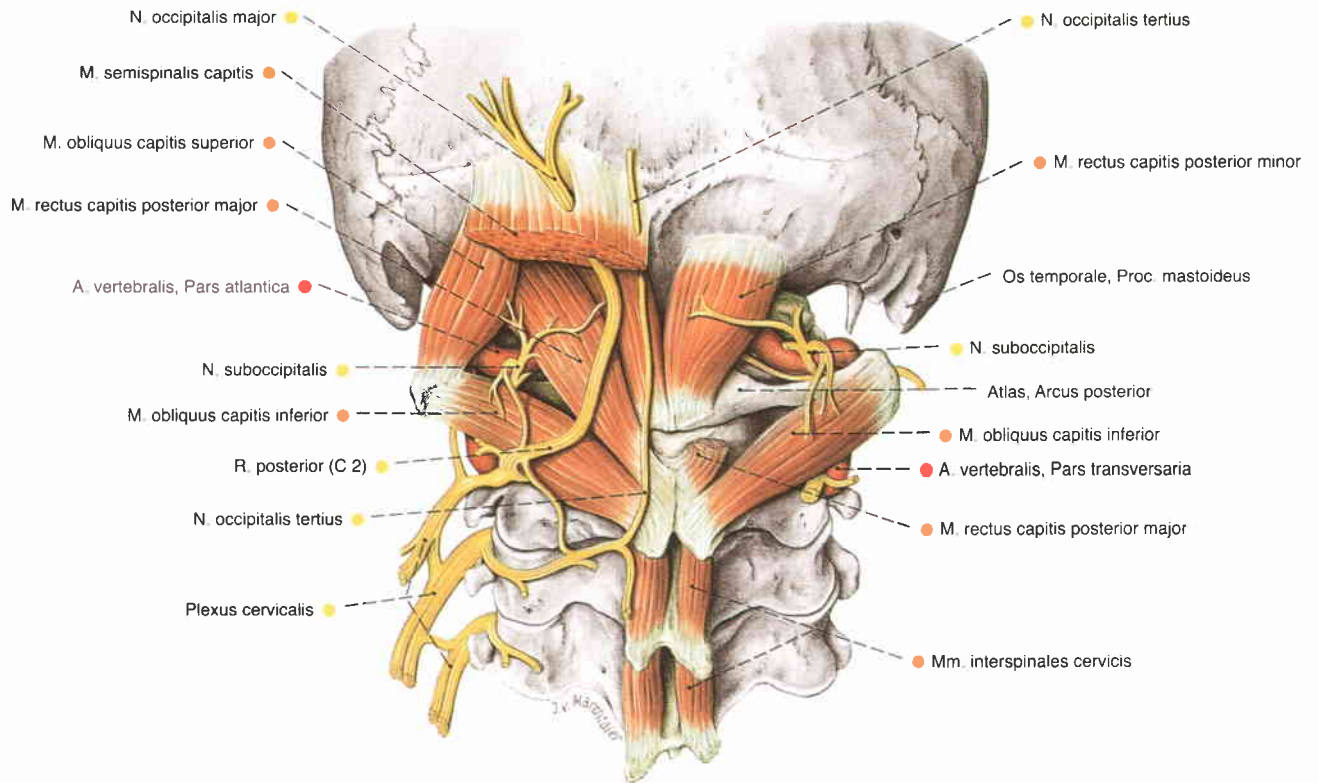
**Fig. 795** Blood vessels and nerves of the occipital region, Regio occipitalis, the nuchal region, Regio cervicalis posterior, and the upper part of the back; the superficial muscles of the back have been partially removed on the left; dorsal view.



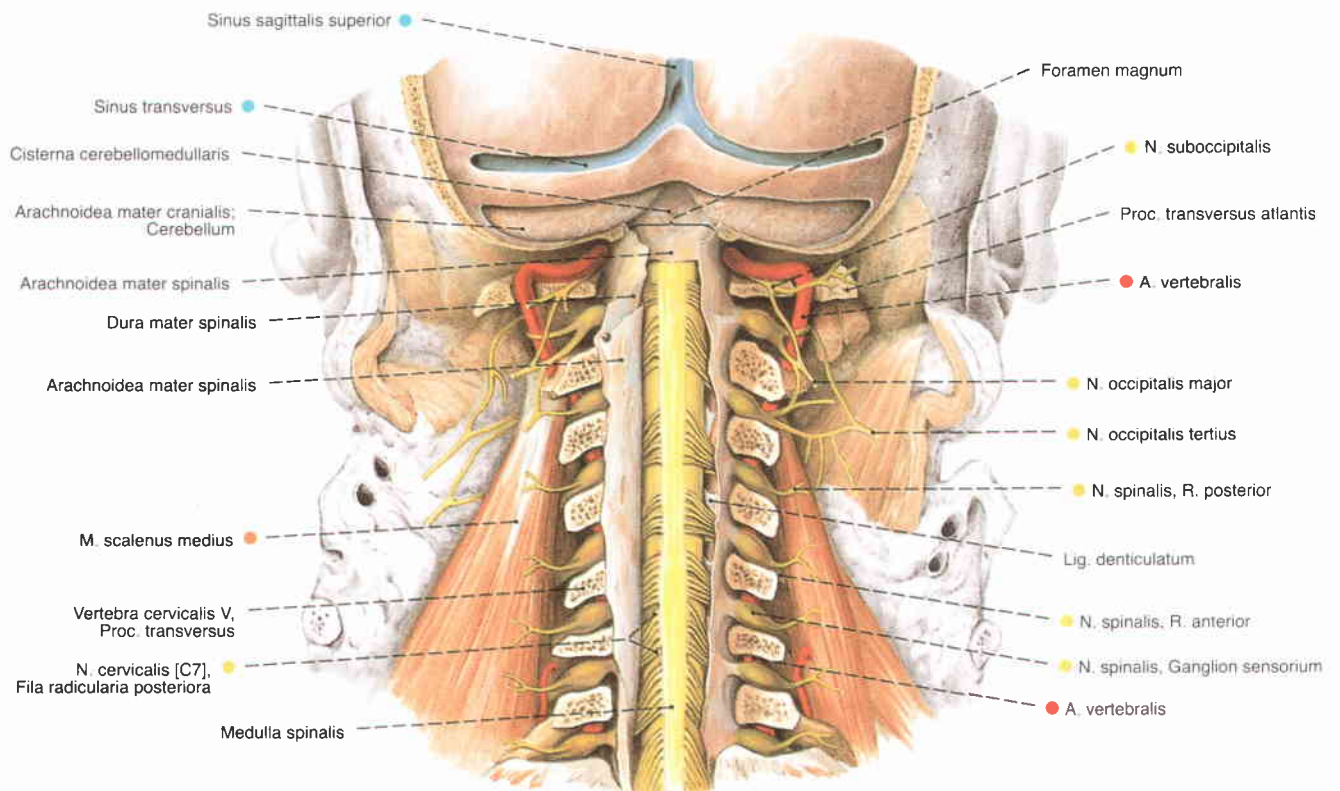
**Fig. 796** Blood vessels and nerves of the occipital region, Regio occipitalis, the nuchal region, Regio cervicalis posterior; dorsal view.

+ Tubercula of the Proc. spinosus of the axis





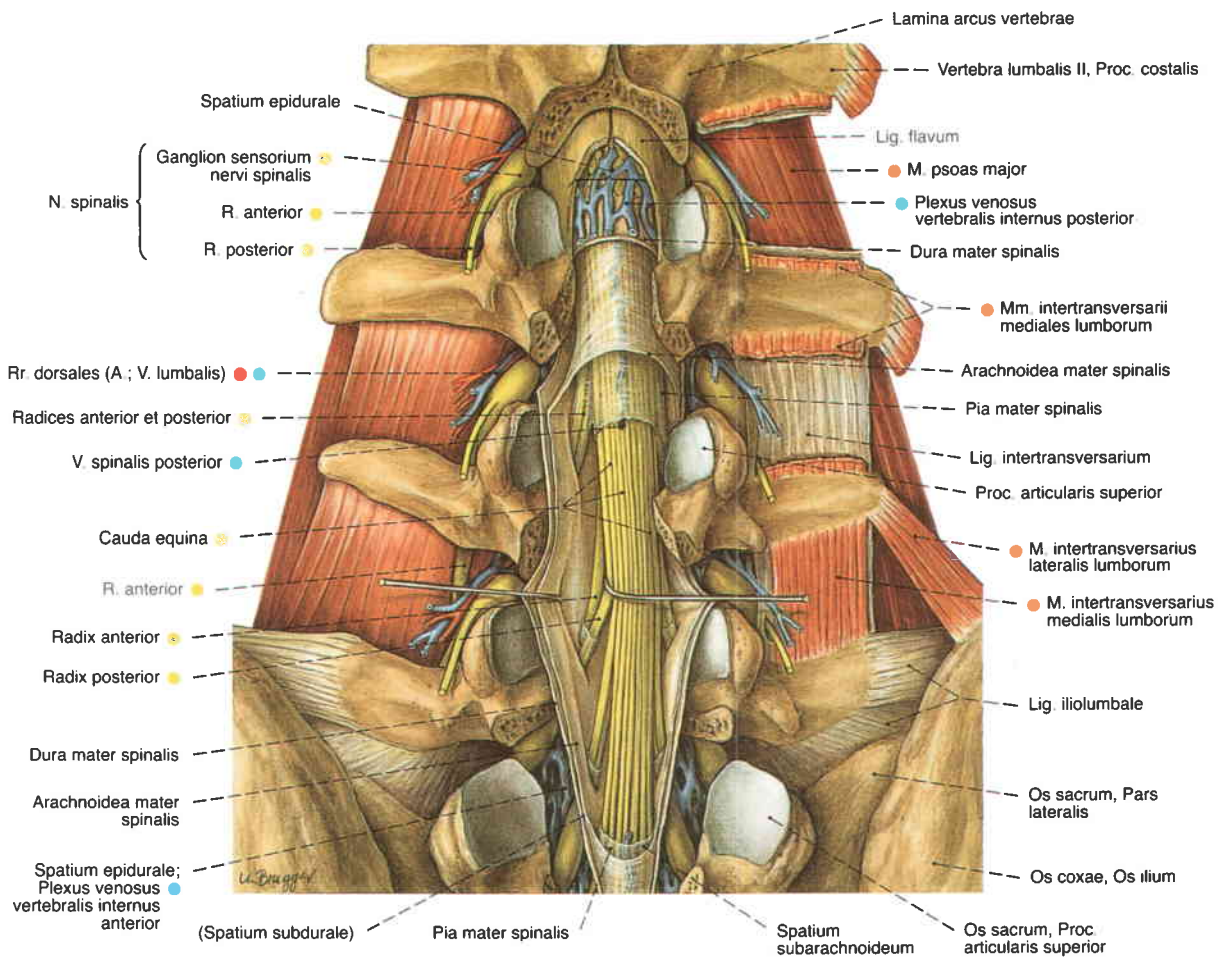
**Fig. 797** Nerves of the nuchal region, Regio cervicalis posterior, and vertebral artery; dorsal view.



**Fig. 798** Blood vessels and nerves of the deep posterior cervical region, Regio cervicalis posterior, and the contents of the vertebral canal;

the vertebral arches have been completely removed as well as a portion of the occipital bone. The meninges of the spinal cord are shown in several layers; dorsal view.





**Fig. 799** Blood vessels and nerves of the vertebral canal in the lumbar region, Regio lumbalis; the vertebral arches have been removed and the meninges of the spinal cord are shown in several layers; dorsal view.

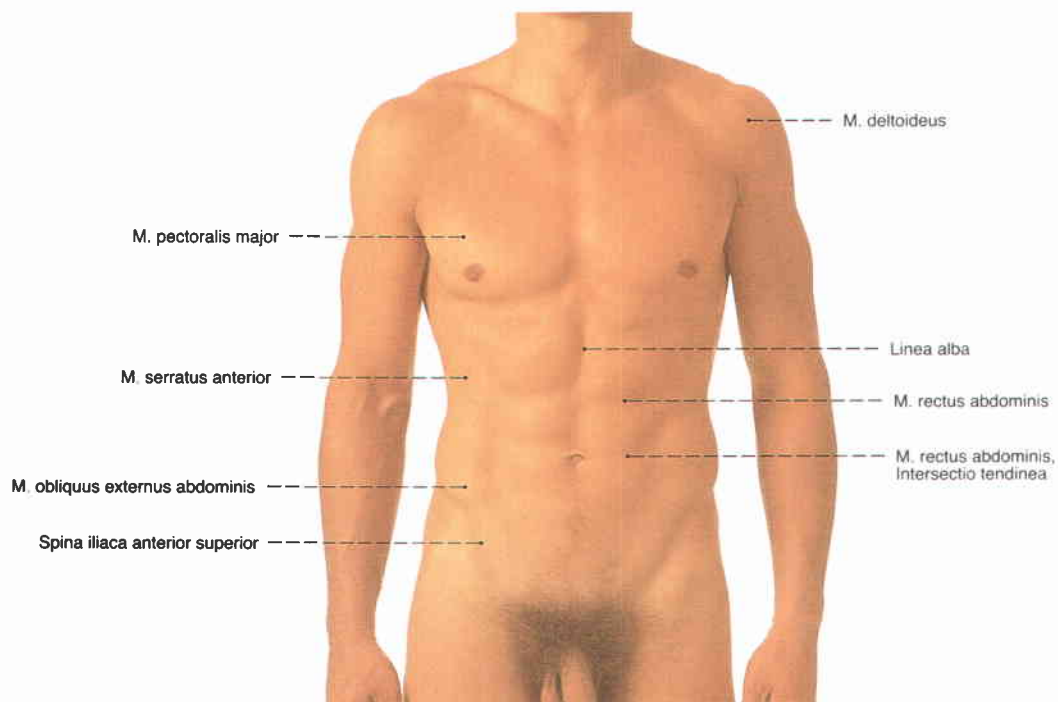


Fig. 800 Surface anatomy of the thoracic and abdominal walls of a young male; the prominent muscles are indicated.

Note the upper limit of the pubic hair. It extends to the umbilicus and has a triangular shape in the male. In the female, the upper limit is horizontal. The regions of the thoracic and abdominal walls are shown in Fig. 7.

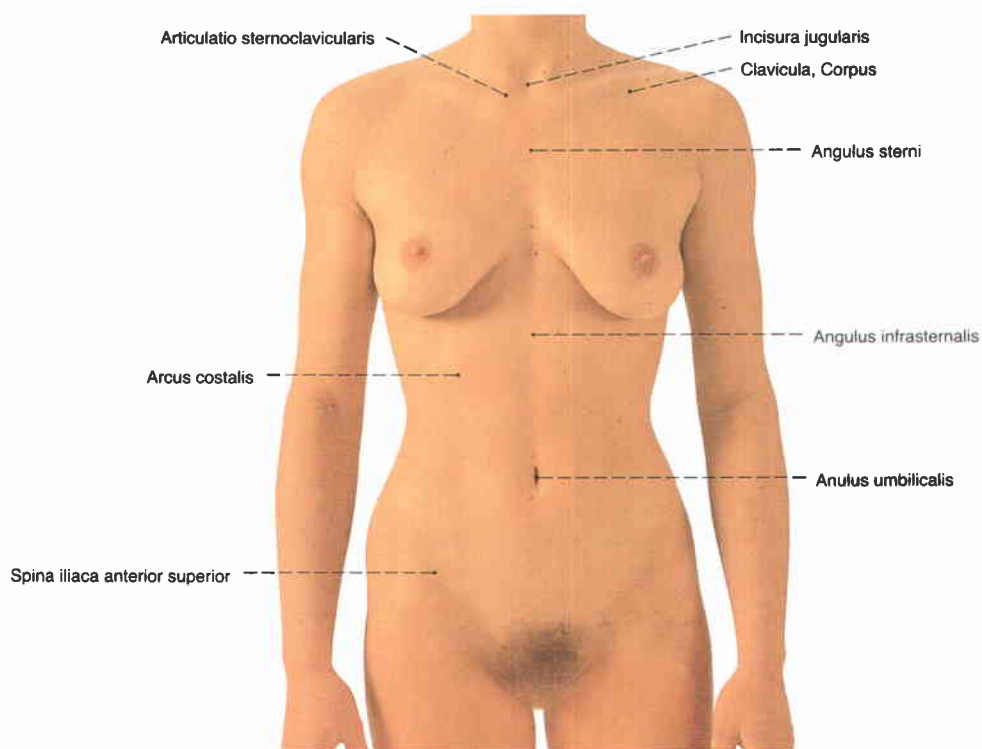
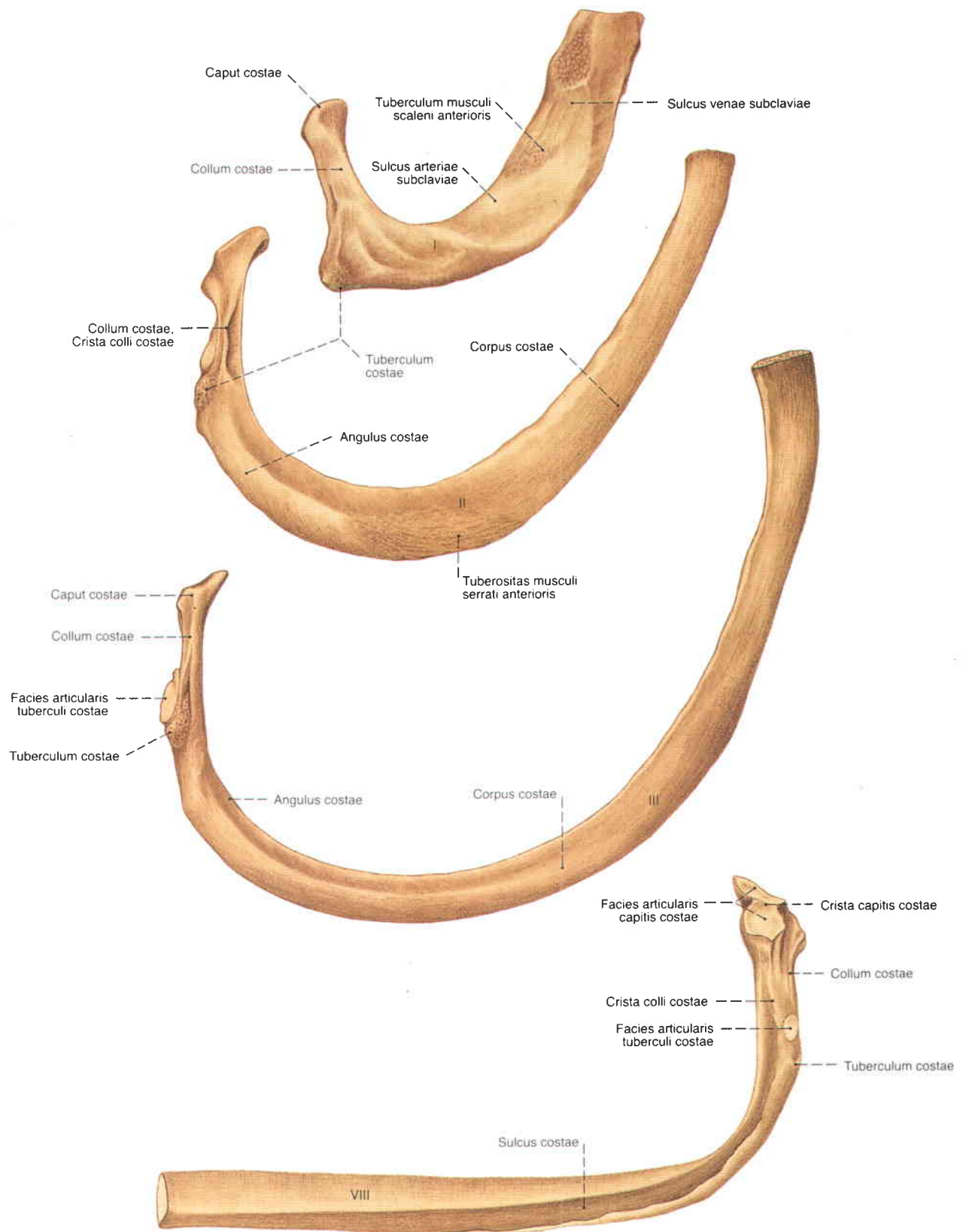
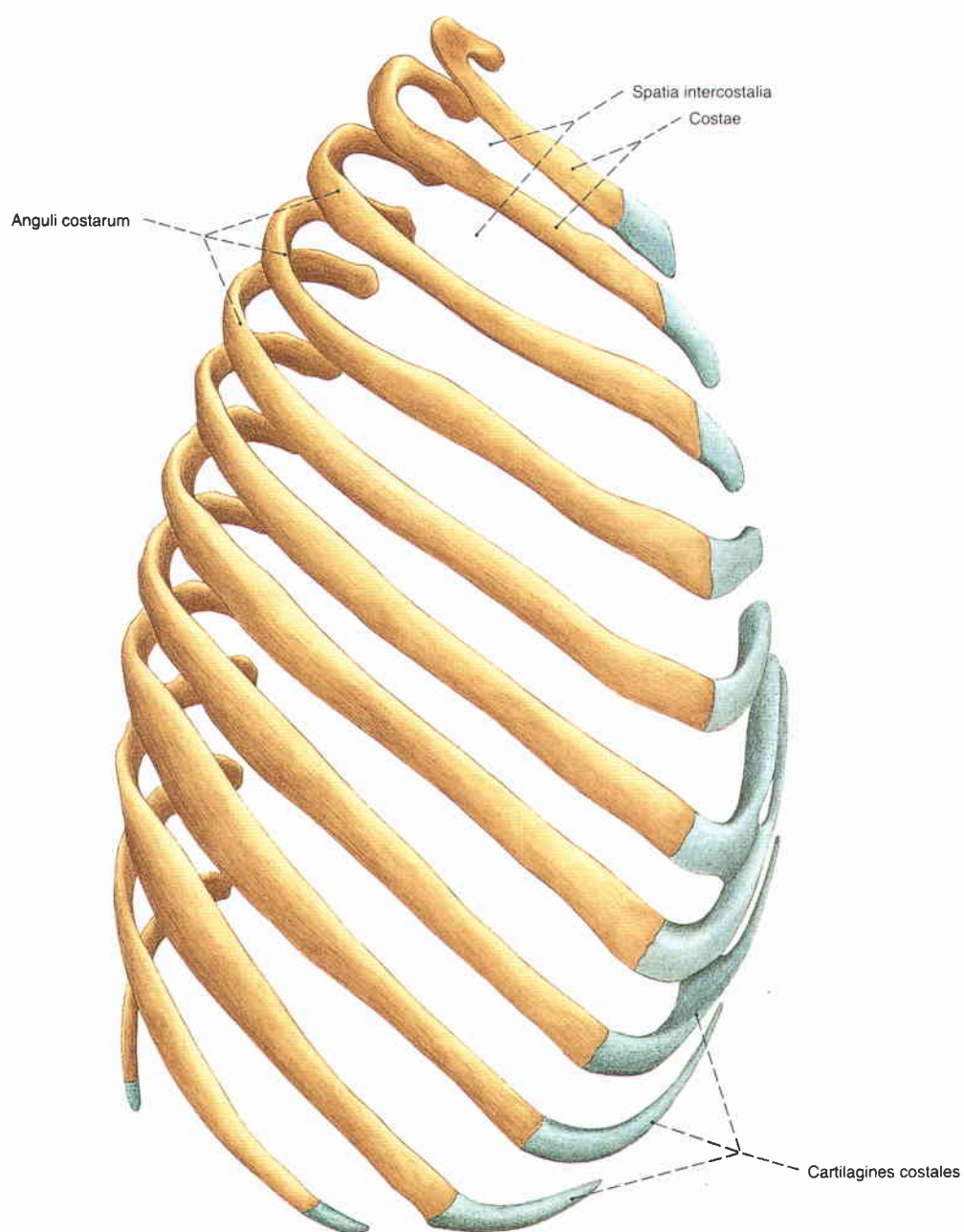


Fig. 801 Surface anatomy of the thoracic and abdominal walls of a young female; the prominent bones are indicated.

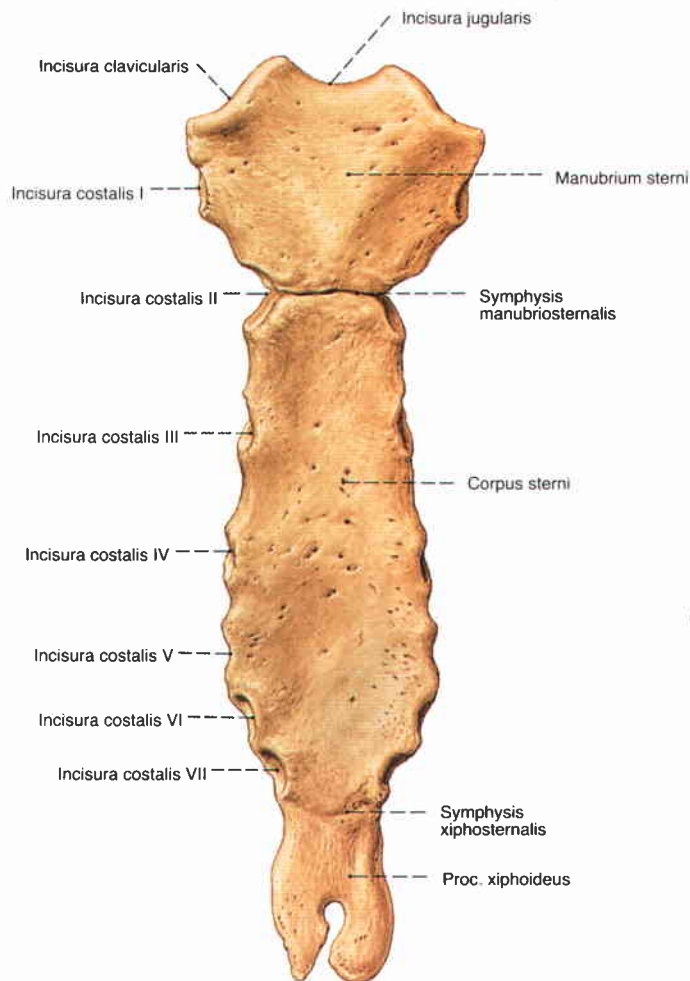


**Fig. 802** Ribs, Costae.  
Ribs I to III, superior view  
Rib VIII, inferior view



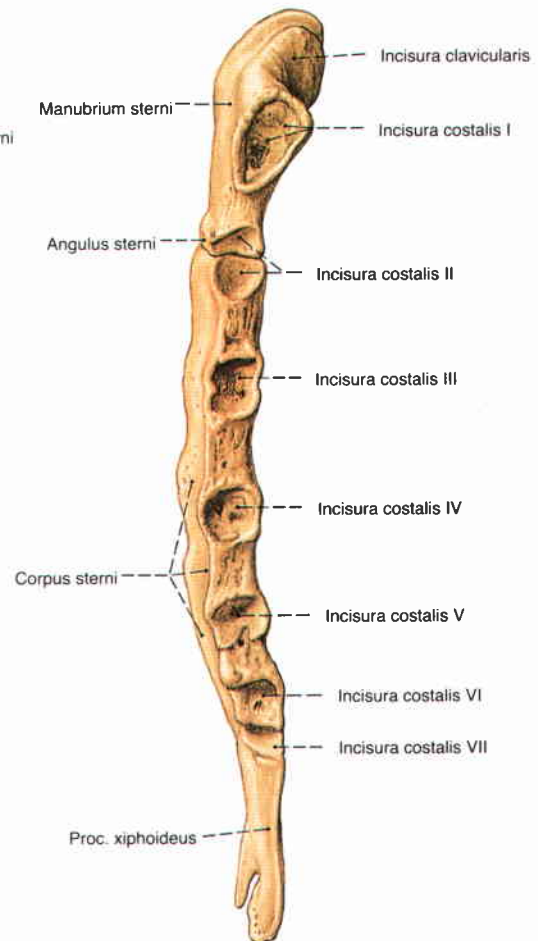


**Fig. 803** Ribs, Costae;  
viewed from the right.  
The distance between the ribs is as in nature.



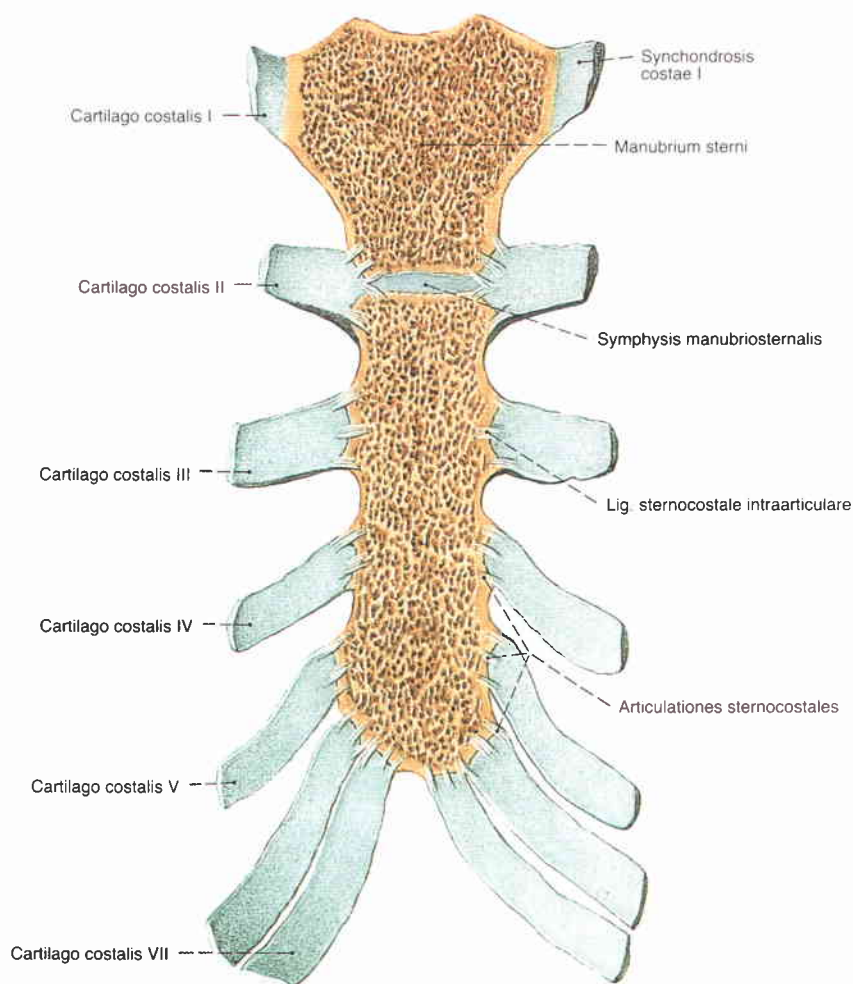
**Fig. 804** Sternum, Sternum;  
ventral view.

Form, length and dorsal or ventral direction of the xiphoid process, Proc. xiphoideus, differ very much.



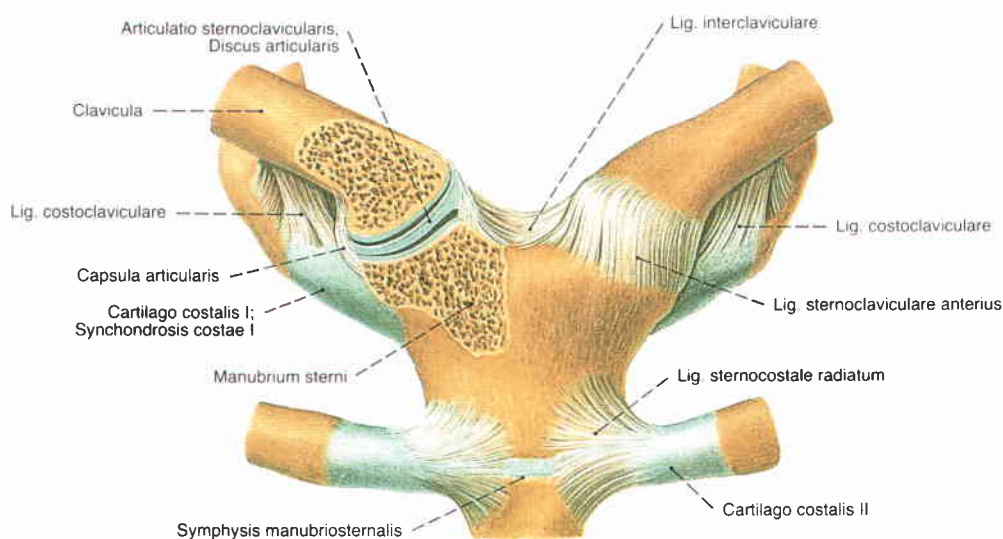
**Fig. 805** Sternum, Sternum;  
left lateral view.

Orientation of ribs and intercostal spaces on the anterior thoracic wall is facilitated by the Angulus sterni, which demarcates the articulation of the 2nd rib.



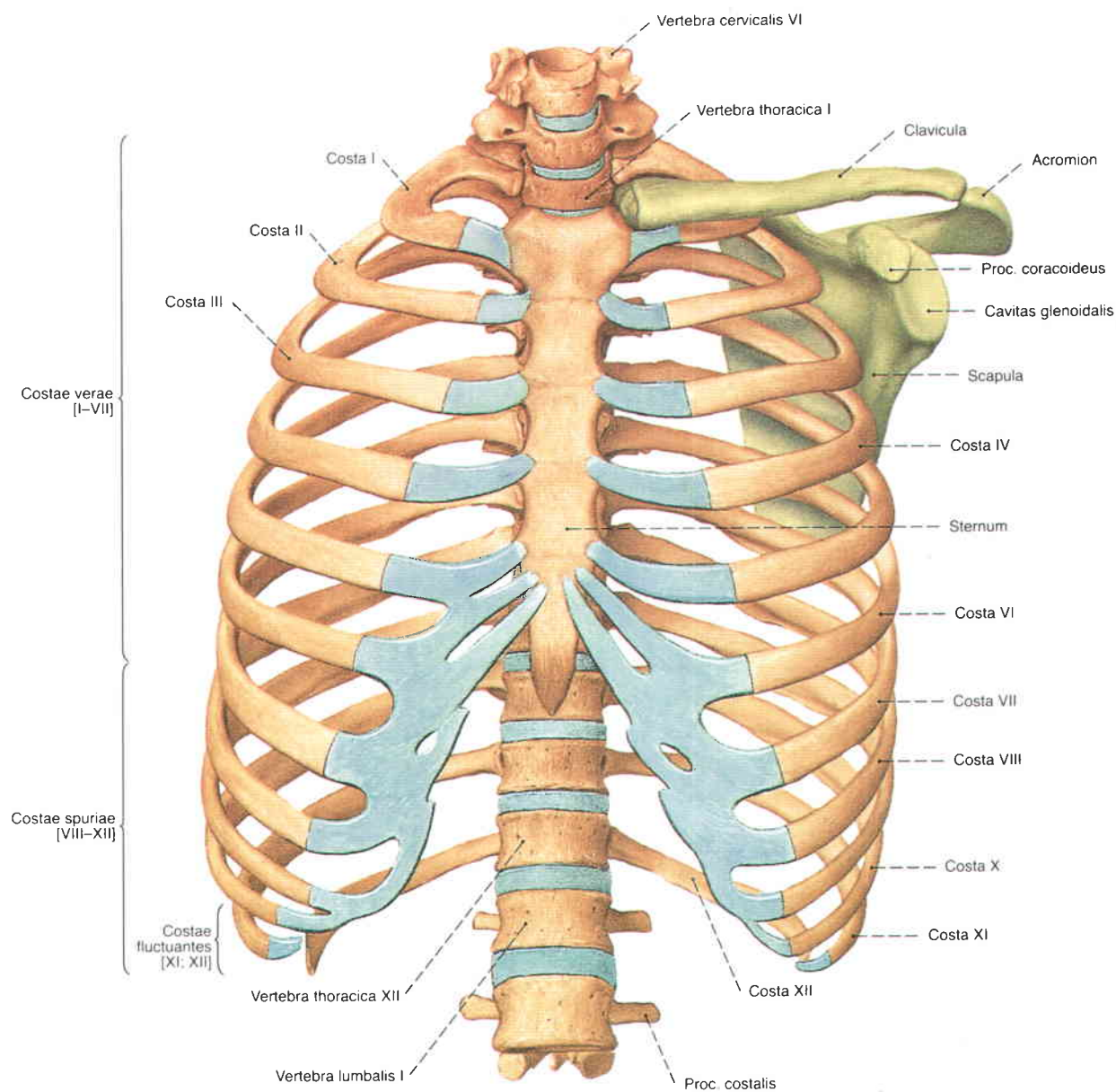
**Fig. 806** Sternum, Sternum; costal cartilages, Cartilagine costales; frontal section; ventral view.

Note that the xiphoid process is not seen in this figure due to the curvature of the sternum in the sagittal axis.



**Fig. 807** Sternoclavicular joint, Articulatio sternoclavicularis; the right joint has been exposed by a frontal section to show the articular disc; ventral view.

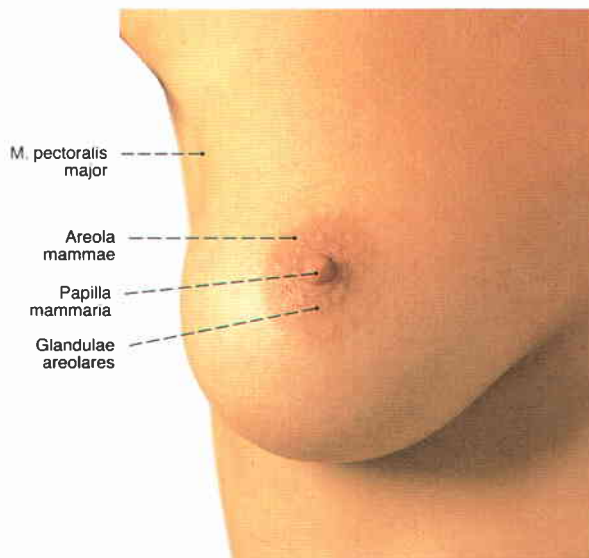




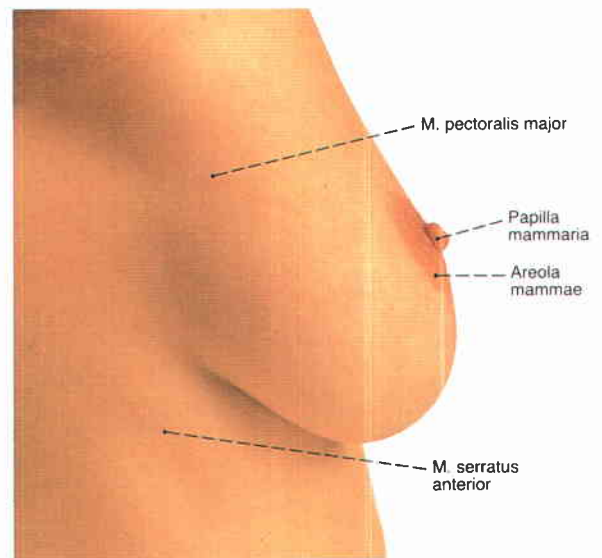
**Fig. 808** Thoracic cage, Cavea thoracis; left shoulder girdle, Cingulum pectorale; ventral view.

The thoracic cage is shown in a moderate inhalation position. The bones of the shoulder girdle are shown in green, the cartilages in blue.

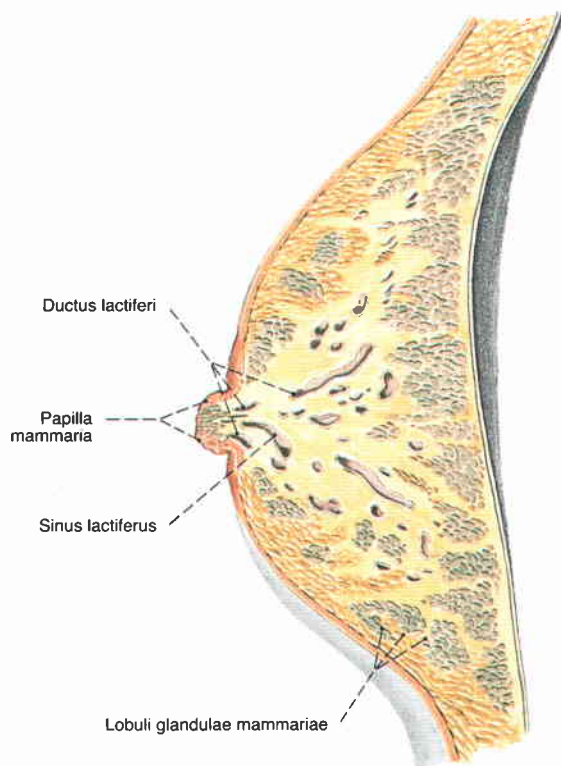
The length of ribs XI and XII can vary greatly.



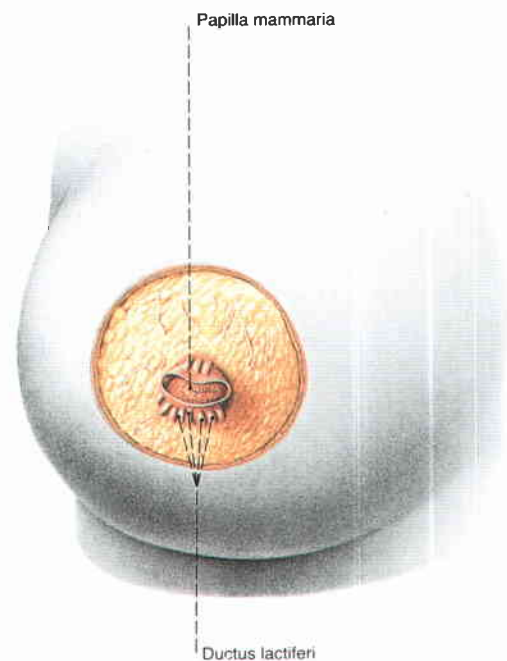
**Fig. 809** Mammary gland, Mamma; ventral view.



**Fig. 810** Mammary gland, Mamma; right lateral view.



**Fig. 811** Mammary gland, Mamma, of a pregnant woman; the mammary gland has been sectioned in the sagittal plane; lateral view.



**Fig. 812** Mammary gland, Mamma, of a pregnant woman; the skin of the areola, Areola mammae, has been removed, the skin around the nipple has been retracted; ventral view.

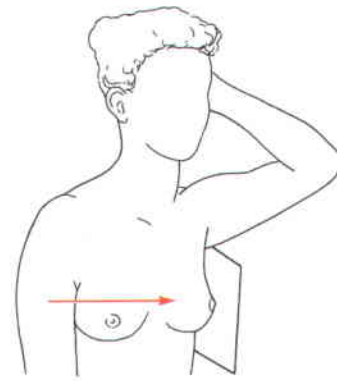


Fig. 813 Radiograph of the mammary gland, mammography of a 47-year-old woman; beam directed laterally.

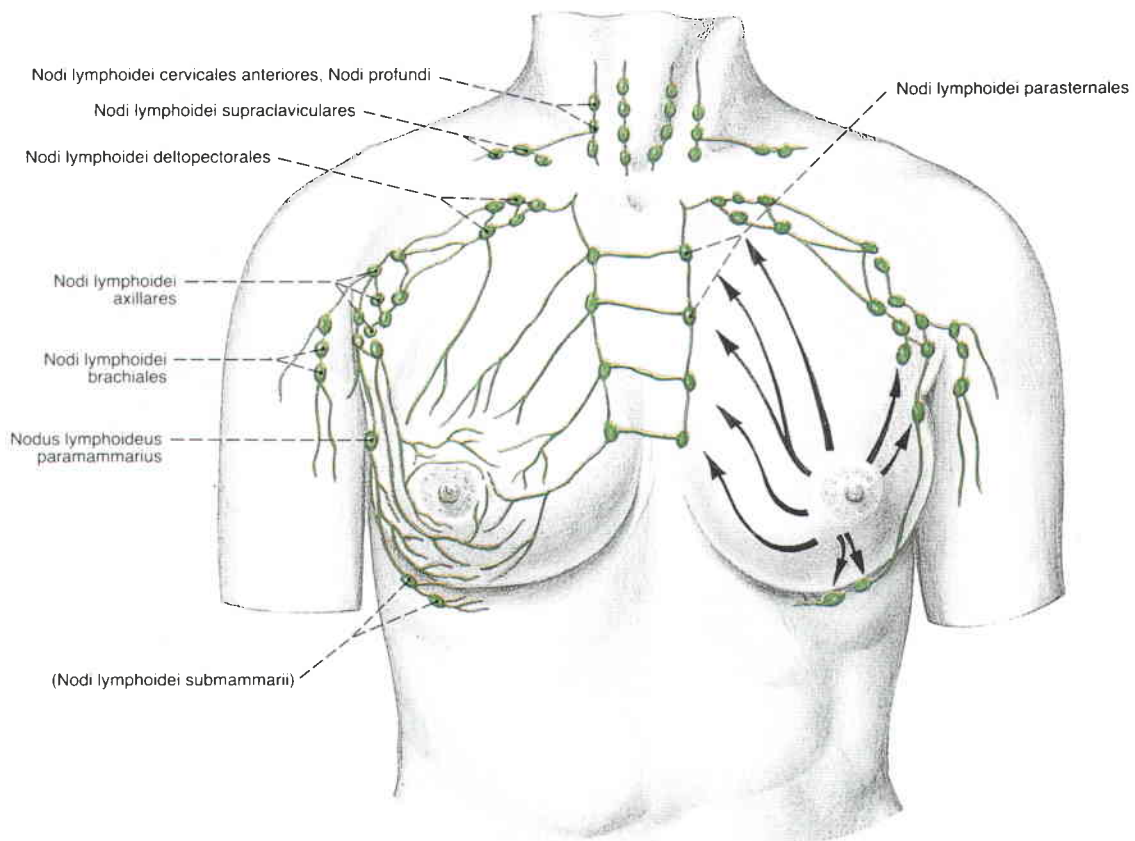
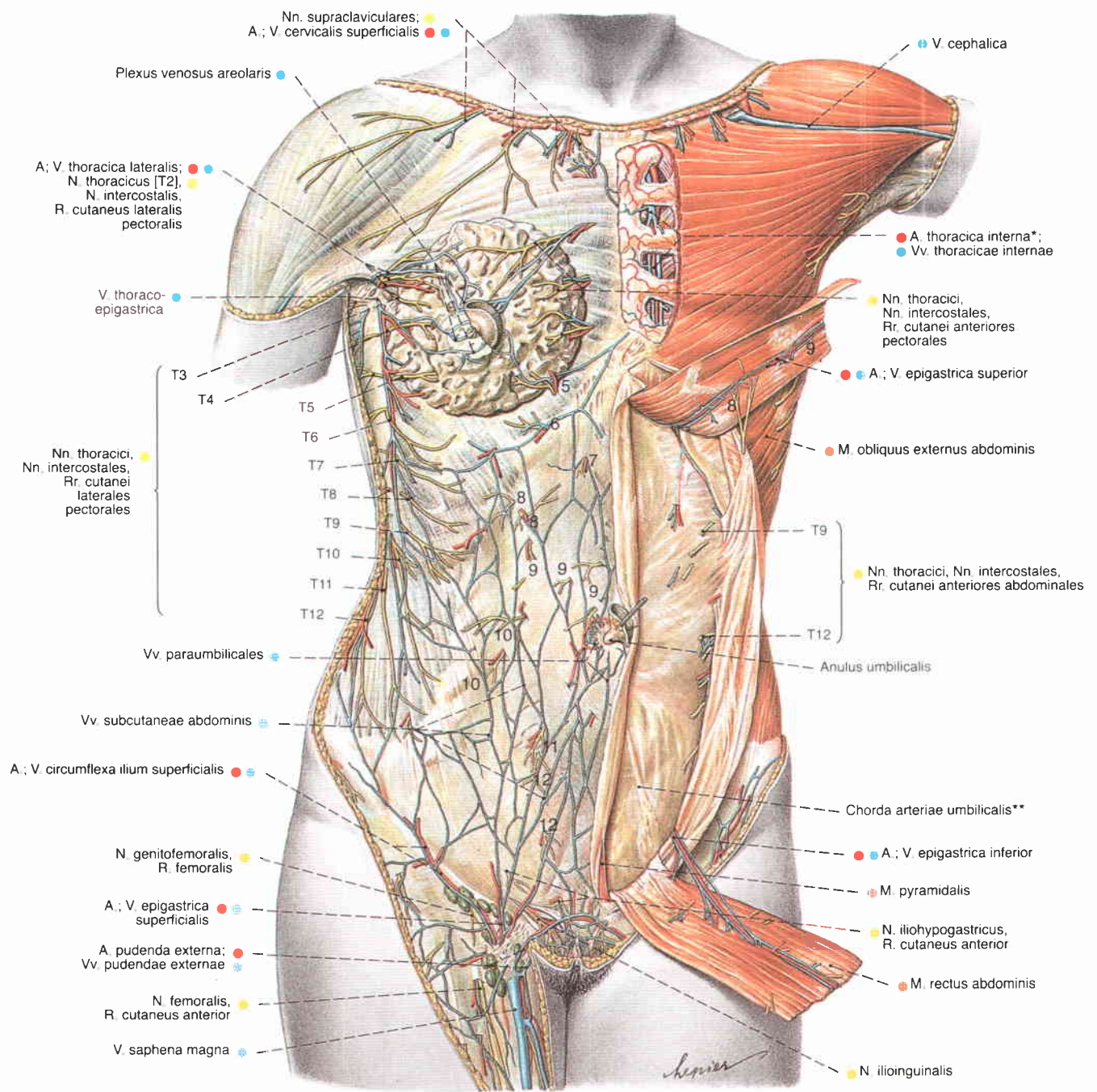


Fig. 814 Lymphatic drainage of the female mammary gland and location of the regional lymph nodes.  
(From BENNINGHOFF/GOERTTLER: Textbook of Human Anatomy. Vol. 2, 12th ed. Munich: Urban & Schwarzenberg, 1979).

Note the communications between the lymphatic vessels of both sides and lymphatic drainage into the intrathoracic lymph nodes.



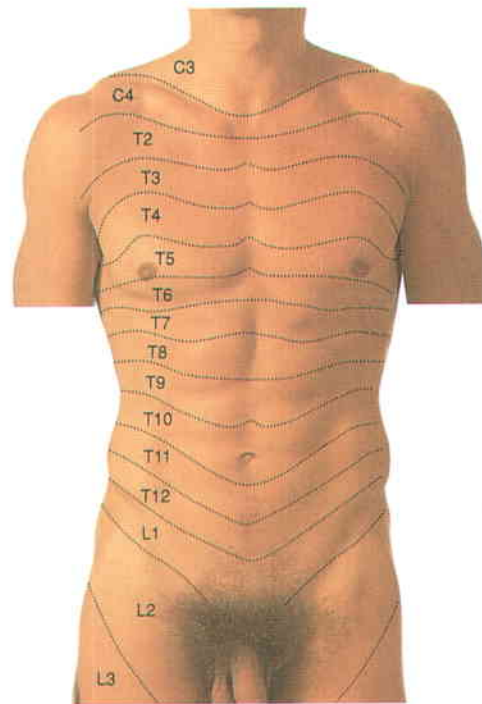


**Fig. 815** Blood vessels and nerves of the thoracic and abdominal walls. The superficial layer is shown on the right side of the body; ventral view.

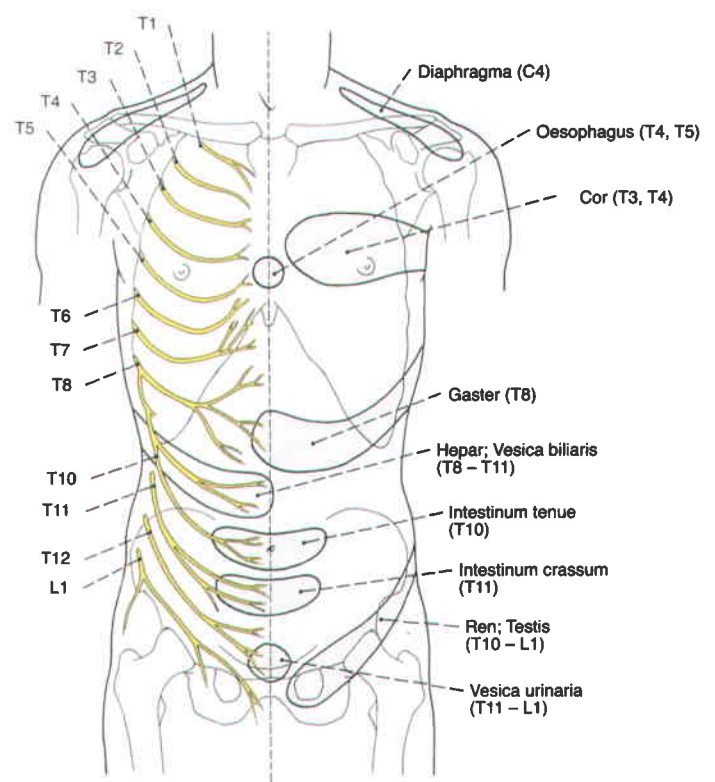
The arabic numerals indicate the cutaneous branches of the corresponding intercostal nerves.

\* Clinical: internal mammary artery

\*\* The Chorda arteriae umbilicalis projects internally as the Plica umbilicalis medialis.

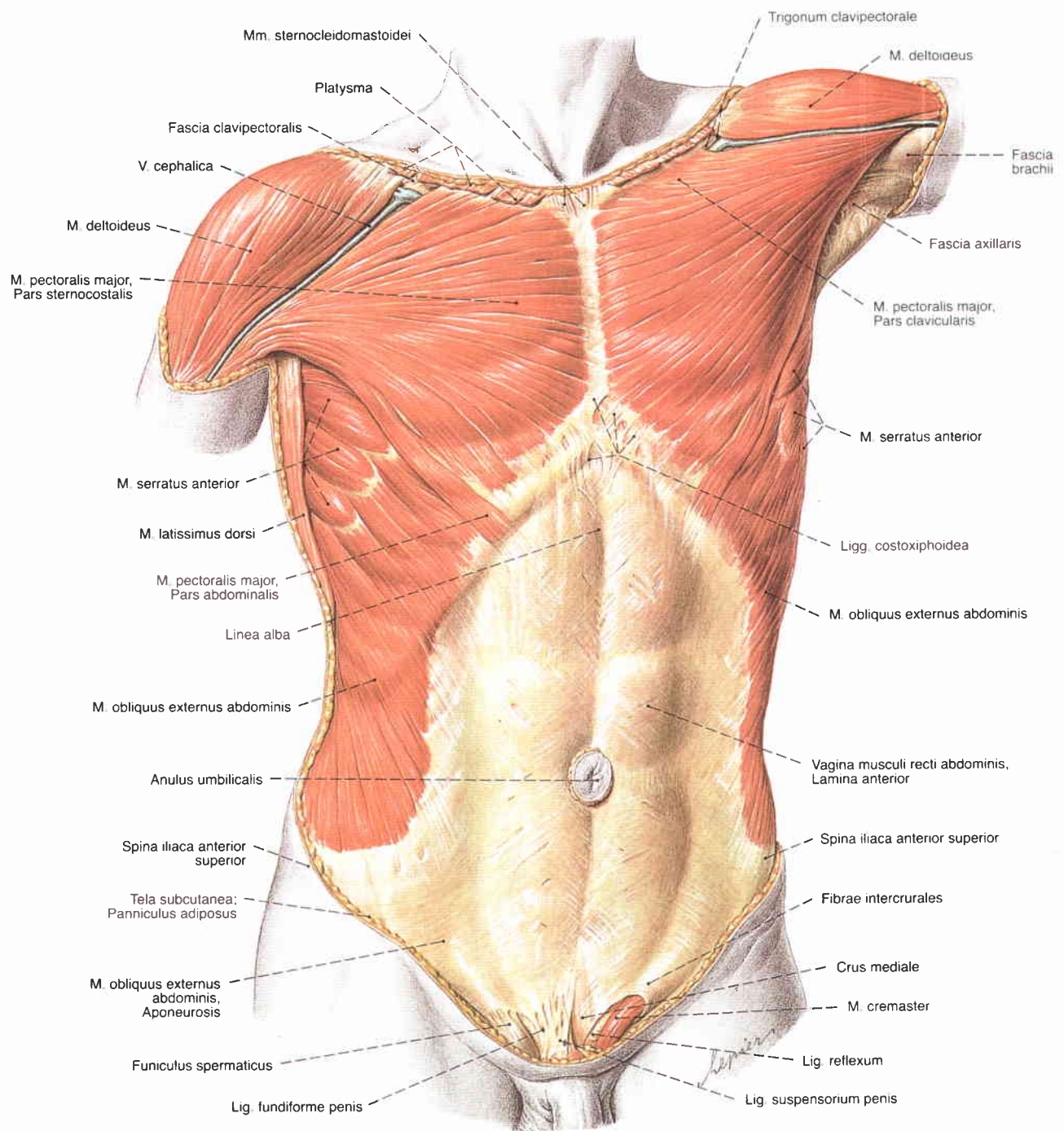


**Fig. 816** Segmental sensory innervation of the anterior thoracic and abdominal walls (dermatomes). Letters and numbers indicate the corresponding segments of the spinal cord.



**Fig. 817** Segmental sensory innervation of the thoracic and abdominal walls. The regions on the left half of the body are those where pain caused by diseased internal organs is projected (HEAD's zones).





**Fig. 818** Muscles of the thoracic and abdominal walls; superficial layer; ventral view.



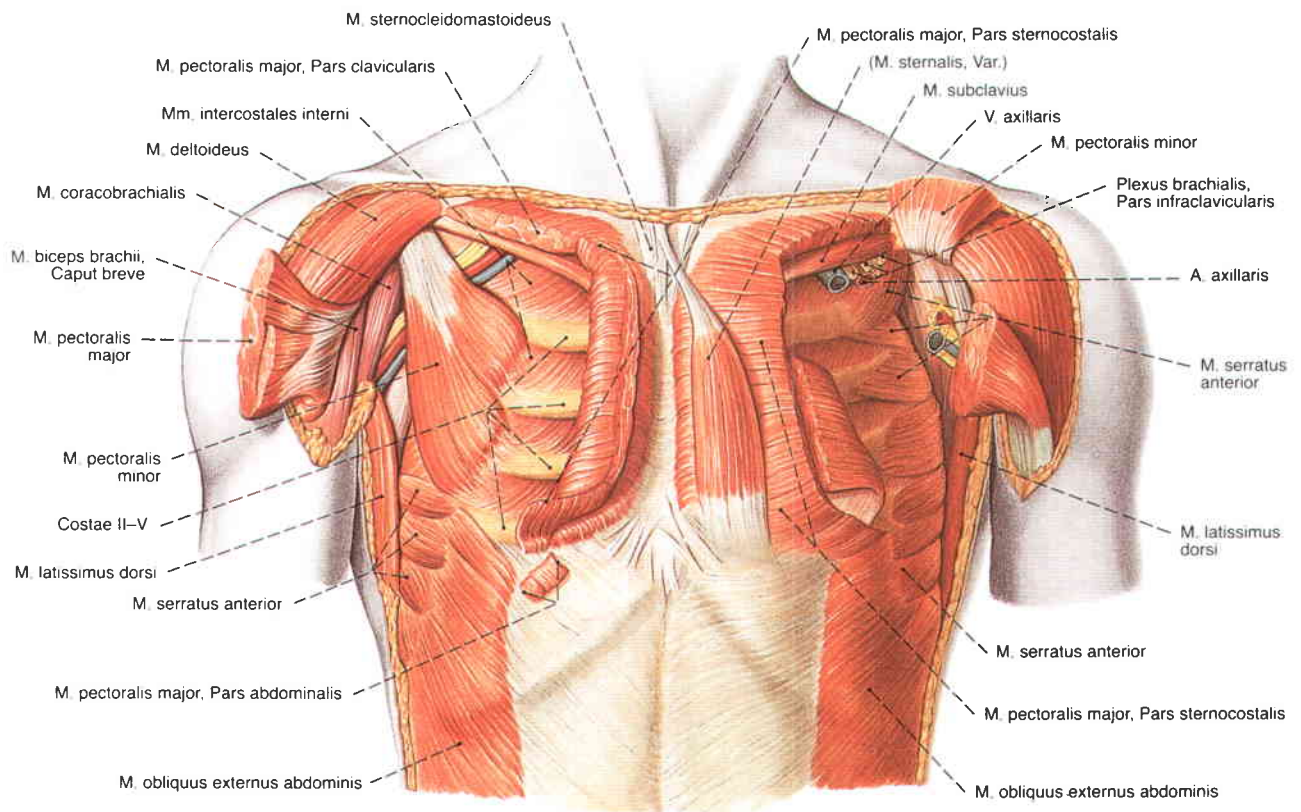


Fig. 819 Thoracic muscles, Mm. thoracis; the right M. pectoralis major has been partially removed.

On the left side the M. pectoralis minor has been sectioned and reflected; the Membrana intercostalis externa has been removed; ventral view.

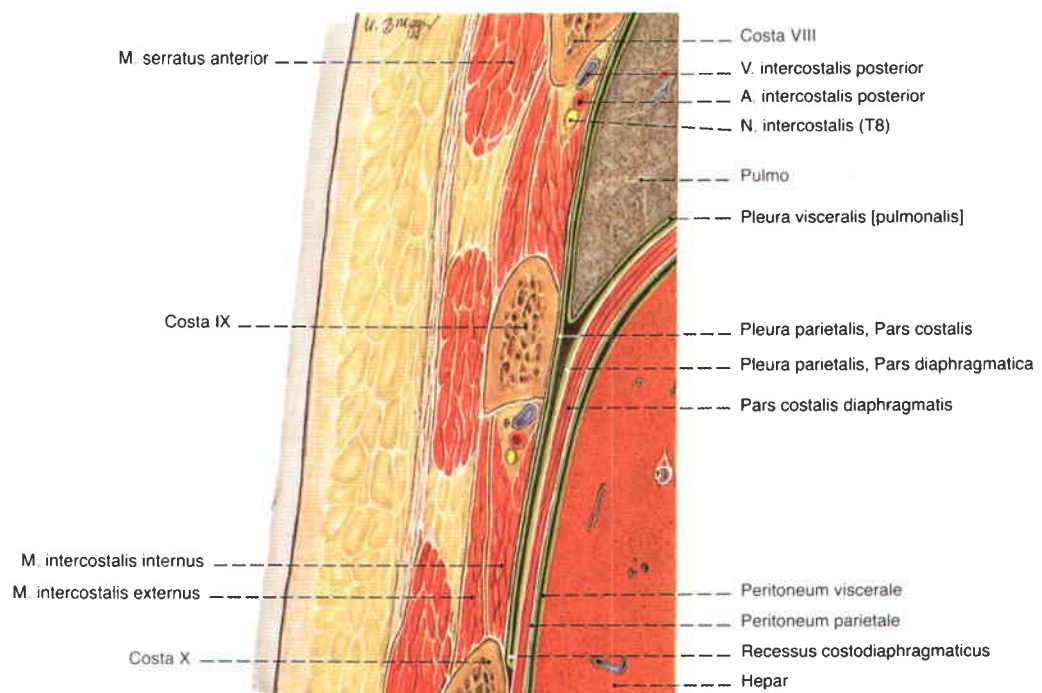


Fig. 820 Thoracic muscles, Mm. thoracis; frontal section showing the thoracic wall and the thoracic and abdominal cavities; right lateral view.

During puncture of the liver or aspiration of accumulated fluid in the pleural cavity, the course of the intercostal nerves and vessels, the position of the diaphragm and the expansion of the lung into the costodiaphragmatic recess must be taken into account.

### Ventral muscles of the shoulder (Figs. 818, 819)

The M. pectoralis major is a muscle of both the arm and the trunk. It defines the superficial relief of the upper anterior thoracic wall. Underneath it lies the M. pectoralis minor, a muscle of the trunk-shoulder girdle. The M. subclavius is also a muscle of the trunk-shoulder girdle. Its course to the clavicle is from caudal. The deepest muscle of the shoulder girdle is M. subscapularis, which runs from the anterior (ventral) surface of the scapula to the humerus.

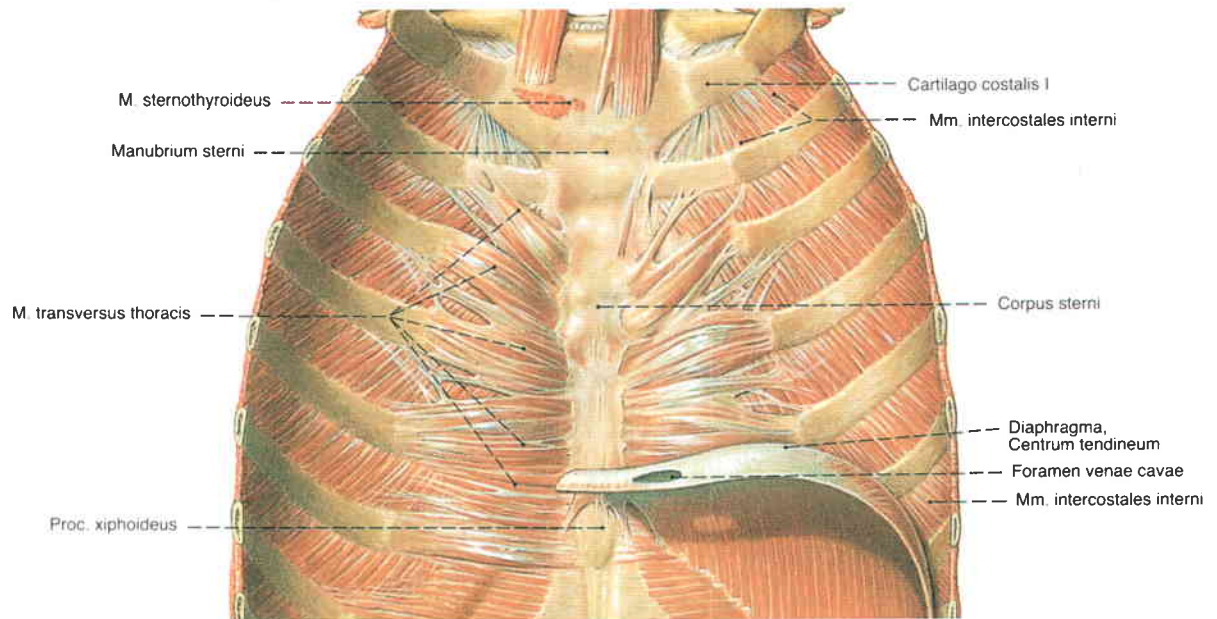
Muscle / Innervation	Origin	Insertion	Function
<b>1. M. pectoralis major</b> <i>Nn. pectorales medialis et lateralis (Plexus brachialis, Pars infra-/supraclavicularis)</i>  The fibres converge towards a flat tendon	<b>Pars clavicularis:</b> Clavicula (sternal half)  <b>Pars sternocostalis:</b> Manubrium and Corpus sterni, costal cartilages of ribs 1–6  <b>Pars abdominalis:</b> Rectus sheath (aponeurosis of the external oblique abdominal muscle)	Crista tuberculi majoris of the humerus	<b>Shoulder joint:</b> adduction (very effective when the arm is elevated), internal rotation; <b>Pars clavicularis:</b> anteversion <b>Shoulder girdle:</b> depression, anteversion <b>Thorax:</b> elevation of the sternum, enlargement of the thorax (when the arms are supported it assists in extreme inspiration)
<b>2. M. pectoralis minor</b> <i>Nn. pectorales medialis et lateralis (Plexus brachialis, Pars infra-/supraclavicularis)</i>	Ribs (2) 3 to 5 (close to the junction of bone and cartilage)	Apex of the Proc. coracoideus of the scapula	<b>Shoulder girdle:</b> depression, anteversion <b>Thorax:</b> elevation of the upper ribs, enlargement of the thorax (when the arms are supported and the shoulder girdle is fixed it assists in extreme inspiration)
<b>3. M. subclavius</b> <i>N. subclavius (Plexus brachialis, Pars supraclavicularis)</i>	1st rib (close to the junction of bone and cartilage)	Clavicula (lateral third), the fascia is merged with the adventitia of V. subclavia	<b>Shoulder girdle:</b> depression (mild effect), resistance to lateral pull on the clavicle
<b>4. M. subscapularis</b> <i>Nn. subscapulares (Plexus brachialis, Pars infraclavicularis)</i>	Facies costalis, Fossa subscapularis	Tuberculum minus and adjacent part of the Crista tuberculi minoris (inferior to the insertion of Bursa subtendinea musculi subscapularis)	<b>Shoulder joint:</b> internal rotation, abduction in the scapular plane (cranial portion), adduction in the scapular plane (caudal portion)

### Muscles of the thoracic wall (Fig. 819)

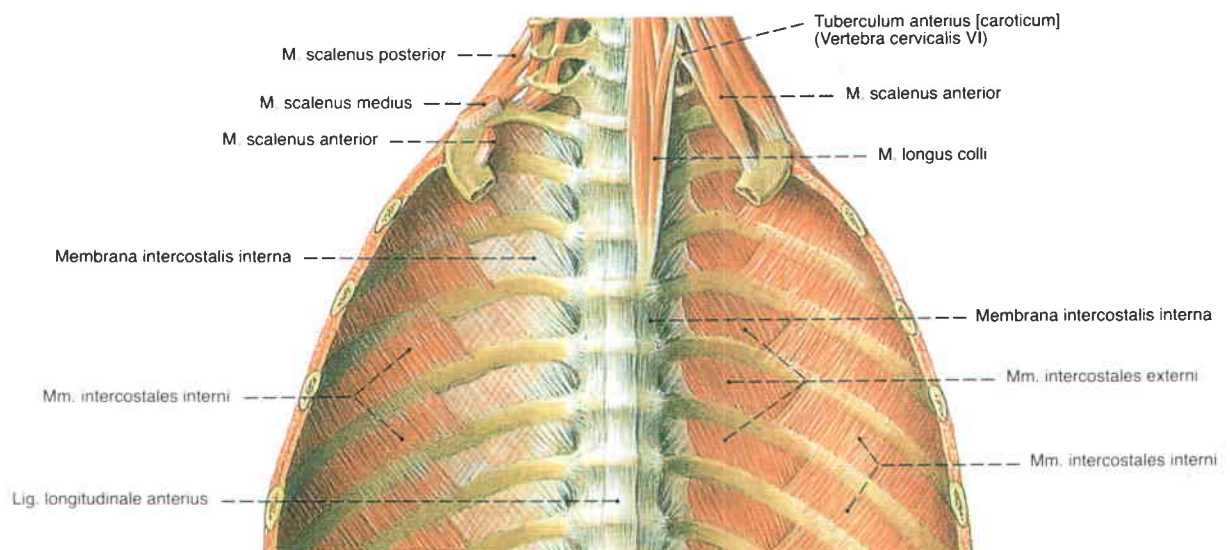
The intercostal spaces are taken up by the Mm. intercostales externi and interni. The inner surface of the thoracic wall is covered by Mm. subcostales and by M. transversus thoracis. An occasional superficial variant is the M. sternalis. M. pectoralis major, which dominates the superficial contour of the upper thoracic wall, is a trunk-arm muscle. It overlies M. pectoralis minor, a trunk-shoulder girdle muscle. Both are described with the muscles of the shoulder.

Muscle / Innervation	Origin	Insertion	Function
<b>1. M. sternalis</b> (inconstant, exists in 5% of the population) <i>Divisions of Nn. pectorales (Plexus brachialis, Pars supraclavicularis) or Nn. intercostales (Nn. thoracici)</i>	Rim of sternum (on the fascia pectoralis)	Into the fascia	Contracts the skin of the chest
<b>2. Mm. intercostales externi</b> <i>Nn. intercostales (Nn. thoracici)</i>	Ribs 1 to 11 (lower border from Tuberculum costae to the junction of bone and cartilage)	Ribs 2 to 12 (upper border of the rib below)	Elevate the ribs, expand the intercostal spaces during inspiration
<b>3. Mm. intercostales interni</b> <i>Nn. intercostales (Nn. thoracici)</i>	Ribs 2 to 12 (upper border from sternal end of Cartilago costalis to Angulus costae)	Border of Mm. intercostales intimi on the inner surface by Vasa intercostalia posteriora and N. intercostalis	Lower the ribs and expand the intercostal spaces during expiration
<b>4. Mm. subcostales</b> (inconstant) <i>Nn. intercostales (Nn. thoracici)</i>	Lower ribs (upper border between Tuberculum and Angulus costae)	Lower ribs (lower border, always skipping one rib)	Expand the thoracic wall during expiration
<b>5. M. transversus thoracis</b> (inconstant) <i>Nn. intercostales (Nn. thoracici)</i>	Corpus sterni, Proc. xiphoideus (dorsal lateral rim), Cartilago costalis of rib (6) 7	Costal cartilages of ribs 2 to 6 (close to the junction of bone and cartilage)	



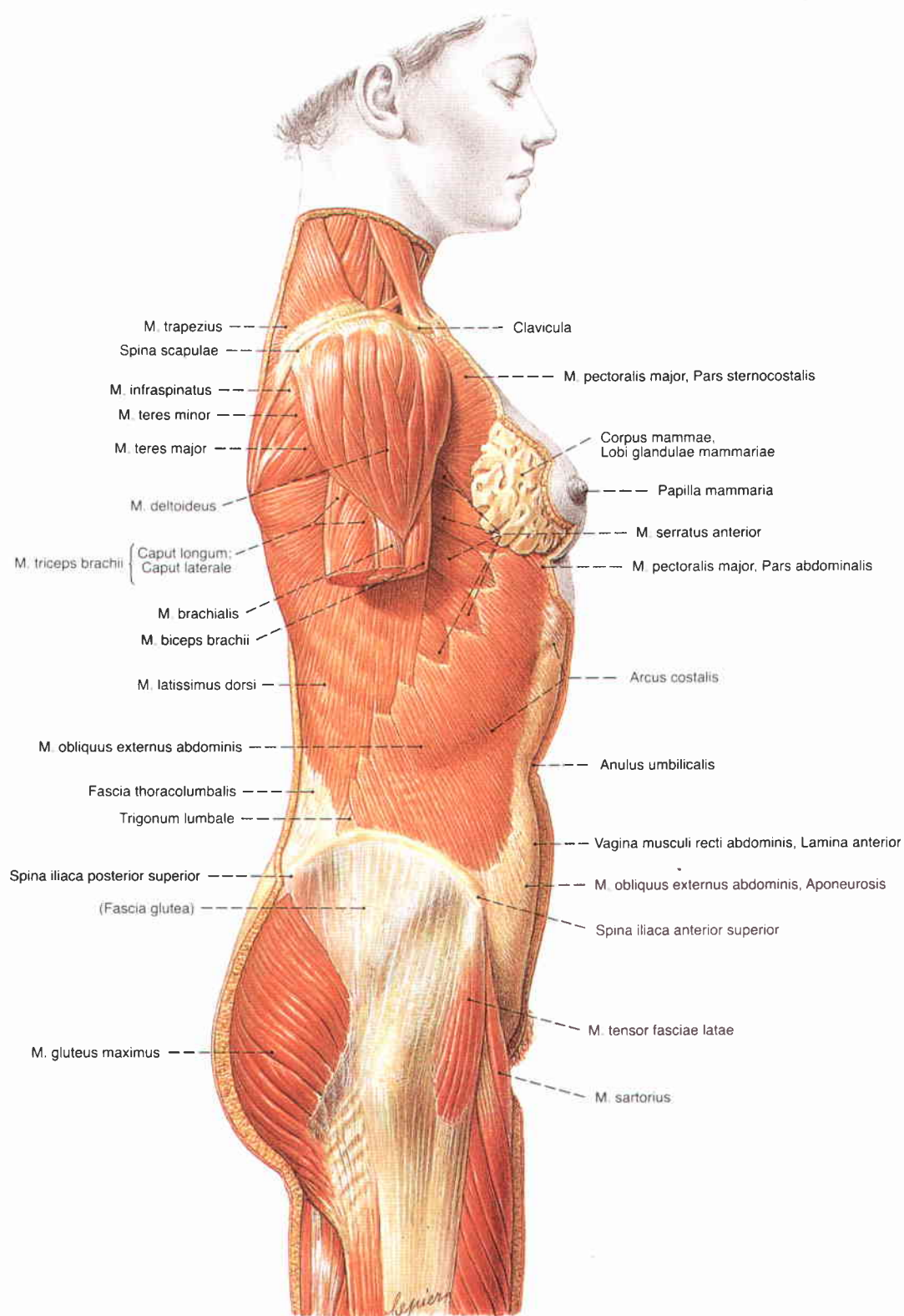


**Fig. 821** Thoracic cage, Cavea thoracis; internal aspect of the anterior thoracic wall with the diaphragm in place on the right side; dorsal view.



**Fig. 822** Thoracic cage, Cavea thoracis; posterior part; frontal section; the muscles of the neck are partly in place; ventral view.



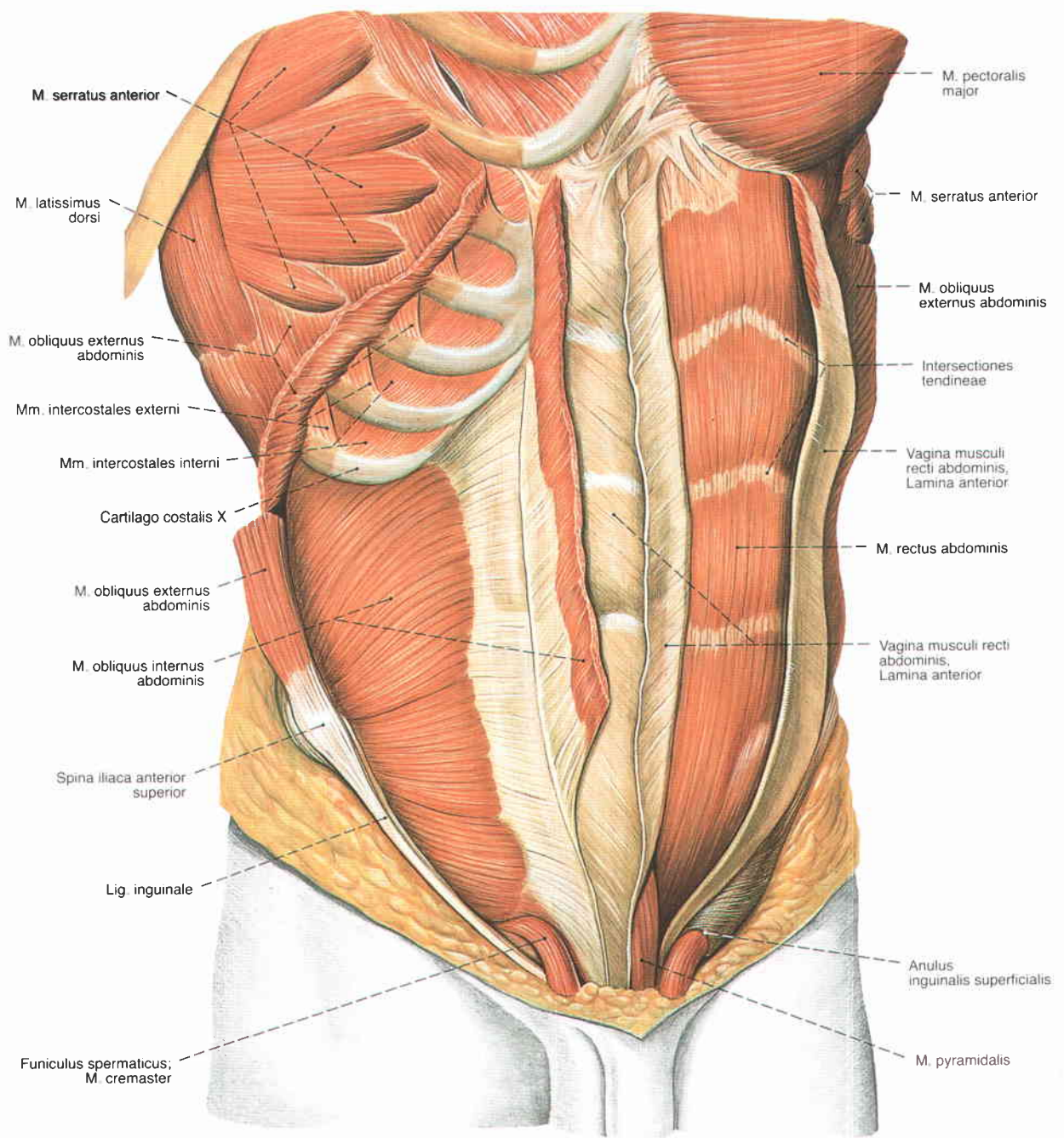


**Fig. 823** Muscles of the thoracic and abdominal walls, Mm. thoracis and Mm. abdominis. The mammary gland has been dissected; lateral view.



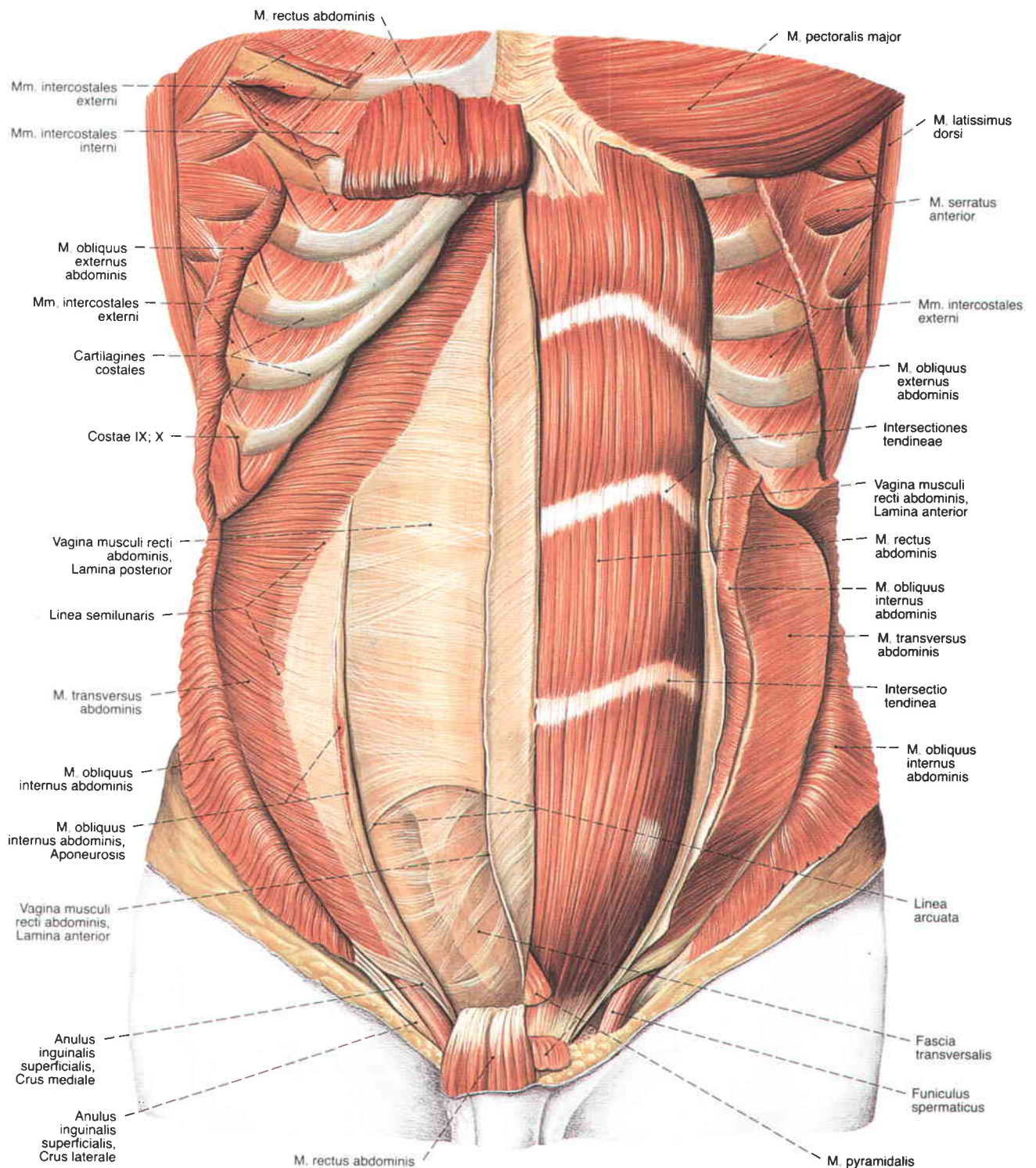
**Fig. 824** Abdominal muscles, *Mm. abdominis*; on the right side of the body, the anterior layer of the rectus sheath has been opened to display the *M. rectus abdominis* and the *M. pyramidalis*. On the left side of the body, the *M. obliquus externus abdominis* has been sectioned to show the *M. obliquus internus abdominis*; ventral view.





**Fig. 825** Abdominal muscles, Mm. abdominis; on the left side of the body, the anterior layer of the rectus sheath has been opened. On the right side of the body, the M. obliquus externus abdominis has been sectioned; the Membrana intercostalis externa has been removed; ventrolateral view.





**Fig. 826** Abdominal muscles, *Mm. abdominis*; on the left side of the body, the *M. pyramidalis* has been sectioned. On the right side of the body, the *M. rectus abdominis* is reflected upwards and downwards; the *M. obliquus externus abdominis* has been sectioned; the anterior layer of the rectus sheath has been pulled to the right over the midline; ventral view.

**Anterior muscles of the abdominal wall (Fig. 826)**

The anterior muscles of the abdominal wall, M. rectus abdominis and M. pyramidalis, lay within the rectus sheath.

Muscle Innervation	Origin	Insertion	Function
<b>1. M. rectus abdominis</b> <i>Nn. intercostales (Nn. thoracici); rarely ventral divisions of upper Nn. lumbales</i>	Ventral surface of costal cartilages of the 5th to 7th ribs, Proc. xiphoideus, Ligg. costoxiphoidea	Crista pubica of Os coxae, Symphysis pubica	Flexes the trunk towards the pelvis, compresses the abdomen, abdominal breathing (expiration)
<b>2. M. pyramidalis</b> (inconstant) <i>caudal Nn. intercostales (Nn. thoracici)</i>	Crista pubica of Os coxae, Symphysis pubica (ventral of M. rectus abdominis)	Linea alba	Tenses the Linea alba

**Lateral muscles of the abdominal wall (Figs. 824, 826)**

The lateral muscles of the abdominal wall are: M. obliquus internus abdominis, M. obliquus externus abdominis, and M. transversus abdominis.

In the male the M. cremaster branches off from M. obliquus internus and M. transversus.

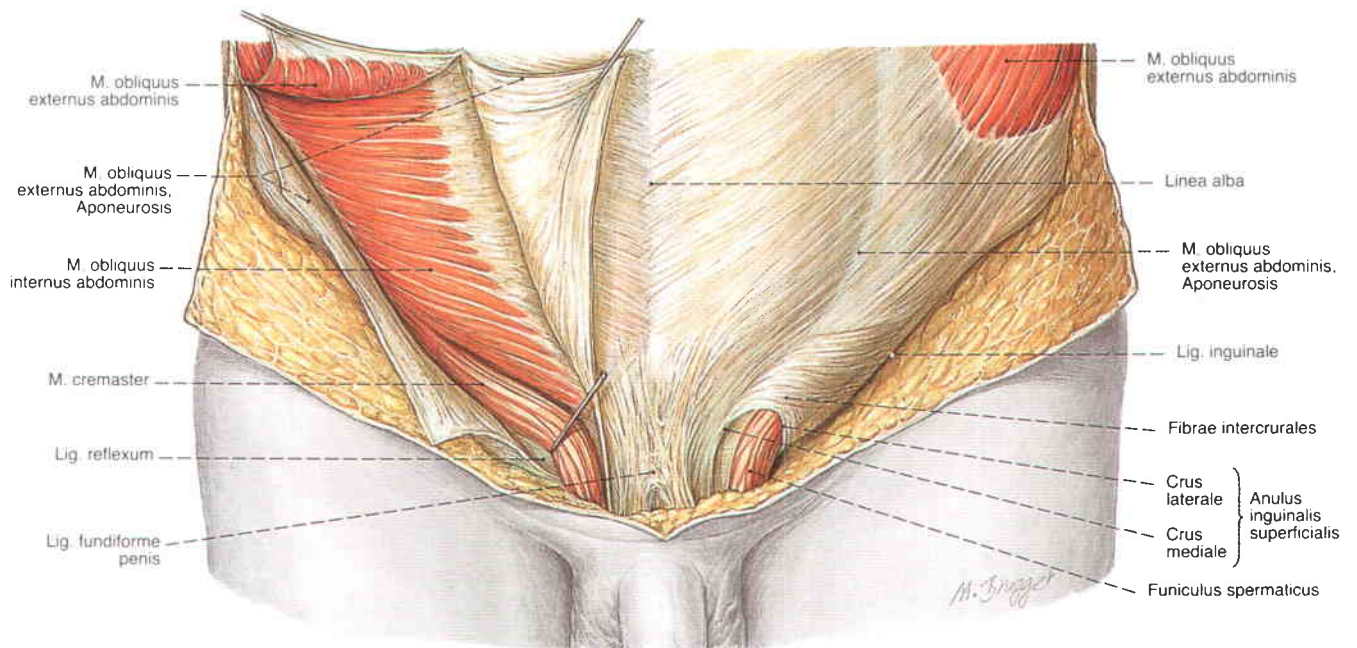
Muscle Innervation	Origin	Insertion	Function
<b>1. M. obliquus externus abdominis</b> <i>Caudal Nn. intercostales (Nn. thoracici); N. iliohypogastricus; N. ilioinguinalis (Plexus lumbalis)</i>	Ribs 5 to 12 (external surface, interdigitates with M. serratus anterior)	Labium externum of Crista iliaca, Lig. inguinale, Tuberculum pubicum, Crista pubica, Linea alba (part of the anterior layer of rectus sheath)	Unilaterally acting, rotates the thorax to the opposite side and bends the Columna vertebralis laterally. Acting bilaterally, bends the thorax towards the pelvis, compresses the abdomen, abdominal breathing (expiration)
<b>2. M. obliquus internus abdominis</b> <i>Caudal Nn. intercostales (Nn. thoracici); N. iliohypogastricus; N. ilioinguinalis (Plexus lumbalis)</i>	Fascia thoracolumbalis (superficial layer), Linea intermedia of Crista iliaca, Lig. inguinale (lateral two-thirds)	Inferior border of the costal cartilages of ribs (9) 10 to 12. Linea alba (above Linea arcuata it contributes to the anterior and posterior layer of the rectus sheath; inferior of Linea arcuata all fibres contribute to the anterior layer). In the male the inferior fibres become M. cremaster and extend to the spermatic cord.	Unilaterally acting, rotates the thorax to the same side and bends the Columna vertebralis laterally. Acting bilaterally, bends the thorax towards the pelvis, compresses the abdomen, abdominal breathing (expiration). M. cremaster draws the testis and its tunics up towards the superficial inguinal ring.
<b>3. M. transversus abdominis</b> <i>Caudal Nn. intercostales (Nn. thoracici); N. iliohypogastricus; N. ilioinguinalis (Plexus lumbalis); N. genitofemoralis</i>	Inner surface of the costal cartilages of ribs (5, 6) 7 to 12. Procc. costales of the lumbar vertebrae (by way of the thoracolumbar fascia), Labium internum of Crista iliaca, Lig. inguinale (lateral third)	Linea alba (above Linea arcuata this muscle contributes to the posterior layer of the rectus sheath; inferior to Linea arcuata all fibres contribute to the anterior layer). In the male the inferior fibres become M. cremaster and extend to the spermatic cord.	Compresses the abdomen, abdominal breathing (expiration)

**Posterior muscles of the abdominal wall (Fig. 829)**

The foundation of the muscles of the posterior abdominal wall is formed superiorly by Pars lumbalis of the diaphragm, inferiorly by M. quadratus lumborum, and with participation of the M. psoas major medially.

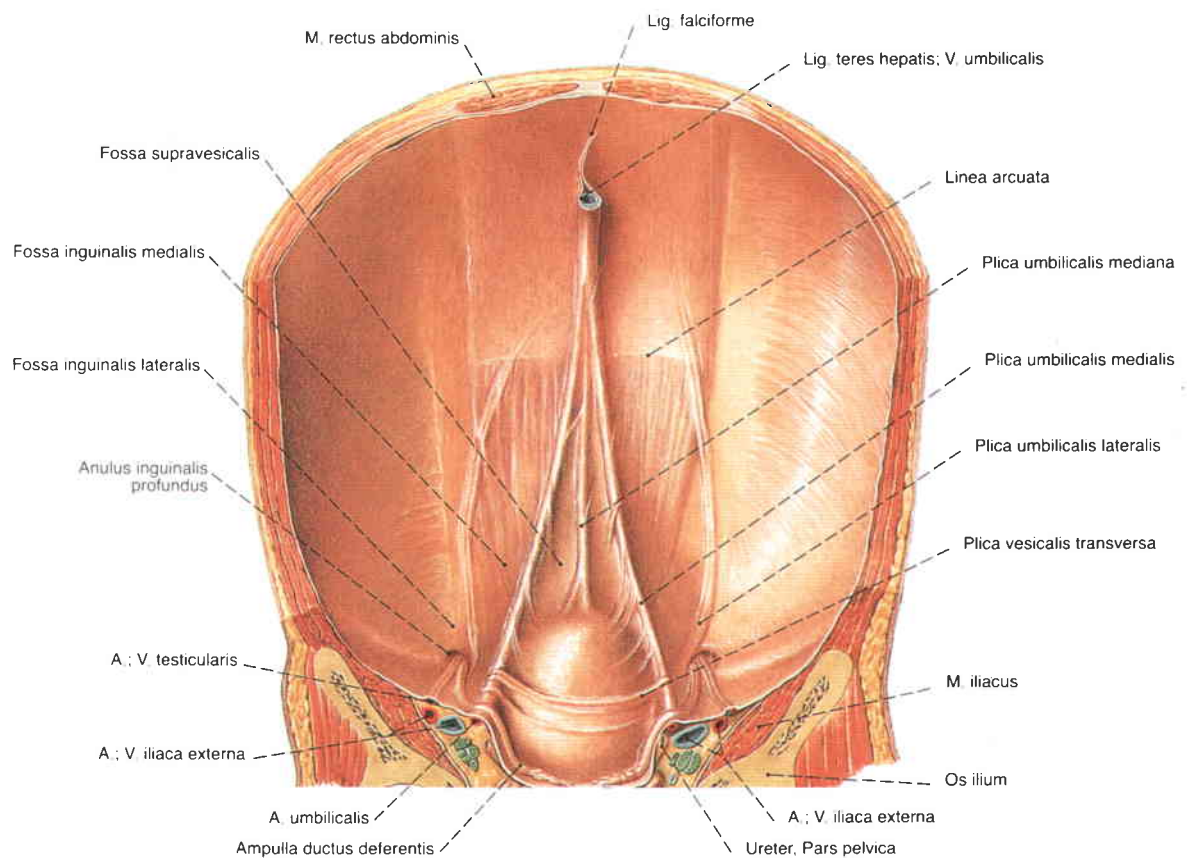
Muscle Innervation	Origin	Insertion	Function
<b>M. quadratus lumborum</b> <i>Rr. musculares (Plexus lumbalis); N. intercostalis (N. thoracicus [T12])</i>	Labium internum of Crista iliaca (posterior third), Lig. iliolumbale	12th rib (medial part), Procc. costales of the lumbar vertebrae 4 to one.	Depresses the ribs (expiration), laterally flexes the lumbar vertebral column





**Fig. 827** Superficial inguinal ring, Anulus inguinalis superficialis; the right spermatic cord, Funiculus spermaticus, is retracted by a hook.

The aponeurosis of the right M. obliquus externus abdominis is opened; ventral view. Compare to Fig. 835.



**Fig. 828** Anterior abdominal wall in a newborn; dorsal view.

The V. umbilicalis obliterates after birth. In portal hypertension this vein can once again enlarge. Compare to Fig. 1029, portocaval anastomosis.



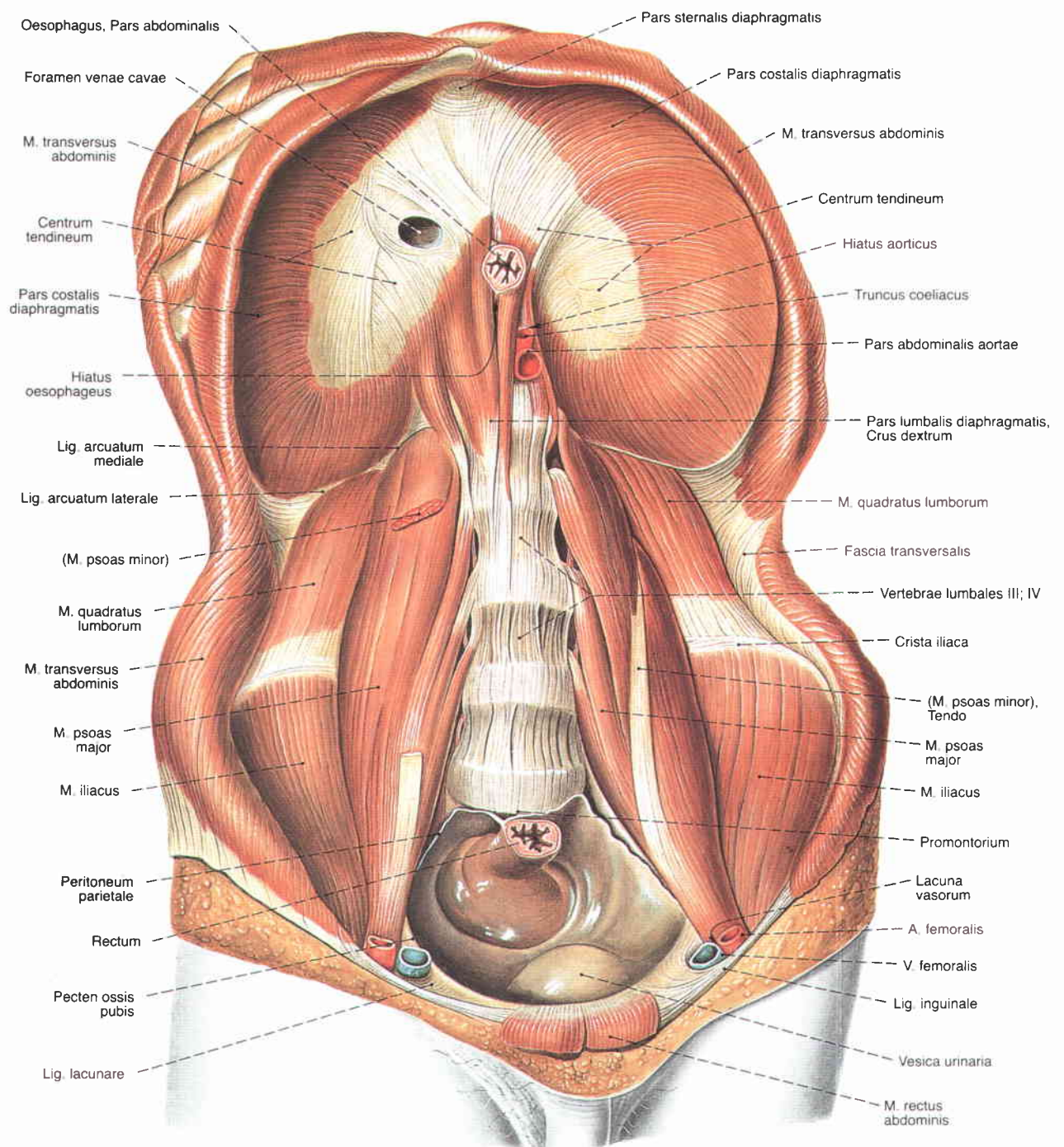
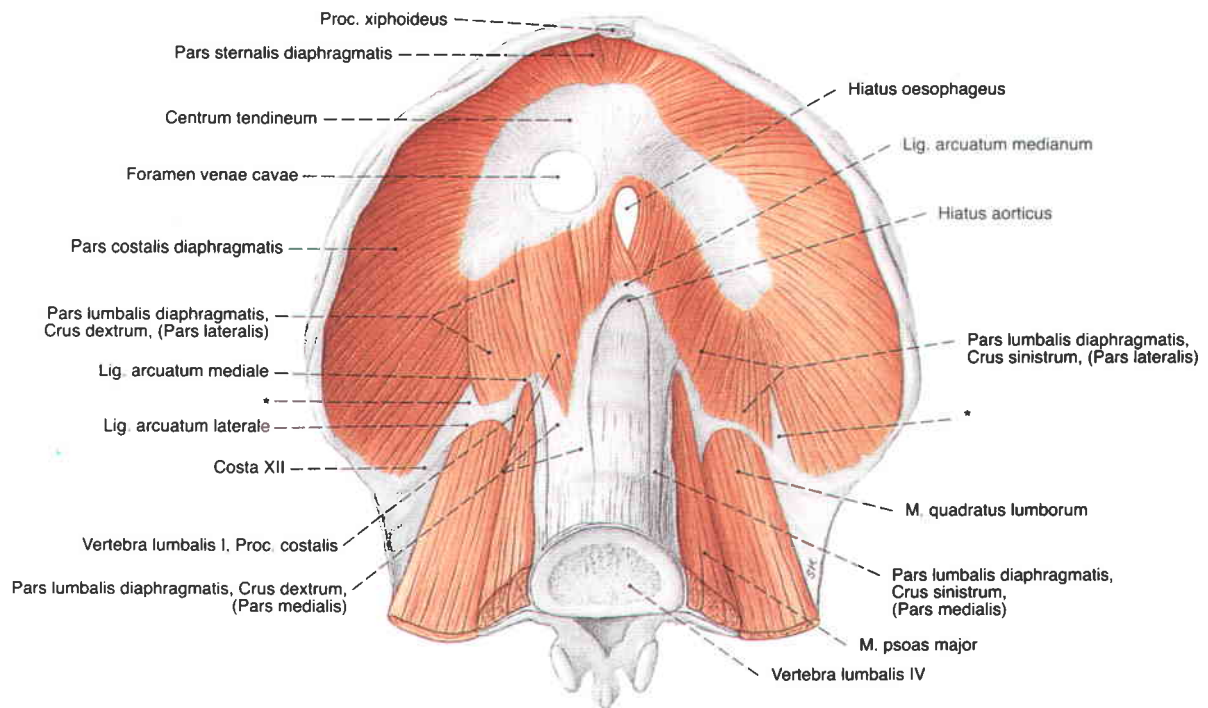


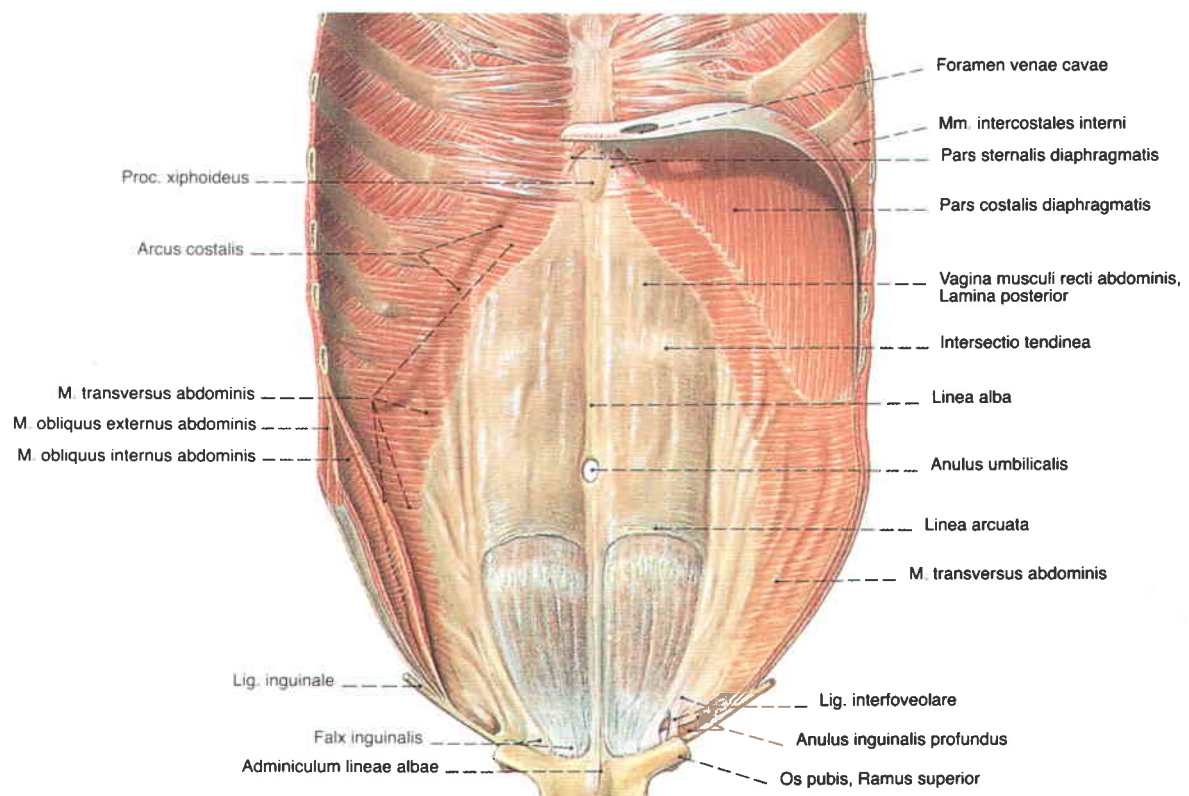
Fig. 829 Diaphragm, Diaphragma; abdominal muscles, Mm. abdominis; ventral view.



**Fig. 830** Diaphragm, Diaphragma, and posterior abdominal wall; inferior view.

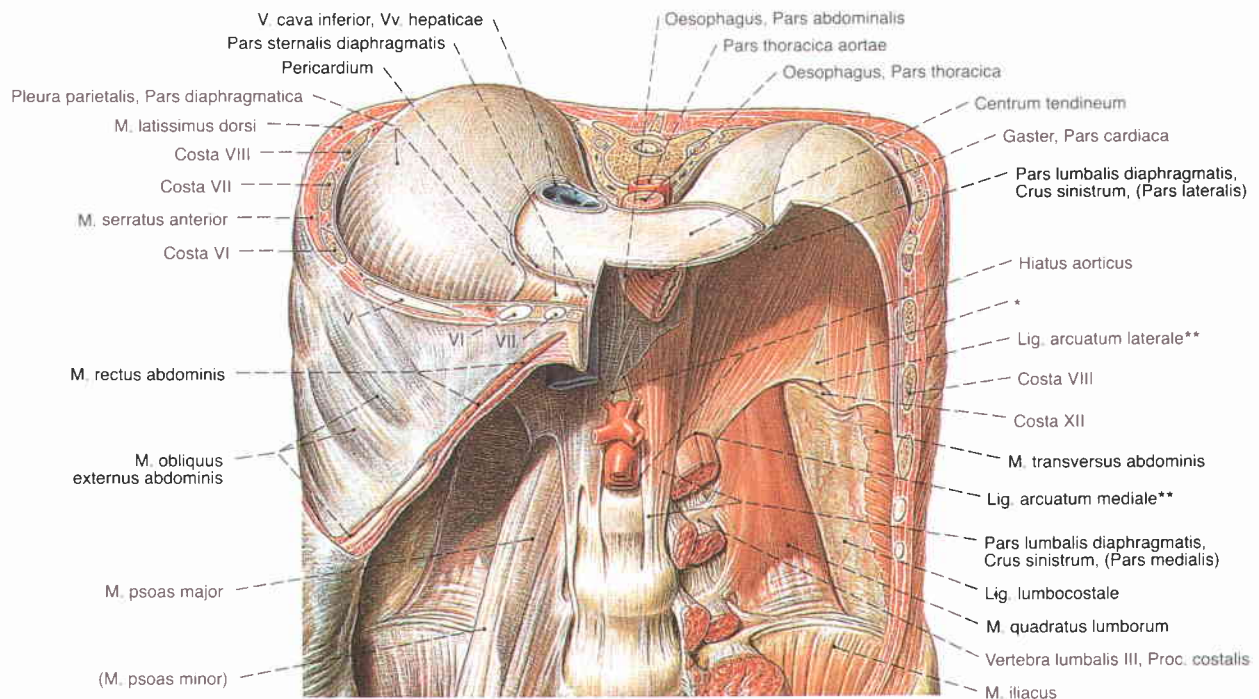
The Crus dextrum, Pars medialis often consists of three parts and reaches further caudally than the Crus sinistrum.

\* Clinical: BOCHDALEK's triangle



**Fig. 831** Anterior abdominal wall and parts of the diaphragm, Diaphragma; dorsal view.





**Fig. 832** Diaphragm, Diaphragma, with its apertures and the muscles of the posterior abdominal wall; the trunk has been sectioned at the level of the 10th thoracic vertebra; ventral view.

\* Clinical: BOCHDALEK's triangle, Trigonum lumbocostale diaphragmatis, a region free of muscles  
 \*\* also psoas arch, Arcus musculi psoatis, and quadratus arch (also called HALLER's arch), Arcus musculi quadrati;  
 V, VI, VII - ribs 5, 6, 7

## Diaphragm, Diaphragma (Fig. 832)

The diaphragm separates the thoracic from the abdominal cavities. Its domes form the floor of the right and left pleural cavities. The Pars lumbalis borders the retroperitoneum dorsally and, in a strict sense, represents a portion of the posterior abdominal wall.

Muscle Innervation	Origin	Insertion	Function
<b>Diaphragma</b> <i>N. phrenicus (Plexus cervicalis)</i>	<b>Pars sternalis:</b> Proc. xiphoideus (inner surface), rectus sheath (aponeurosis of M. transversus abdominis) <b>Pars costalis:</b> costal cartilages of ribs 12 to 6 (inner surface, connected to the origin of M. transversus abdominis) <b>Pars lumbalis, Crus dextrum,</b> - Pars medialis: bodies of lumbar vertebrae 1 to 3, Disci intervertebrales - Pars lateralis: Lig. arcuata mediale (arch of the psoas muscle) and laterale (arch of the quadratus lumborum muscle) <b>Pars lumbalis, Crus sinistrum,</b> - Pars medialis: bodies of lumbar vertebrae 1 to 4, Disci intervertebrales - Pars lateralis: Lig. arcuata mediale (arch of the psoas muscle) and laterale (arch of the quadratus lumborum muscle)	All parts unite at the central tendon, Centrum tendineum Weak points and diaphragmatic openings: Trigonum sternocostale, Trigonum lumbocostale, Foramen venae cavae, Hiatus oesophageus, Hiatus aorticus	Respiratory muscle, diaphragmatic breathing (inspiration), increases abdominal pressure



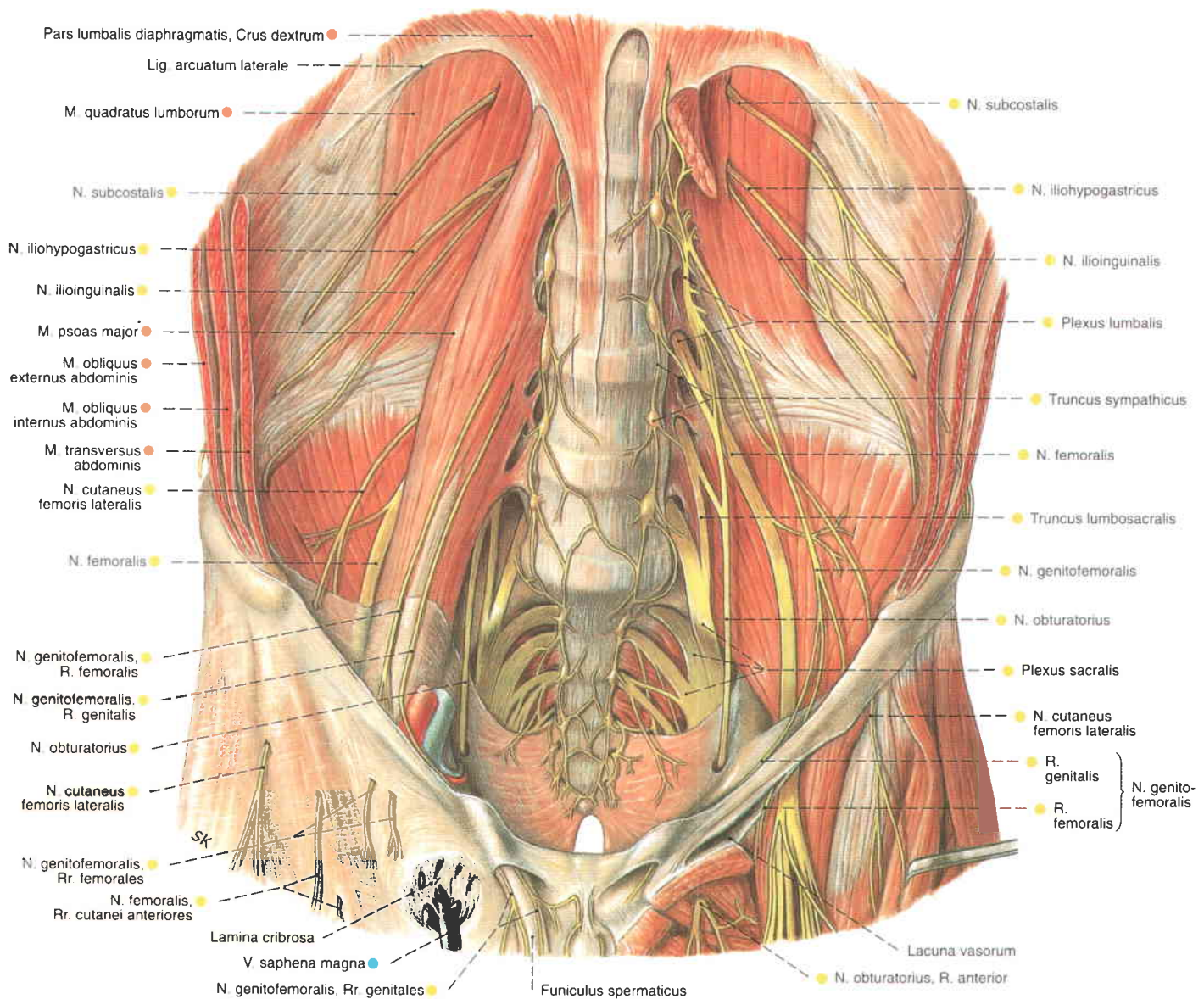
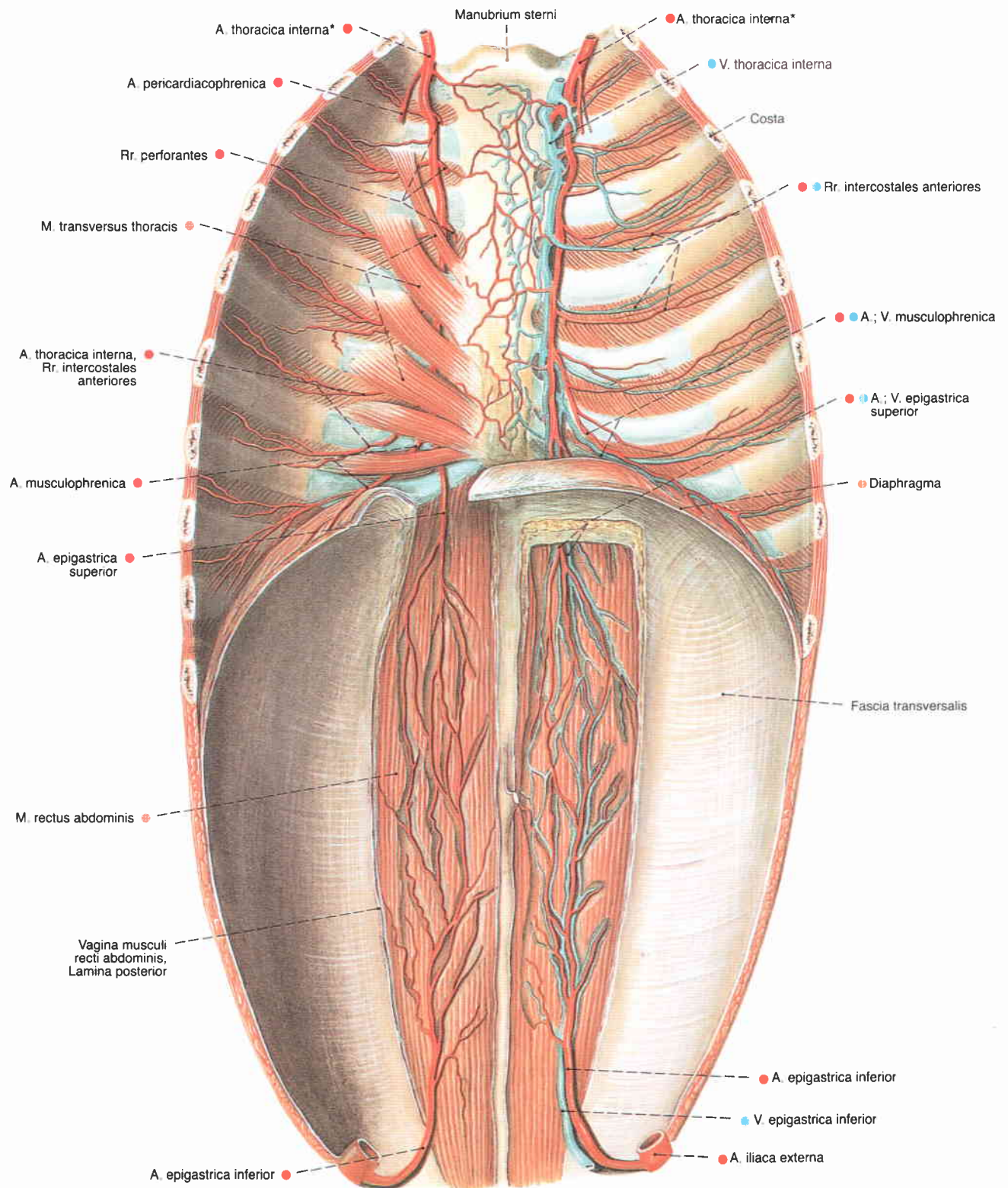


Fig. 833 The lumbosacral plexus, Plexus lumbosacralis; the psoas major, the pectineus and the adductor longus muscles have been removed on the left; ventral view.

### Diaphragmatic openings

Name	Position	Structures
Hiatus aorticus	Pars lumbalis, between Crus dextrum and Crus sinistrum	Aorta; Ductus thoracicus
Hiatus oesophageus	Pars lumbalis, Crus dextrum	Oesophagus; Nn. vagi; N. phrenicus, R. phrenicoabdominalis sinister
Foramen venae cavae	Centrum tendineum	V. cava inferior; N. phrenicus, R. phrenicoabdominalis dexter
LARREY'S fissure	between Pars sternalis and Pars costalis	A. and V. epigastrica superior
Unnamed	Pars lumbalis, between Crus dextrum/sinistrum, Pars medialis	N. splanchnicus major and minor; V. azygos; V. hemiazygos
Unnamed	Pars lumbalis, between Pars medialis and Pars lateralis	Truncus sympathicus



**Fig. 834** Blood vessels of the anterior thoracic and abdominal walls; the right transverse thoracic muscle has been removed; dorsal view.

\* Clinical: internal mammary artery



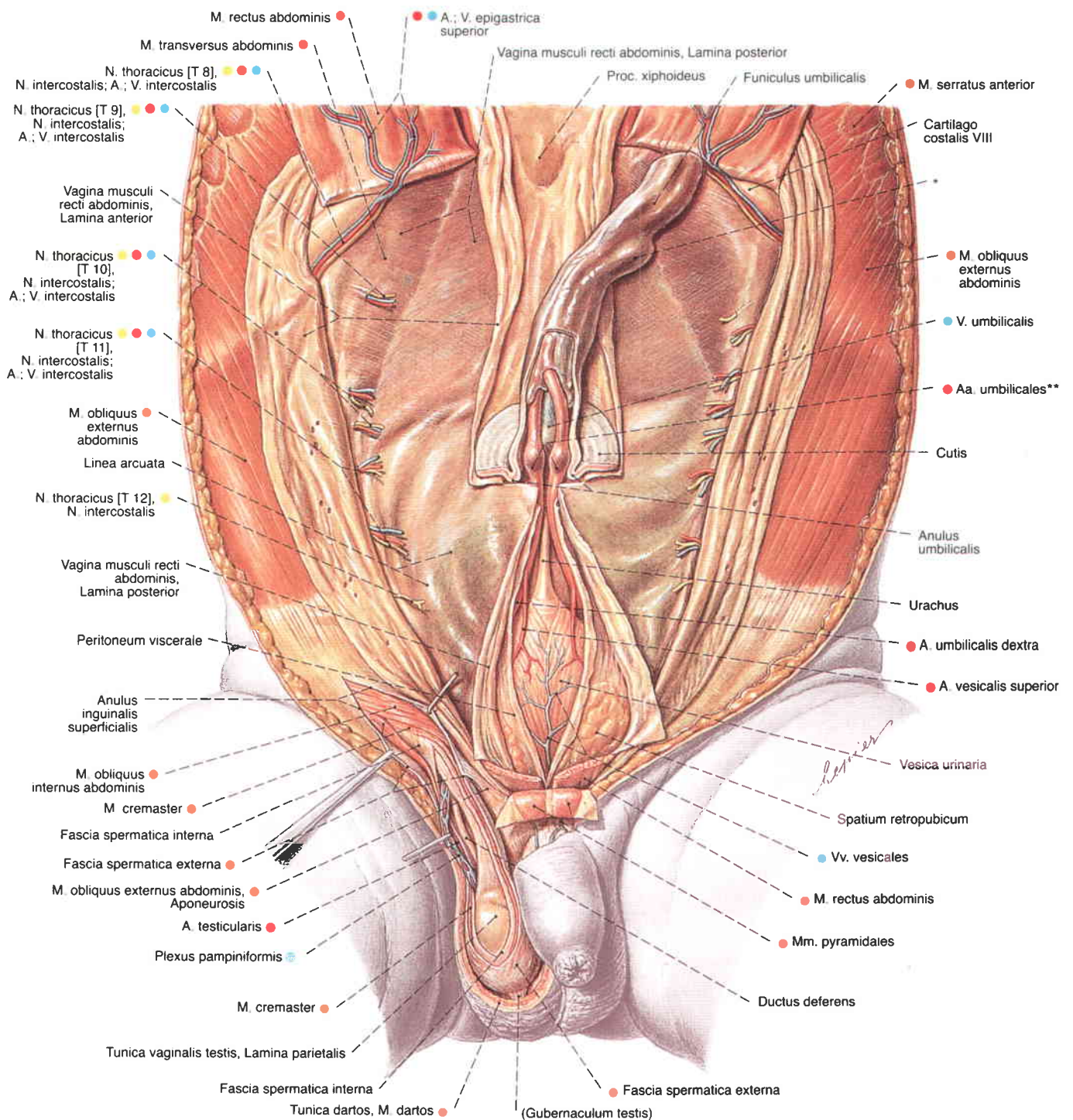
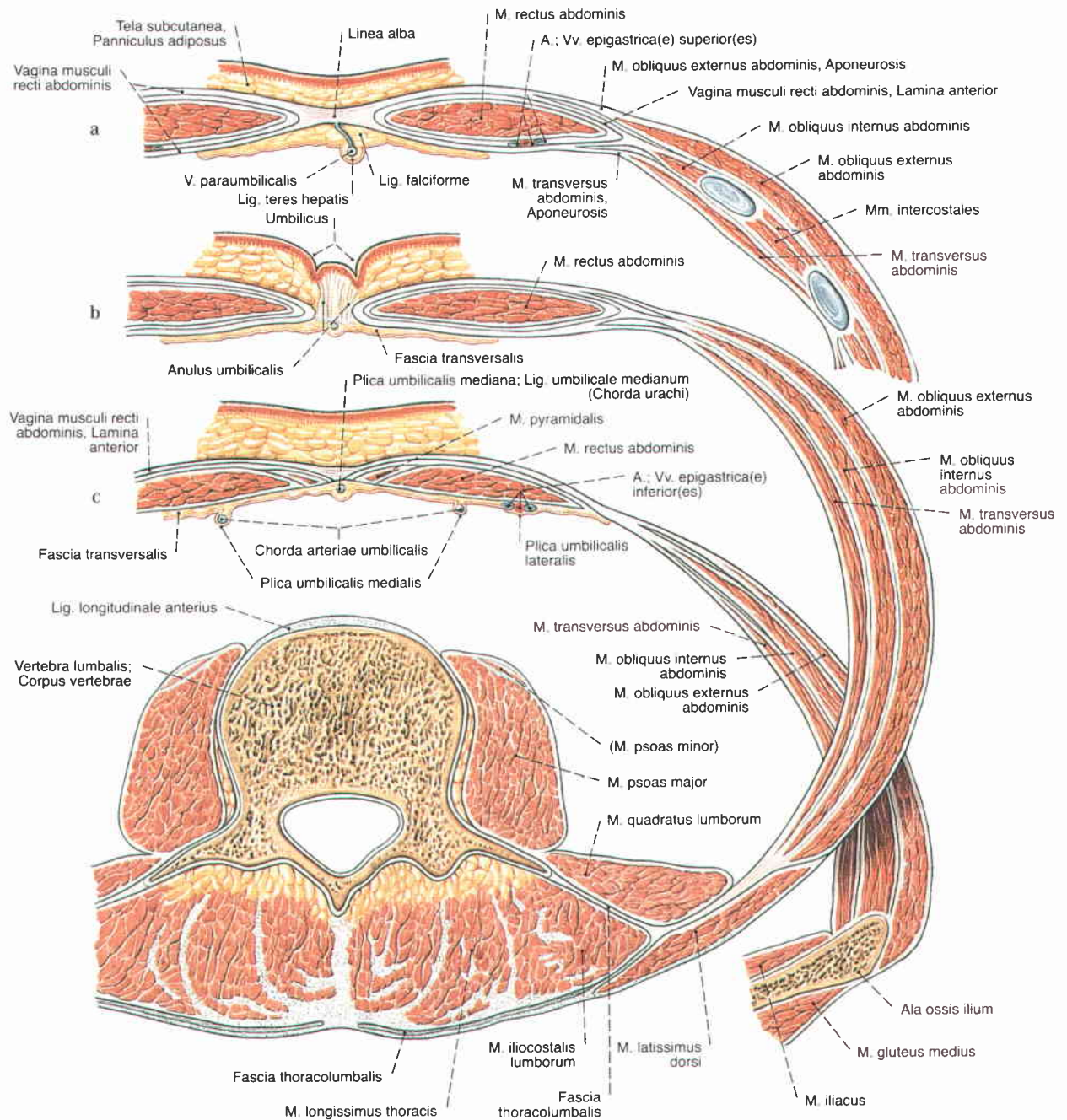


Fig. 835 The anterior abdominal wall of a newborn. The rectus abdominis muscle has been retracted superiorly and the abdominal cavity has been opened in the median plane to show the urinary bladder and the urachus. The right inguinal canal has been dissected; ventral view.

\* bulge caused by looping of the umbilical blood vessels (also called false umbilical cord knot)

\*\* blood clot, thrombus in the umbilical arteries





Figs. 836 a–c Abdominal muscles, Mm. abdominis; horizontal sections.

- a above the umbilicus
- b at the level of the umbilicus
- c below the umbilicus and the arcuate line

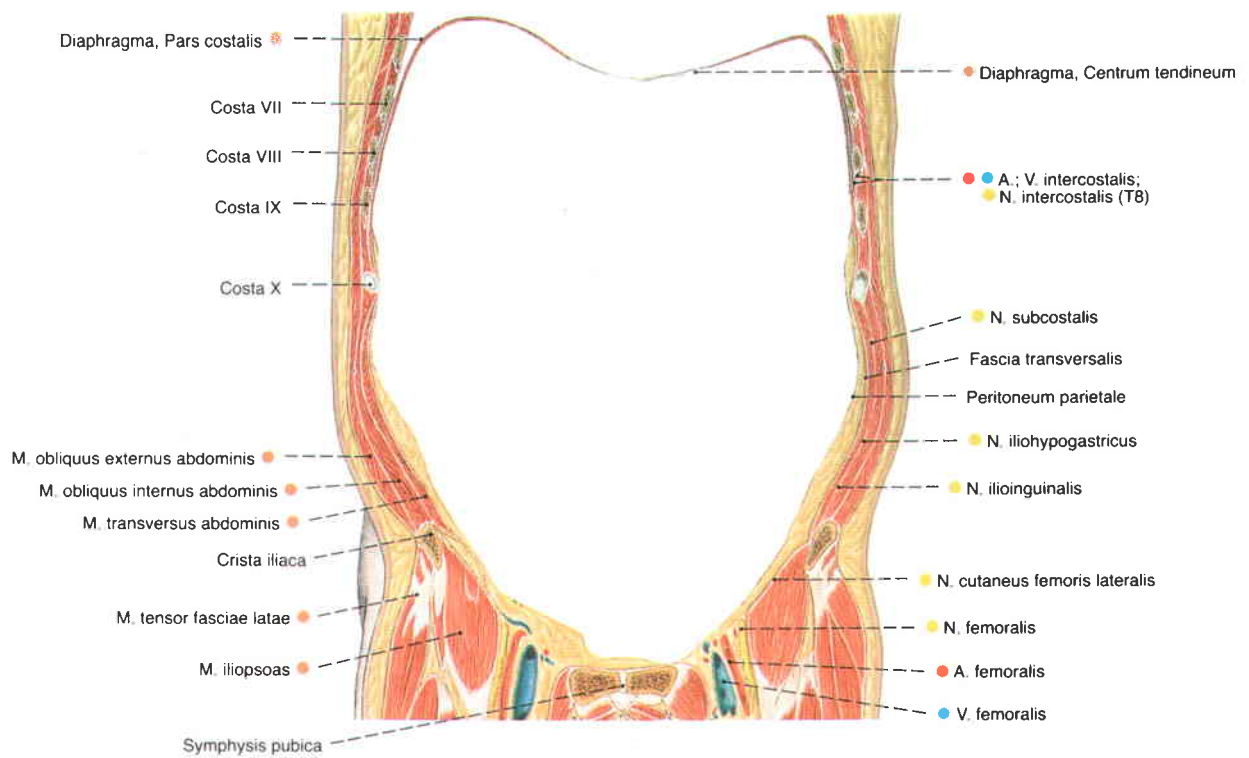
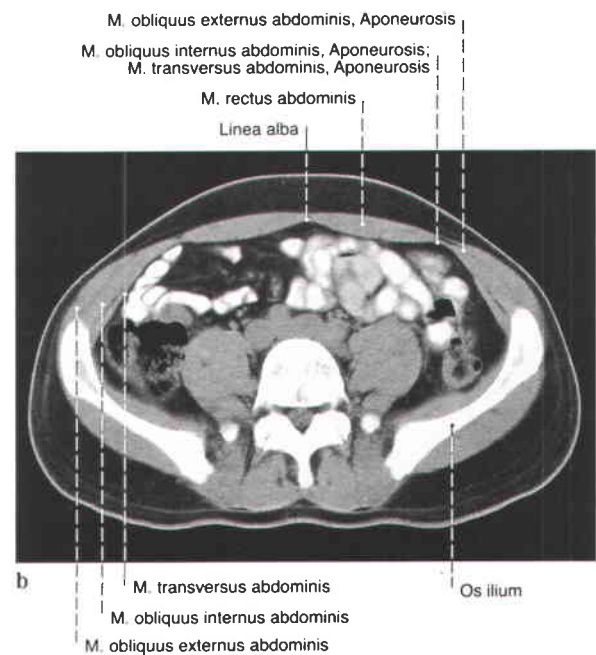
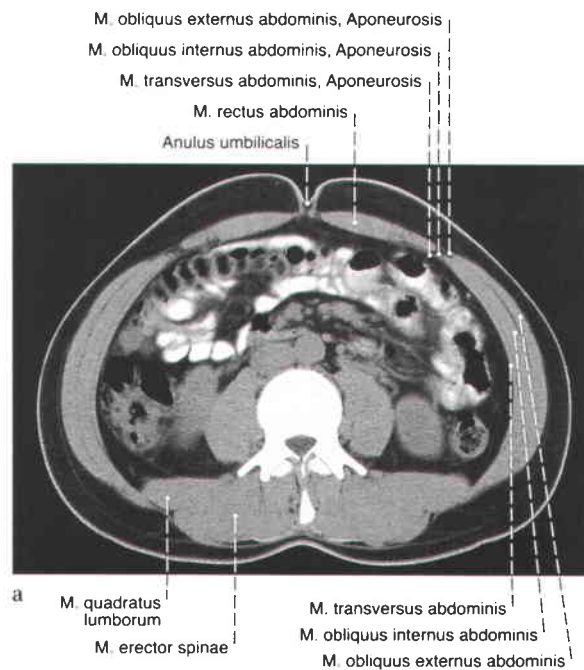


Fig. 837 Abdominal muscles, Mm. abdominis;  
frontal section;  
ventral view.  
Compare to Fig. 1134



Figs. 838 a, b Abdominal muscles, Mm. abdominis;  
computed tomography (CT).

- a at the level of the umbilicus  
b at the level of the fifth lumbar vertebra

The participation of the aponeurosis in forming the rectus sheath is clearly discernible (cf. to Figs. 837, 1148).



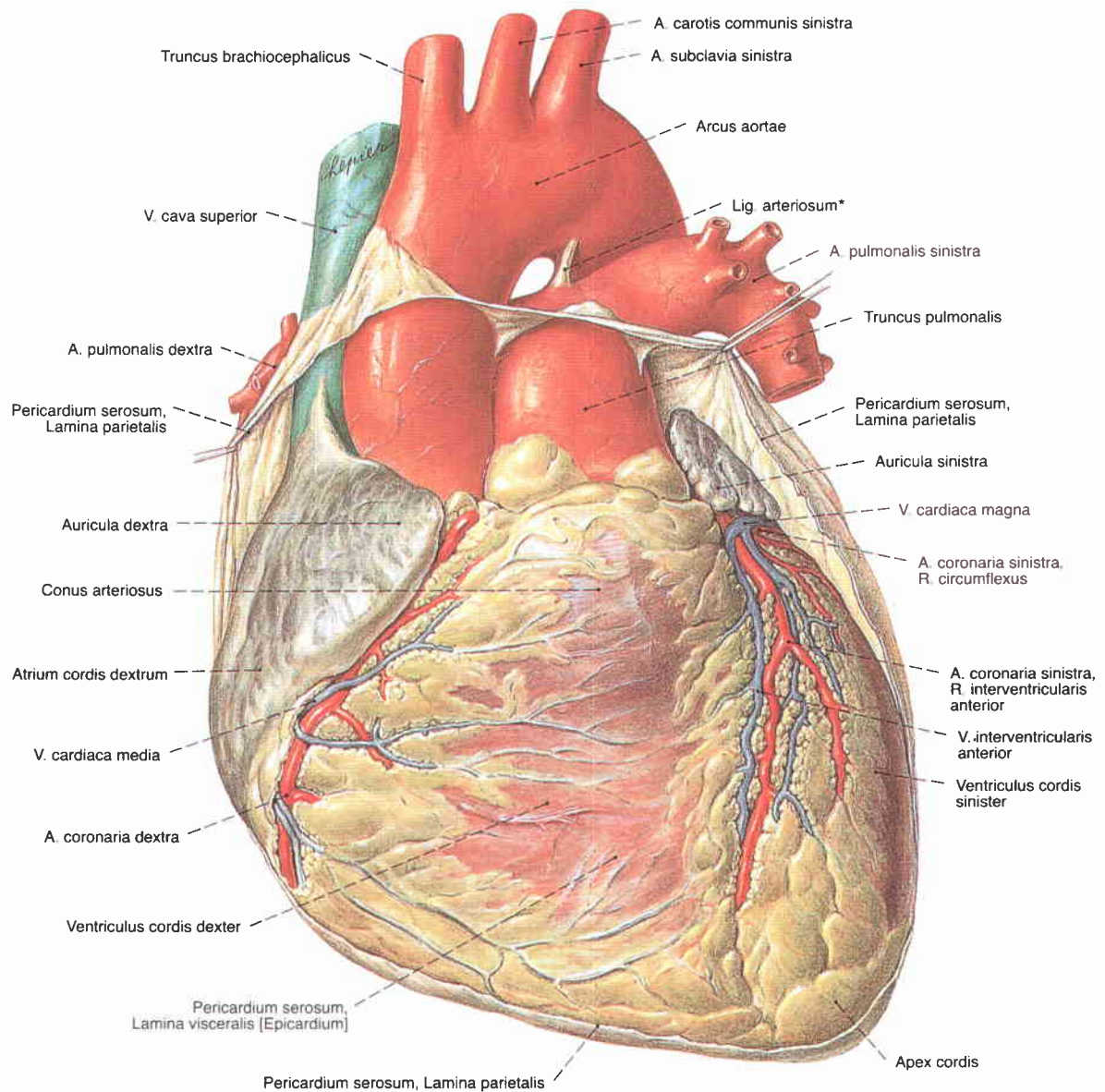
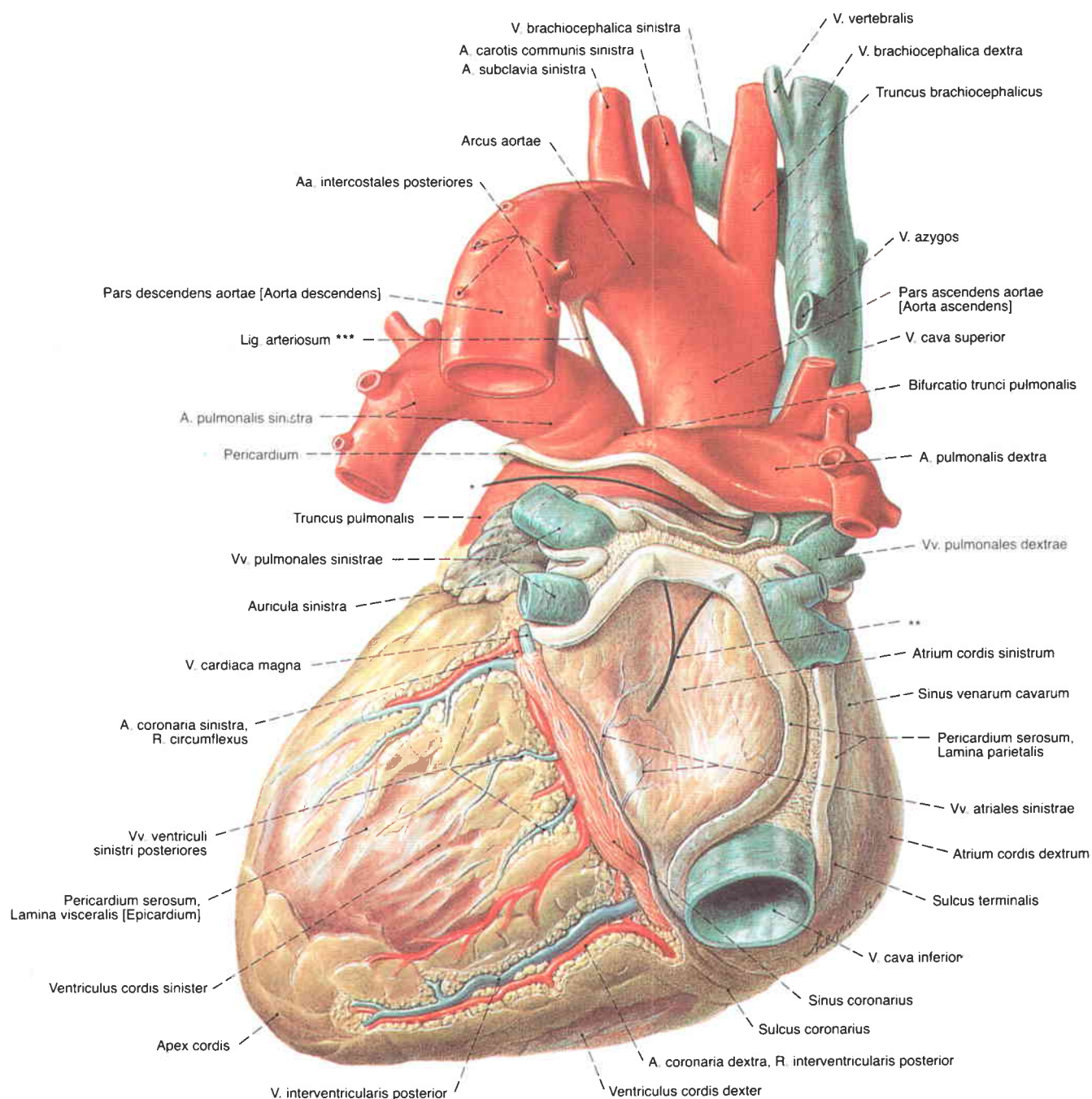


Fig. 839 The heart, Cor;  
the pericardium has been opened and most of its  
parietal layer has been removed; the major branches  
of the coronary arteries have been dissected;  
the epicardium on the Aorta ascendens and on the  
Truncus pulmonalis is not shown;  
ventral view.

\* BOTALLI's ligament, a remnant of the fetal ductus arteriosus.

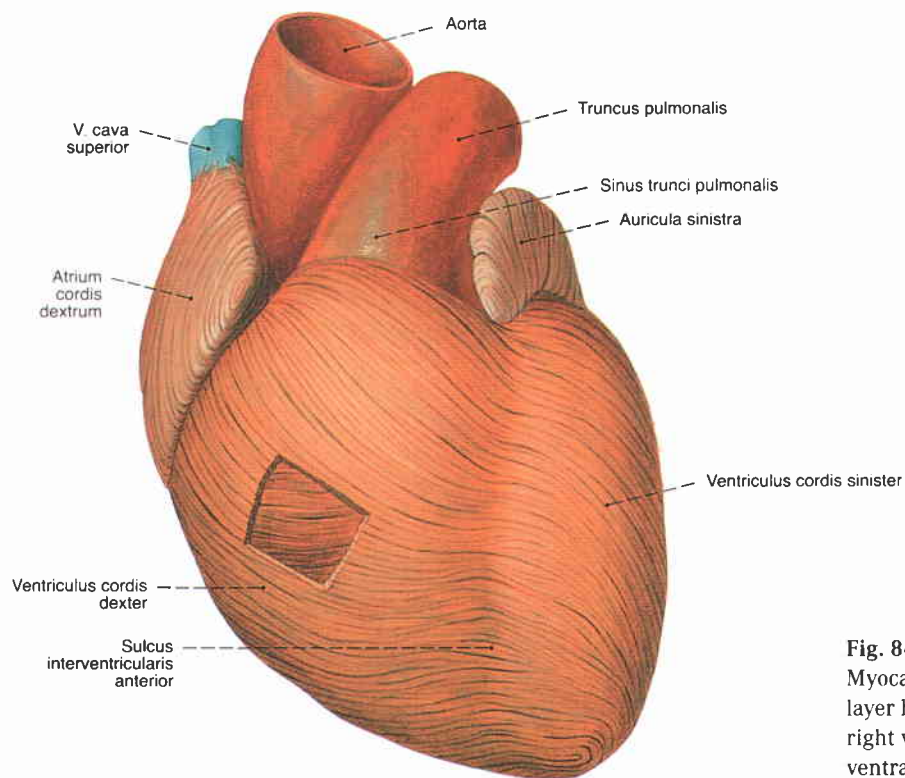
Pericardium fibrosum	}	pericardium
Pericardium serosum		
Lamina parietalis		
Lamina visceralis	=	epicardium



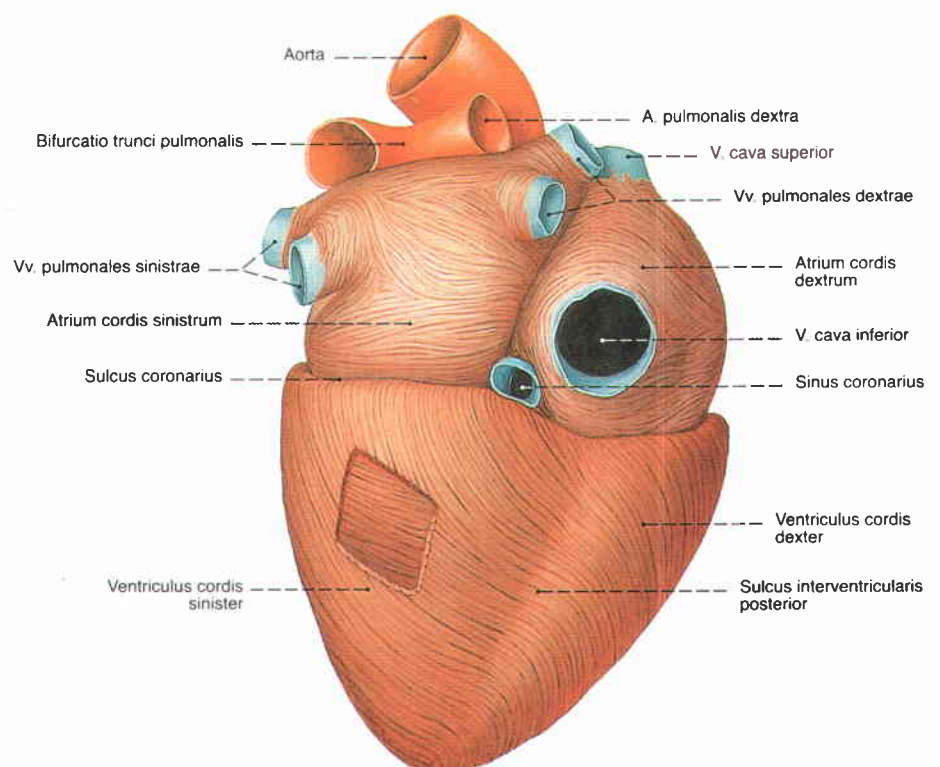


**Fig. 840** The heart, Cor, and adjacent vessels; the pericardium has been sectioned close to the reflected folds on the great vessels; the major coronary arteries have been dissected; dorsal view.

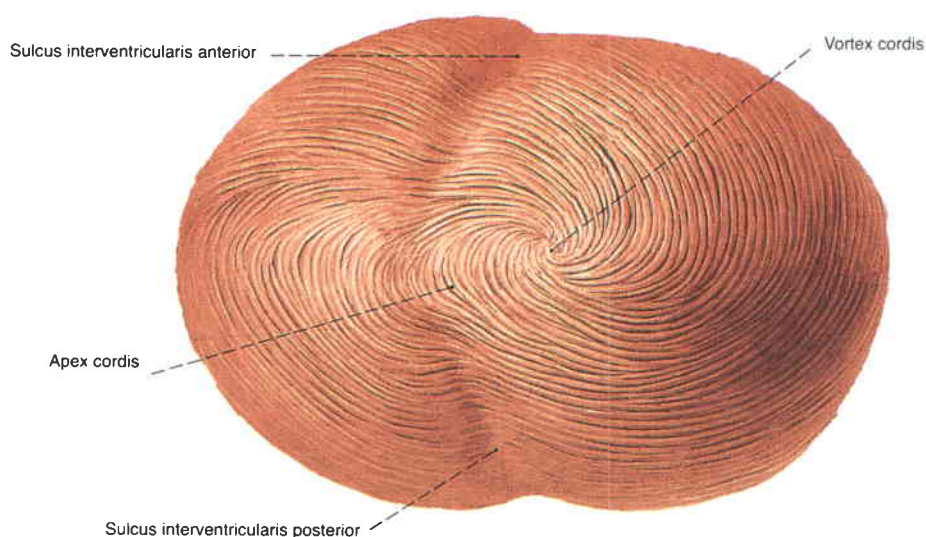
- \* arrow in the transverse pericardial sinus, Sinus transversus pericardii
- \*\* double arrows in the oblique pericardial sinus, Sinus obliquus pericardii
- \*\*\* BOTALLI's ligament, a remnant of the fetal ductus arteriosus



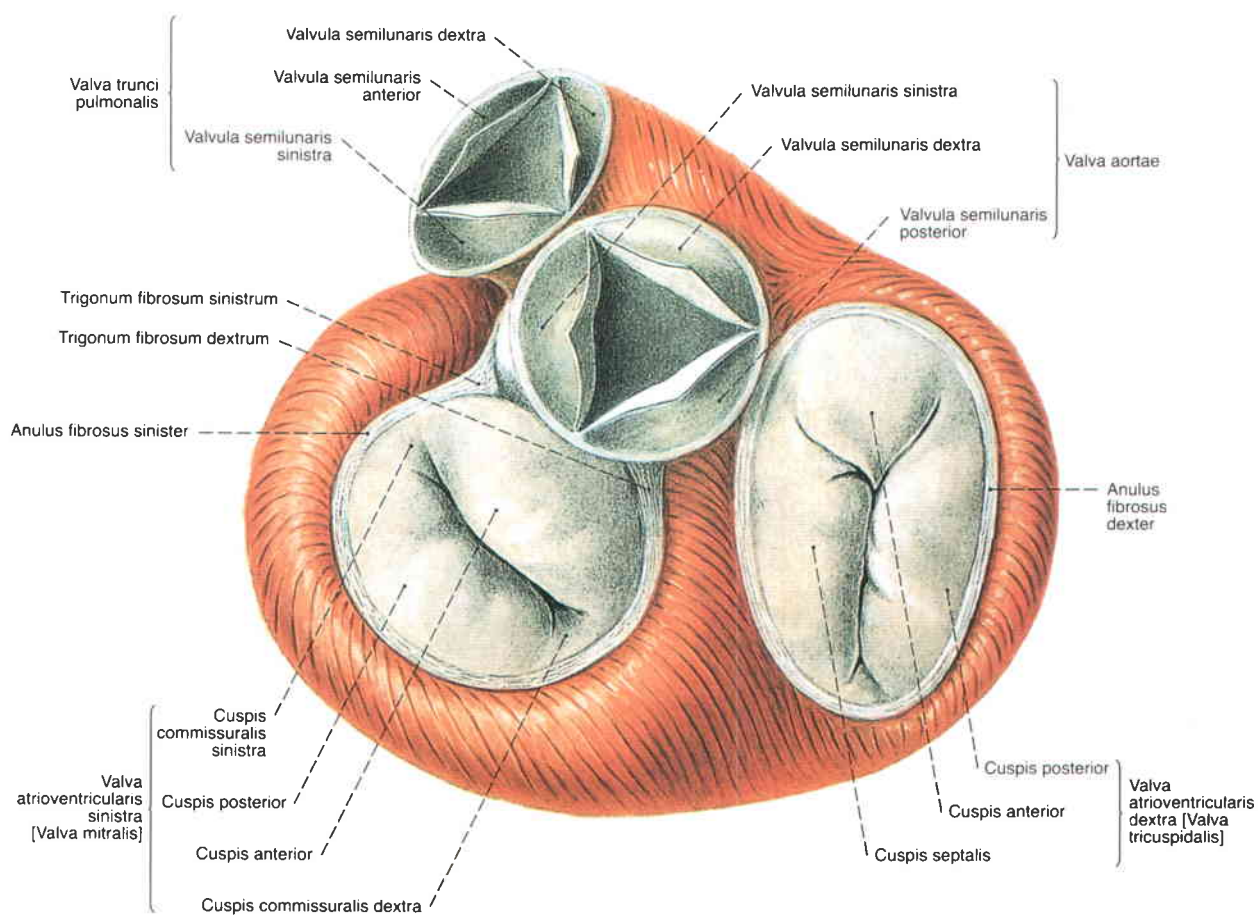
**Fig. 841** Musculature of the heart, Myocardium; a part of the superficial muscle layer has been removed from the wall of the right ventricle to expose the deep layer; ventral view.



**Fig. 842** Musculature of the heart, Myocardium; a part of the superficial muscle layer has been removed from the wall of the left ventricle to expose the deep layer; dorsoinferior view.

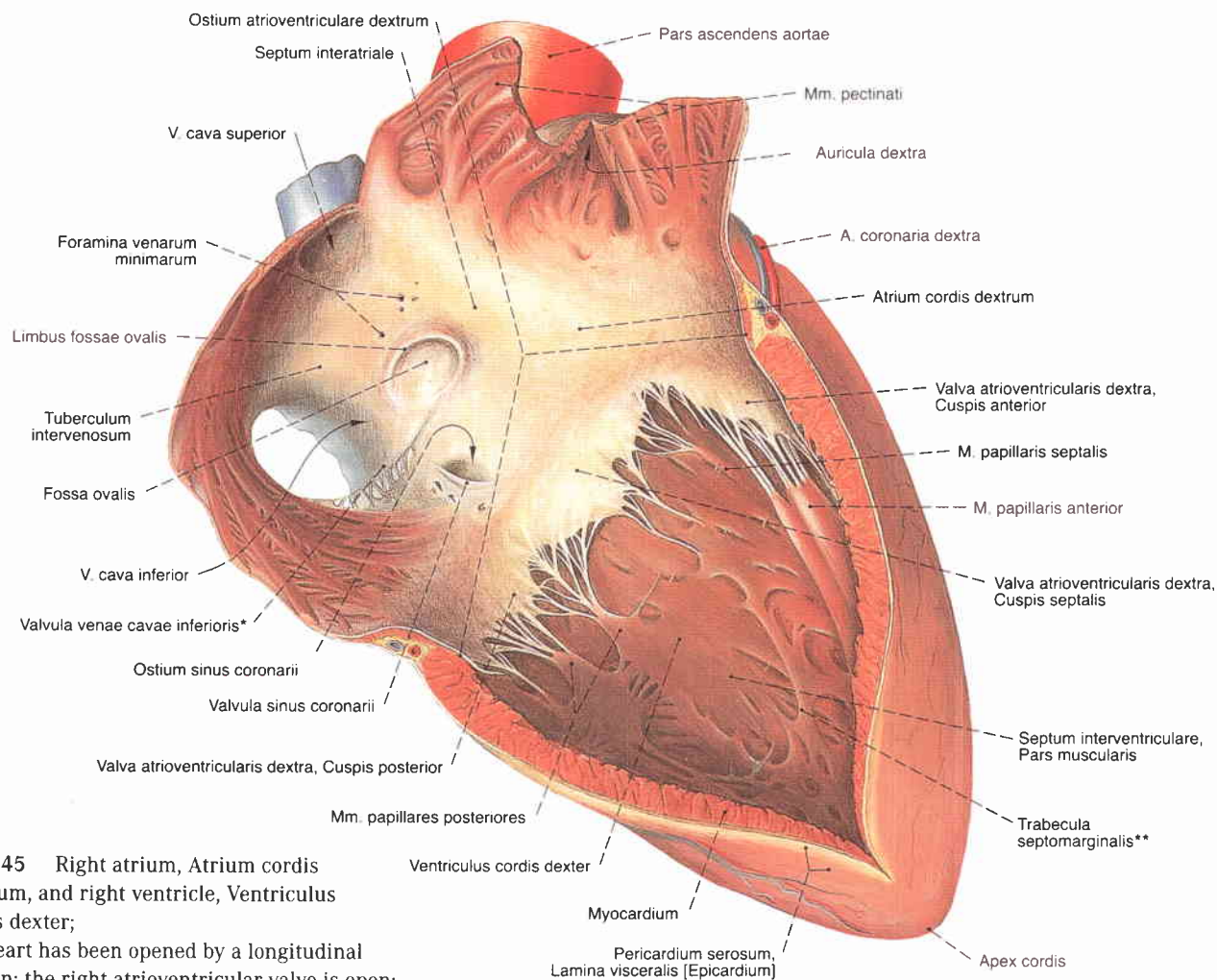


**Fig. 843** Musculature of the heart, Myocardium; viewed from the apex of the heart.



**Fig. 844** Musculature of the heart, Myocardium; valves, Valvae cordis; the dissection plane after removal of the atrial septum as well as the point of entry of the bundle of His are not shown. Systolic phase with atrial valves open and atrioventricular valves closed; superior view.

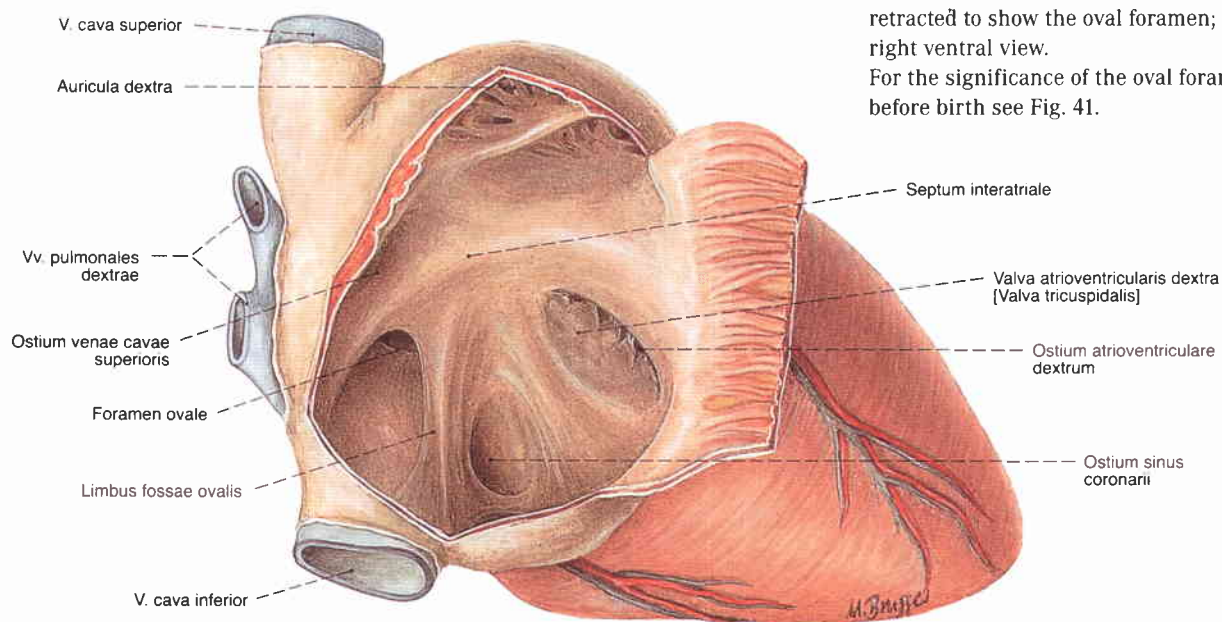




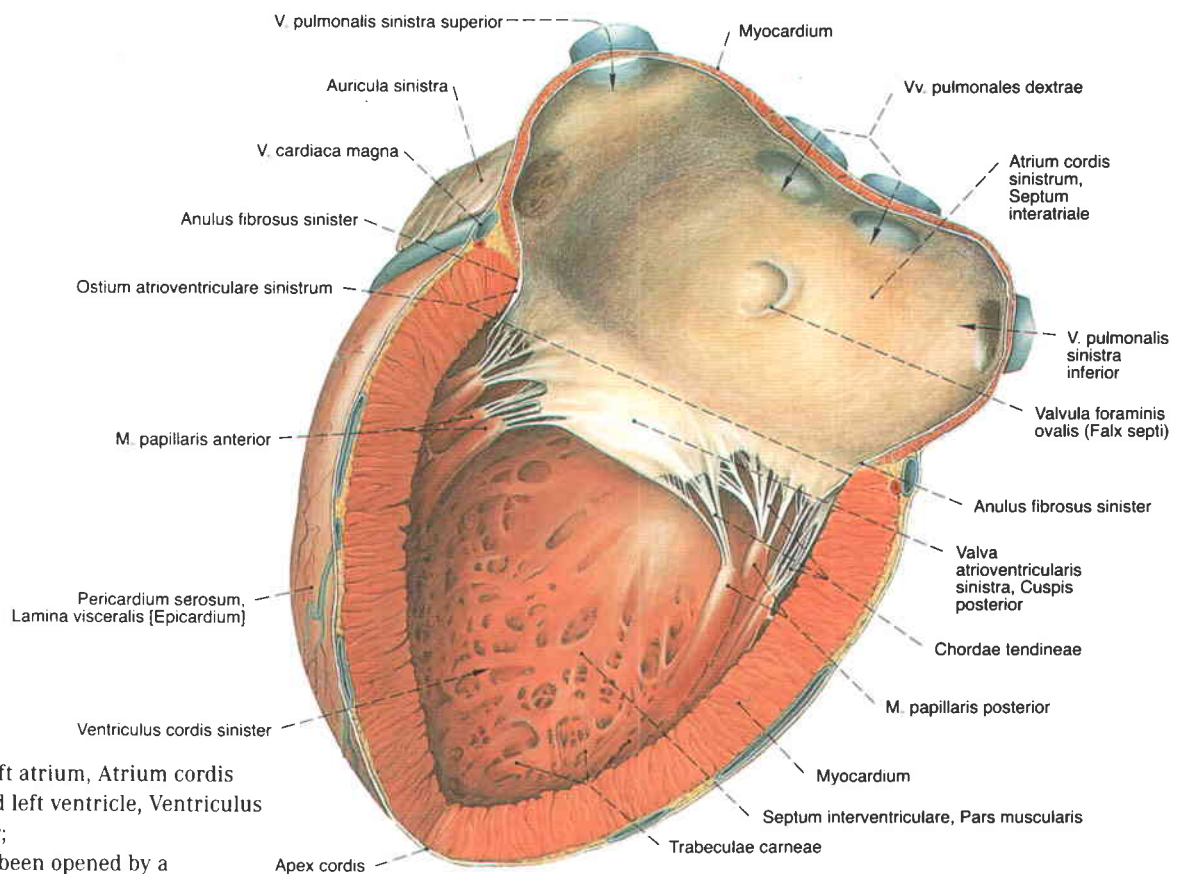
**Fig. 845** Right atrium, Atrium cordis dextrum, and right ventricle, Ventriculus cordis dexter; the heart has been opened by a longitudinal section; the right atrioventricular valve is open; ventral view.

\* also: EUSTACHIAN valve

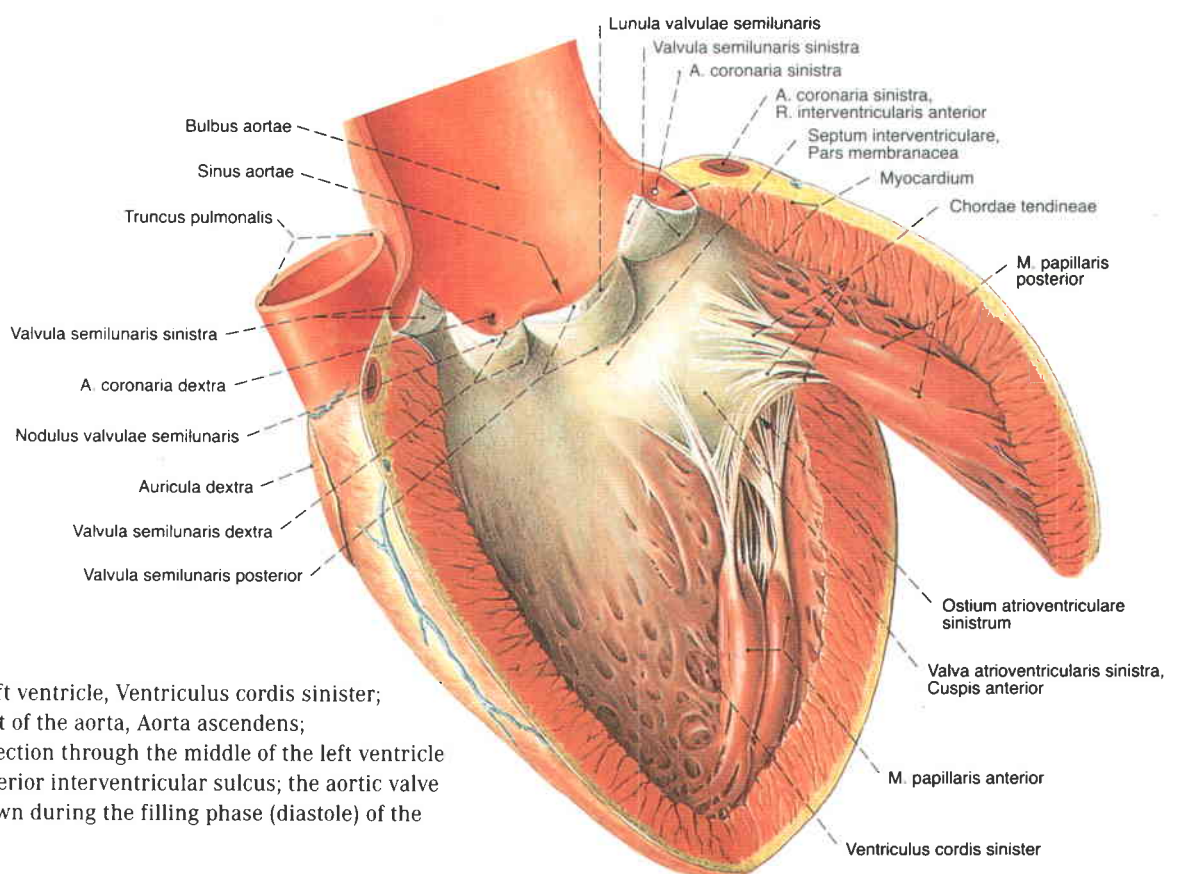
\* \* also; Moderator band



**Fig. 846** Right atrium, Atrium cordis dextrum, of a newborn; the anterior wall of the atrium has been retracted to show the oval foramen; right ventral view.  
For the significance of the oval foramen before birth see Fig. 41.

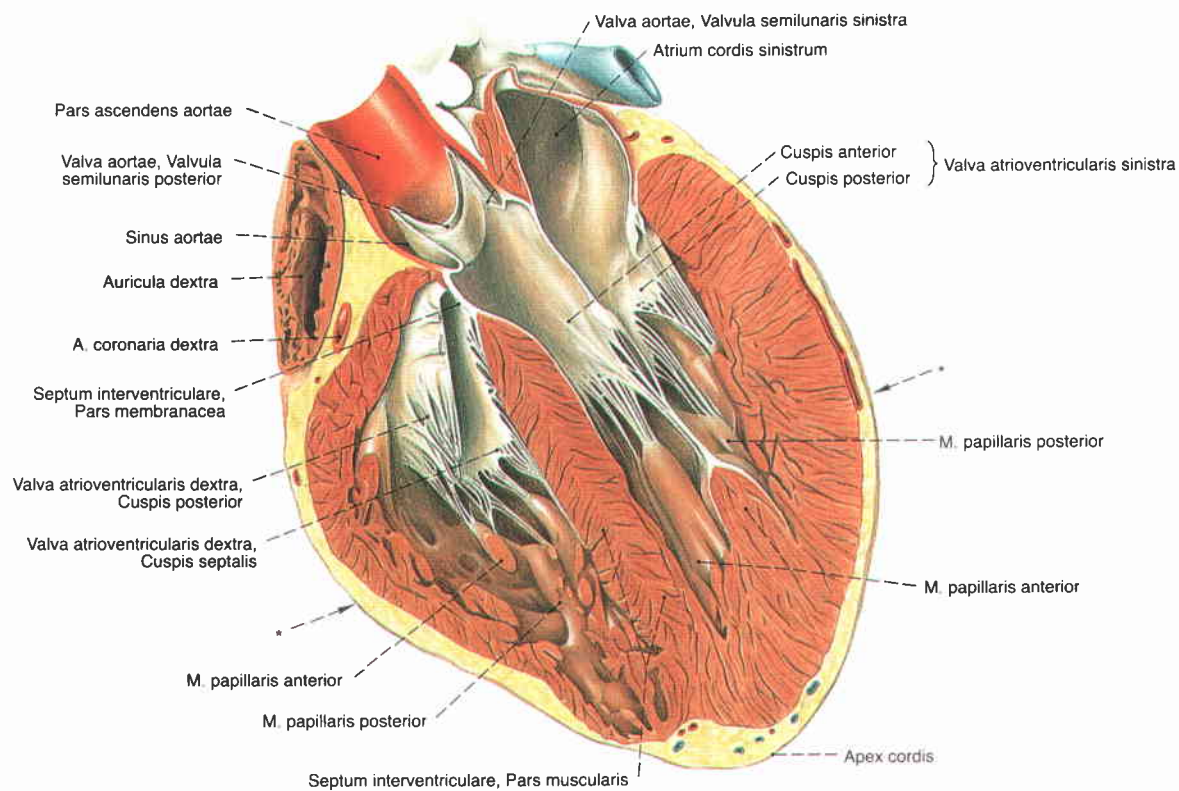


**Fig. 847** Left atrium, Atrium cordis sinistrum, and left ventricle, Ventriculus cordis sinister; the heart has been opened by a longitudinal section; lateral view.



**Fig. 848** Left ventricle, Ventriculus cordis sinister; ascending part of the aorta, Aorta ascendens; longitudinal section through the middle of the left ventricle and in the anterior interventricular sulcus; the aortic valve (arrow) is shown during the filling phase (diastole) of the heart; lateral view.

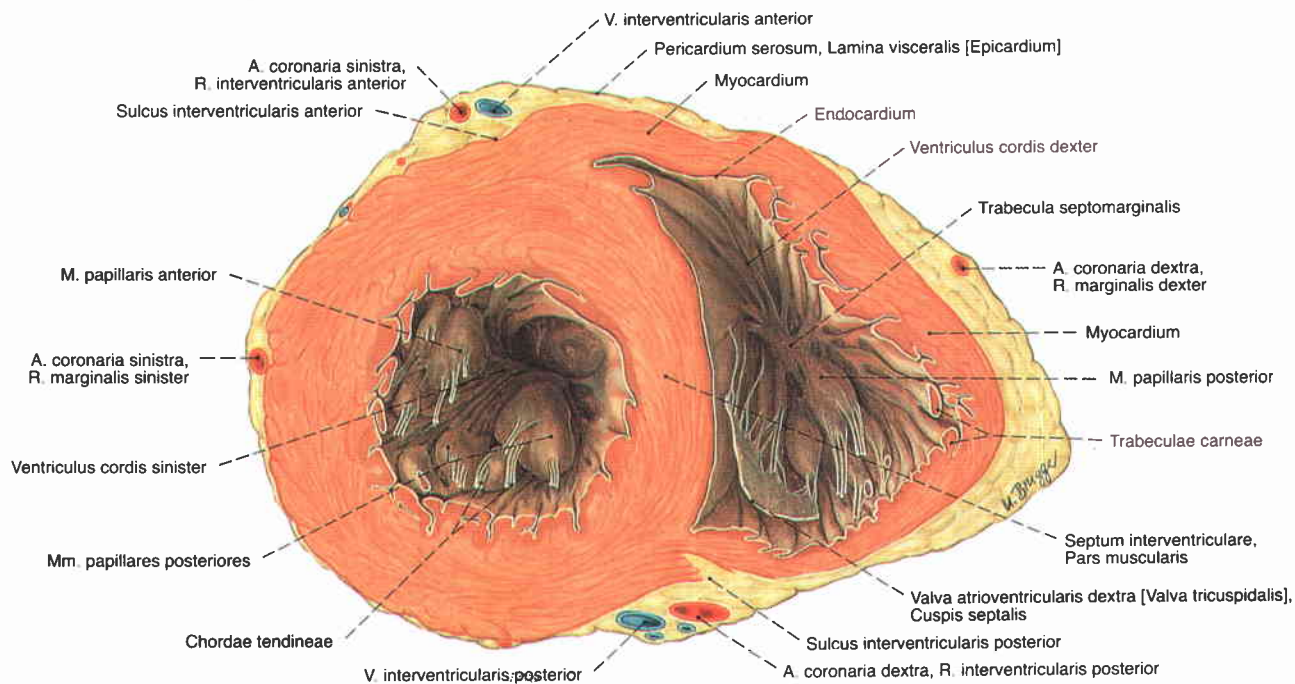




**Fig. 849** Left and right ventricle, *Ventriculus cordis sinister* and *dextra*; longitudinal section through the long axis of the heart; left ventrolateral view.

Note the difference in thickness of the myocardium of the right and left ventricle.

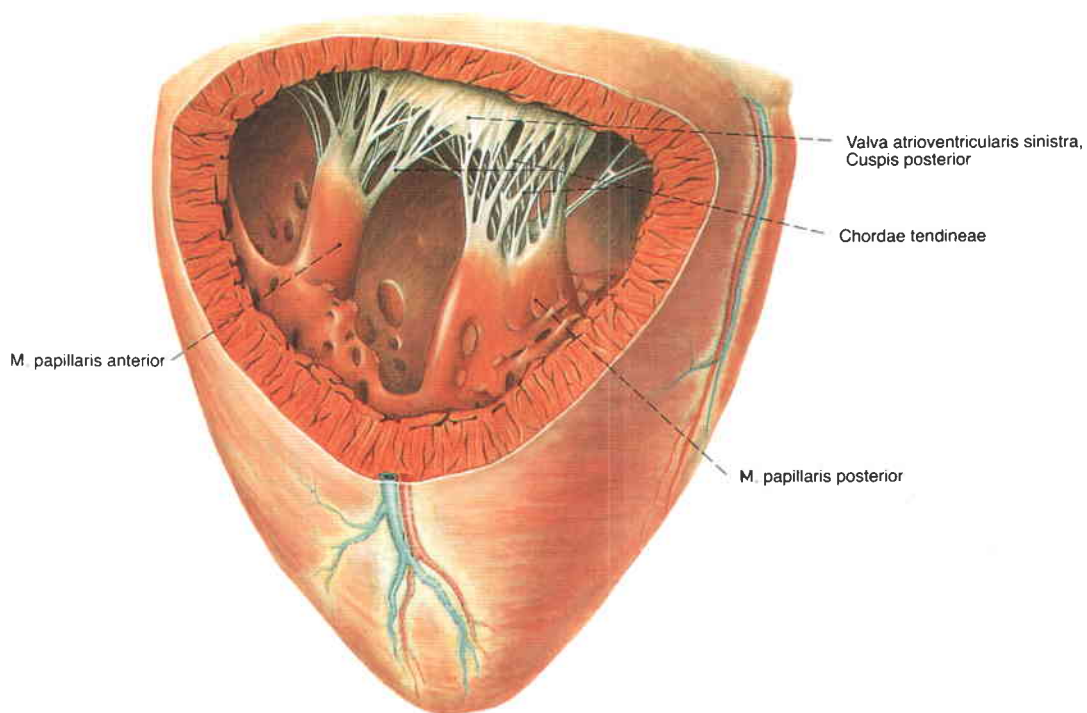
\* Plane of section of Fig. 850.



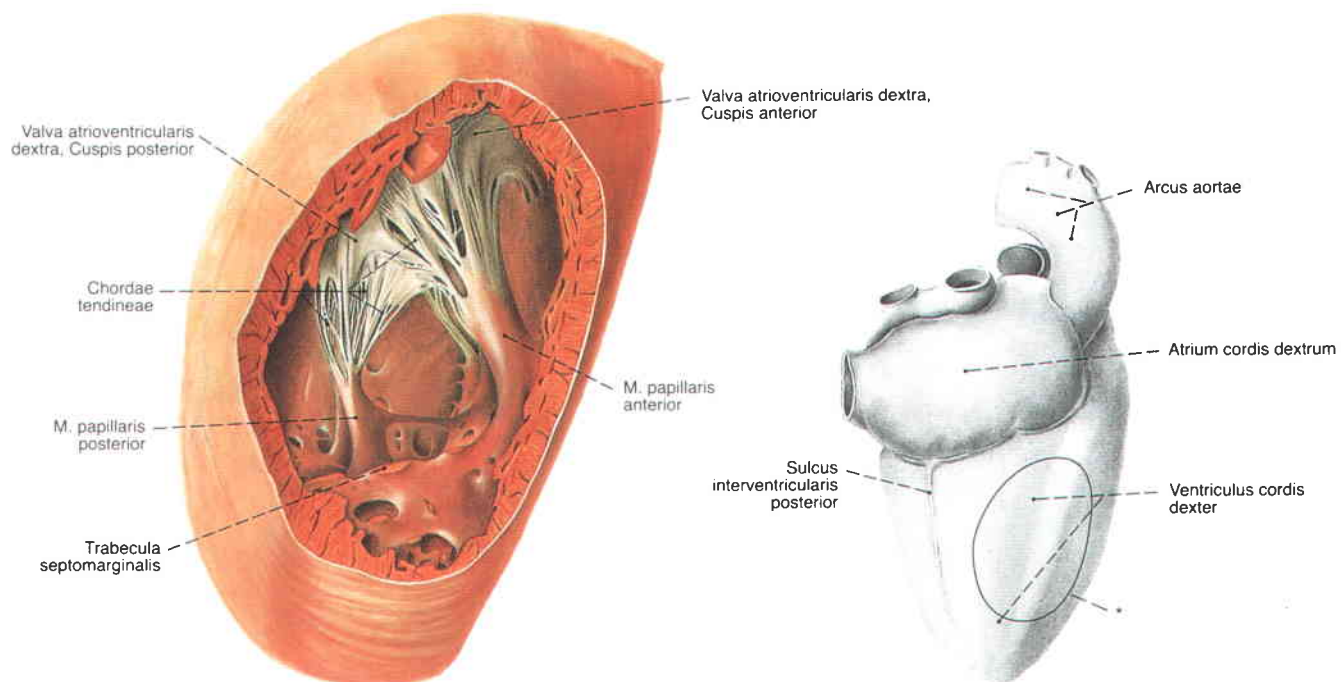
**Fig. 850** Left and right ventricle, *Ventriculus cordis sinister* and *dextra*; cross section perpendicular to the longitudinal axis of the heart; superior view.

Note the difference in thickness of the myocardium of the right and left ventricle.



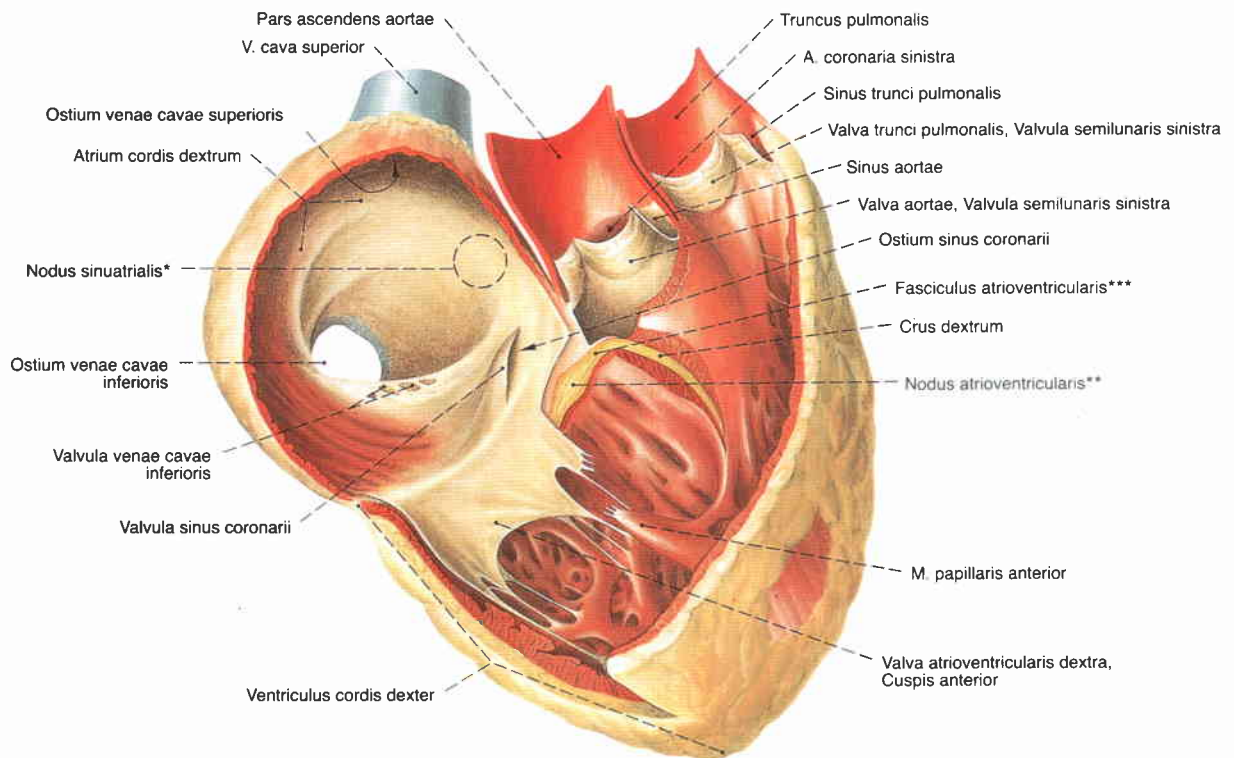


**Fig. 851** Left ventricle, *Ventriculus cordis sinister*. A segment has been removed to show the papillary muscles and the *Chordae tendineae*; left ventrosuperior view.



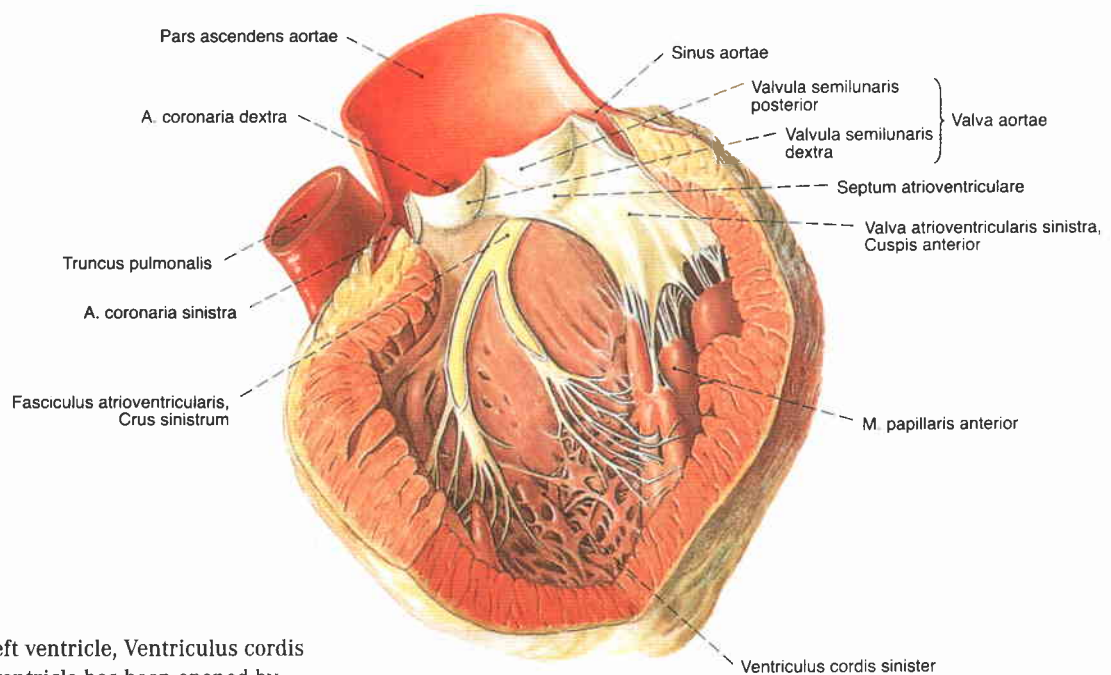
**Fig. 852** Right ventricle, *Ventriculus cordis dexter*. A segment has been removed to show the papillary muscles and the *Chordae tendineae*; dorsal view.

\* outline of removed segment

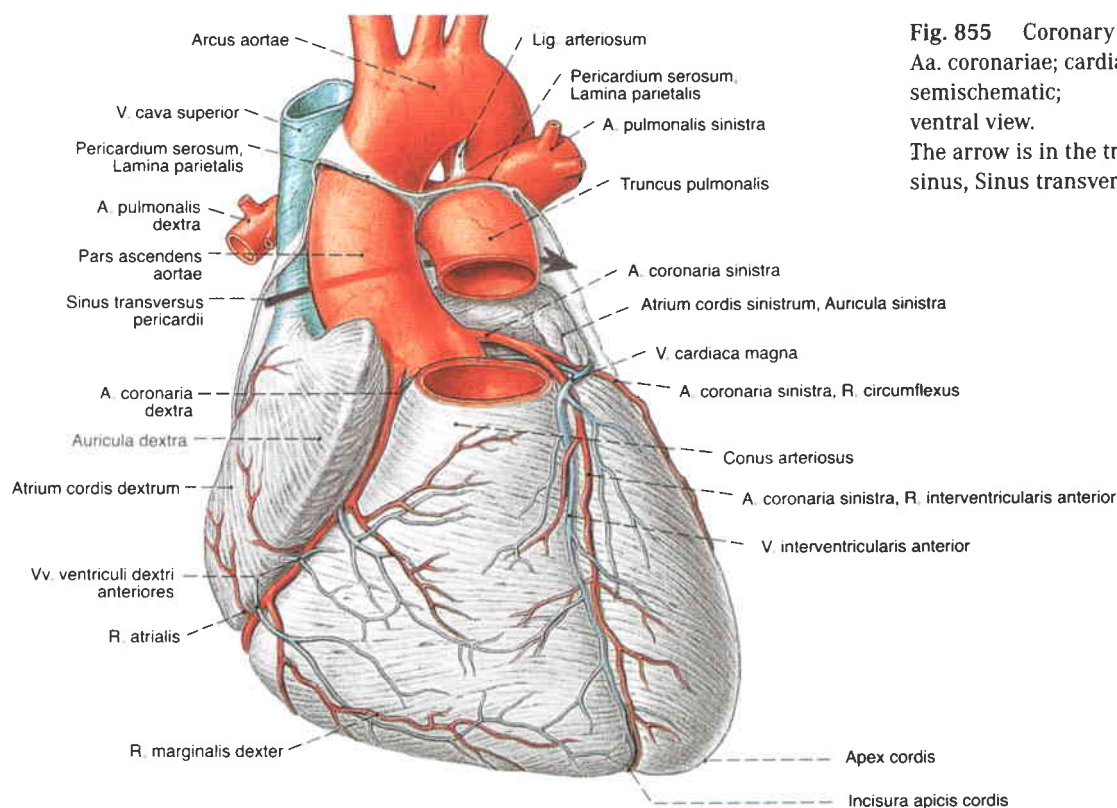


**Fig. 853** Right atrium, Atrium cordis dextrum, and right ventricle, Ventriculus cordis dexter, with the conducting system; the atrium, the ventricle and the arterial orifices have been opened, the conducting system is displayed in yellow; ventral view.

- \* Clinical: KEITH-FLACK node, sinus node
- \*\* Clinical: ASCHOFF-TAWARA node, atrioventricular (AV) node
- \*\*\* Clinical: bundle of His

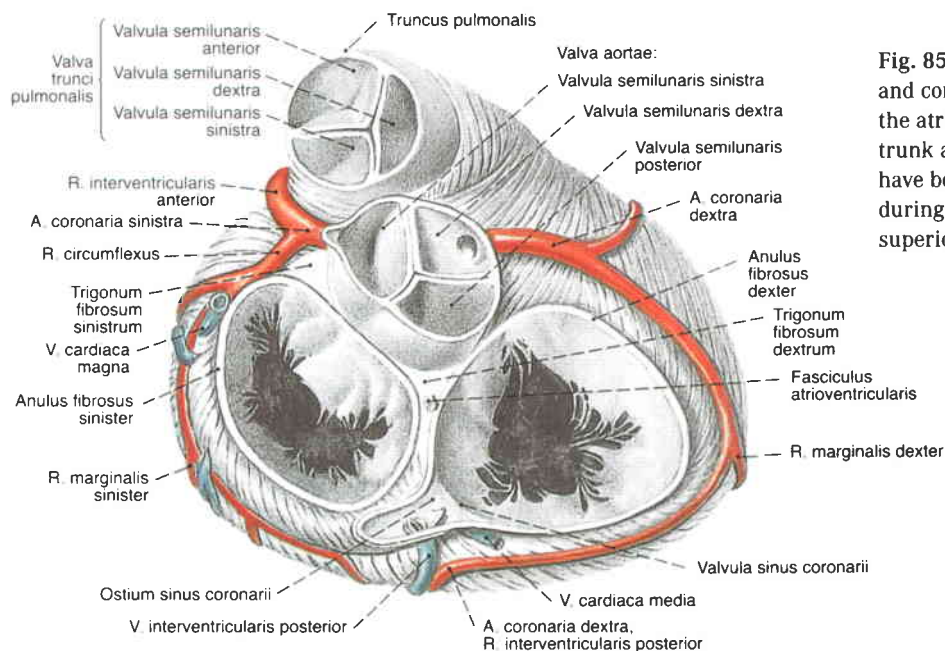


**Fig. 854** Left ventricle, Ventriculus cordis sinister; the ventricle has been opened by a longitudinal section; the left branch of the conducting system is displayed in yellow; left ventral view.



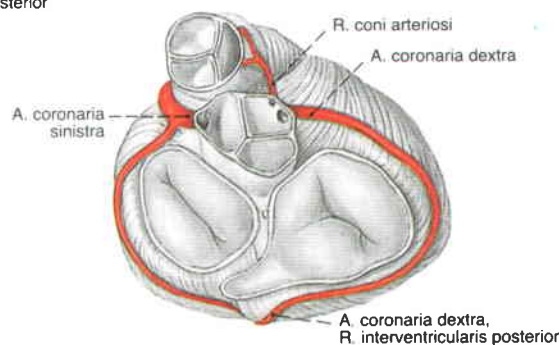
**Fig. 855** Coronary arteries, Aa. coronariae; cardiac veins, Vv. cordis; semischematic; ventral view.

The arrow is in the transverse pericardial sinus, Sinus transversus pericardii.

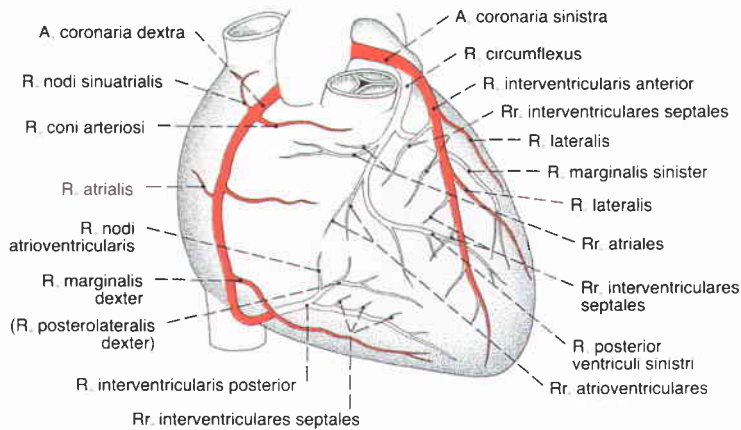


**Fig. 856** The cardiac valves, Valvae cordis, and coronary arteries, Aa. coronariae; the atria have been removed; the pulmonary trunk and the ascending part of the aorta have been sectioned; the valves are shown during filling of the ventricle (diastole); superior view.

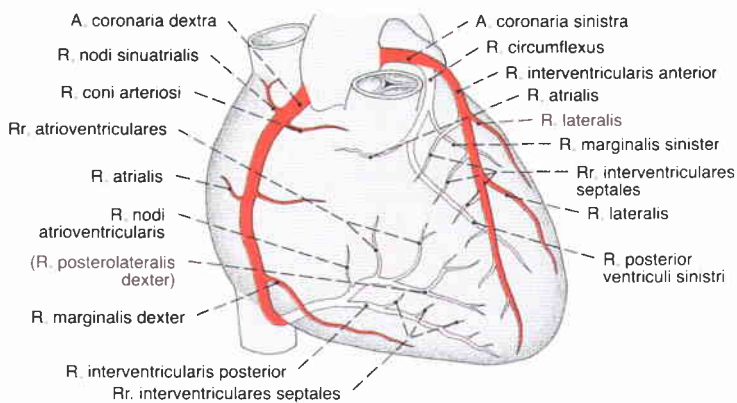
**Fig. 857** Variability of the coronary arteries. The conus arteriosus branch, R. coni arteriosi, originates from the aorta as an independent artery with a frequency of approximately 37%.



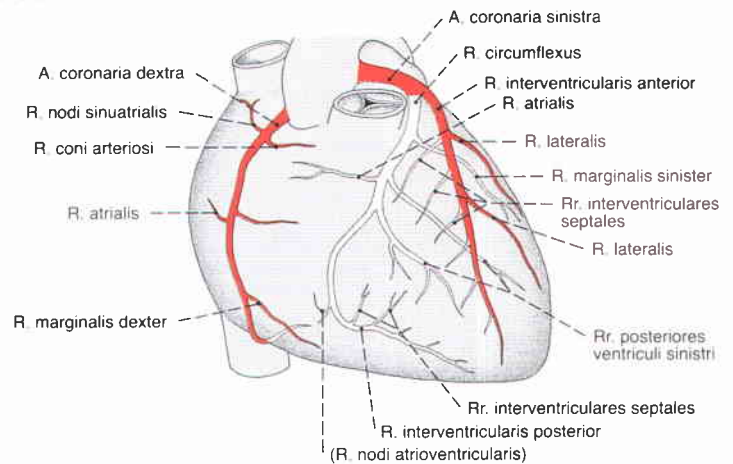




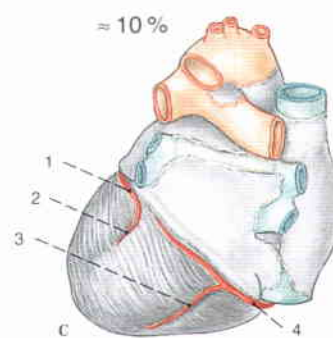
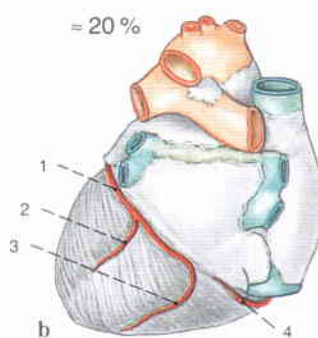
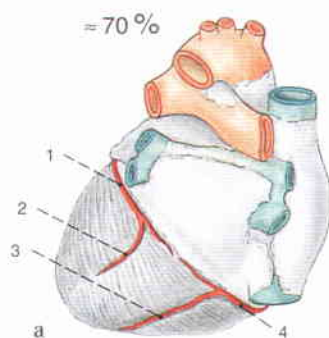
**Fig. 859** Coronary arteries, Aa. coronariae; the posterior interventricular branch arises from the left coronary artery (left dominant supply); ventral view.  
Compare to Fig. 861 b.



**Fig. 858** Coronary arteries, Aa. coronariae; posterior arterial branches are shown in pink. The posterior interventricular branch arises from the right coronary artery (balanced supply); ventral view.  
Compare to Fig. 861 a.



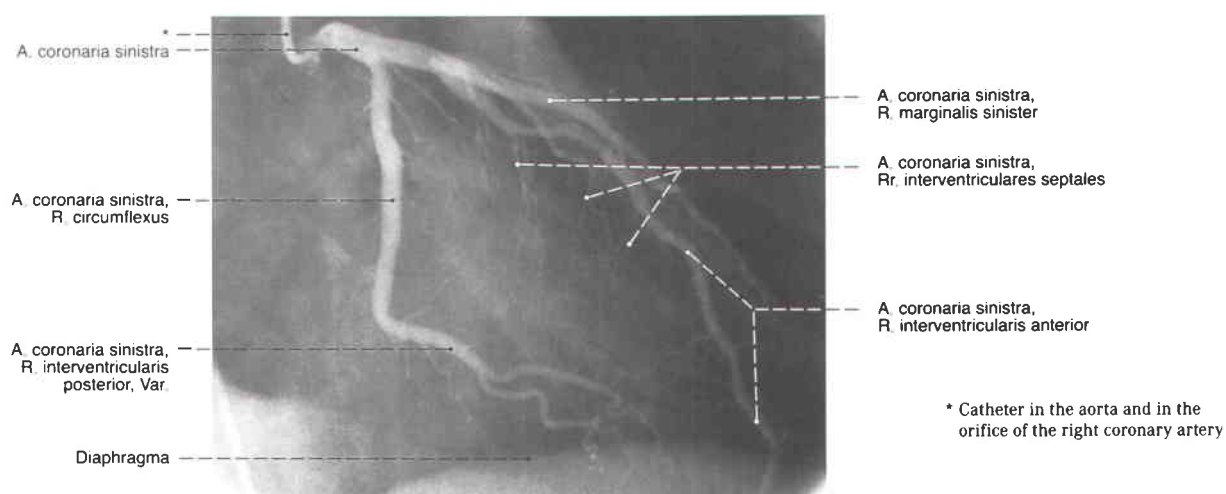
**Fig. 860** Coronary arteries, Aa. coronariae; the posterior wall of the ventricles is mainly supplied by branches of the right coronary artery (right dominant supply); ventral view.  
Compare to Fig. 861 c.



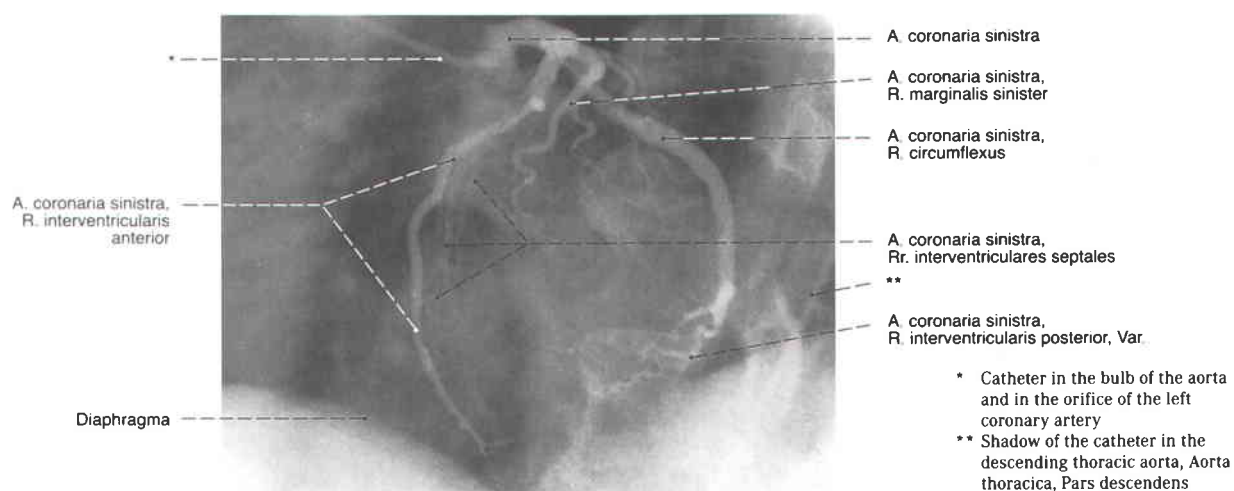
- 1 A. coronaria sinistra, R. circumflexus
- 2 A. coronaria sinistra, R. posterior ventriculi sinistri
- 3 A. coronaria dextra, R. interventricularis posterior
- 4 A. coronaria dextra

**Figs. 861 a–c** Variations in the arterial supply of the posterior wall of the heart; dorsal view.

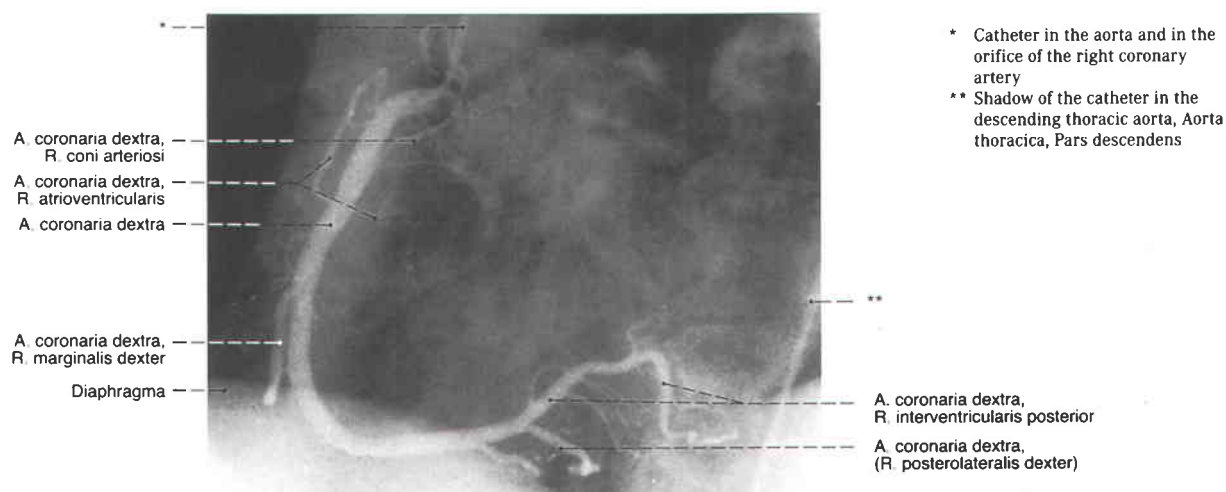
- a balanced supply
- b left dominant supply
- c right dominant supply



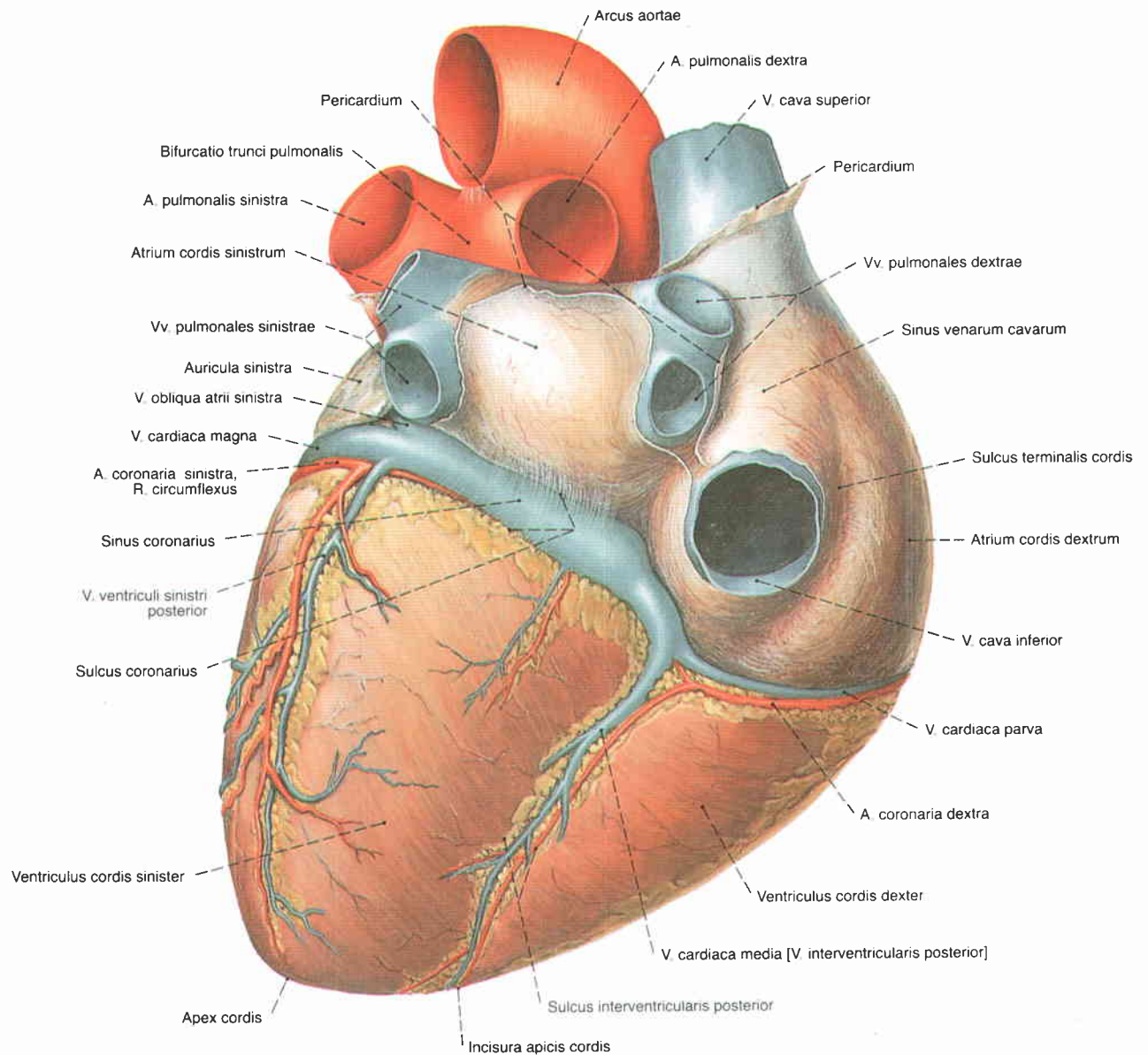
**Fig. 862** Left coronary artery, A. coronaria sinistra. Coronary arteriography (radiograph after selective injection of a contrast medium); the beam is directed obliquely from right anterior to left posterior (RAO).



**Fig. 863** Left coronary artery, A. coronaria sinistra. Coronary arteriography (radiograph after selective injection of a contrast medium); the beam is directed obliquely from left anterior to right posterior (LAO). Same patient as in Fig. 862.

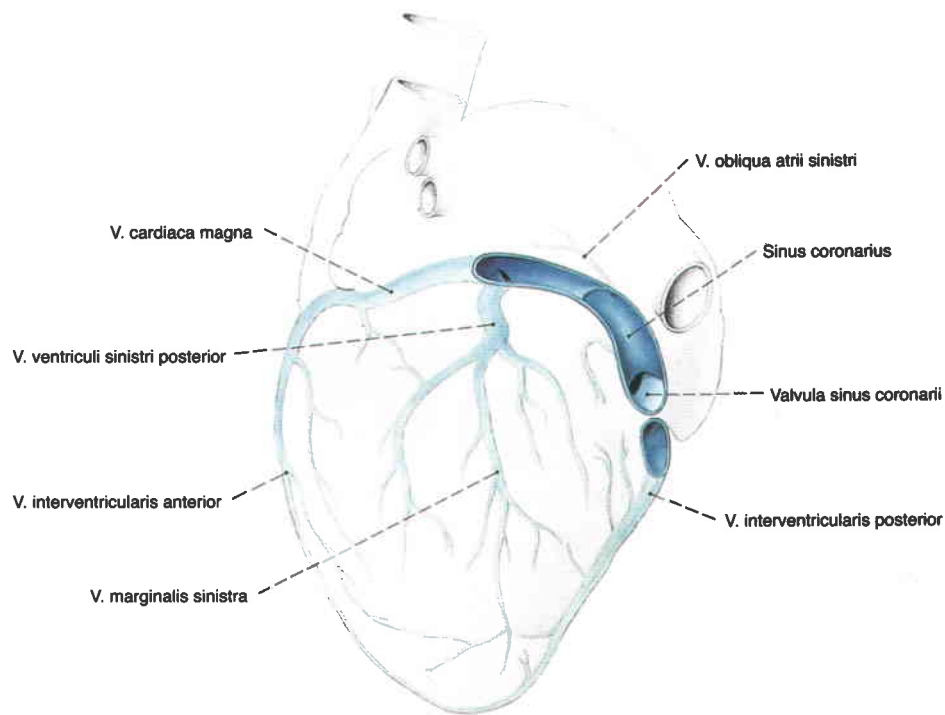


**Fig. 864** Right coronary artery, A. coronaria dextra. Coronary arteriography (radiograph after selective injection of a contrast medium); the beam is directed obliquely from left anterior to right posterior (LAO). Same patient as in Figs. 862 and 863.



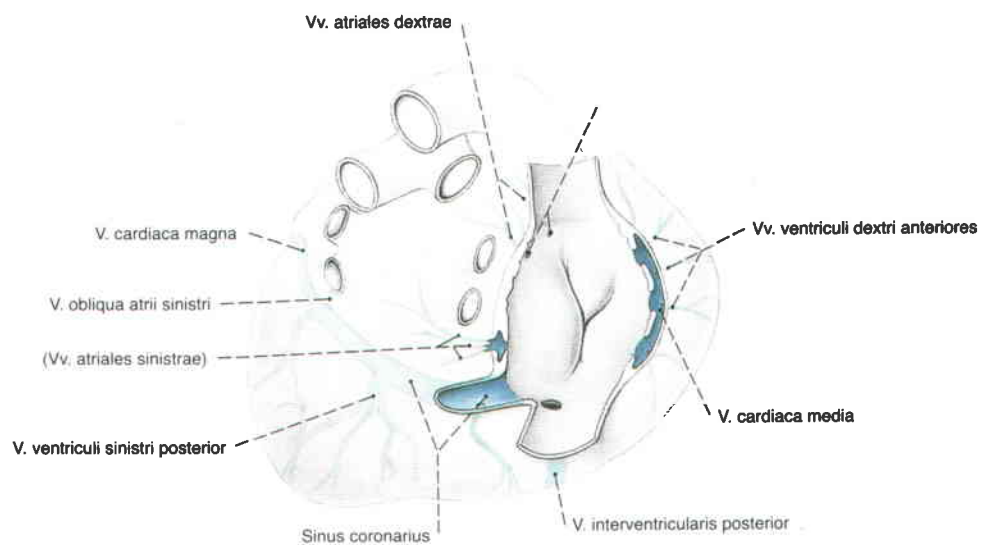
**Fig. 865** Cardiac veins, Vv. cordis; the pericardium has been removed down to the pericardial reflections around the great vessels; dorsoinferior view. The coronary sinus is often covered by thin strands of muscle (compare to Fig. 840).





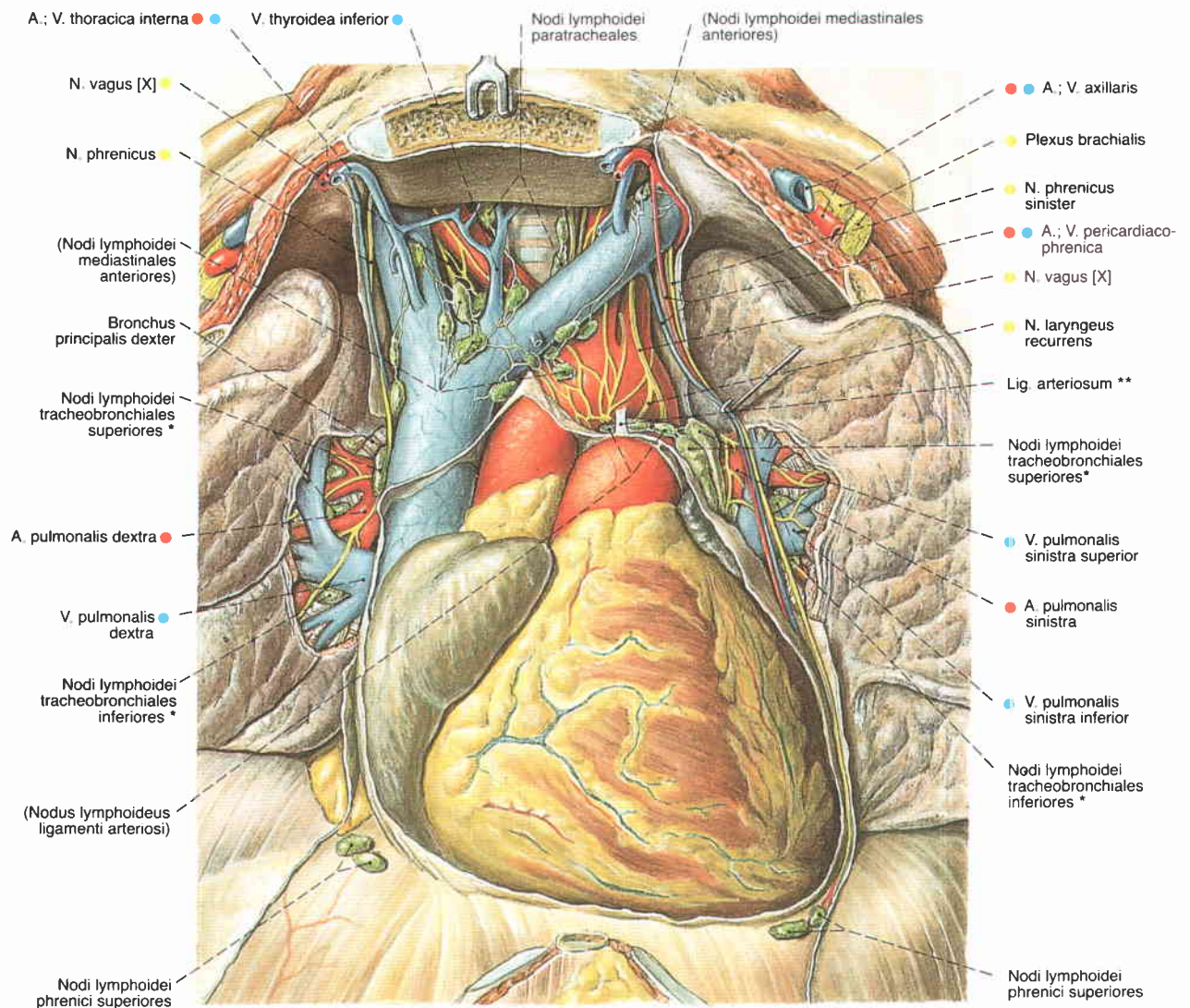
**Fig. 866** Cardiac veins, Vv. cordis; the diagram shows the branches of the large cardiac veins (after v. LÜDINGHAUSEN); left inferior view.

The size and course of the cardiac veins vary considerably.



**Fig. 867** Cardiac veins, Vv. cordis; the right atrium has been removed to show the orifice of the cardiac veins (after v. LÜDINGHAUSEN); superior view.

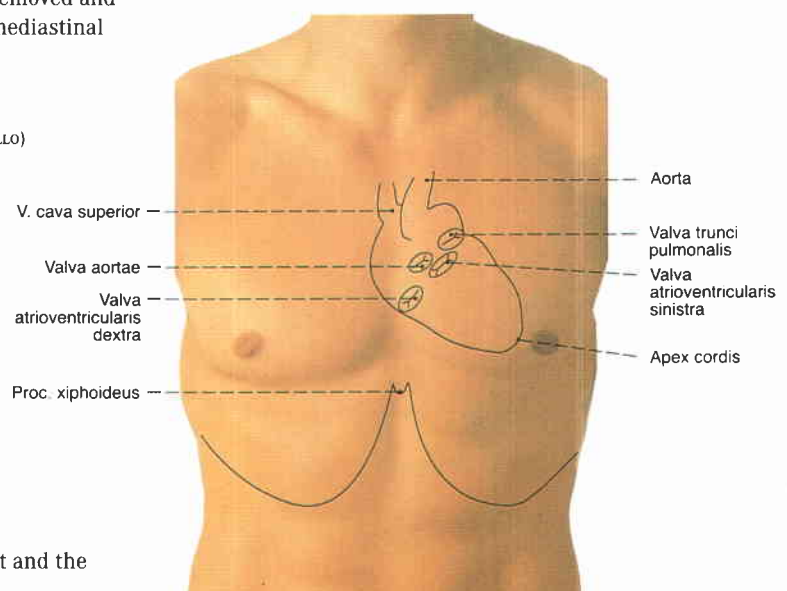
\* Orifices of the anterior atrial veins = LANNELONGUE's crypts.  
The orifices of the cardiac veins vary considerably.



**Fig. 868** Position of the heart in the thorax, Situs cordis; the thymus has been removed; the Manubrium sterni retracted superiorly; the pericardium partially removed and the hilum of the lungs dissected to expose the mediastinal lymph nodes; ventral view.

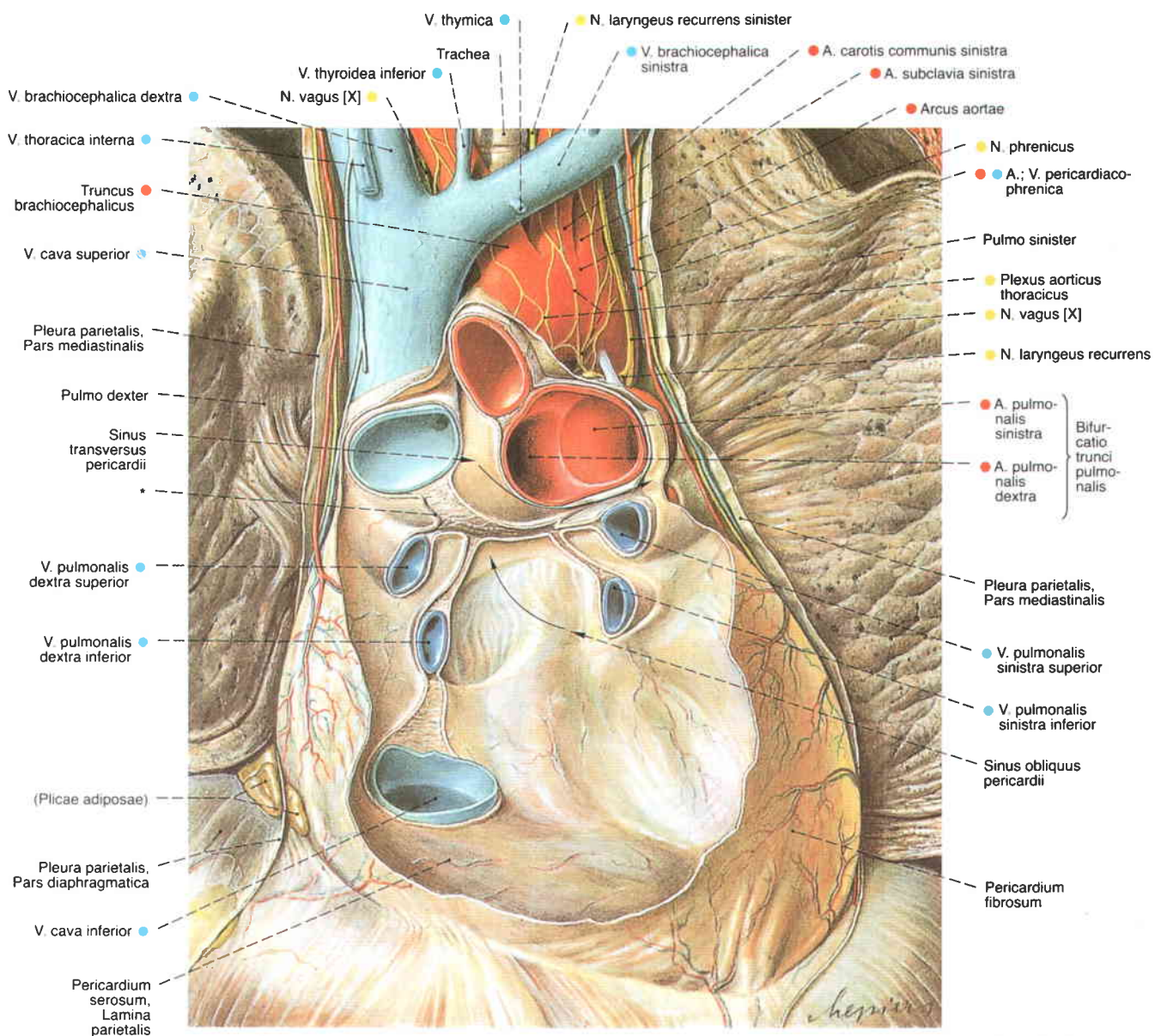
\* Clinical: lymph nodes of the hilum

\*\* ligamentous remnant of the fetal ductus arteriosus (BOTALLO)



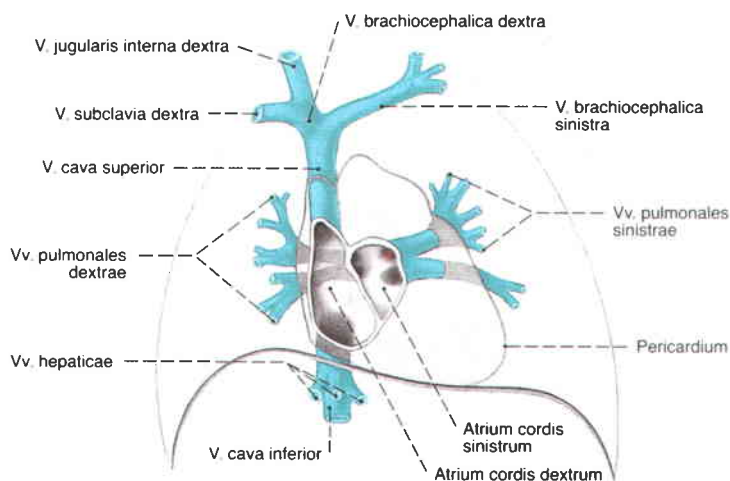
**Fig. 869** Projection of the contour of the heart and the cardiac valves onto the anterior thoracic wall.





**Fig. 870** Pericardium, Pericardium; the anterior parts of the pericardium and the heart with its great vessels have been removed; ventral view.

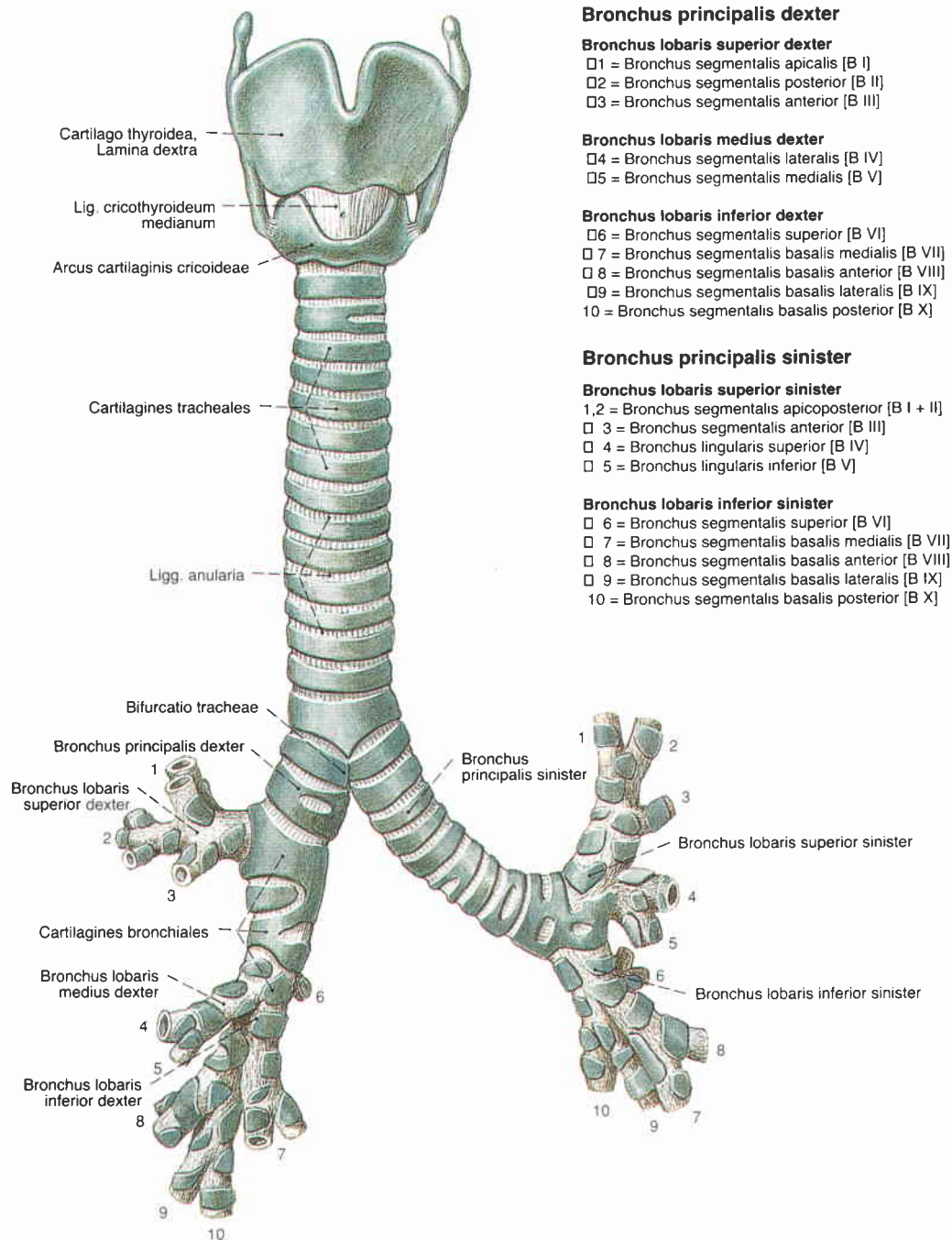
\* reflection of the visceral layer, Lamina visceralis [Epicardium], into the parietal layer, Lamina parietalis, of the serous pericardium, Pericardium serosum.



**Fig. 871** Openings of the great veins into the heart; ventral view.

"Venous cross": the pulmonary veins form the horizontal arms, the superior and inferior Venae cavae the vertical branches.





**Fig. 872** Larynx, Larynx; trachea, Trachea;  
bronchi, Bronchi;  
ventral view.  
The Bronchus segmentalis basalis medialis  
[B VII] is often missing on the left.

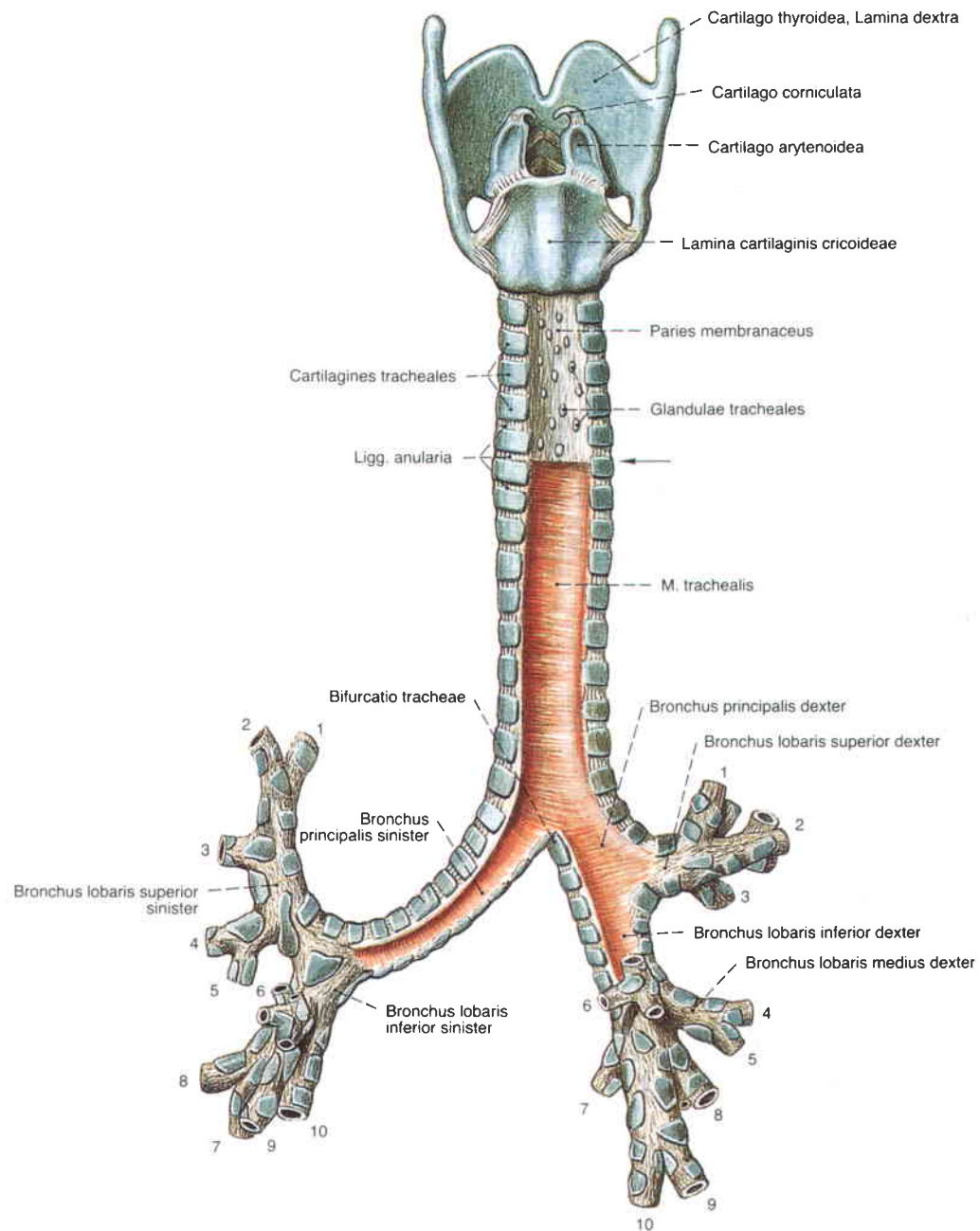
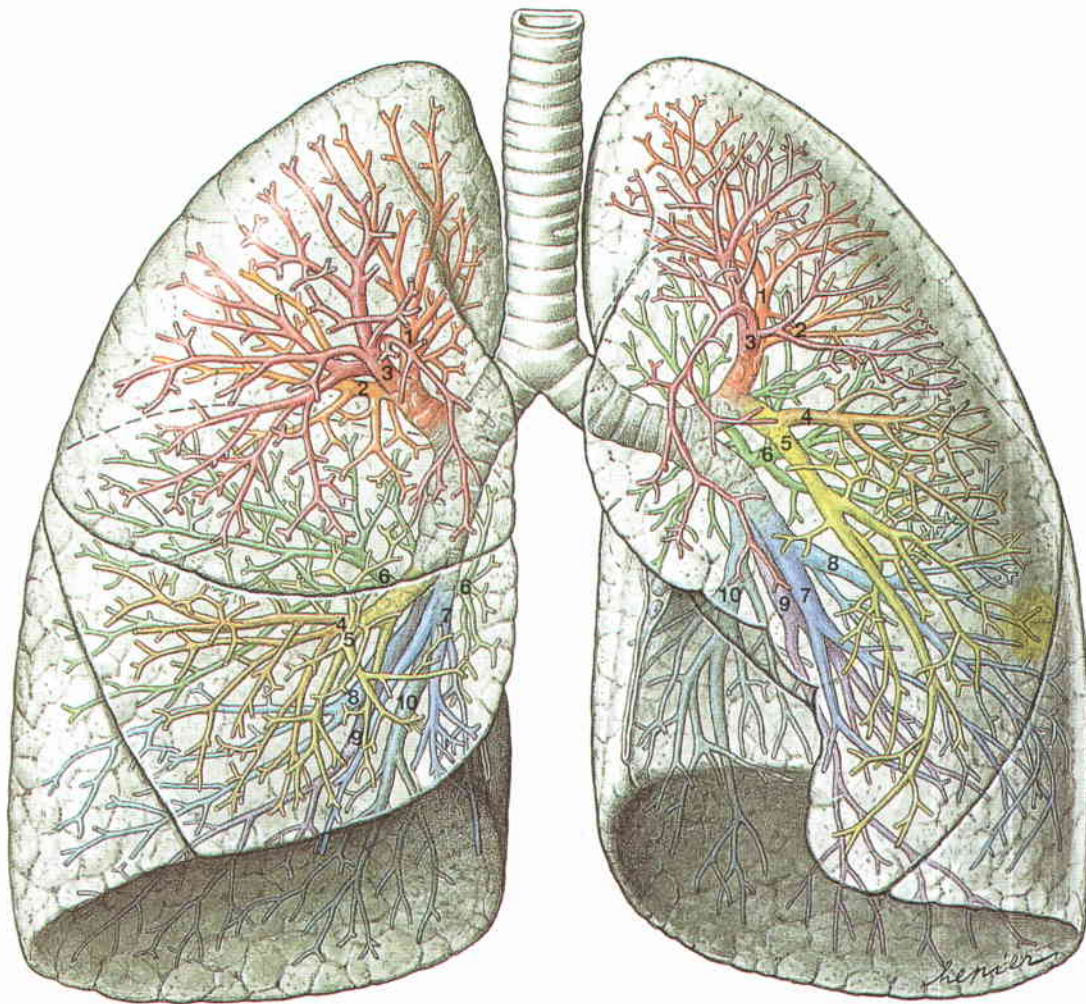
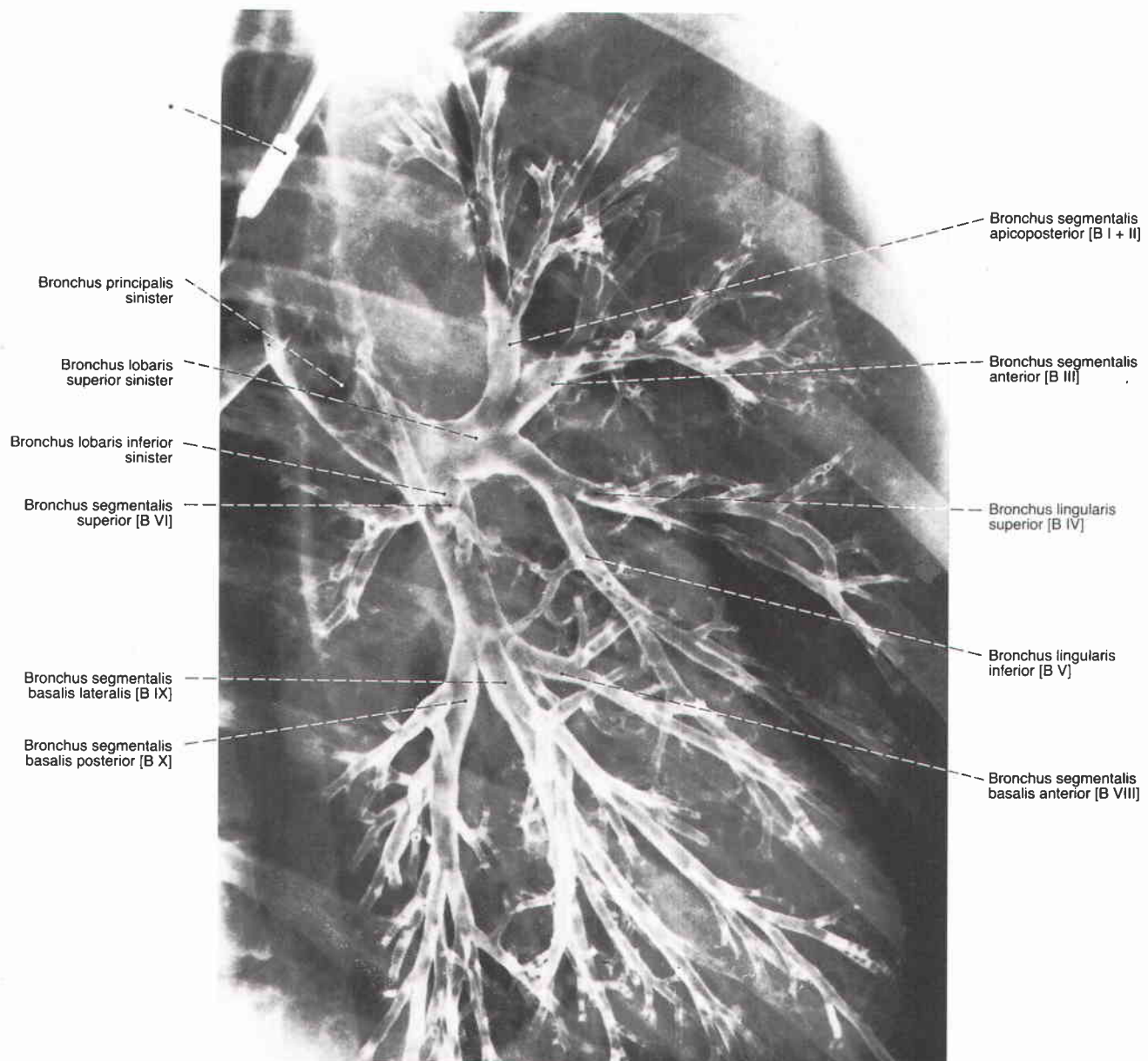


Fig. 873 Larynx, Larynx; trachea, Trachea;  
 bronchi, Bronchi;  
 below the arrow, the superficial layer of the membranous  
 wall has been removed to show the muscles of the trachea;  
 dorsal view.  
 The numbers indicate the segmental bronchi (see page 92).



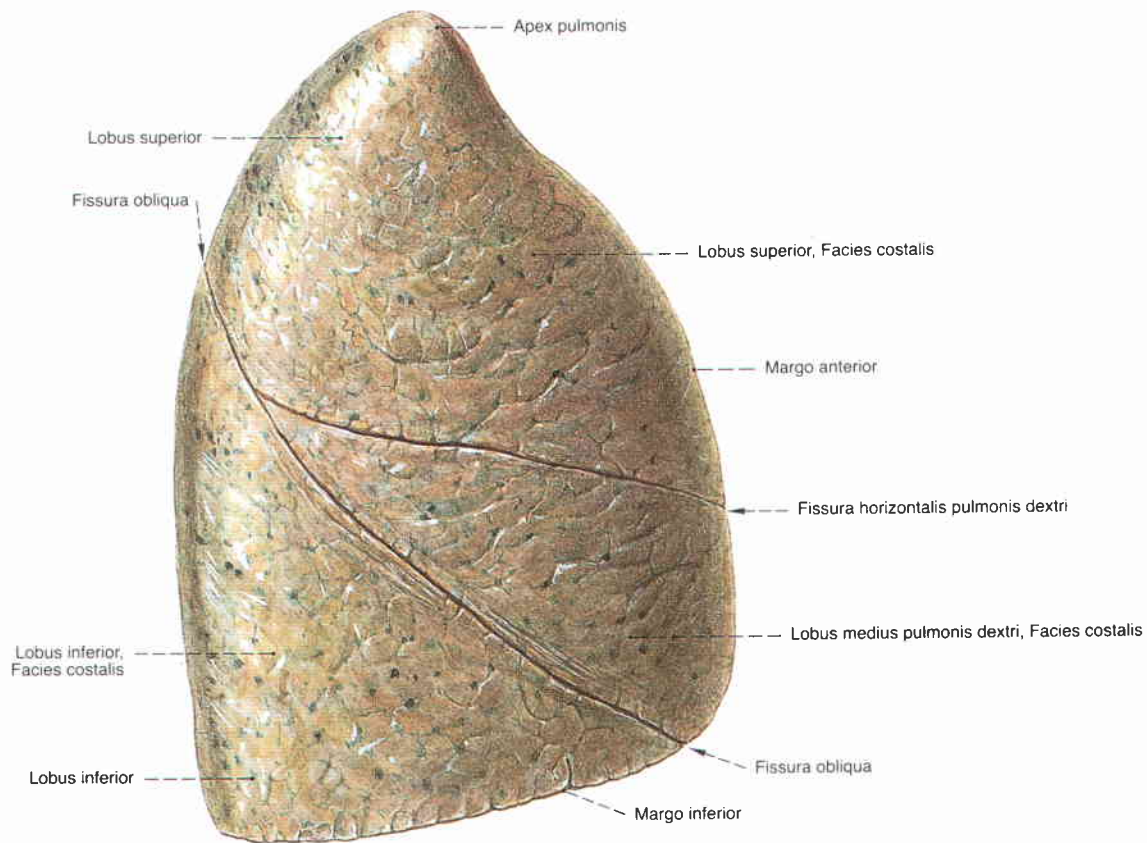
**Fig. 874** Lungs, Pulmones, bronchi, Bronchi; the lobar and segmental bronchi have been projected onto the lung in different colours; ventral view. The numbers indicate the segmental bronchi (see page 92). On the left side the segments I and II frequently arise from a common primary bronchus; the mediobasal segment S VII is often absent.



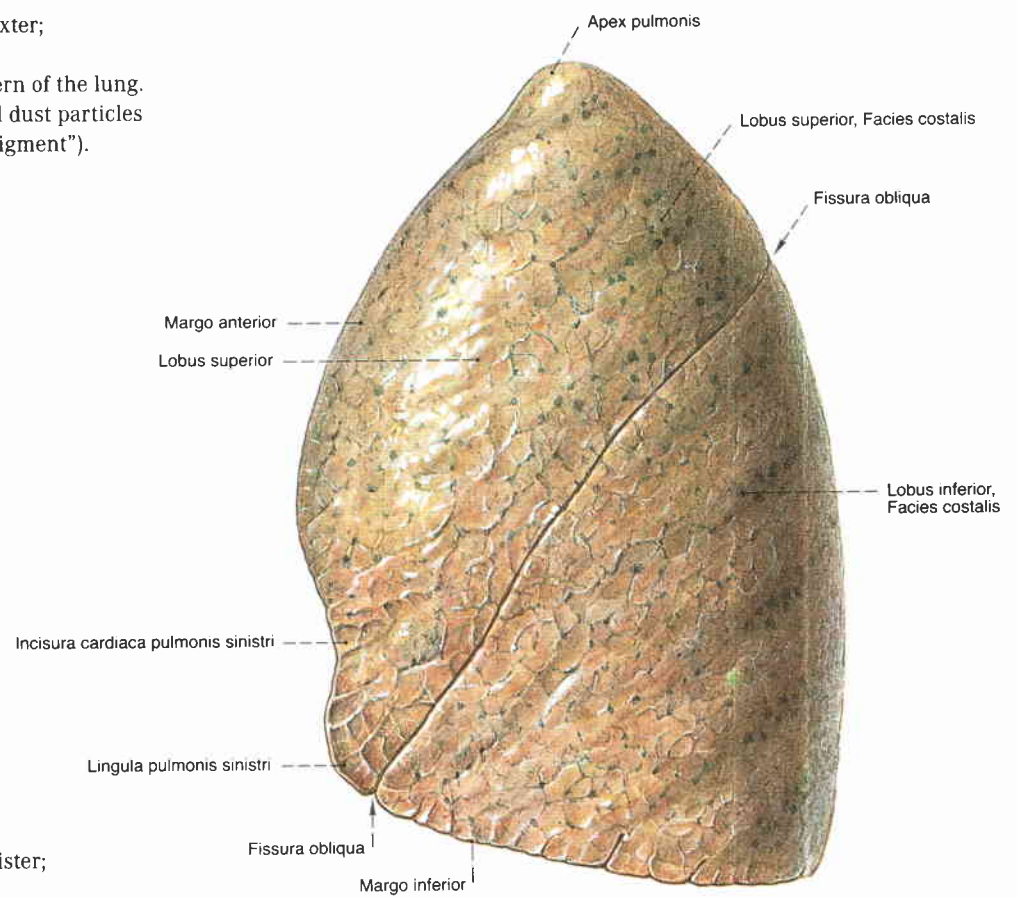


**Fig. 875** Bronchi, Bronchi;  
AP-radiograph; bronchography  
(the divisions of the bronchial tree are made visible by  
inhalation of powder containing contrast medium);  
left ventral view.

\* Bronchographic catheter in the trachea

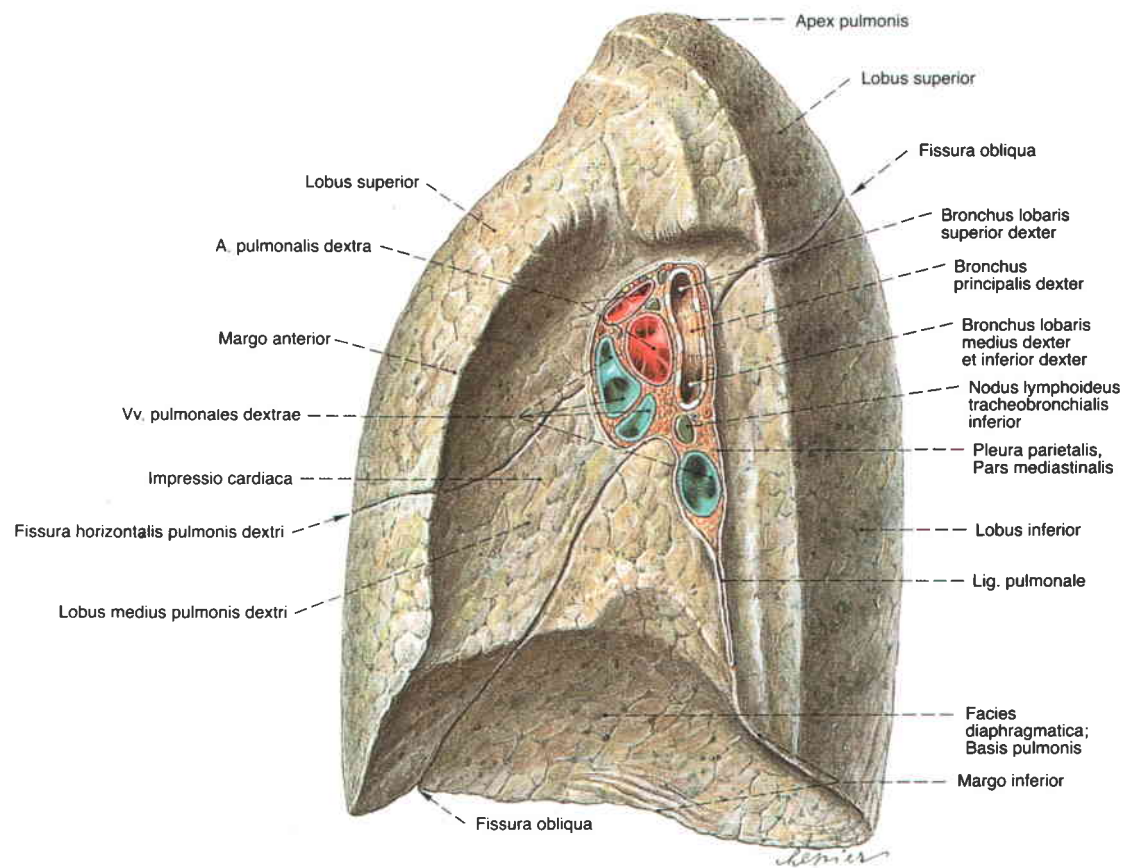


**Fig. 876** Right lung, Pulmo dexter; lateral view.  
Note the grey-black spotted pattern of the lung. This is due to deposits of inhaled dust particles under the pleura ("anthracotic pigment").



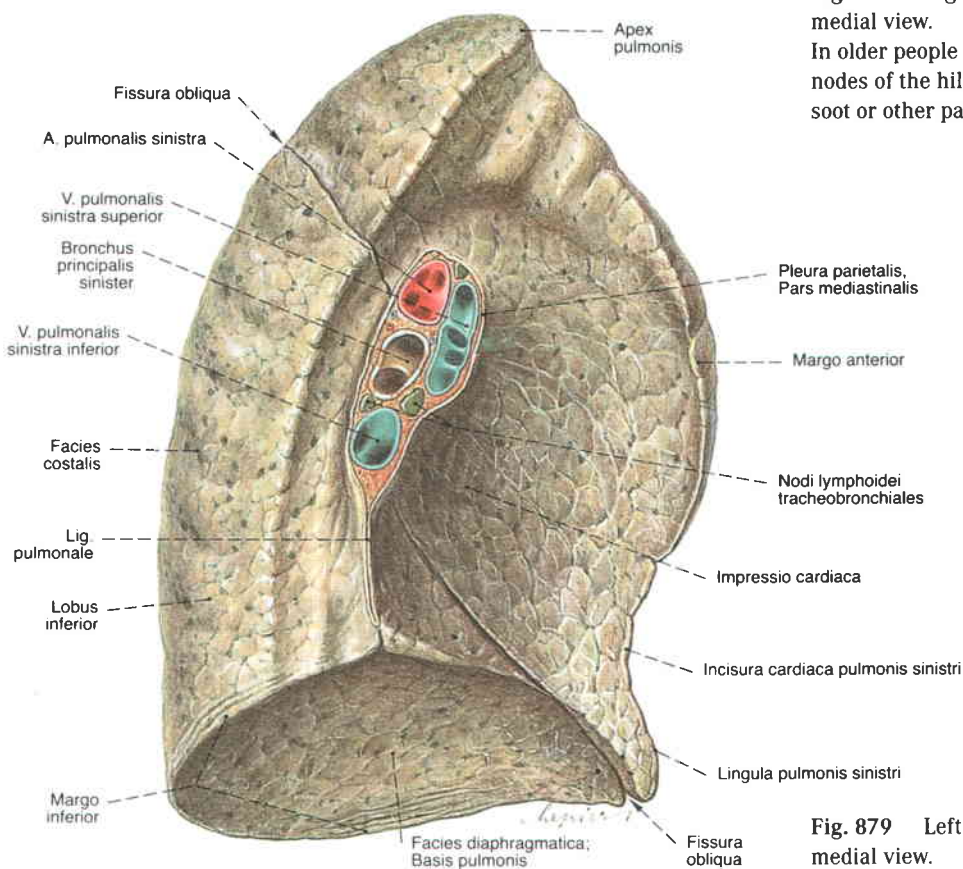
**Fig. 877** Left lung, Pulmo sinister; lateral view.





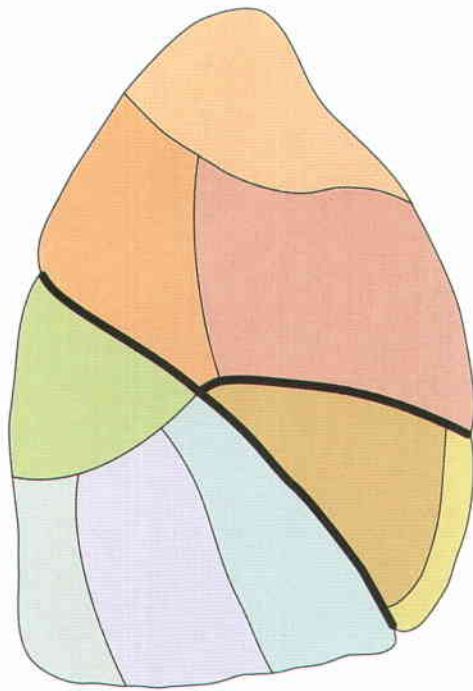
**Fig. 878** Right lung, Pulmo dexter; medial view.

In older people or persons exposed to dust, the lymph nodes of the hilum are often blackened by deposits of soot or other particles ("anthracotic lymph nodes").



**Fig. 879** Left lung, Pulmo sinister; medial view.



**Pulmo dexter****Pulmo dexter, Lobus superior**

- Segmentum apicale [S I]
- Segmentum posterius [S II]
- Segmentum anterius [S III]

**Pulmo dexter, Lobus medius**

- Segmentum laterale [S IV]
- Segmentum mediale [S V]

**Pulmo dexter, Lobus inferior**

- Segmentum superius [S VI]
- Segmentum basale mediale [cardiacum] [S VII]
- Segmentum basale anterius [S VIII]
- Segmentum basale laterale [S IX]
- Segmentum basale posterius [S X]

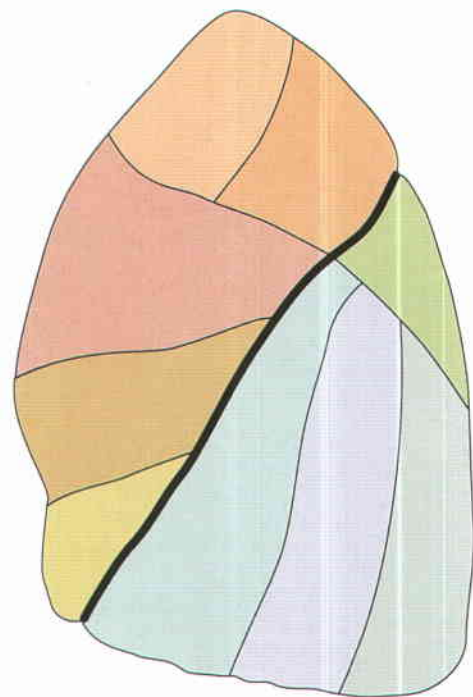
**Fig. 880** Right lung, Pulmo dexter; bronchopulmonary segments, Segmenta bronchopulmonalia. Lateral view.

**Pulmo sinister****Pulmo sinister, Lobus superior**

- Segmentum apicoposterius [S I + II]
- Segmentum anterius [S III]
- Segmentum lingulare superius [S IV]
- Segmentum lingulare inferius [S V]

**Pulmo sinister, Lobus inferior**

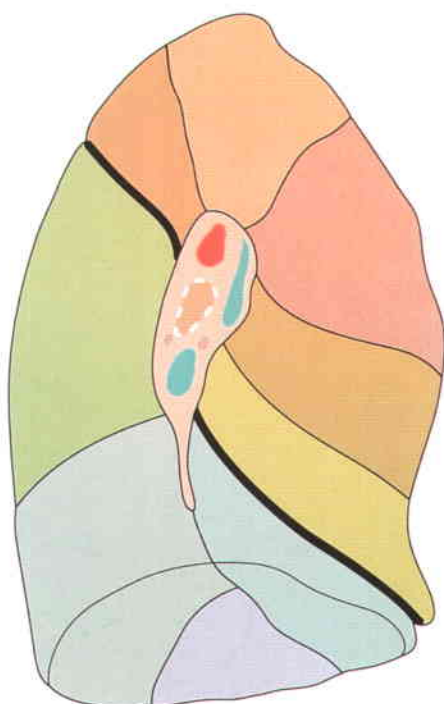
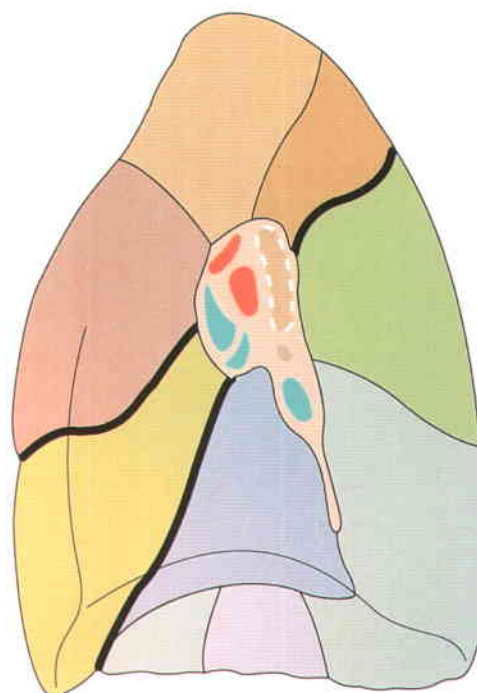
- Segmentum superius [S VI]
- Segmentum basale mediale [cardiacum] [S VII] \*
- Segmentum basale anterius [S VIII]
- Segmentum basale laterale [S IX]
- Segmentum basale posterius [S X]



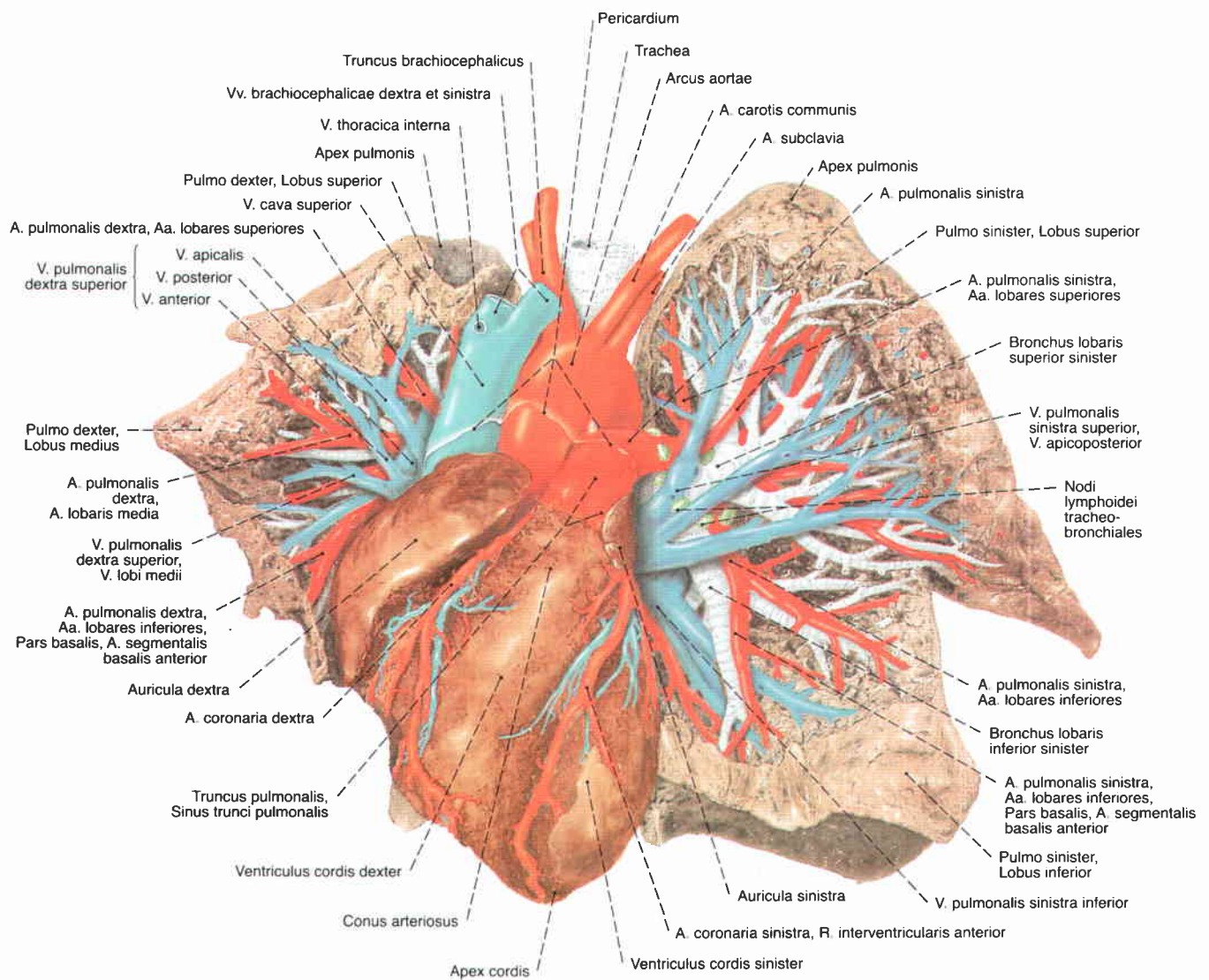
**Fig. 881** Left lung, Pulmo sinister; bronchopulmonary segments, Segmenta bronchopulmonalia. Lateral view.

\* This segment is generally not independent but is fused with the anterior basal segment, Segmentum basale anterius [S VIII].

**Fig. 882** Right lung, Pulmo dexter;  
bronchopulmonal segments,  
Segmenta bronchopulmonalia.  
Medial view.  
For colour codes and segment names see page 98.

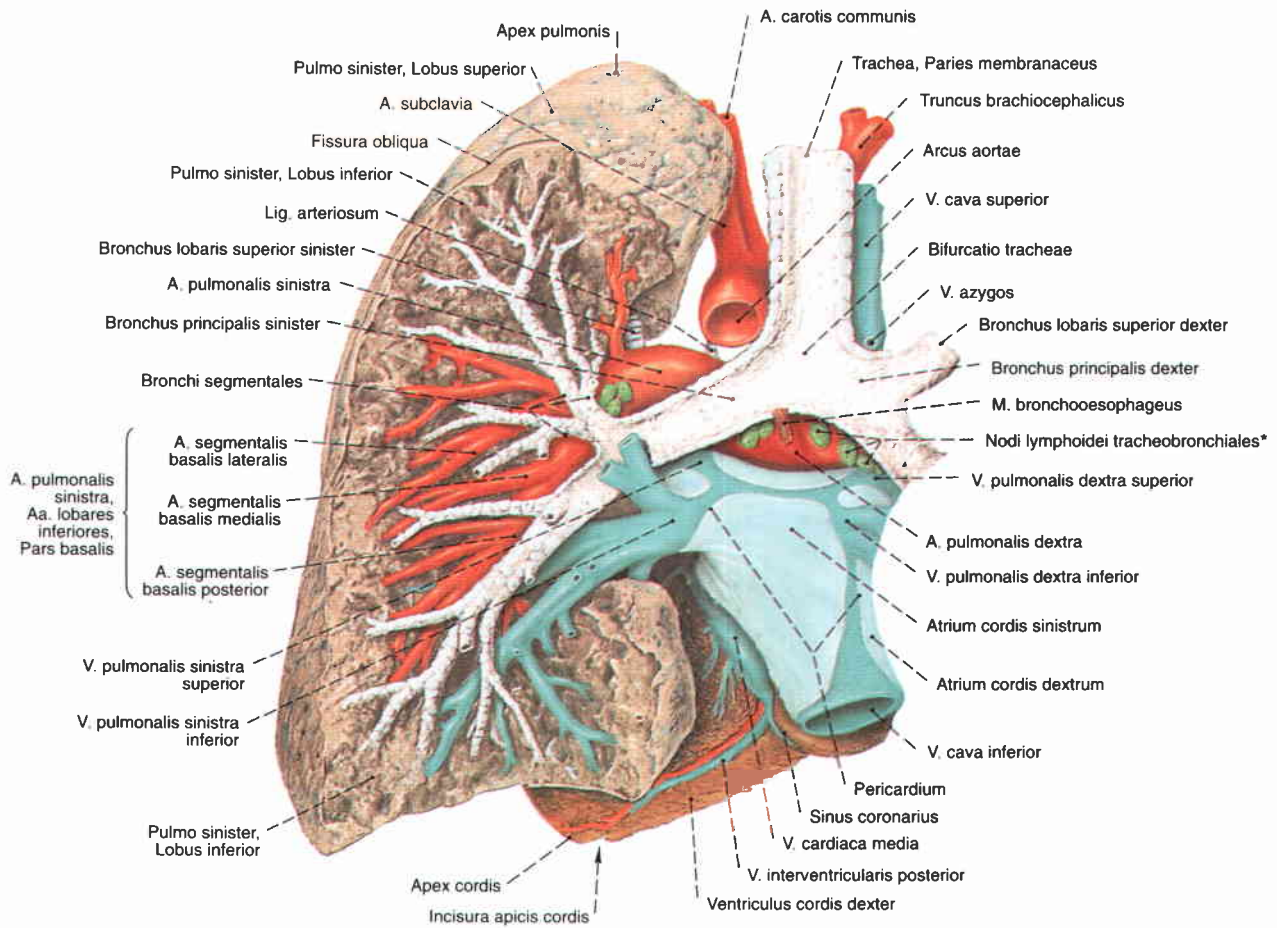


**Fig. 883** Left lung, Pulmo sinister;  
bronchopulmonary segments,  
Segmenta bronchopulmonalia.  
Medial view.  
For colour codes and segment names see page 98.

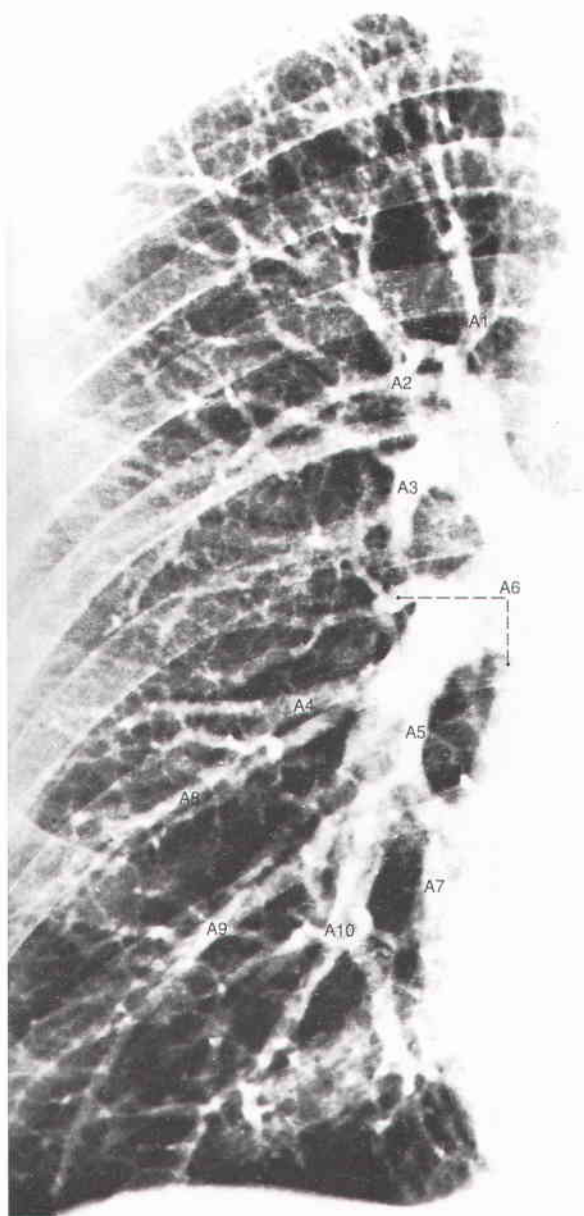


**Fig. 884** Heart, Cor; lungs, Pulmones; the arteries, veins and bronchi of the lungs have been dissected free to the external surface of the lungs. The apex of the heart has been retracted to the right to permit a better view of the structures of the left lung; ventral view.

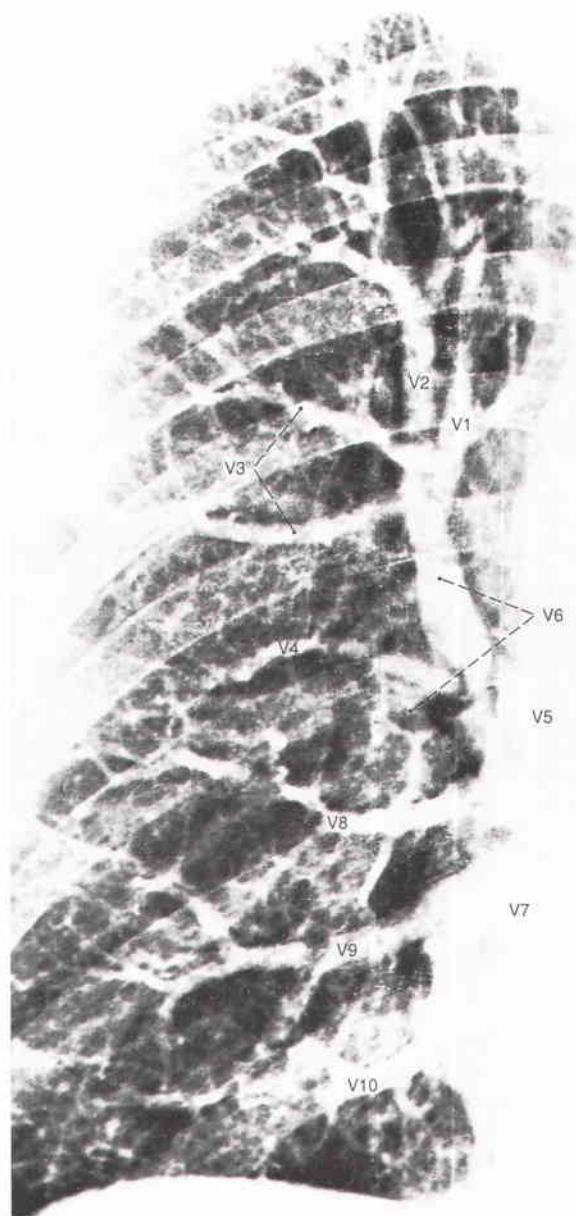




**Fig. 885** Left lung, Pulmo sinister; the large bronchi, pulmonary veins and arteries as well as the lymph nodes of the hilum are dissected.  
\* Clinical: hilum lymph nodes



**Fig. 886** Arteries of the right lung, Aa. pulmonales dextrae; AP-radiograph (pulmonary angiography), contrast media injected into the right ventricle; ventral view.  
Note the similar course of the arteries and the bronchi (see Figs. 874, 875). The numbers indicate the arterial segmental branches (compare to p. 98).



**Fig. 887** Veins of the right lung, Vv. pulmonales dextrae; AP-radiograph (pulmonary angiography), reflux of contrast media injected into the right ventricle; ventral view.  
Note the different course of the pulmonary veins compared to the arteries (see Fig. 886).

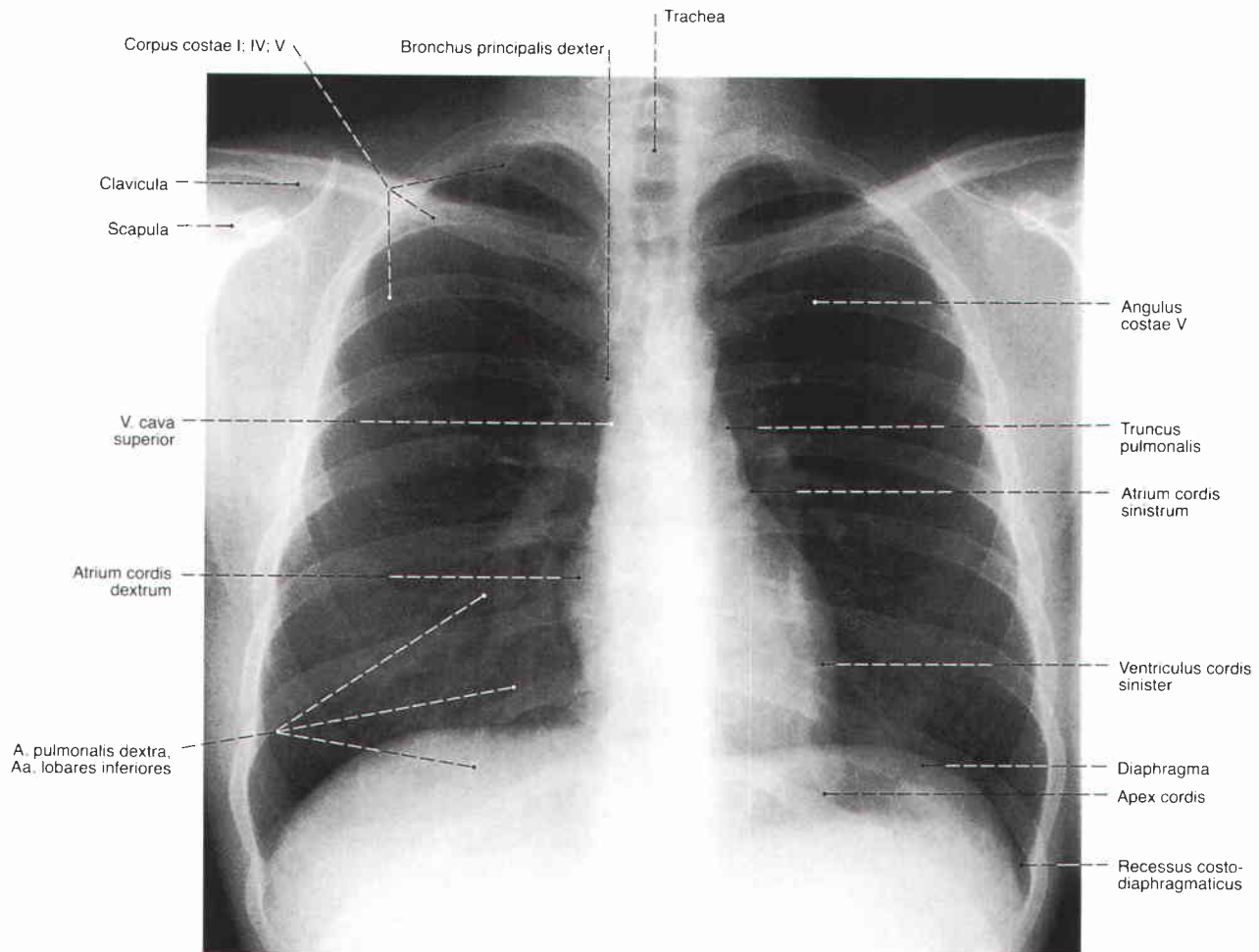


Fig. 888 Thorax, Cavea thoracis, and thoracic viscera; PA-radiograph of a 27-year-old man; the beam is directed sagittally onto the middle of the sternum.

The position and size of the heart, the lungs, and the bony parts of the thoracic cage as well as the vertebral column and ribs can be identified.

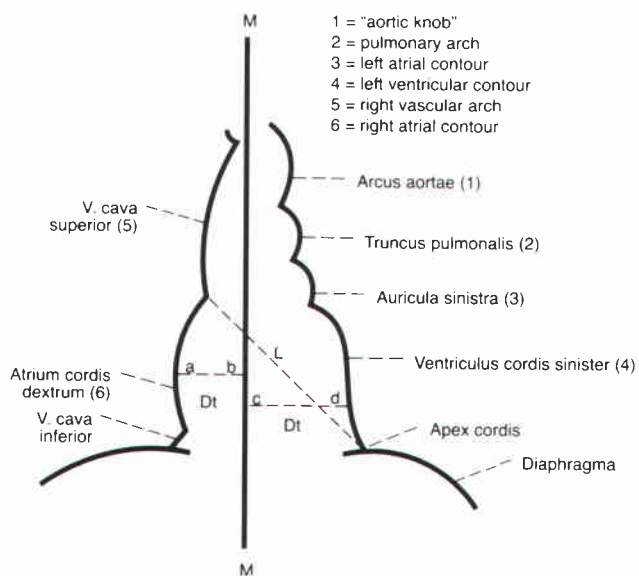


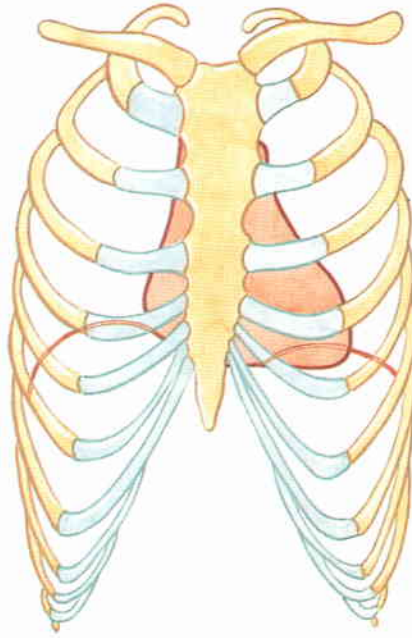
Fig. 889 Diagram of the outline silhouette of the heart in a radiograph.

Dt = transverse diameter (Diameter transversa),  
ab plus cd = 13-14 cm

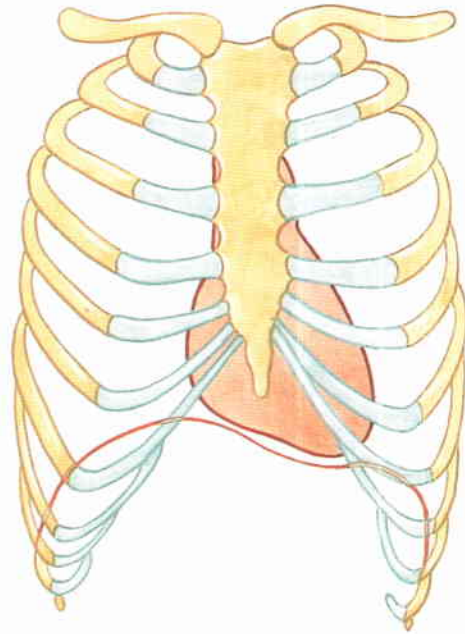
L = longitudinal axis of the heart (from the superior border of the right atrium to the apex of the heart) = 15-16 cm

M = median plane of the body

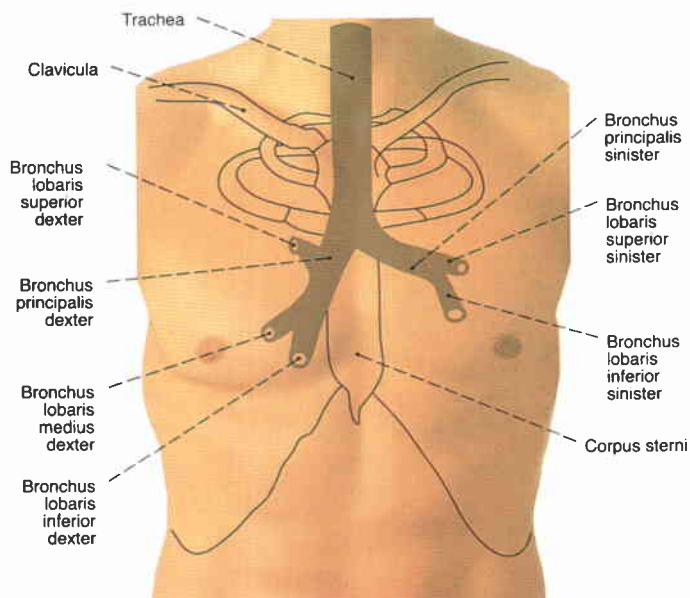




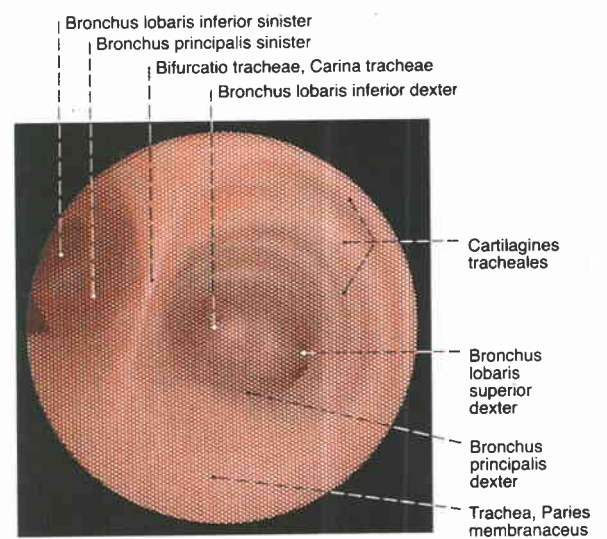
**Fig. 890** Position of the heart in the thorax during expiration; ventral view.



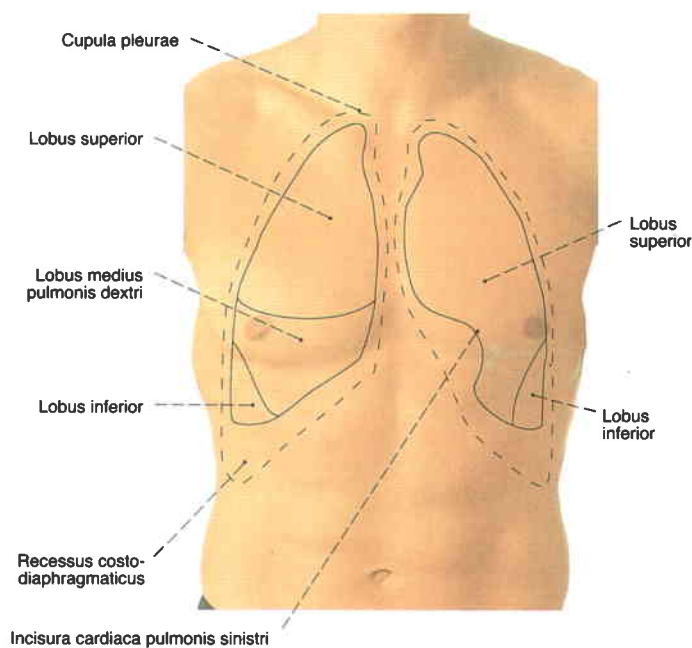
**Fig. 891** Position of the heart in the thorax during inspiration; ventral view.  
The heart is more elongated, the cardiac apex is directed medially and caudally.



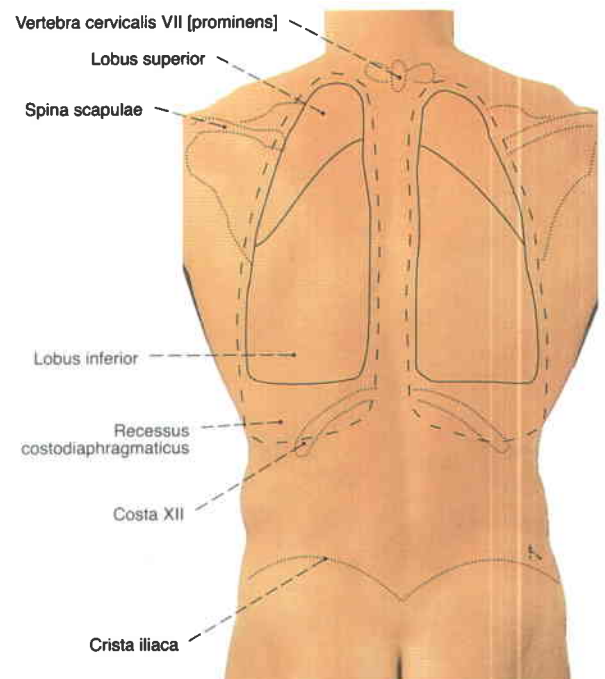
**Fig. 892** Trachea, Trachea, and bronchi, Bronchi; projection onto the anterior thoracic wall.



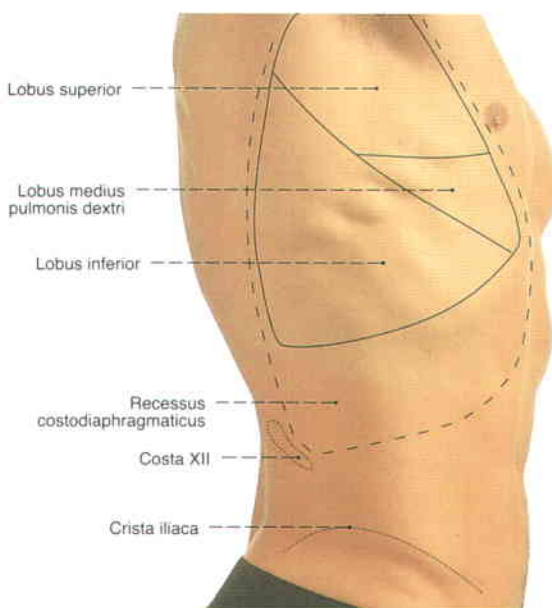
**Fig. 893** Endoscopic image (bronchoscopy) of the bifurcation of the trachea.



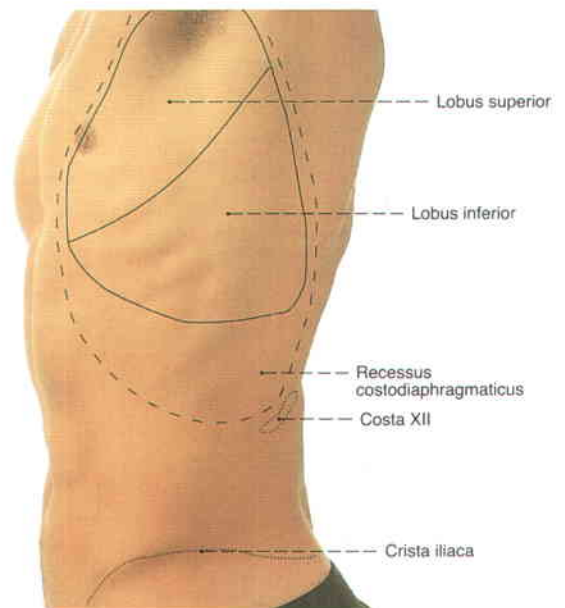
**Fig. 894** Projection of the pulmonary (solid line) and pleural (broken line) boundaries onto the anterior thoracic wall; ventral view.



**Fig. 895** Projection of the pulmonary (solid line) and pleural (broken line) boundaries onto the back; dorsal view.



**Fig. 896** Projection of the pulmonary (solid line) and pleural (broken line) boundaries onto the right lateral thoracic wall; viewed from the right.



**Fig. 897** Projection of the pulmonary (solid line) and pleural (broken line) boundaries onto the left lateral thoracic wall; viewed from the left.

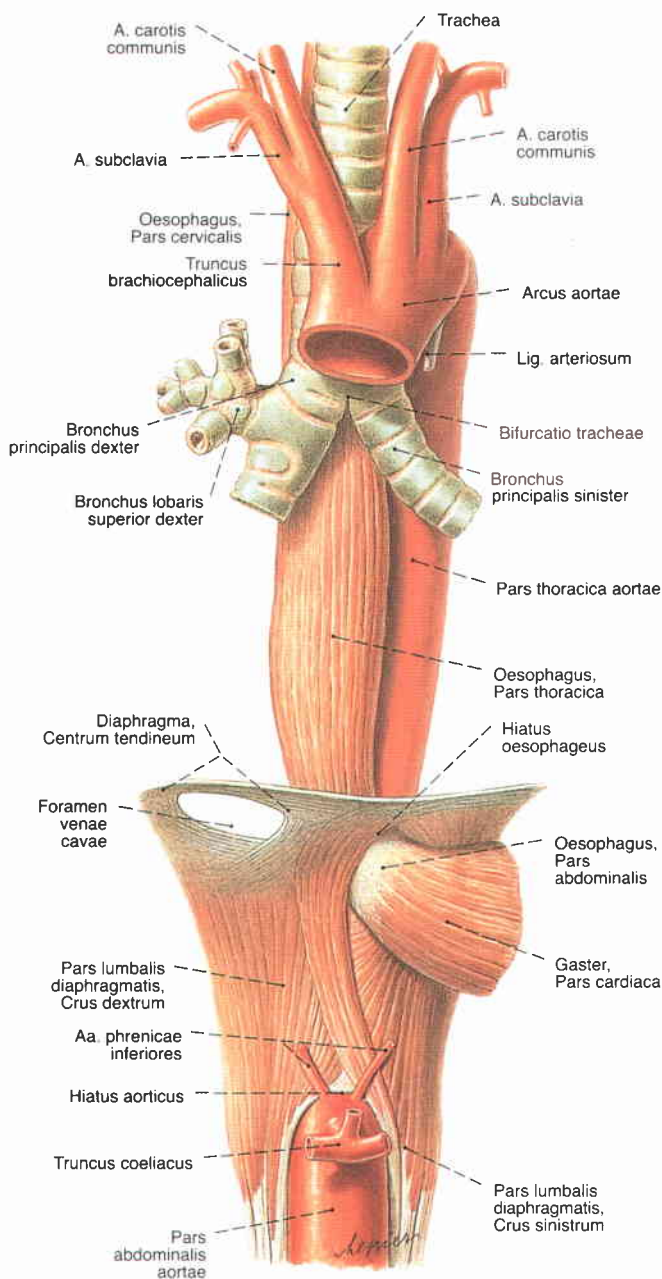


Fig. 898 Oesophagus; trachea, Trachea; thoracic aorta, Pars thoracica aortae; parts of the diaphragm have been preserved to show the openings for the aorta, the inferior vena cava and the oesophagus; ventral view.

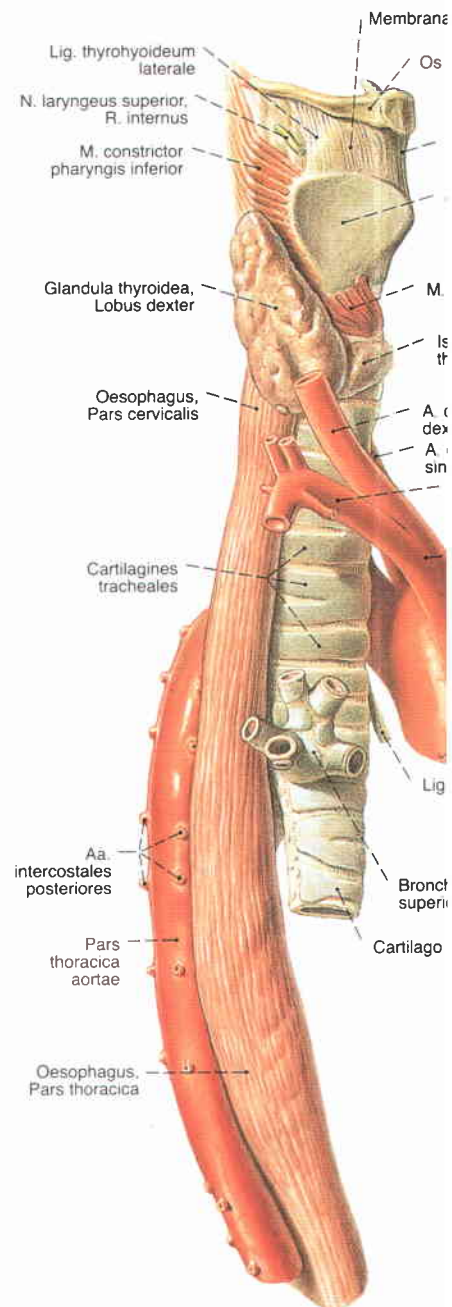
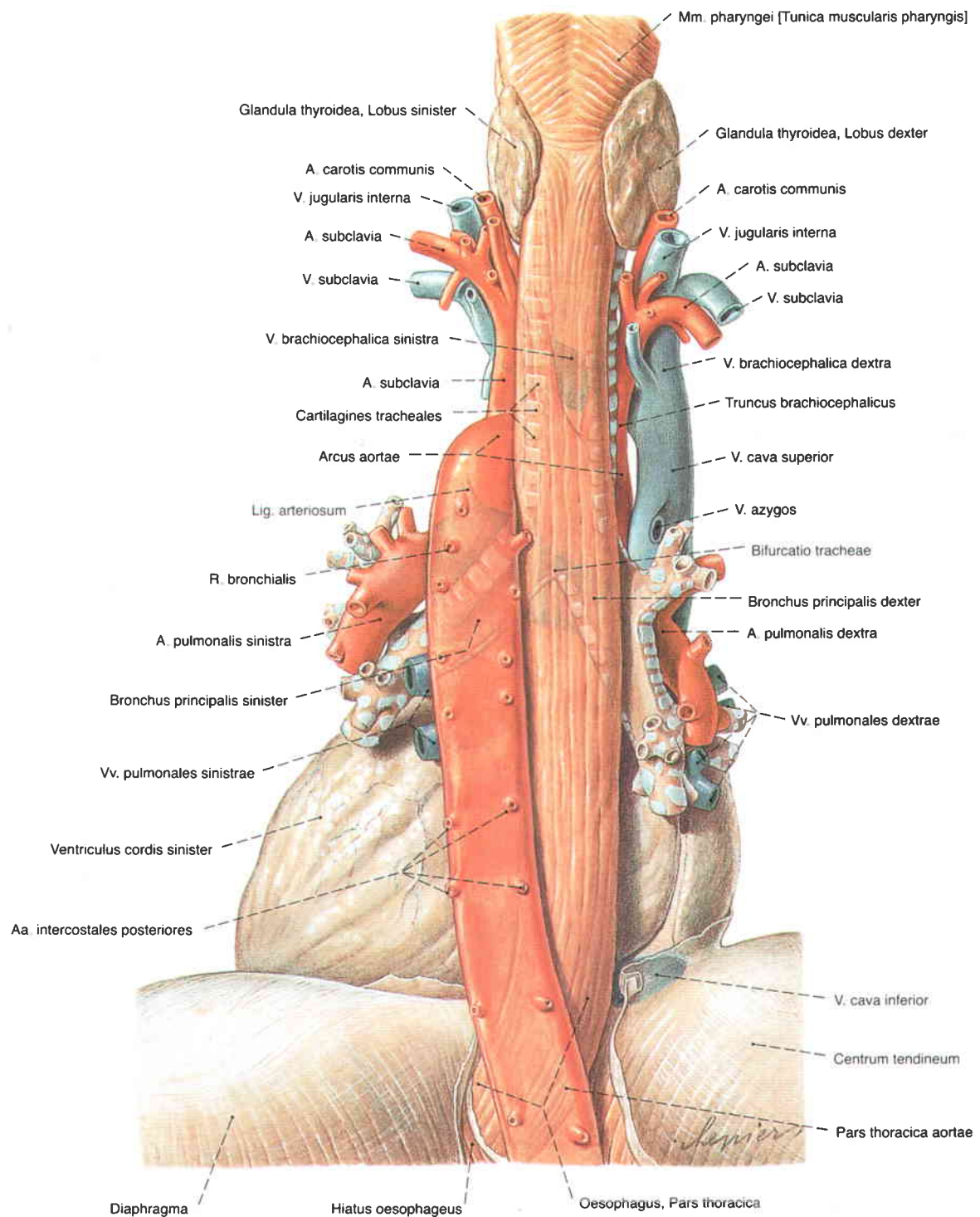
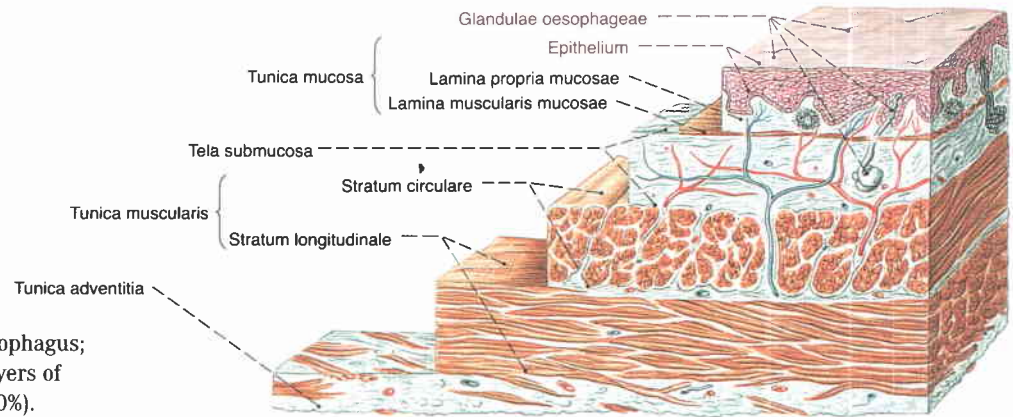


Fig. 899 Oesophagus; trachea, Trachea; thoracic aorta, Pars thoracica aortae; viewed from the right.

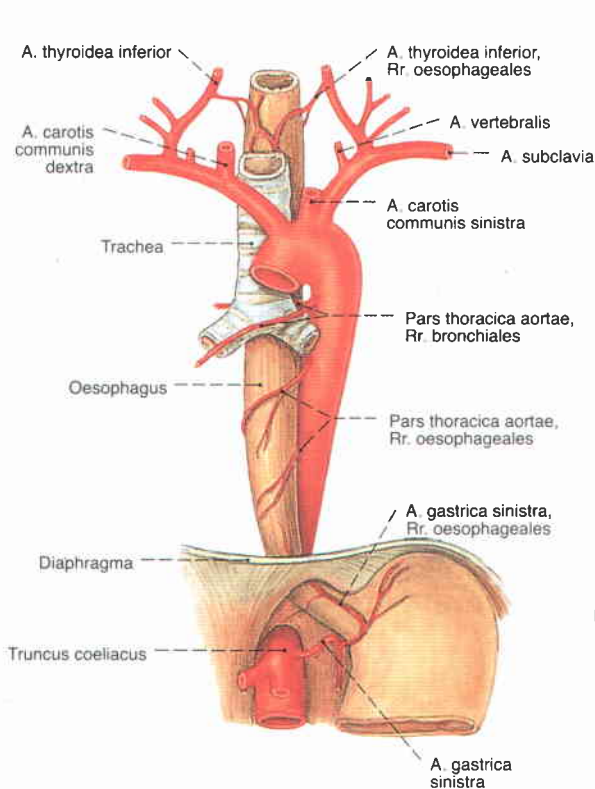




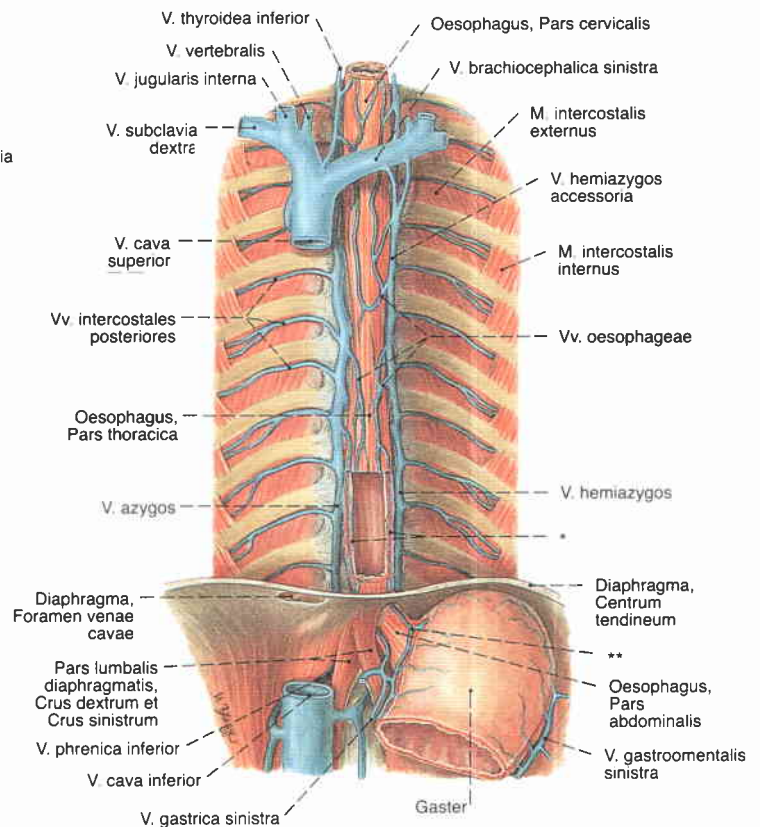
**Fig. 900** Oesophagus; thoracic aorta, Pars thoracica aortae; pericardium, Pericardium; dorsal view.



**Fig. 901** Oesophagus, Oesophagus; cross section showing the layers of the oesophageal wall (ca. 400%).



**Fig. 902** Oesophagus, Oesophagus; arterial supply; ventral view.



**Fig. 903** Veins of the oesophagus, Vv. oesophageae; parts of the diaphragm and stomach have been removed to show the oesophageal veins; the anterior wall of the lower thoracic oesophagus has been excised.

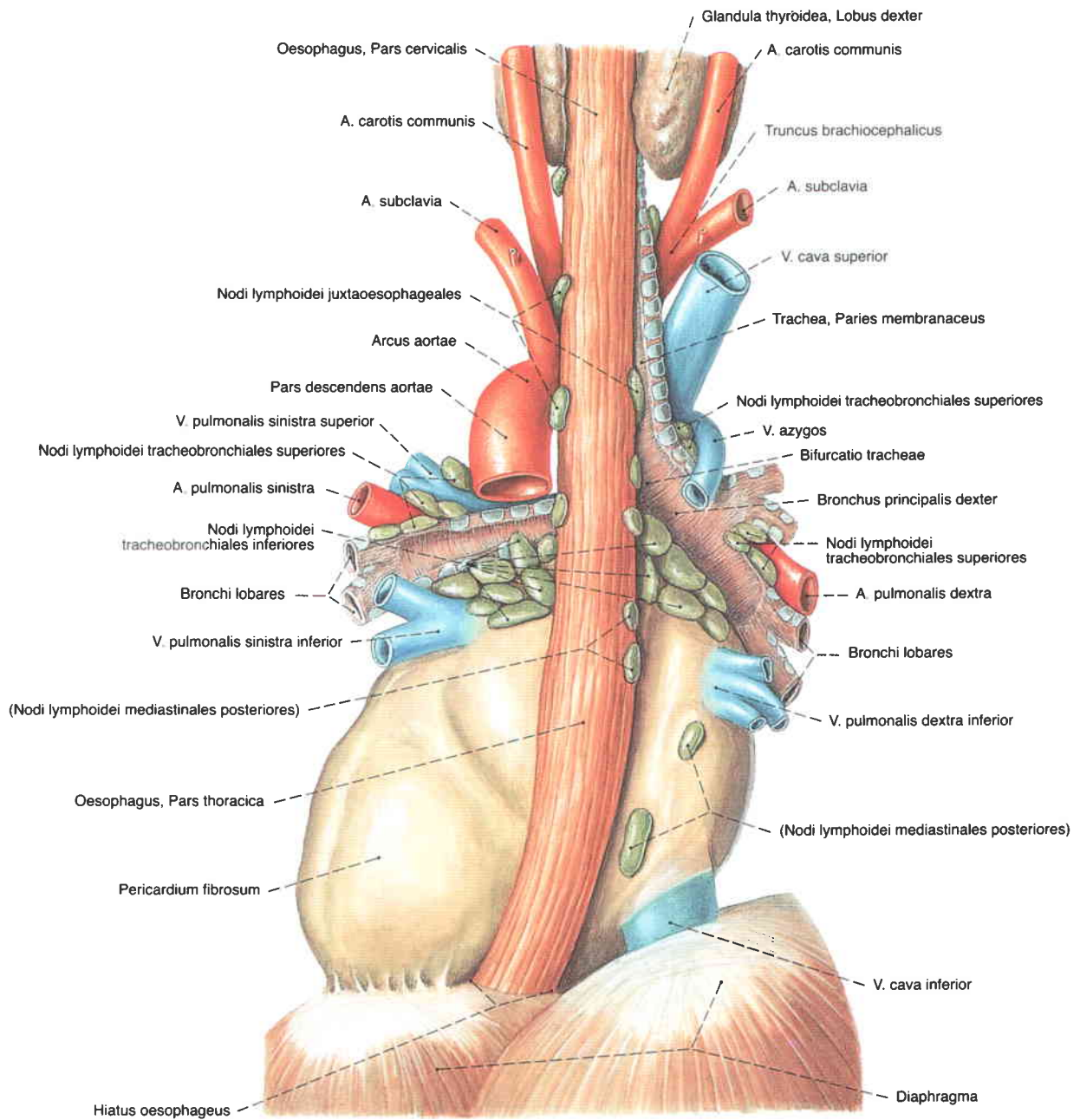
\* Veins in the mucous membrane of the oesophagus

\*\* Branch connecting the veins of the stomach and the veins of the oesophagus

## Venous drainage of the oesophagus

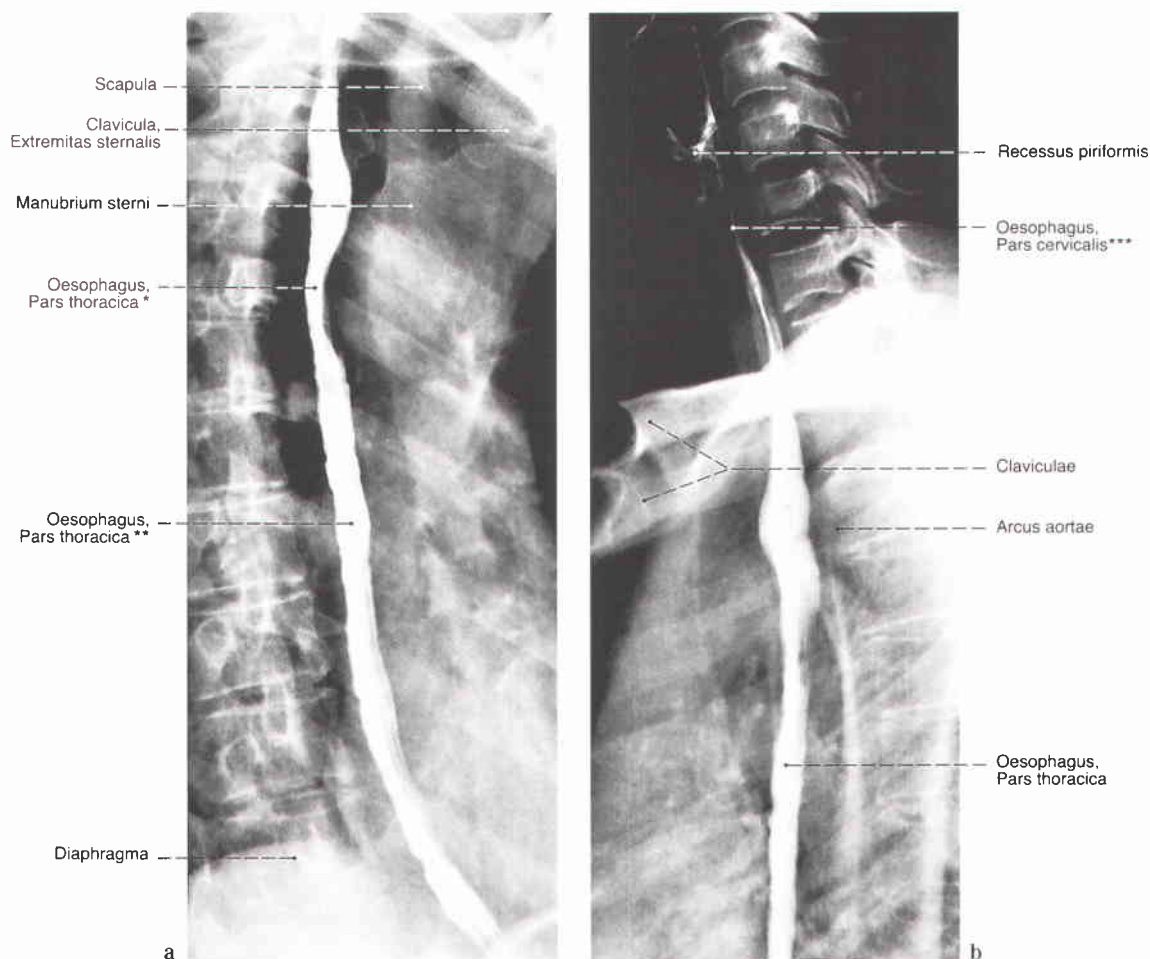
The abdominal oesophageal veins provide communication between the tributary veins of the portal venous system and the V. cava superior (portocaval anastomosis). In portal hypertension they are of considerable clinical significance as they allow blood drainage via the veins of the stomach (\*\*) and the veins of the

lower thoracic oesophagus. However, this causes not only expansion of the Vv. oesophageae in the adventitia but dilation of the veins of the mucosa (\*) as well (oesophageal varices). Rupture of the so-called oesophageal varices can lead to massive bleeding in the oesophagus. Portocaval anastomoses – see Fig. 1029.



**Fig. 904** Thoracic lymph nodes, *Nodi lymphoidei thoracis*; the bronchi have been removed beyond the branching of the lobar bronchi while the great vessels of the mediastinum remain. The lymph nodes in the healthy adult are usually smaller than shown here.





Figs. 905 a, b Oesophagus, Oesophagus;  
radiograph (after swallowing contrast medium).

a) Right anterior oblique (RAO) position, oblique diameter I  
(beam directed from left anterior to right posterior)

b) Left anterior oblique (LAO) position, oblique diameter II  
(beam directed from right anterior to left posterior)

- \* Oesophageal narrowing caused by the aortic arch
- \*\* Retrocardiac portion
- \*\*\* Oesophageal narrowing at the beginning of the oesophagus

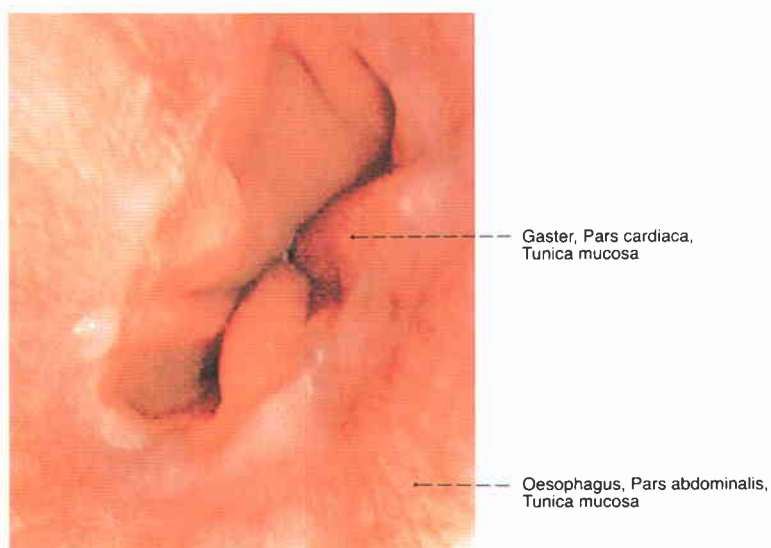


Fig. 906 Oesophagus, Oesophagus;  
the mucous membrane is viewed through an  
endoscope (oesophagoscopy);  
superior view.

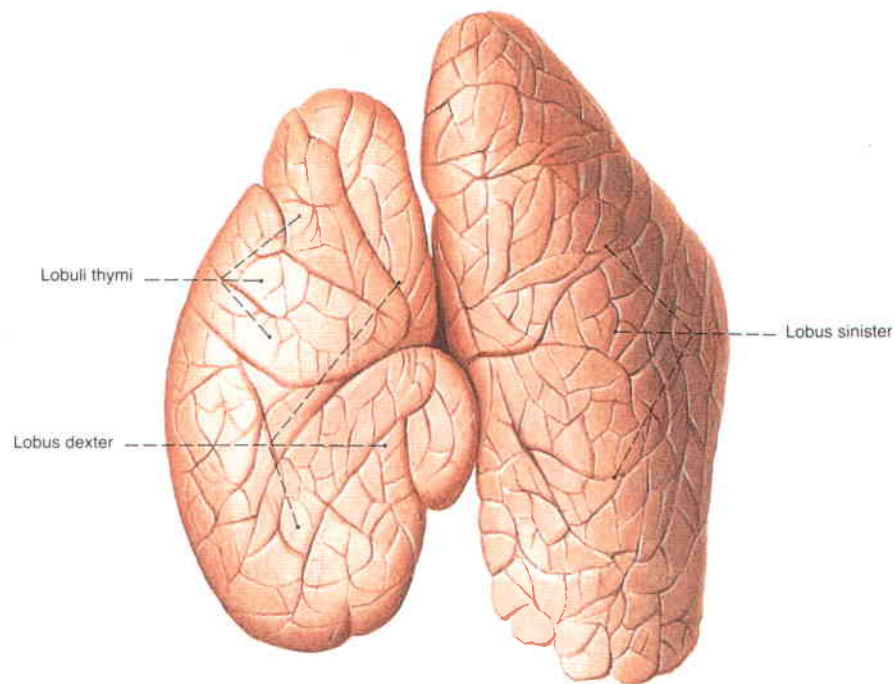


Fig. 907 Thymus, Thymus, of a 2-year-old child; ventral view.

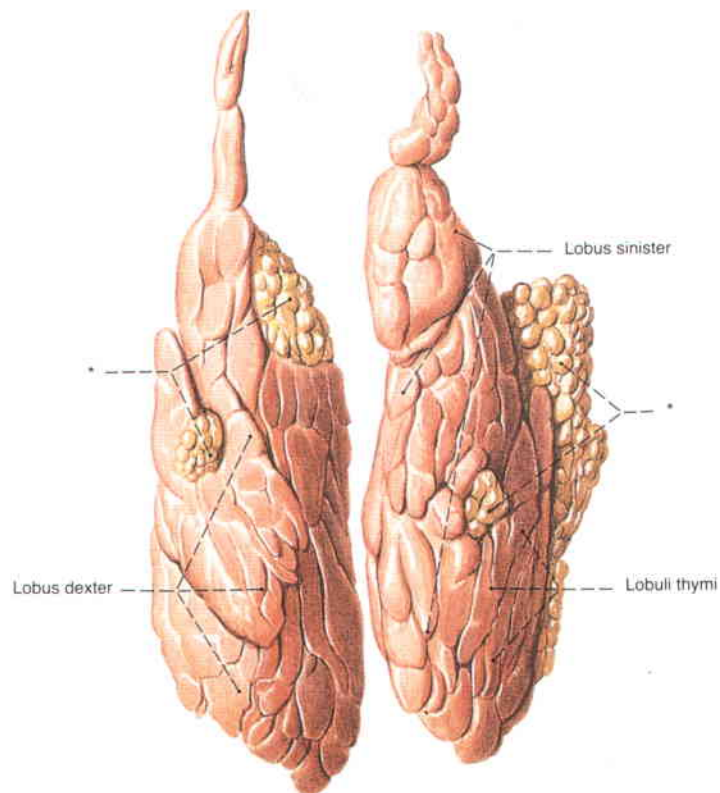
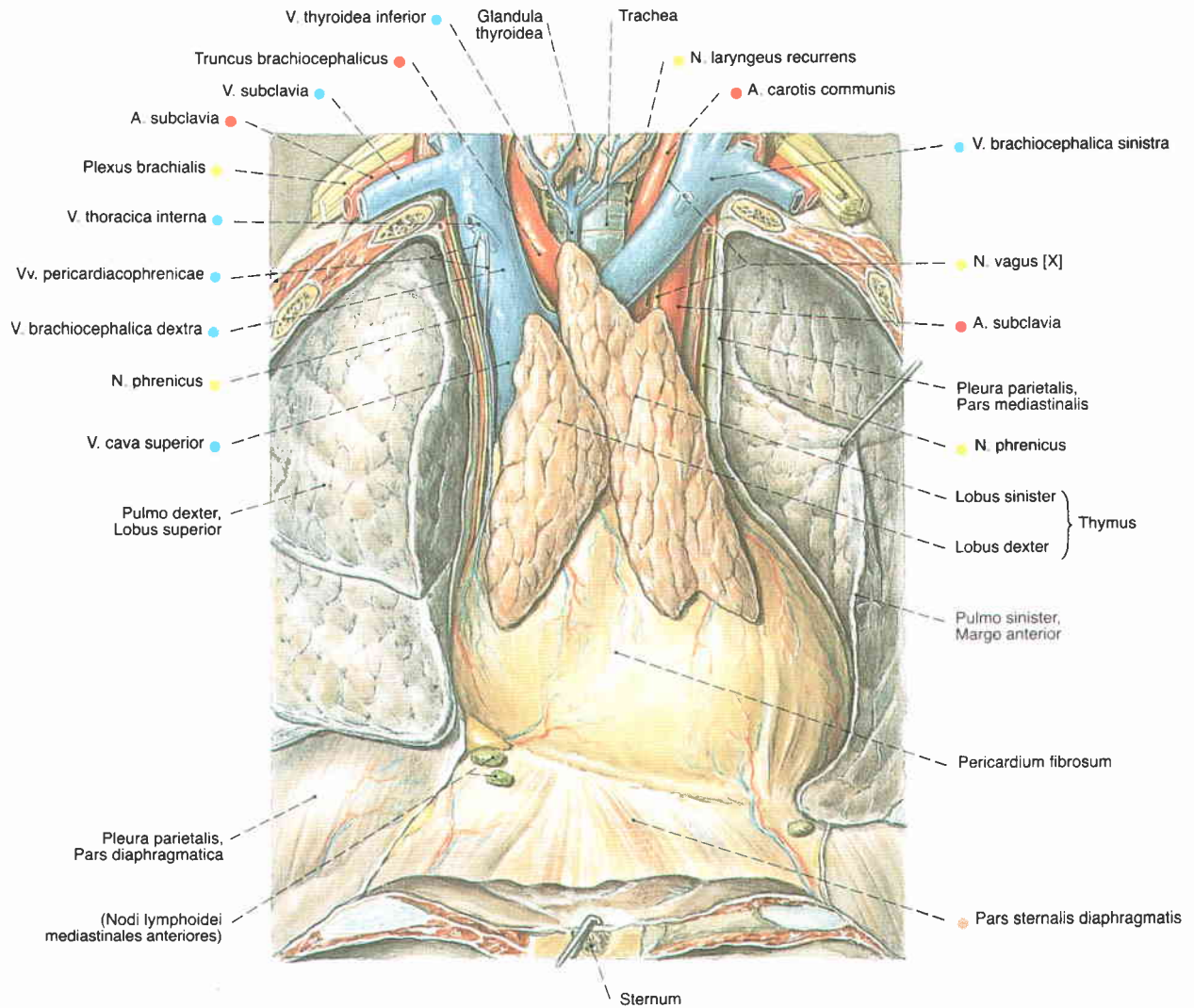


Fig. 908 Thymus, Thymus, of a 24-year-old. The surrounding fat has been extensively removed; ventral view.

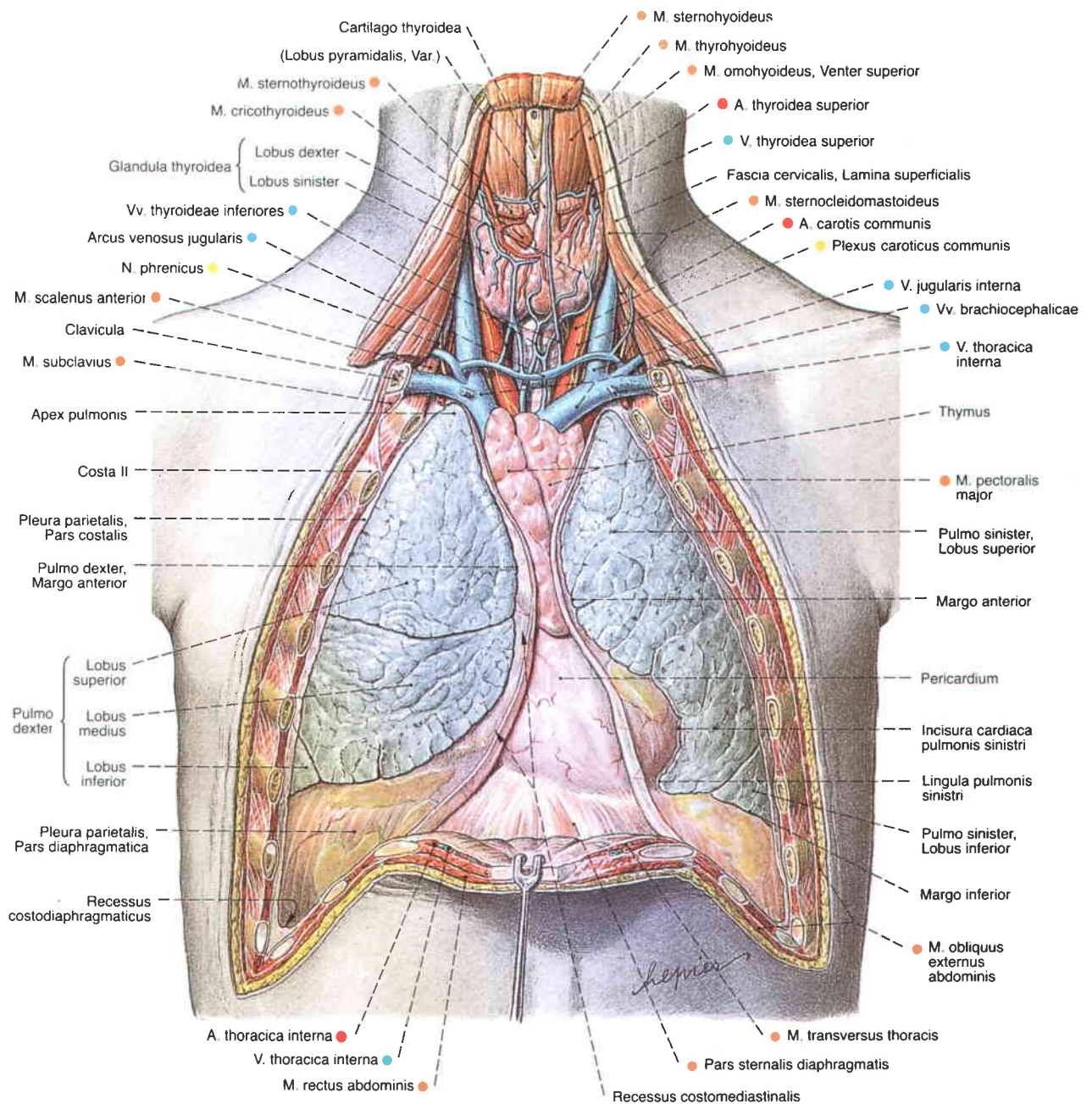
\* Parathyroid adipose tissue.  
The shape and size of the thymus in this specimen are unusually well preserved.



**Fig. 909** Thymus, Thymus, of an adolescent; the anterior thoracic wall has been removed, the pleural cavity opened and the left lung retracted laterally; ventral view.

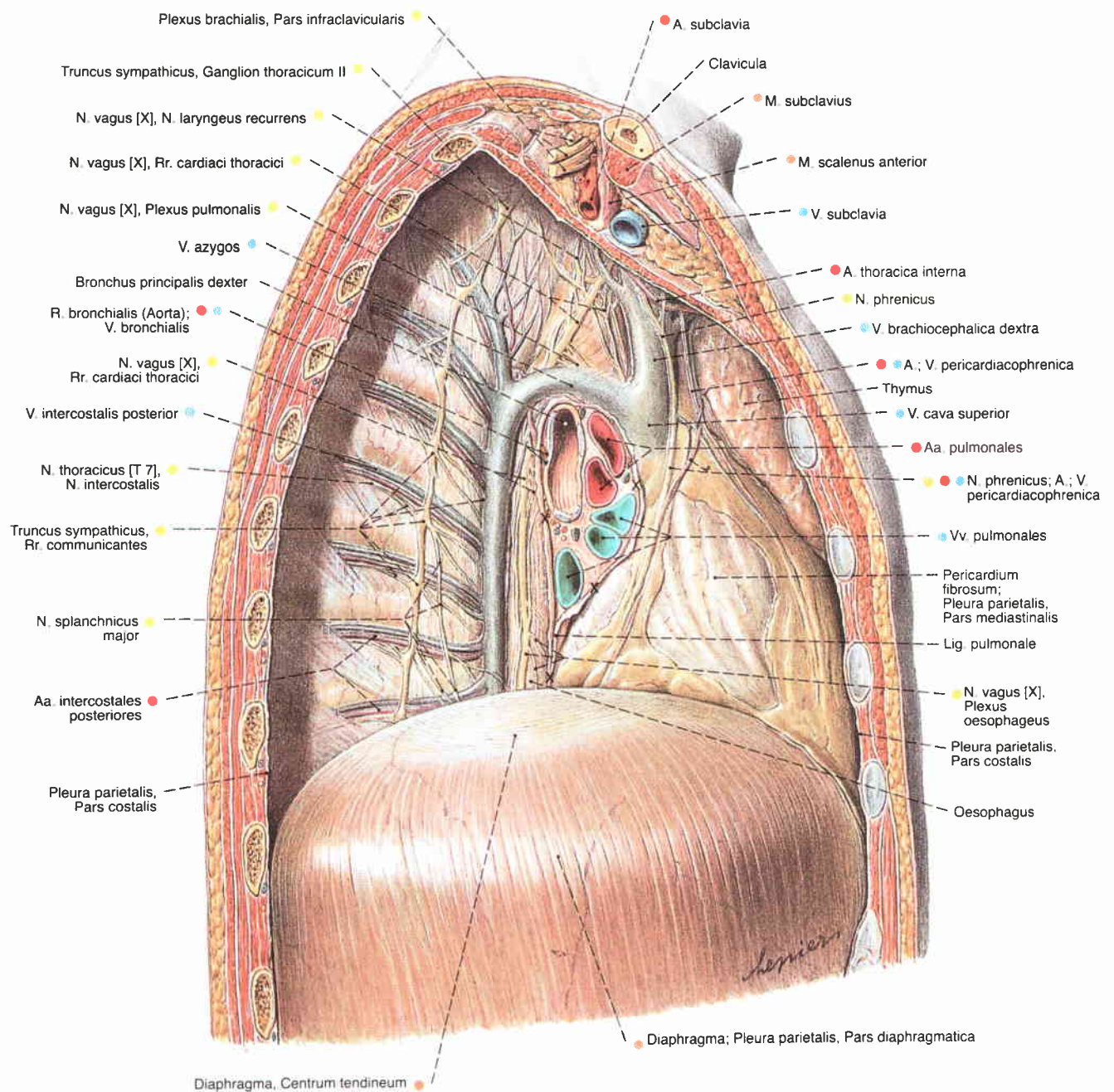
Compare the size of the thymus of a newborn (Fig. 999) to that of a 2-year-old child (Fig. 907).





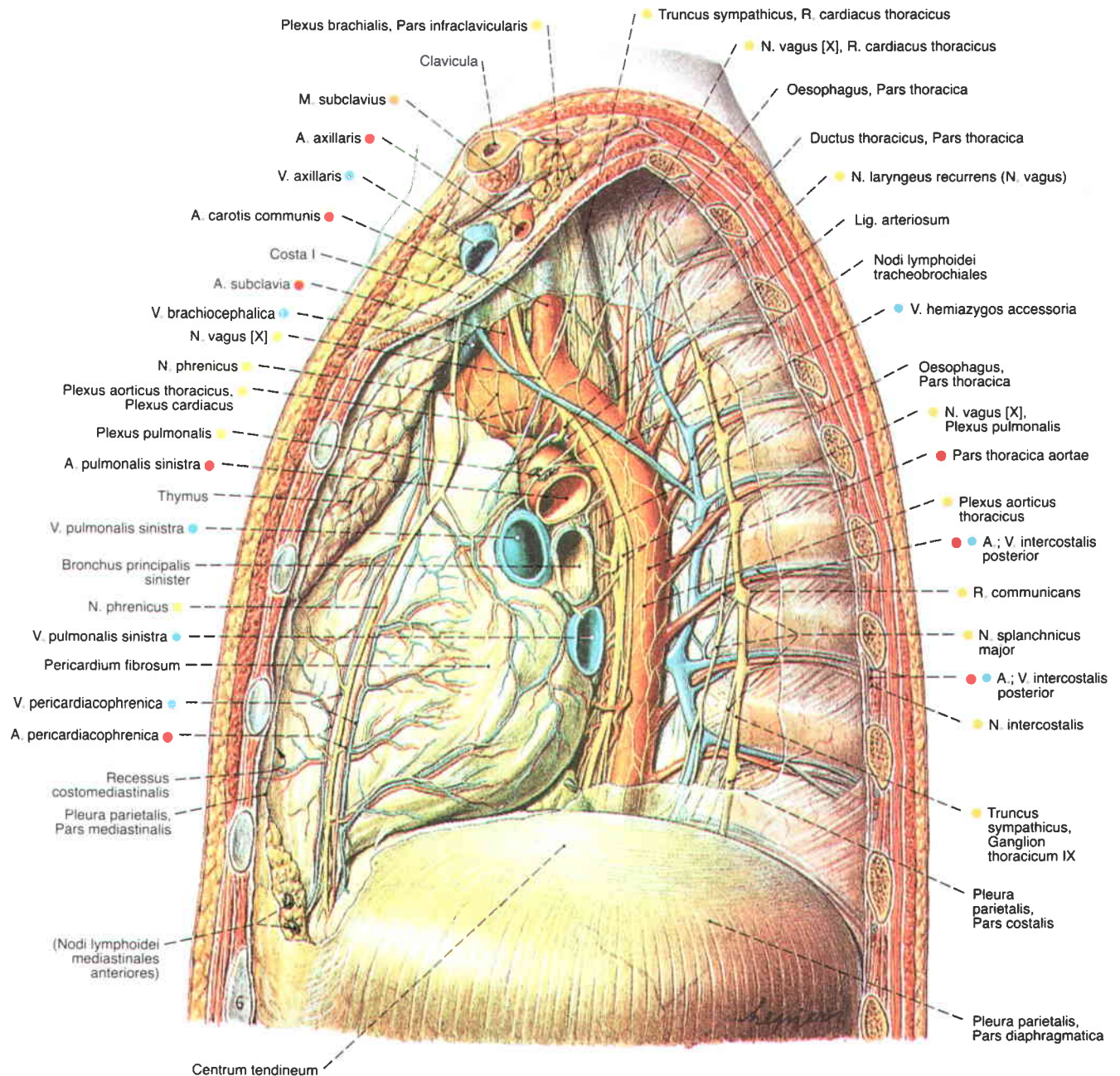
**Fig. 910** Thymus, Thymus; pericardium, Pericardium; lungs, Pulmones; the anterior thoracic wall has been removed, the pleural cavity opened; ventral view.

Note the size of the thymus in the young adult. In older individuals the thymic tissue is almost completely replaced by adipose tissue.



**Fig. 911** Pleural cavity, Cavitas pleuralis; mediastinum, Mediastinum;  
the right lateral thoracic wall and right lung have been removed; parts of the mediastinal and costal pleura have been dissected to expose the vessels and nerves; viewed from the right.  
The xxx indicate the reflection of the visceral pleura into the parietal pleura at the root of the lung and the pulmonary ligament.





**Fig. 912** Pleural cavity, Cavitas pleuralis; mediastinum, Mediastinum; the left lateral thoracic wall and left lung have been removed; parts of the mediastinal and costal pleura have been dissected to expose the vessels and nerves; viewed from the left.



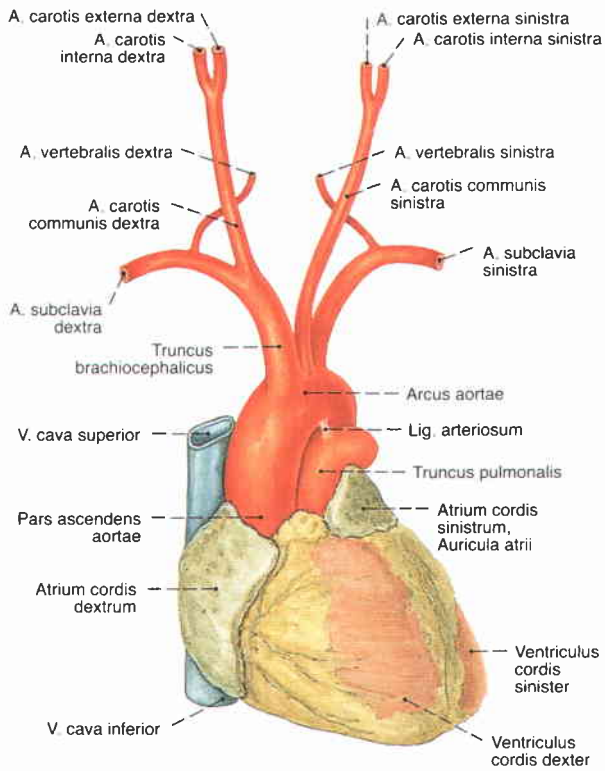
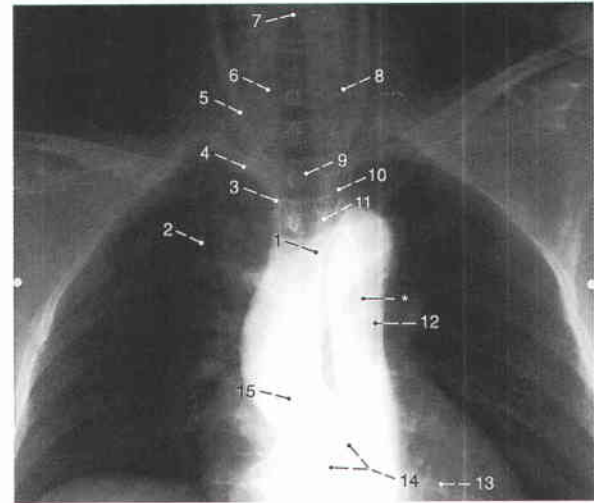


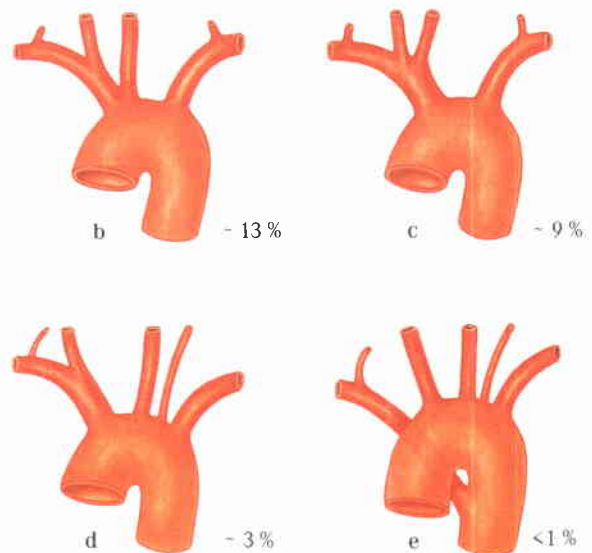
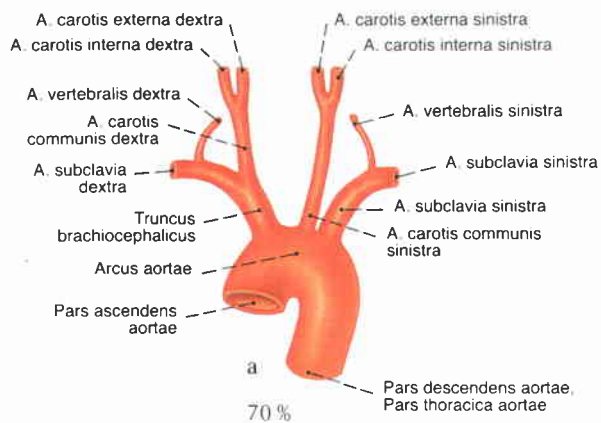
Fig. 913 Heart, Cor; aortic arch, Arcus aortae, with origins of the large arteries; ventral view.



- |                              |                                 |
|------------------------------|---------------------------------|
| 1 Arcus aortae               | 9 Trachea                       |
| 2 A. thoracica interna       | 10 A. subclavia sinistra        |
| 3 Truncus brachiocephalicus  | 11 A. carotis communis sinistra |
| 4 A. subclavia dextra        | 12 Pars descendens aortae       |
| 5 A. carotis communis dextra | 13 Cor                          |
| 6 A. vertebralis dextra      | 14 Valva aortae                 |
| 7 Rima glottidis             | 15 Pars ascendens aortae        |
| 8 A. vertebralis sinistra    |                                 |

Fig. 914 Aortic arch, Arcus aortae, with its branches; AP-radiograph (after injection of contrast medium into the aortic bulb); ventral view.

\* Catheter



Figs. 915 a–e Variations in the origins of the main arterial branches from the aortic arch.

- a "textbook case" or "normal case"
- b common origin of the brachiocephalic trunk and the left common carotid artery
- c common stem from the left common carotid artery and the brachiocephalic trunk

- d left vertebral artery as an independent branch of the aortic arch
- e right subclavian artery as the last branch of the aortic arch. In this variation the artery usually passes to the right, behind the oesophagus. This may cause difficulties in swallowing (dysphagia lusoria).

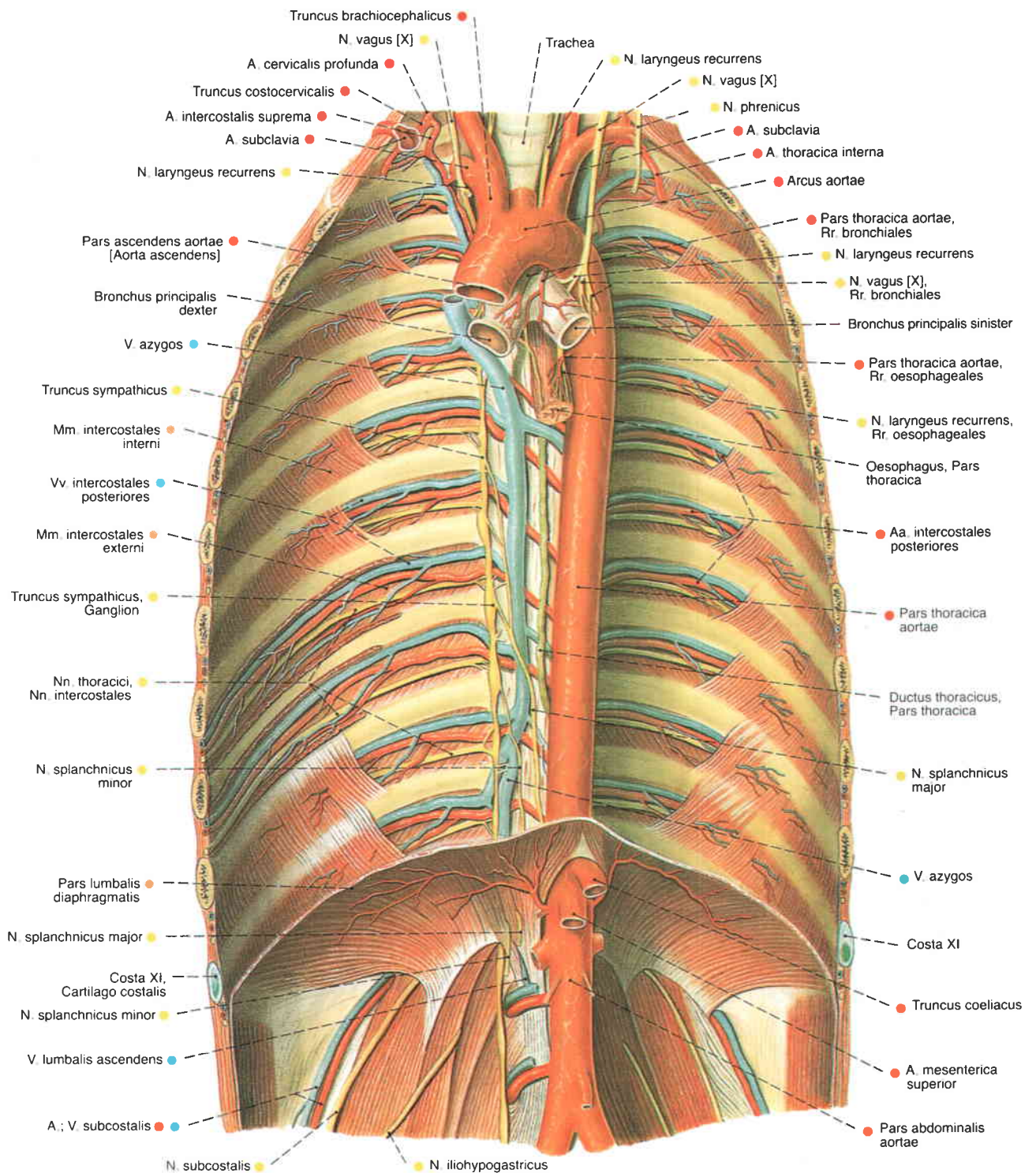
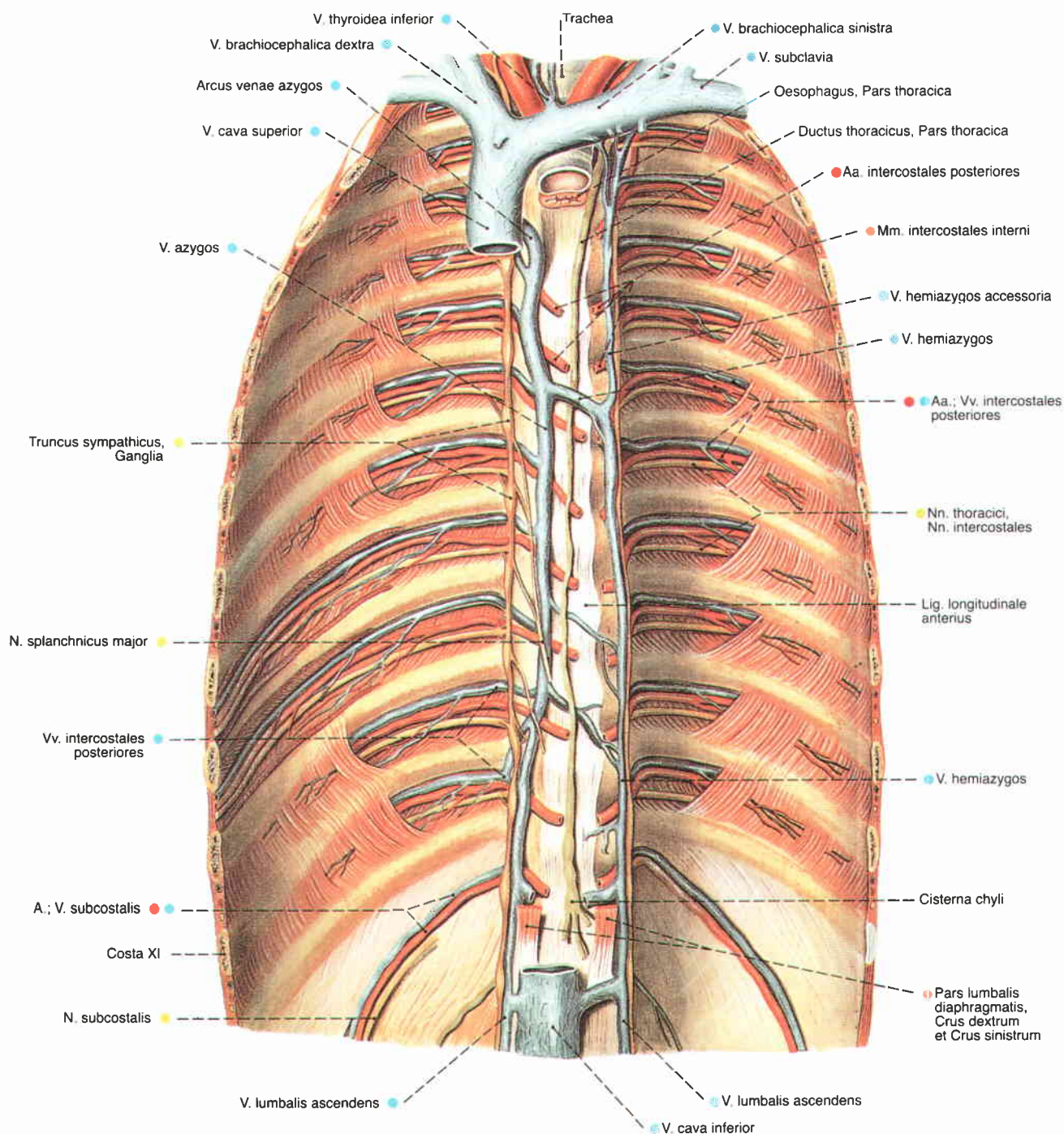


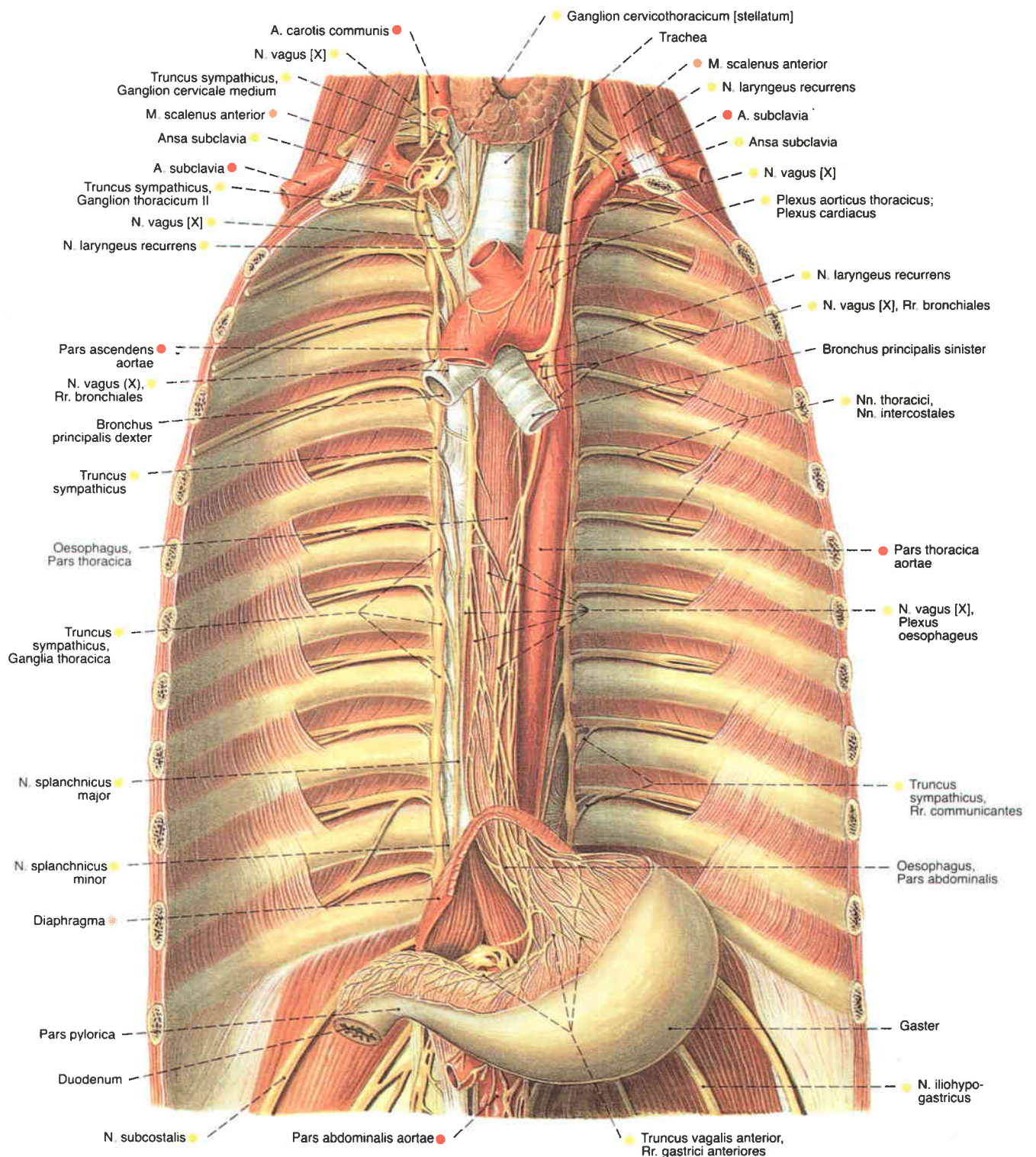
Fig. 916 Thoracic and abdominal aorta, Pars thoracica aortae and Pars abdominalis aortae; posterior mediastinum, Mediastinum posterius; the pleura has been removed to expose the intercostal nerves and the sympathetic trunk; ventral view.





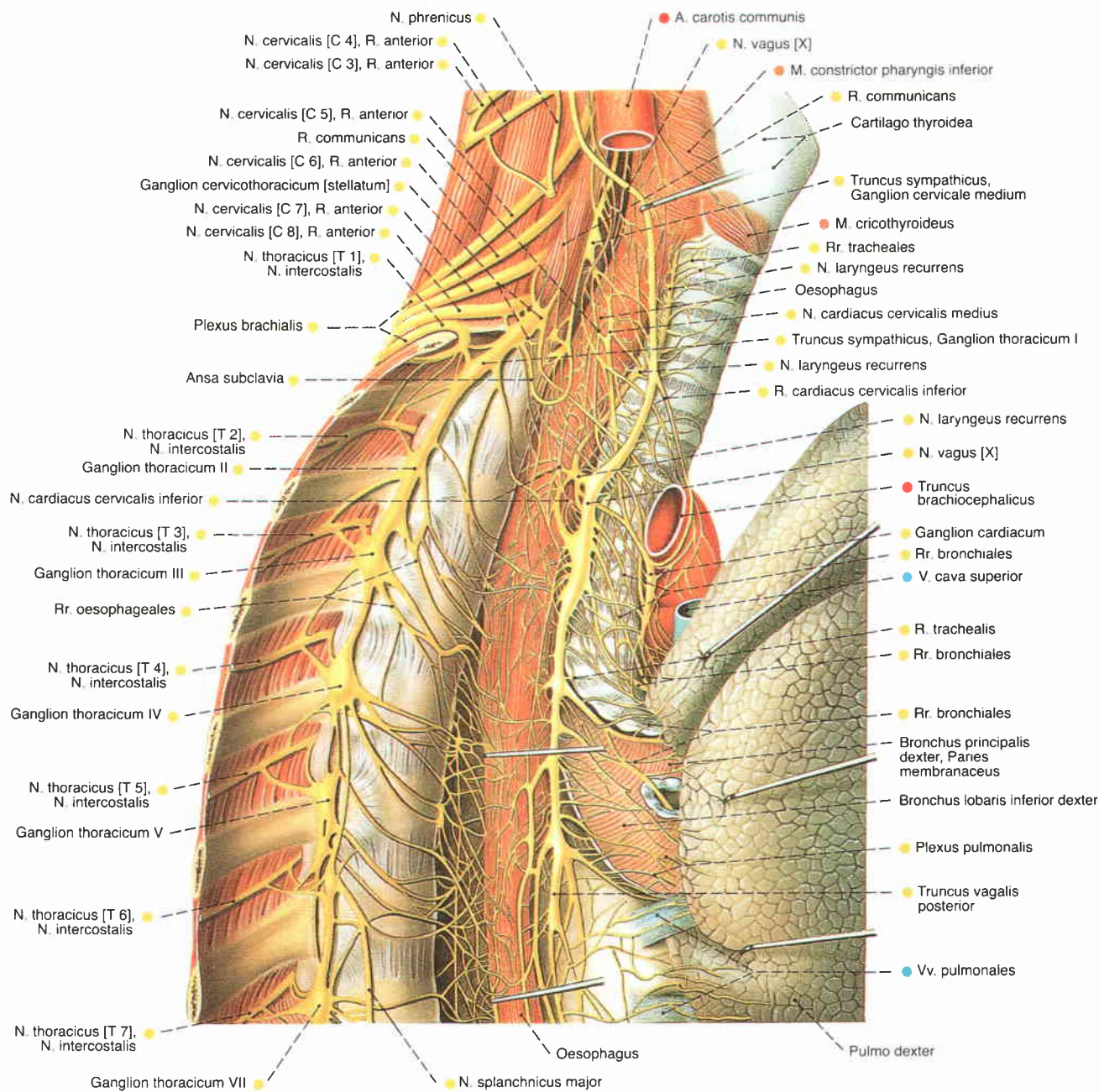
**Fig. 917** Blood vessels and nerves of the posterior mediastinum, *Mediastinum posterius*: the pleura, the aorta and the oesophagus have been removed to expose the thoracic duct, the azygos vein and the blood vessels and nerves in the intercostal spaces; ventral view.





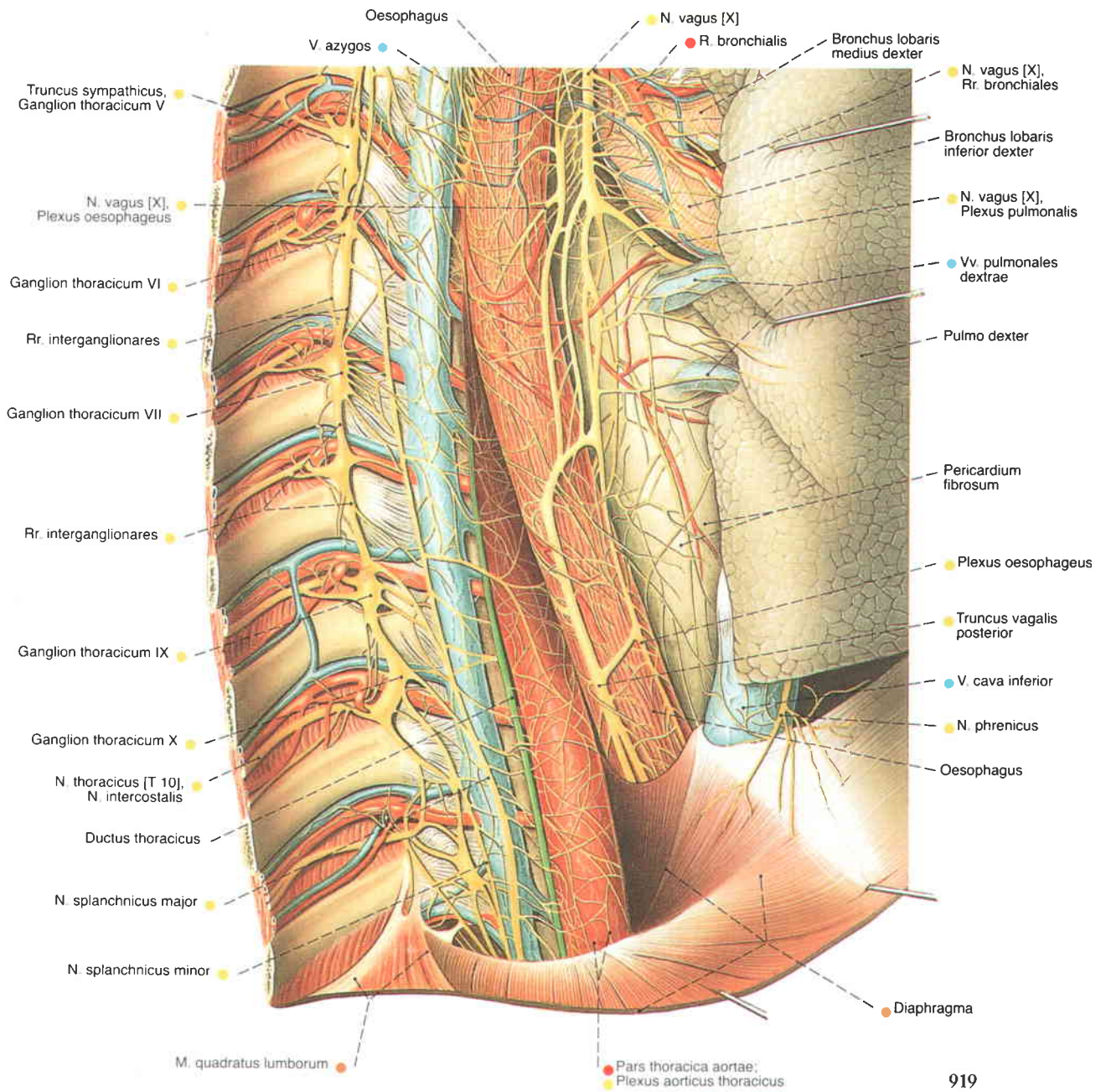
**Fig. 918** Oesophagus, Oesophagus; aorta, Aorta; thoracic autonomic nervous system, Pars thoracica autonomica; stomach, Gaster.

The dorsal portion of the diaphragm has been retained. The pleura has been removed to expose the sympathetic trunk and its connections with the intercostal nerves. Ventral view.



**Fig. 919** Lower cervical and upper thoracic parts of the autonomic nervous system, *Pars thoracica autonómica*; the vagus nerve and the right lung have been retracted to expose the oesophagus; viewed from the right.



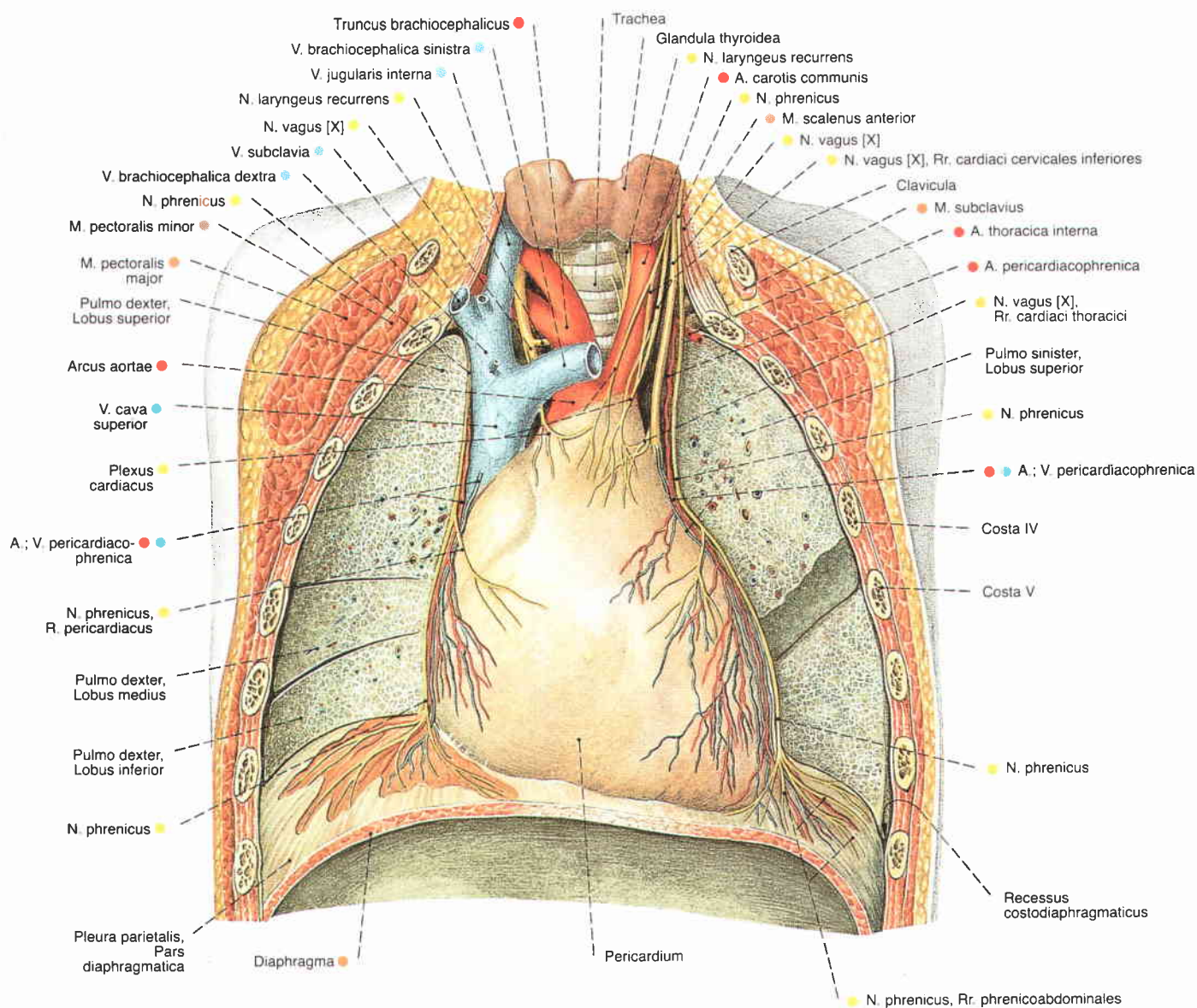


919



**Fig. 920** Lower thoracic part of the autonomic nervous system, Pars thoracica autonmica; the dissection is similar to Fig. 919, but the aorta, the thoracic duct and the azygos vein have been retained anteriorly; viewed from the right.





**Fig. 921** Thoracic cavity, Cavitas thoracis, in an adult. The anterior thoracic wall has been removed; the right and left lung have been sectioned in the frontal plane; the mediastinal and diaphragmatic pleura have been removed to expose the pericardiophrenic artery, A. pericardiophrenica, and the branches of the phrenic nerve; ventral view.

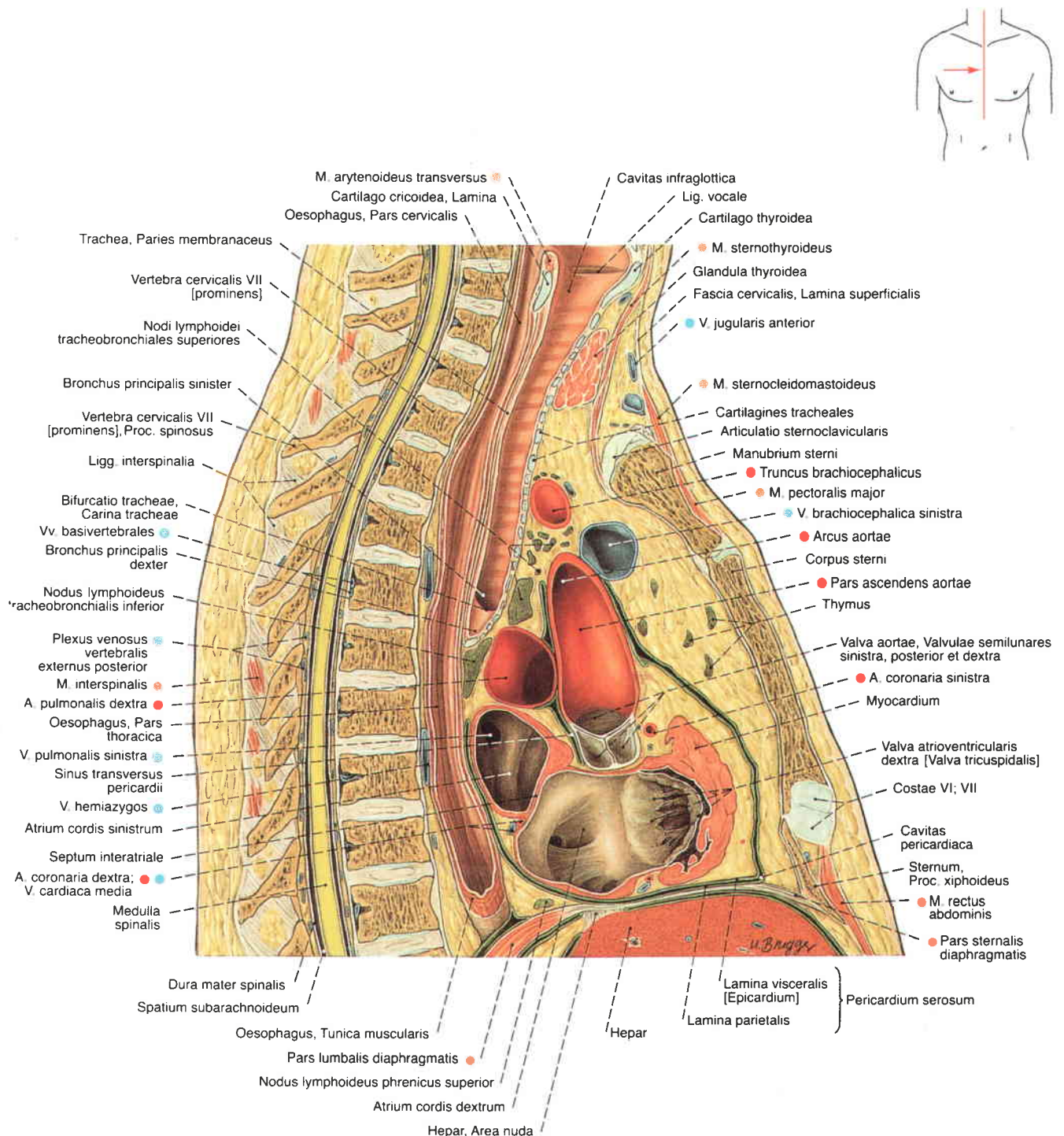
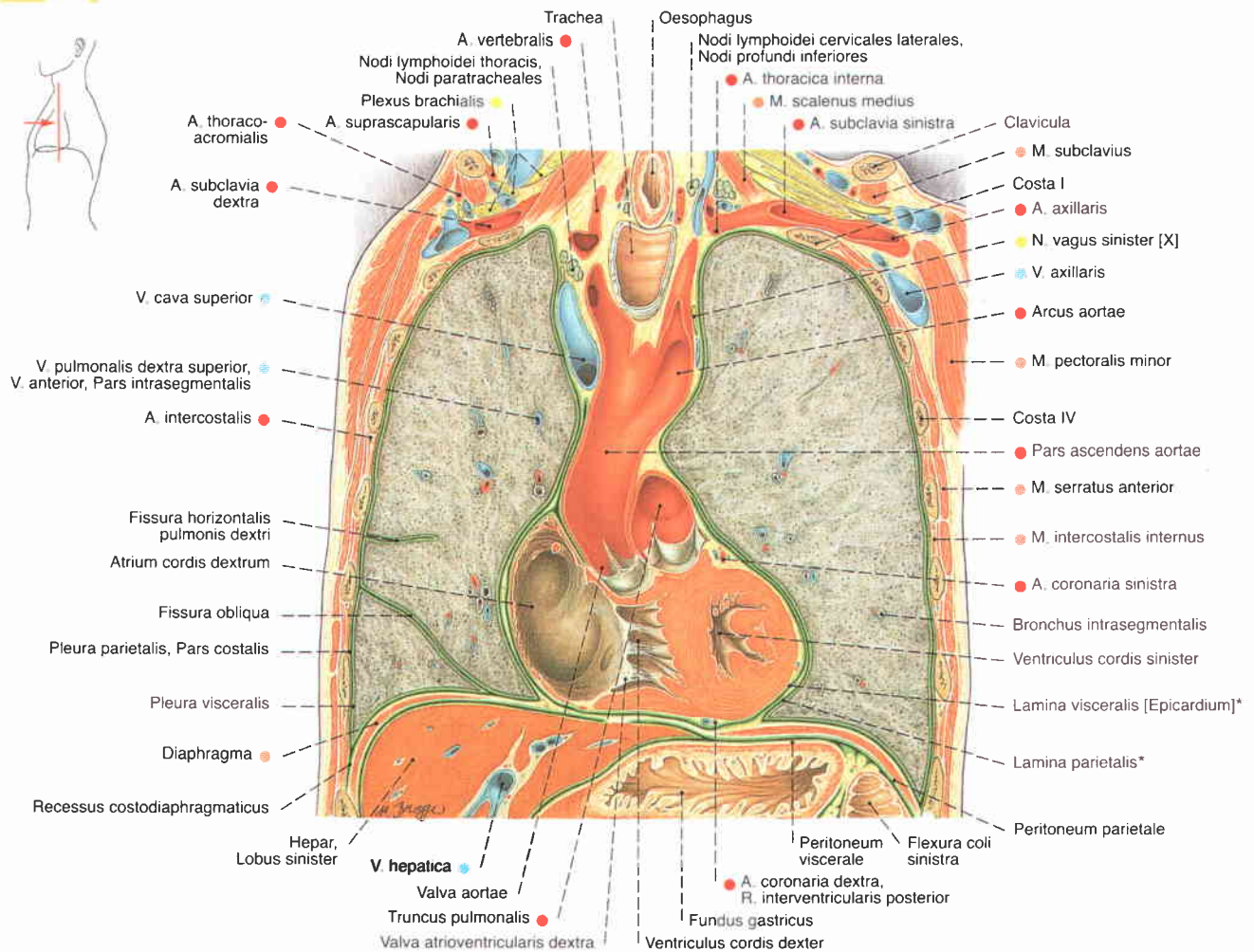


Fig. 922 Thoracic cavity, Cavitas thoracis; mediastinum, Mediastinum; median sagittal section through the neck and thorax; because of the slight asymmetry of this thorax, the sternoclavicular joint has been sectioned above the Manubrium sterni; right lateral view.

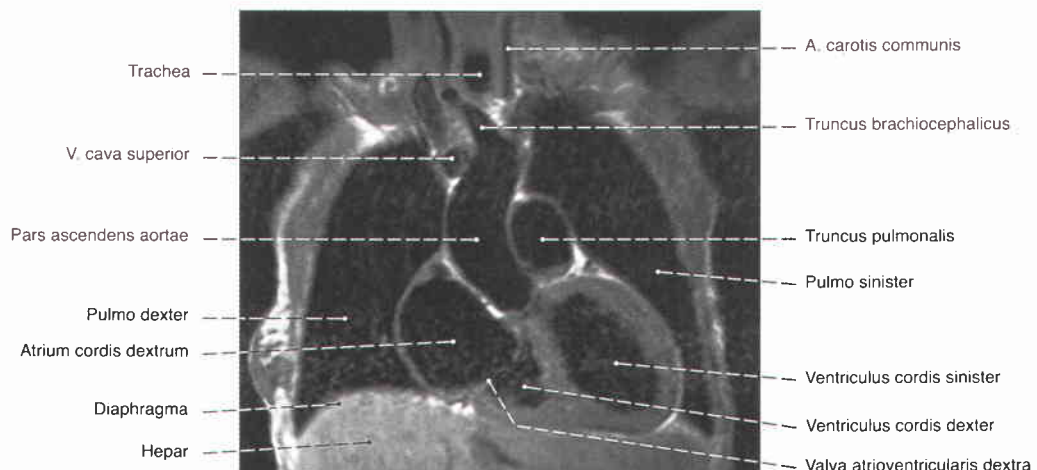
Due to the close topographical relationship between the left atrium and the oesophagus, an enlargement of the left atrium can be assessed by a displacement of the oesophagus in a radiograph. The heart can be examined with ultrasound from the oesophagus (transoesophageal sonography).





**Fig. 923** Thoracic cavity, Cavitas thoracis; frontal section; ventral view.

\* Pericardium serosum



**Fig. 924** Thoracic cavity, Cavitas thoracis; magnetic resonance tomography (MRT); frontal section at the level of the superior vena cava; ventral view. Compare to Fig. 913.



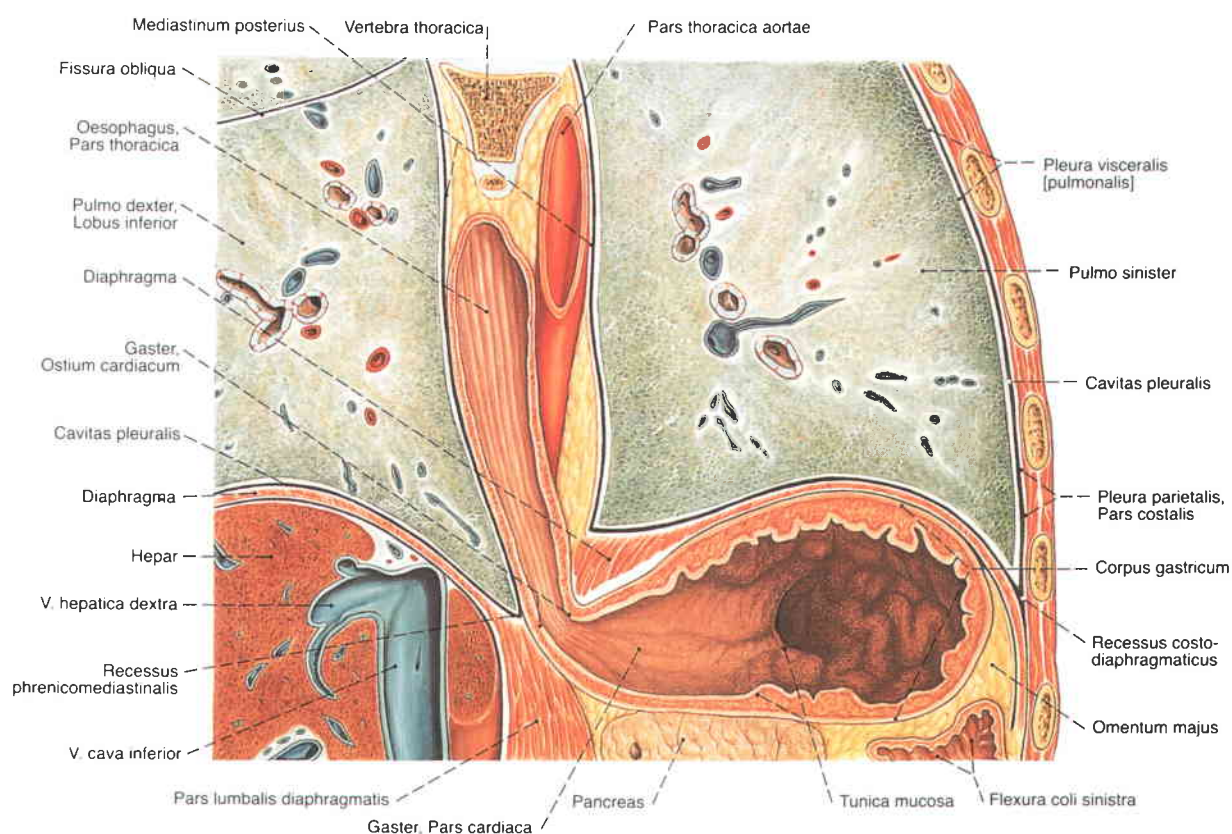


Fig. 925 Diaphragm, Diaphragma; oesophagus, Oesophagus; with transition into the stomach, Gaster;

frontal section through the lower part of the thoracic cavity and the upper part of the abdominal cavity; ventral view.

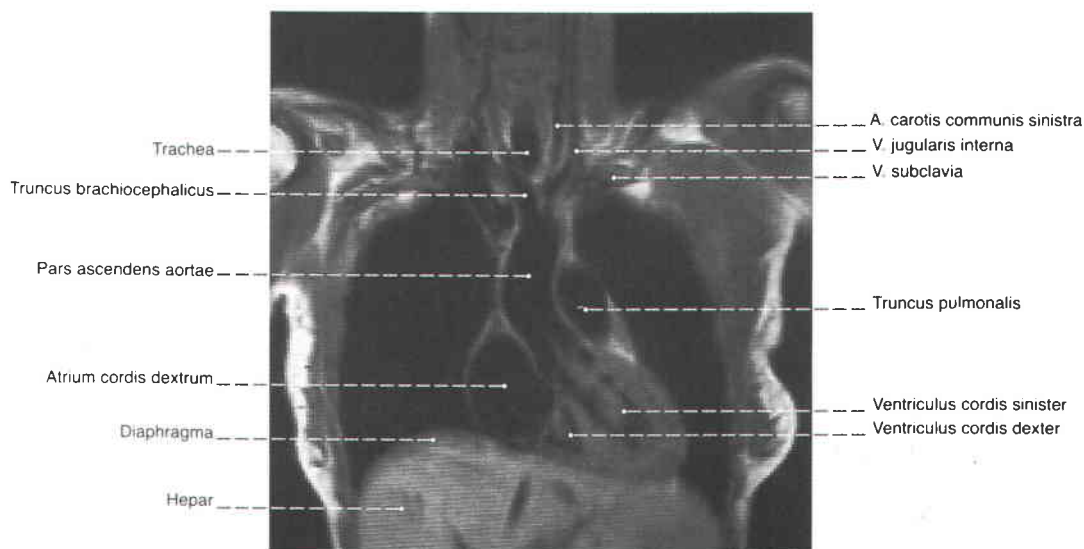


Fig. 926 Thoracic cavity, Cavitas thoracis; magnetic resonance tomography (MRT); frontal section at the level of the aortic valve; ventral view. Compare to Figs. 913 and 923.

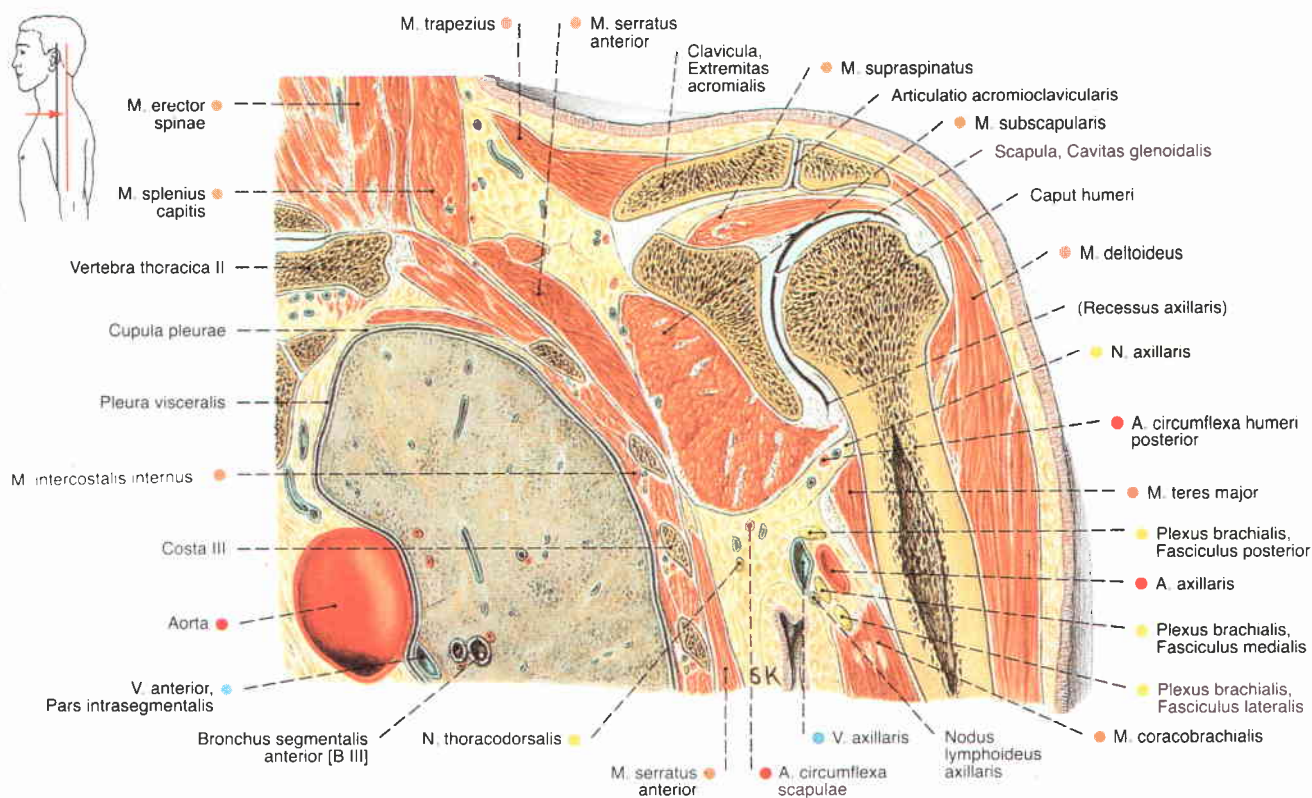


Fig. 927 Neck, Collum; left axillary region, Axilla; thoracic cavity, Cavitas thoracis; frontal section; ventral view.

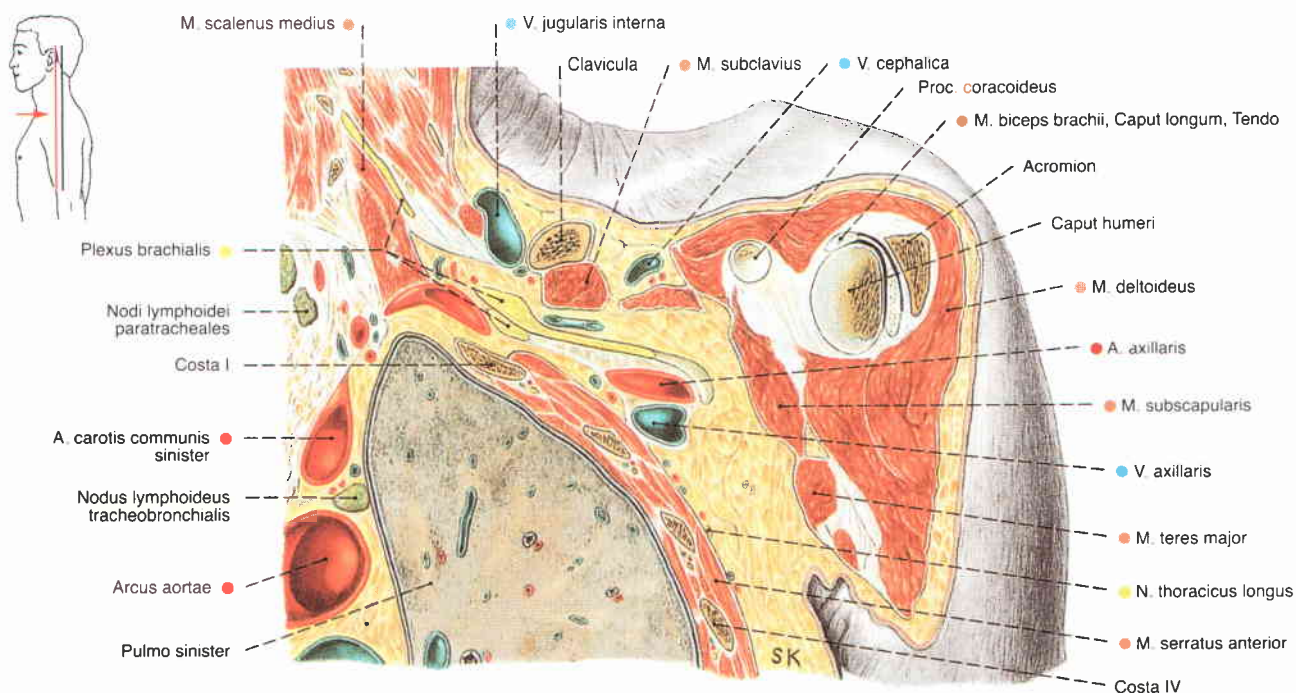
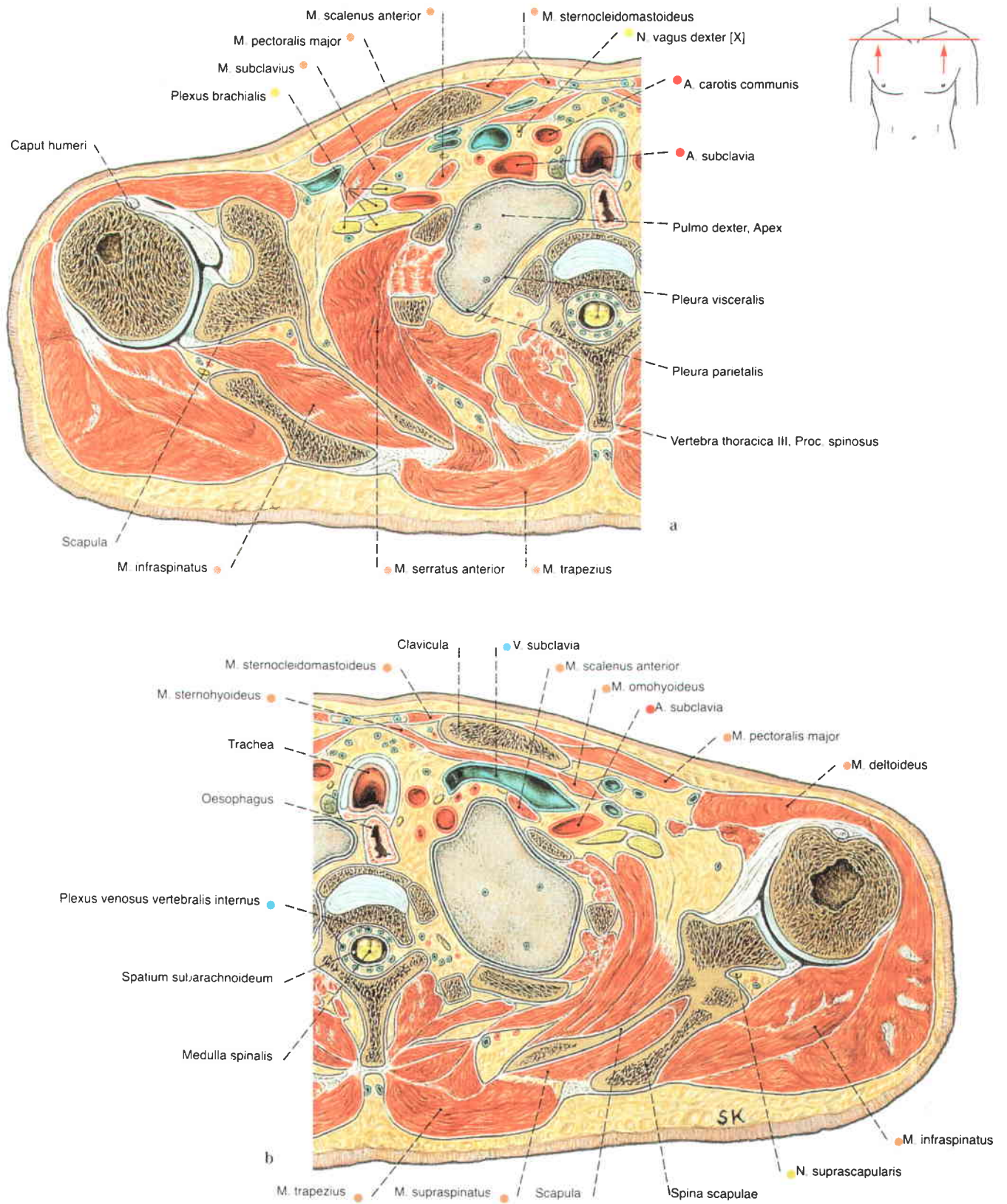


Fig. 928 Neck, Collum; left axillary region, Axilla; thoracic cavity, Cavitas thoracis; frontal section; ventral view.







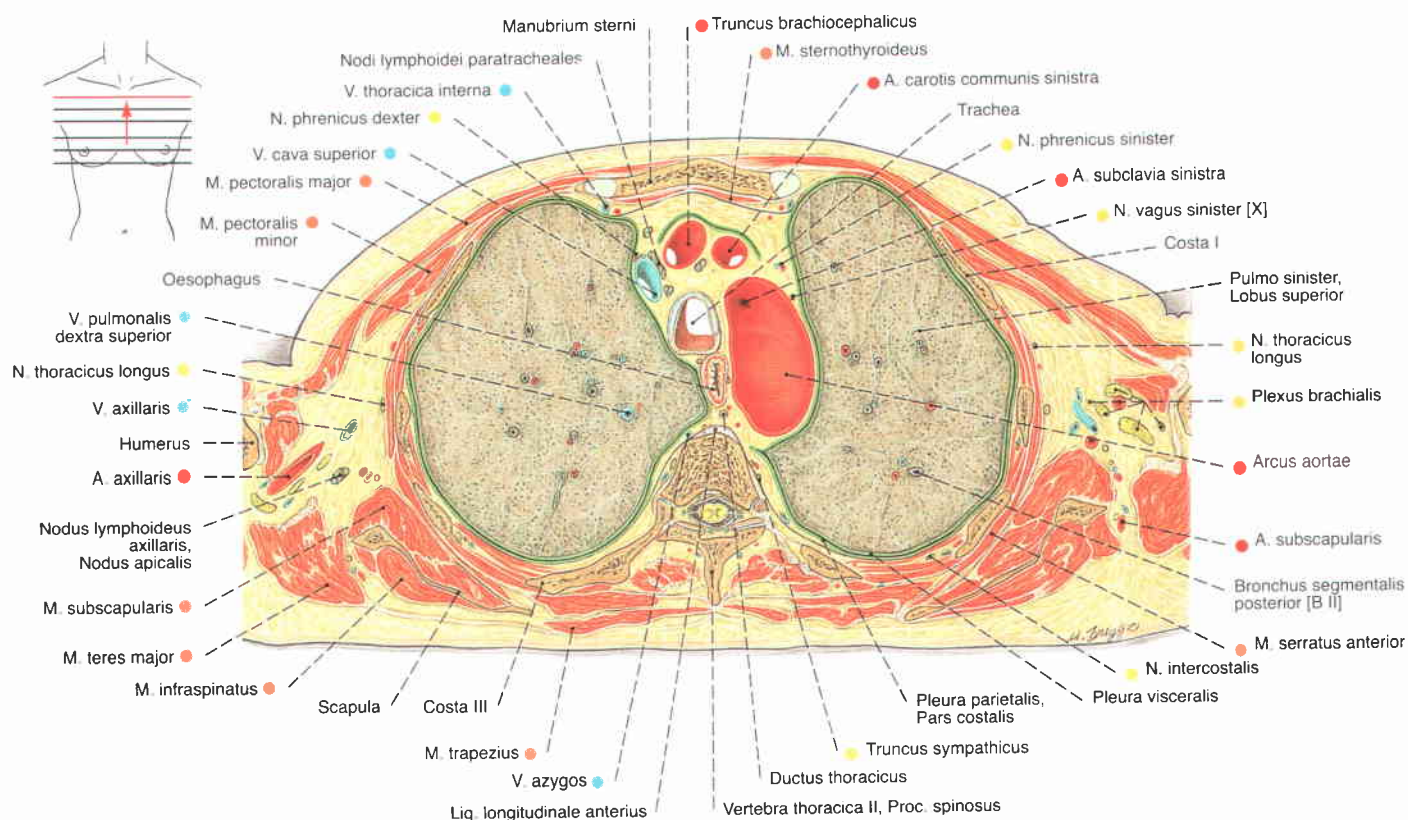


Fig. 930 Thoracic cavity, Cavitas thoracis;  
transverse section at the level of the aortic arch;  
inferior view.

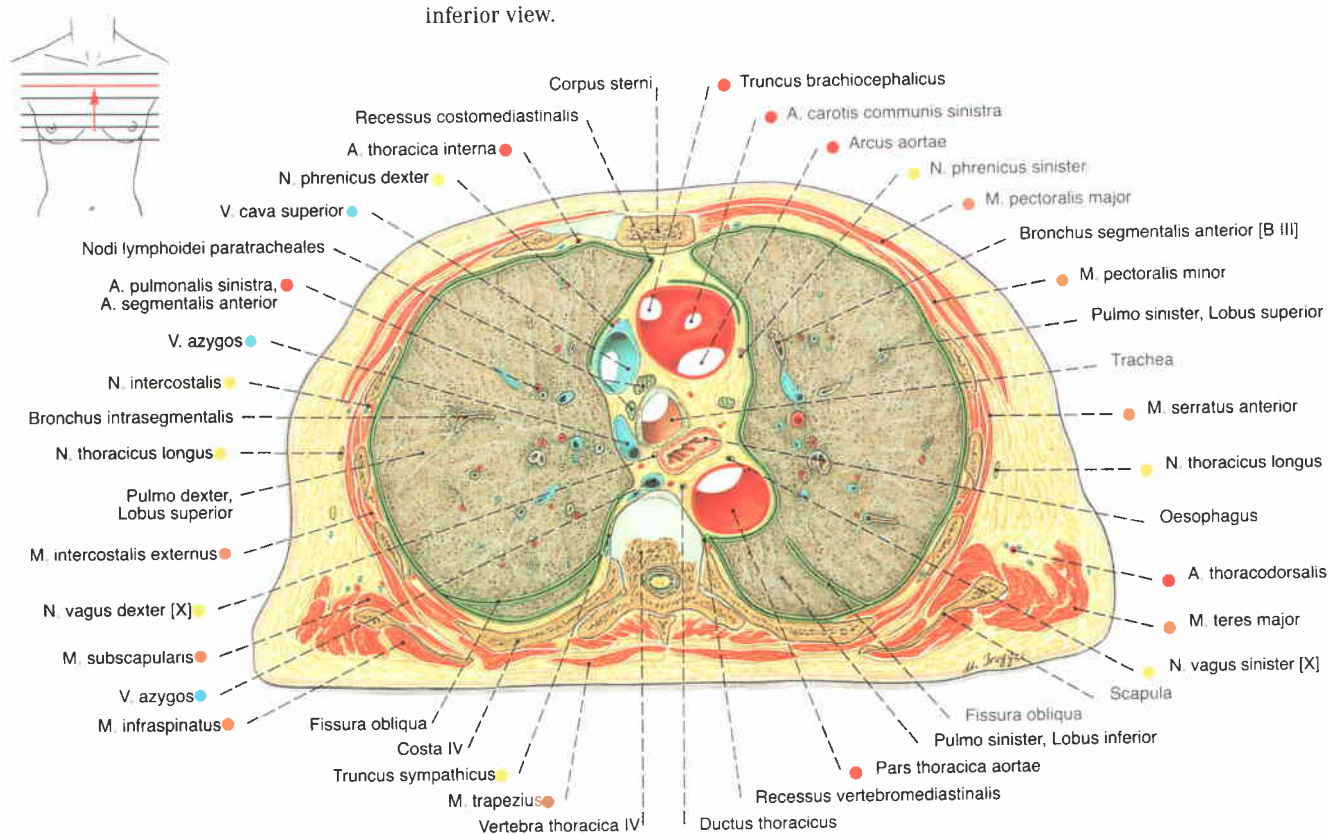


Fig. 931 Thoracic cavity, Cavitas thoracis;  
transverse section at the level of the 4th thoracic vertebra;  
inferior view.

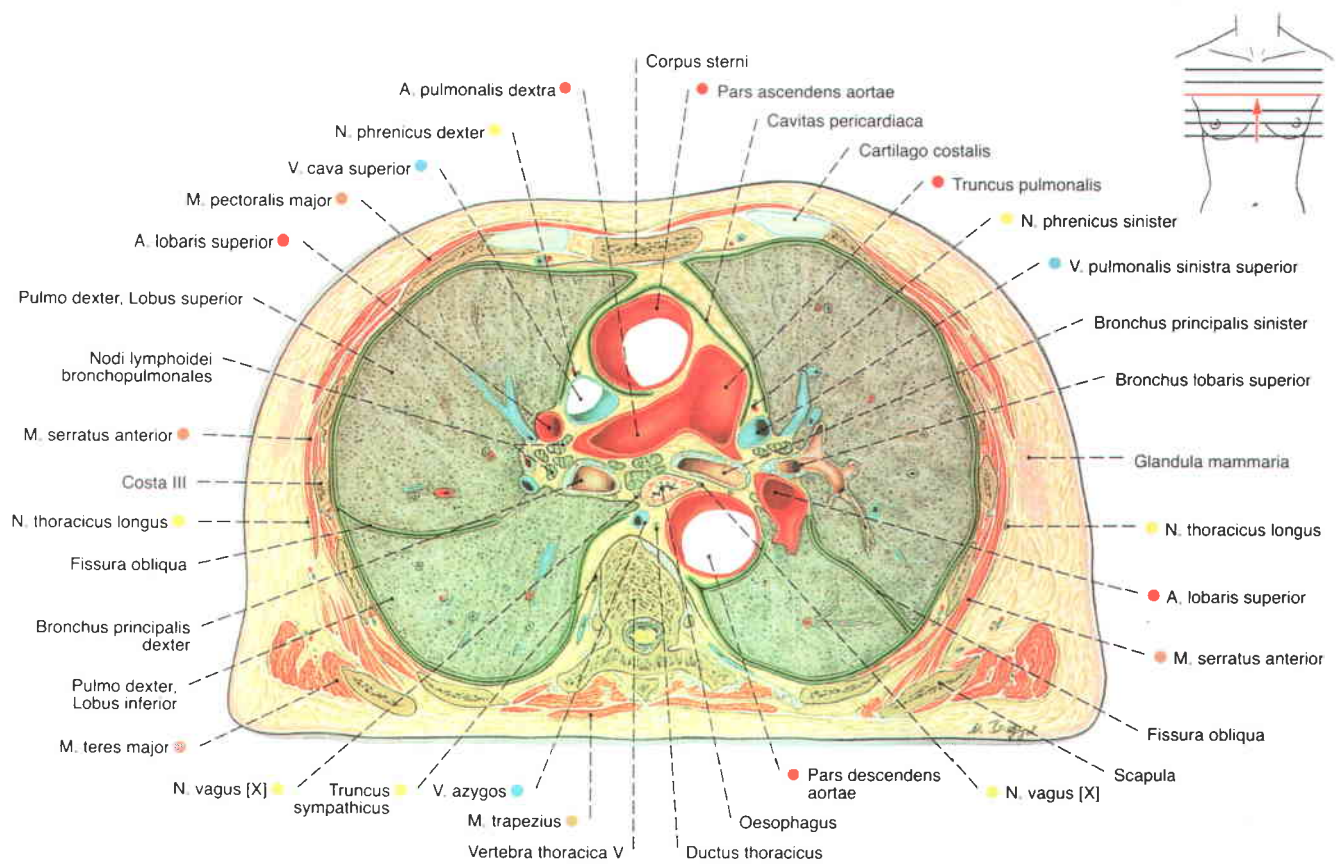


Fig. 932 Thoracic cavity, Cavitas thoracis; transverse section at the level of the bifurcation of the Truncus pulmonalis; inferior view.

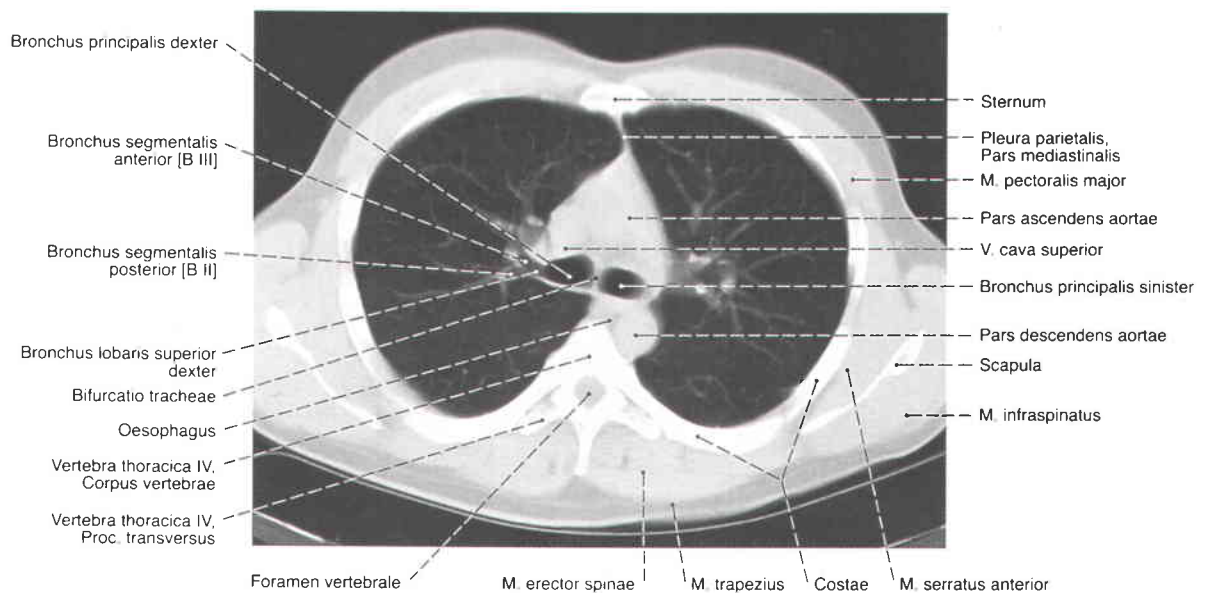


Fig. 933 Thoracic cavity, Cavitas thoracis; computed tomography (CT) at the level of the bifurcation of the trachea. Depending on the electronic

processing of the CT, either the lungs or the skeletal system can be emphasized; inferior view.



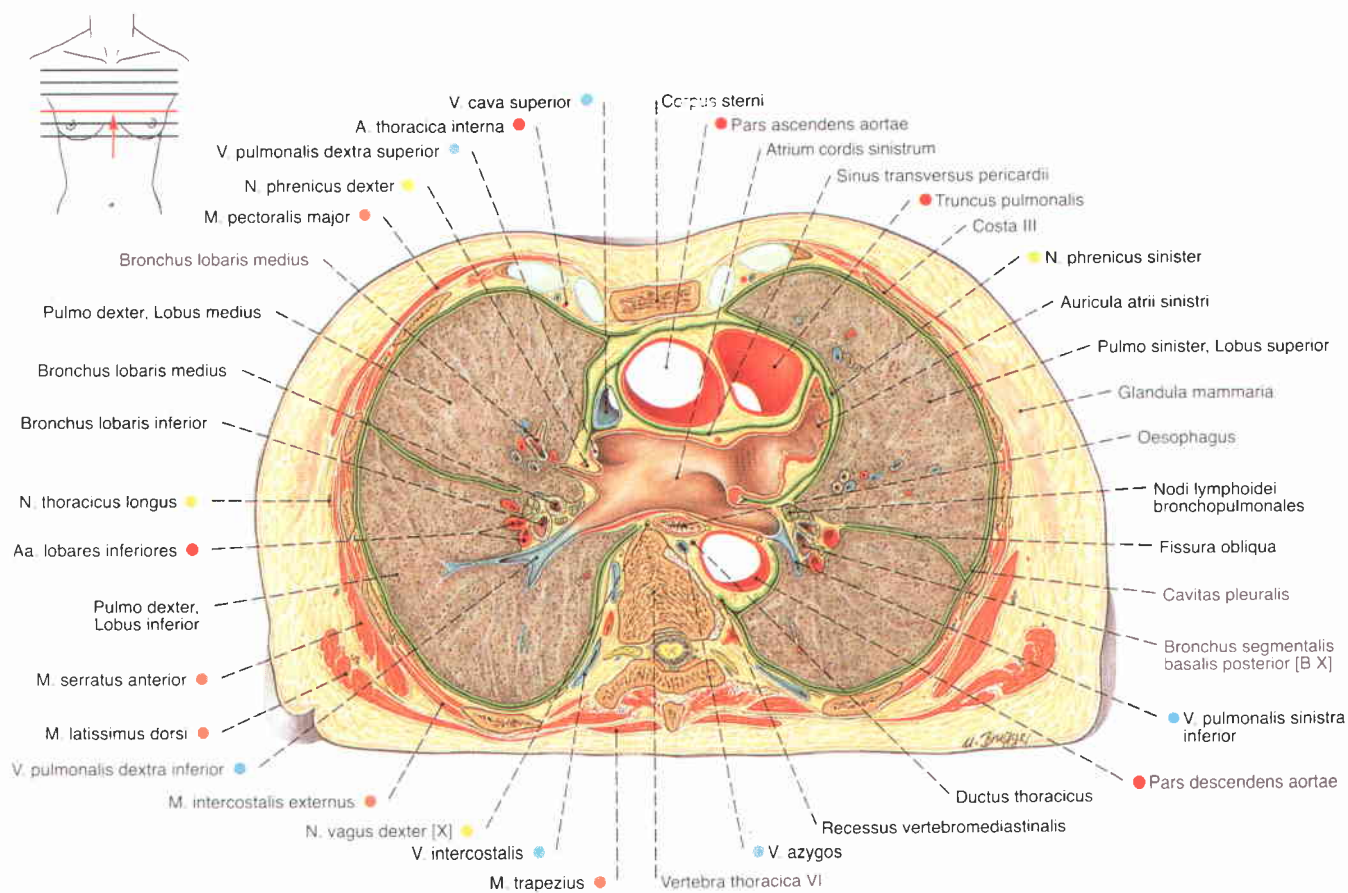


Fig. 934 Thoracic cavity, Cavitas thoracis; transverse section at the level of the left atrium; inferior view.

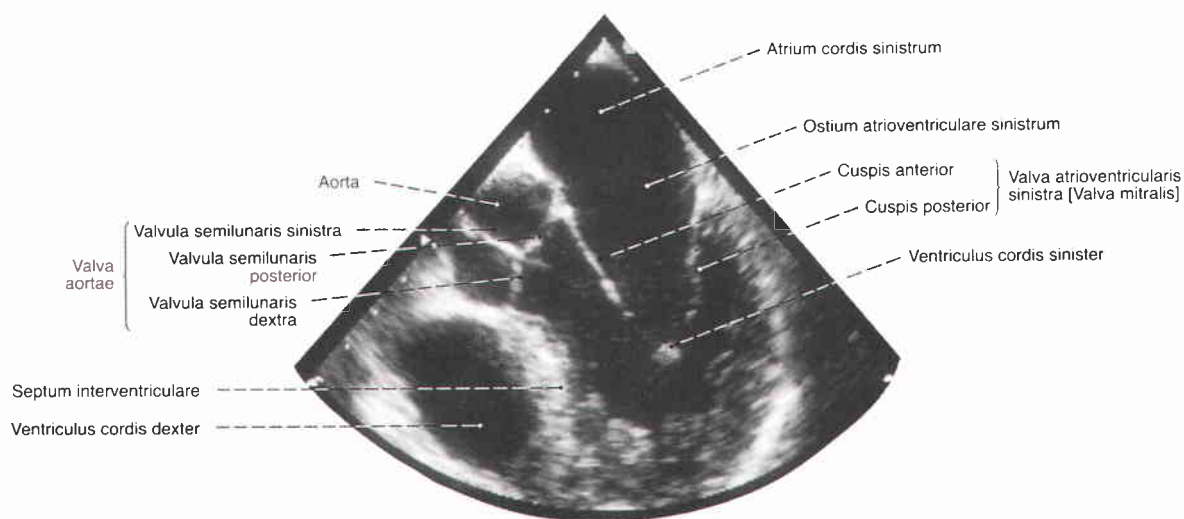


Fig. 935 Heart, Cor; sonographic image; the transducer has been introduced into the oesophagus by an endoscope; using this technique the left

heart and its valves can be depicted. The position of the transducer is at the apex of the triangle; left superior view.



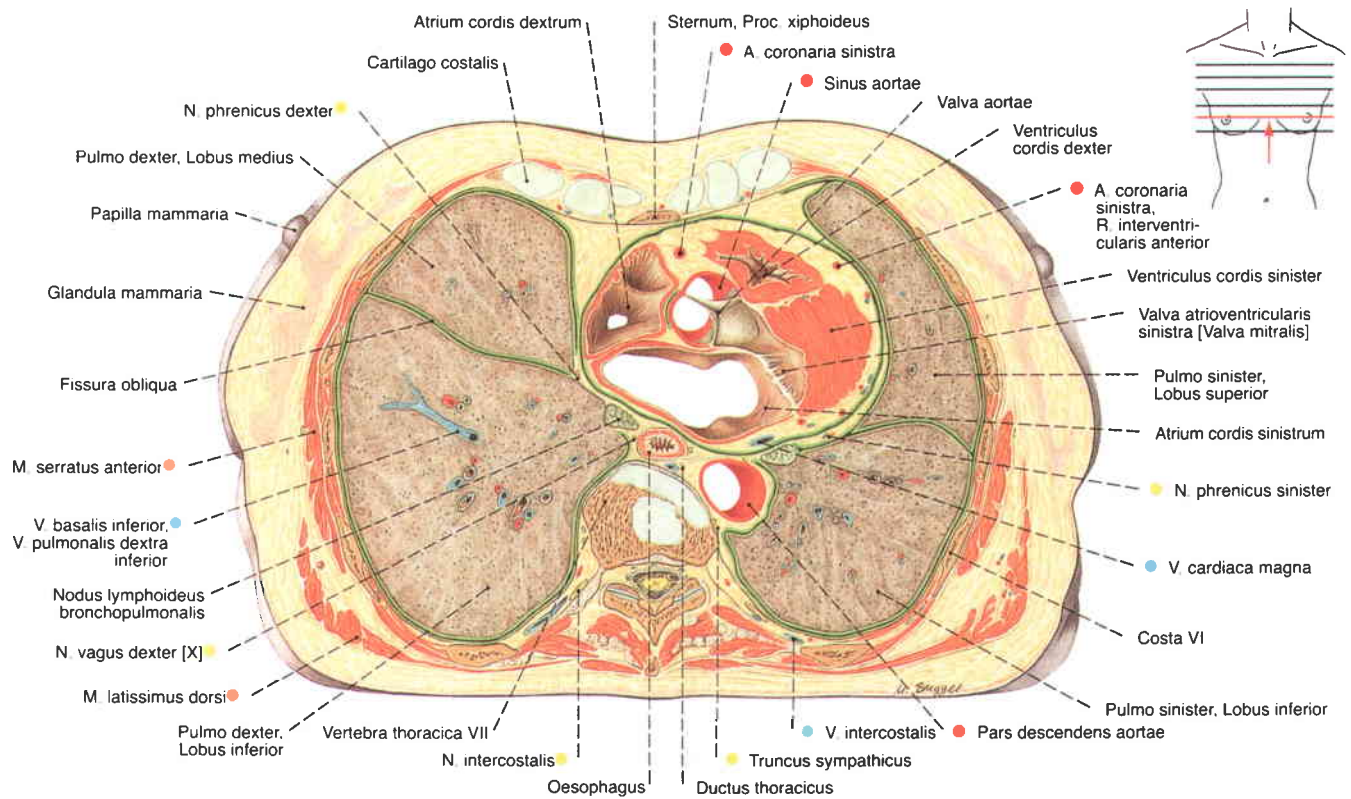


Fig. 936 Thoracic cavity, Cavitas thoracis; transverse section at the level of the 7th thoracic vertebra; inferior view.

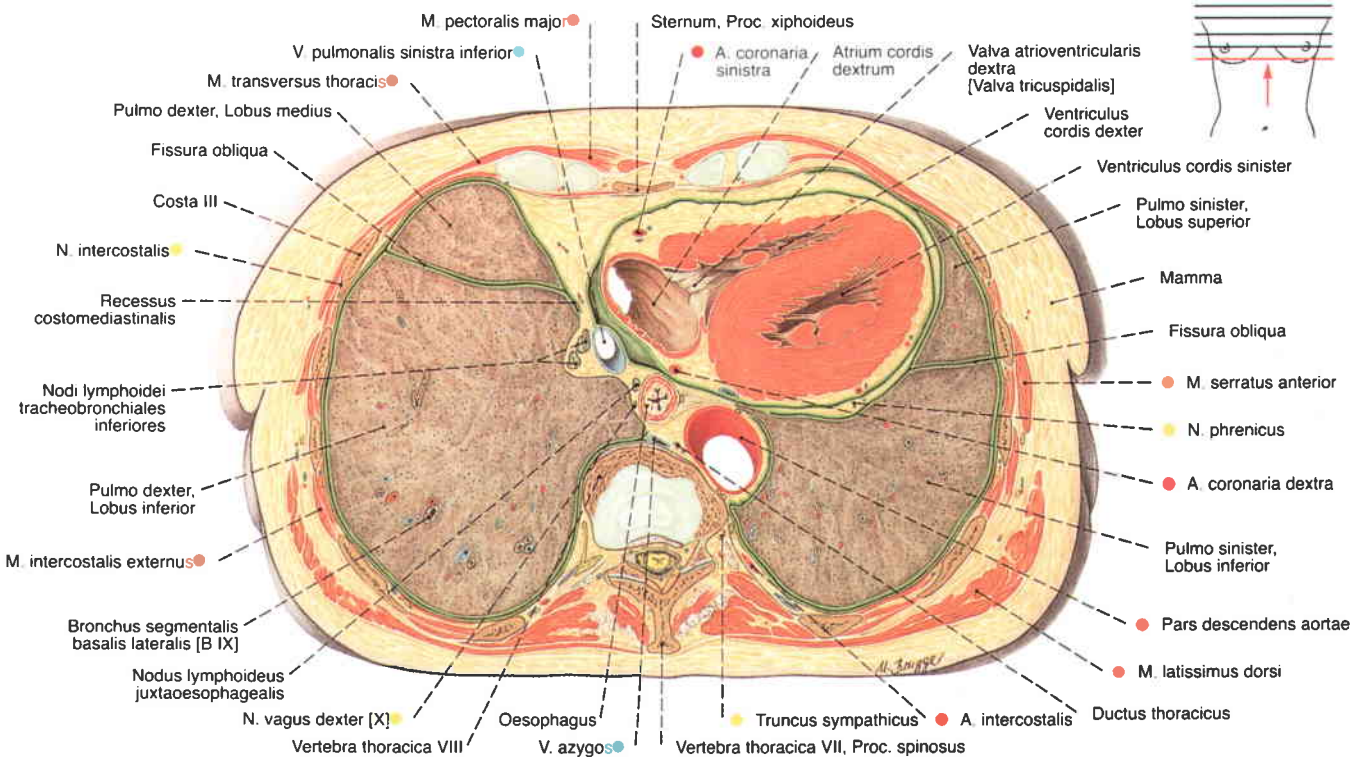


Fig. 937 Thoracic cavity, Cavitas thoracis; transverse section at the level of the 8th thoracic vertebra; inferior view.

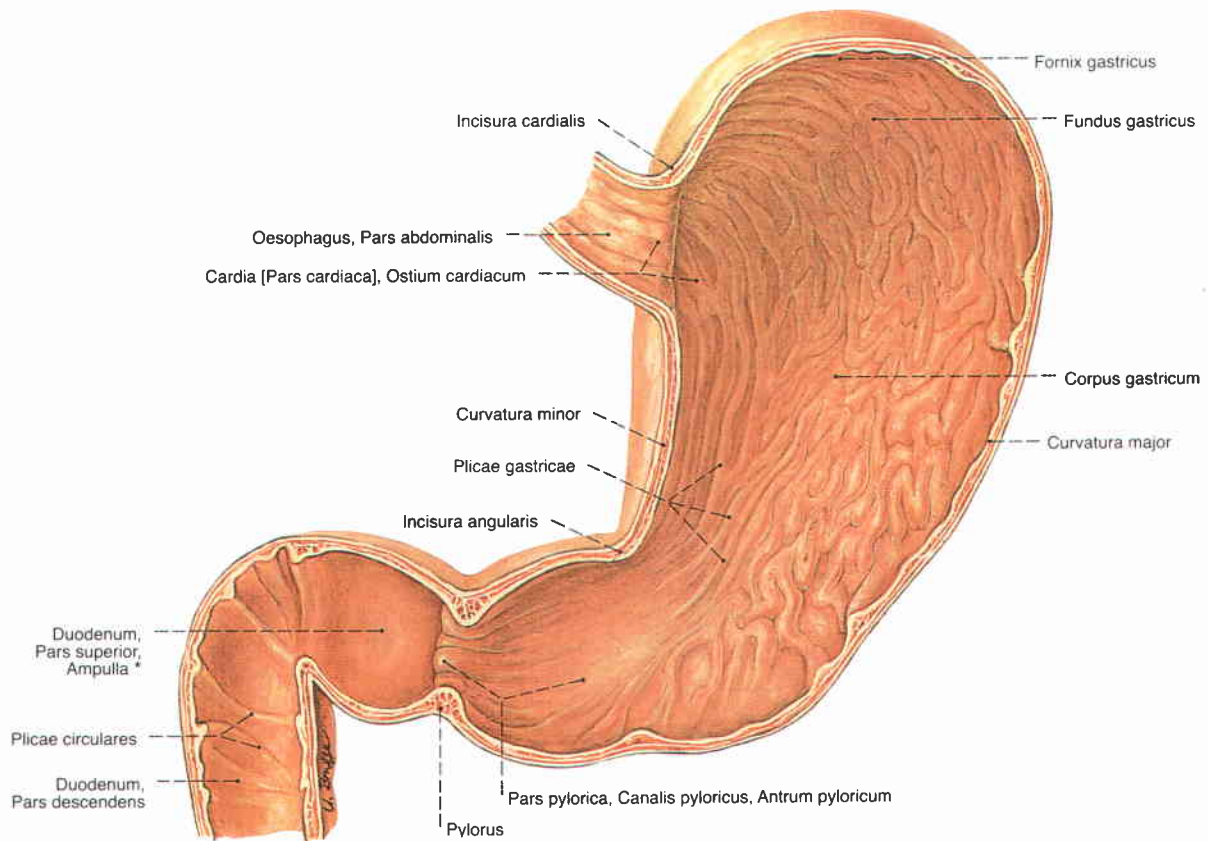


Fig. 938 Stomach, Gaster; duodenum, Duodenum; the anterior wall has been removed to show the folds of the mucosa of the stomach and the intestine; ventral view.

The circular layer of the musculature is particularly well developed in the pylorus.

\* Clinical: Bulbus duodeni

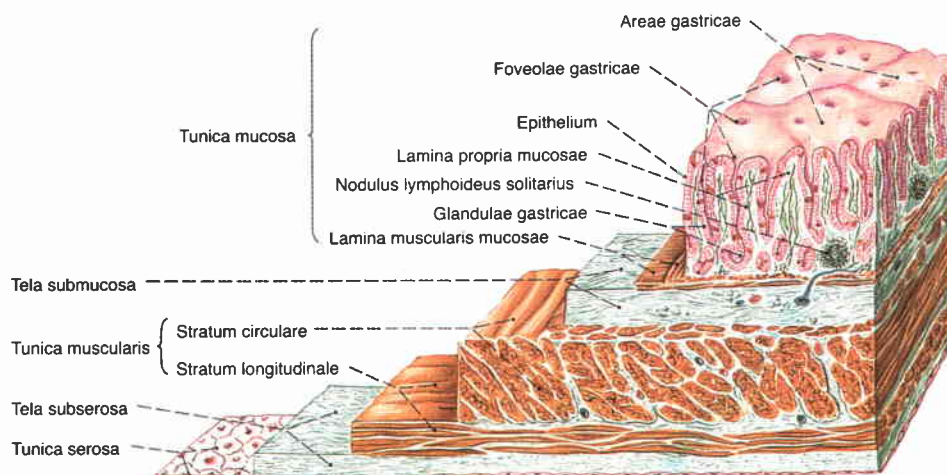
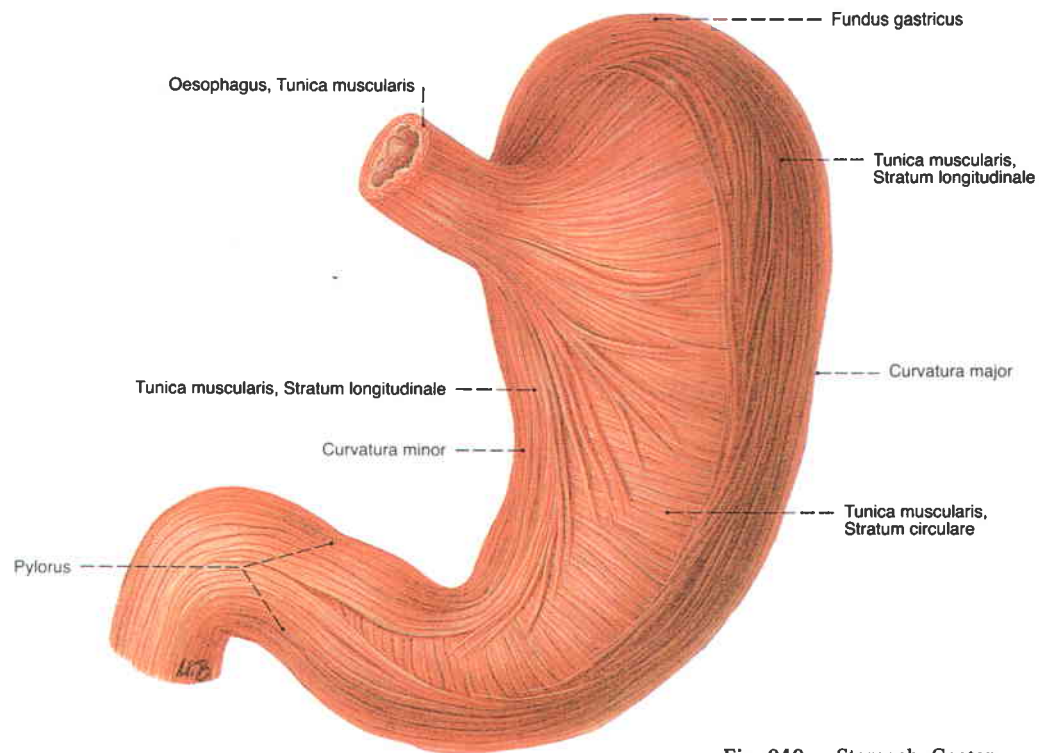
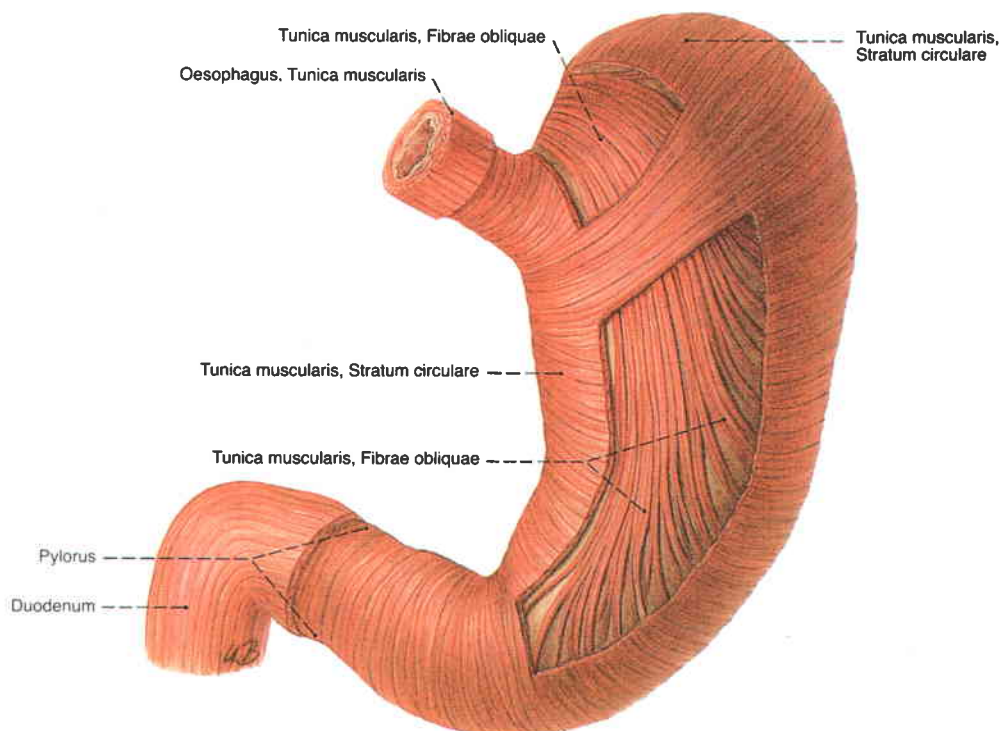


Fig. 939 Diagram of the wall of the stomach; the wall has been dissected layer by layer; microscopic enlargement.





**Fig. 940** Stomach, Gaster;  
the peritoneum has been removed to show the external  
muscular layer of the anterior wall of the stomach;  
ventral view.



**Fig. 941** Stomach, Gaster;  
the peritoneum has been removed;  
the external muscular layer has been partially dissected  
to show the internal oblique muscular layer;  
ventral view.



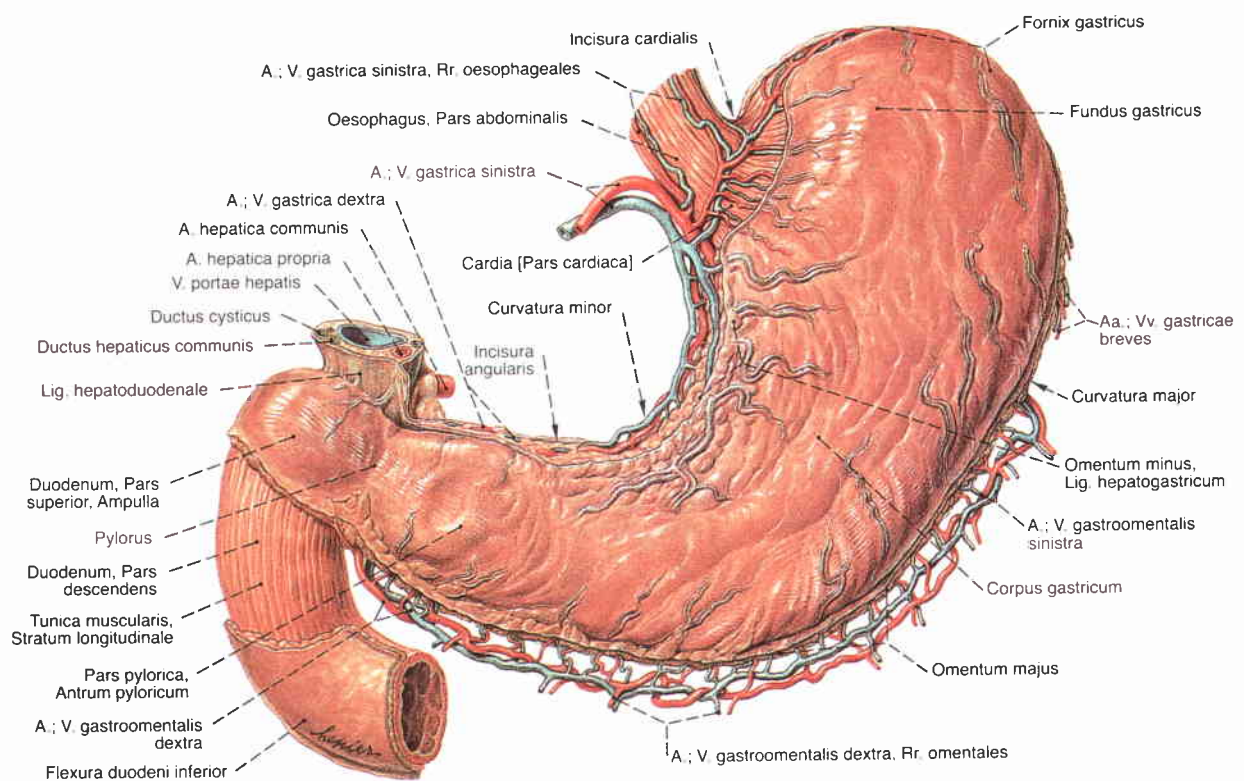


Fig. 942 Stomach, Gaster; duodenum, Duodenum; the peritoneum has been partially removed; ventral view.

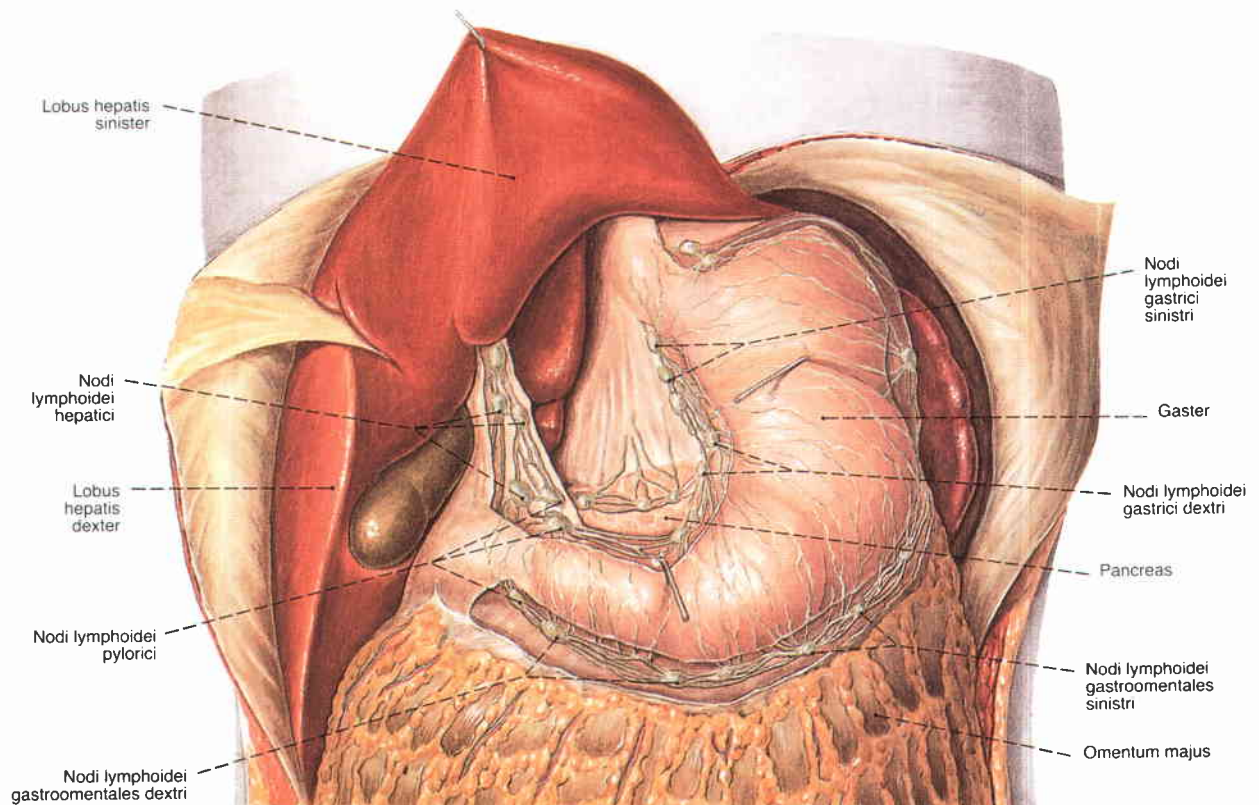
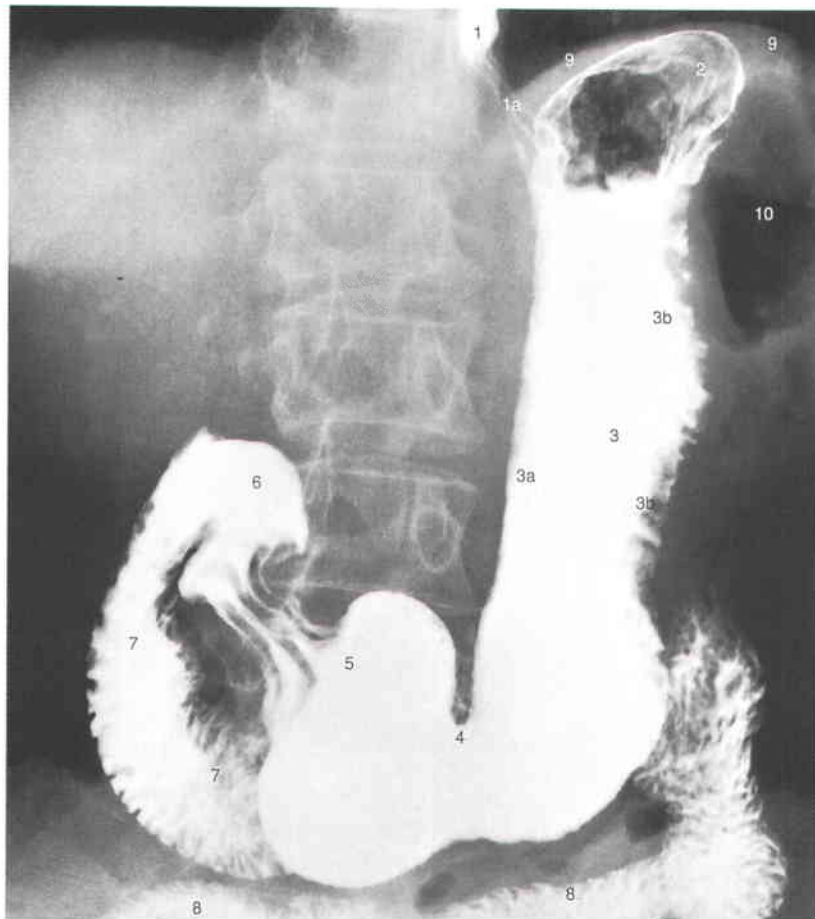


Fig. 943 Stomach, Gaster, and liver, Hepar, with lymph nodes, Nodi lymphoidei; the left lobe of the liver has been retracted superiorly; the omentum has been removed from the greater and lesser curvature

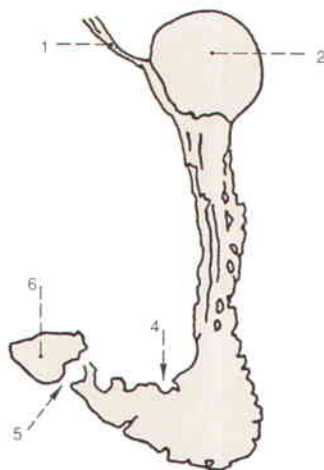
of the stomach to show the lymph nodes; ventral view. The number and size of the gastric lymph nodes vary considerably.



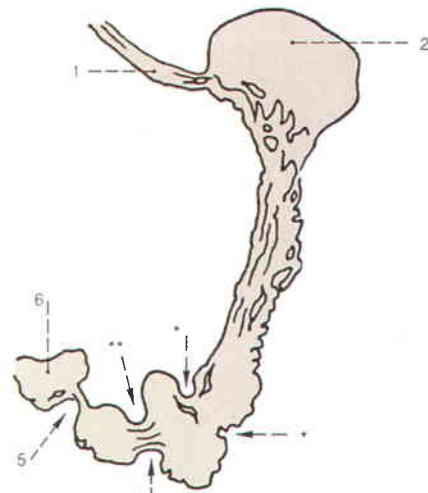
- 1 = Oesophagus with contrast medium.  
In the transitional region between the oesophagus and the fundus of the stomach (1a) the grooves between the folds can be seen as dark striations.
- 2 = Fundus of the stomach with air bubble
- 3 = Body of the stomach, Corpus gastricum
- 3a = Lesser curvature of stomach, Curvatura minor
- 3b = Greater curvature of stomach, Curvatura major.  
In the border between 3a and 3b notches corresponding to the contour of the mucous folds are visible.
- 4 = Peristaltic constrictions at the Incisura angularis
- 5 = Pars pylorica prior to the progression of a portion of stomach's content
- 6 = Ampulla duodeni
- 7 = Pars descendens duodeni with Plicae circulares
- 8 = Jejunum
- 9 = Left dome of diaphragm
- 10 = Flexura coli sinistra (filled with air)

**Fig. 944** Stomach, Gaster; duodenum, Duodenum; AP-radiograph after oral administration of a contrast medium; the patient is standing upright; ventral view.

During radiography of a standing patient, a gas bubble appears in the fundus which is bounded by the liquid below. The stripes in the transitional region between the oesophagus and the stomach and in the pylorus are caused by longitudinal folds of the mucous membrane.

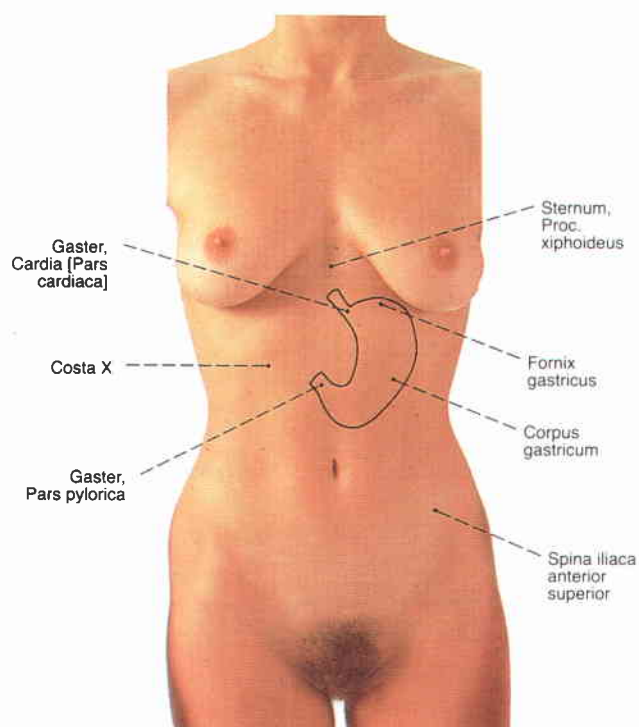


**Fig. 945** Stomach, Gaster; outline drawing of the mucous membrane topography based on an AP-radiograph of a standing patient; ventral view.  
The pyloric part of the stomach is constricted and the wall of the pyloric antrum is relaxed.

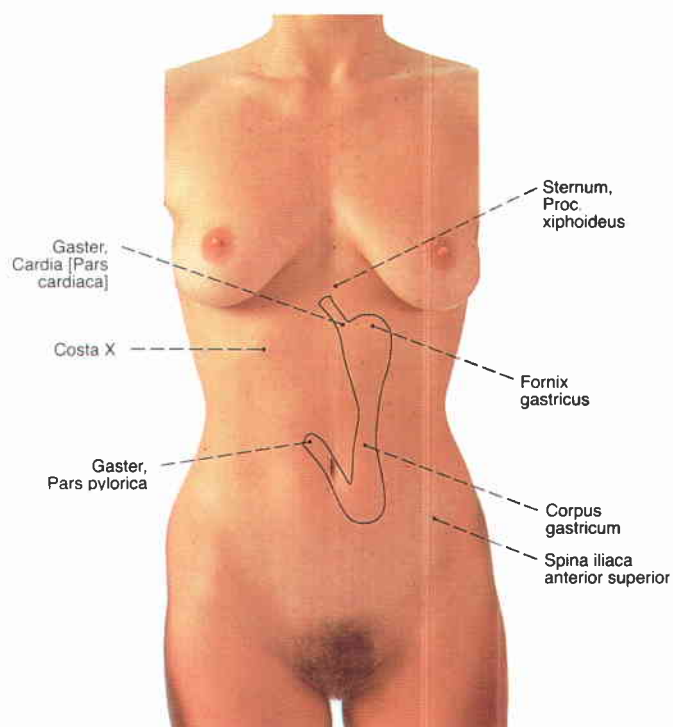


**Fig. 946** Stomach, Gaster; outline drawing of the mucous membrane topography based on an AP-radiograph of a standing patient; ventral view.

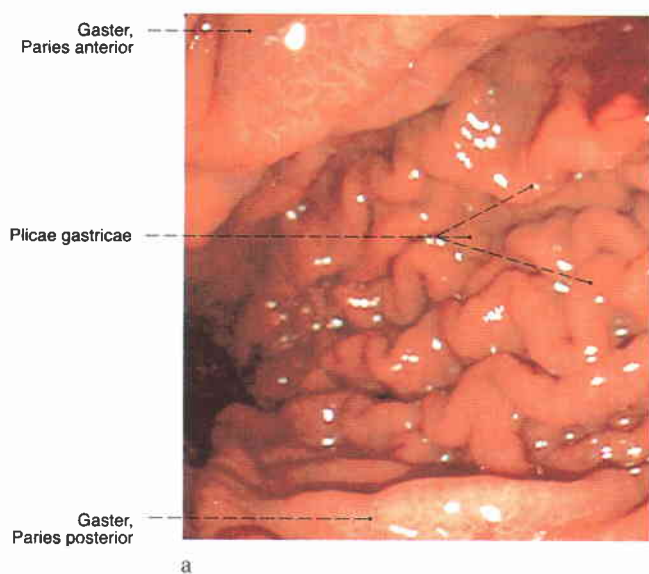
- \* Constriction at the angular notch
  - \*\* Constriction at the pyloric antrum
- Both are signs of a progressive peristaltic wave.



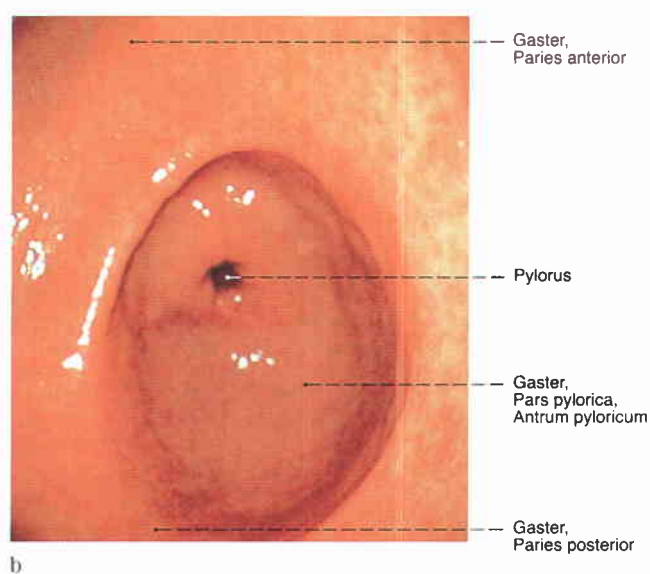
**Fig. 947** Stomach, Gaster; a projection of a “normal” stomach onto the anterior abdominal wall in the upright standing position.



**Fig. 948** Stomach, Gaster; projection of a “long” stomach onto the anterior abdominal wall in the upright standing position. The stomach is fixed at its inlet and outlet. The size and the position of the other segments vary considerably depending on the amount of contents and the position of the body. In addition there are considerable variations among individuals.



**Figs. 949 a, b** Stomach, Gaster; endoscopic view into the stomach (gastroscopy); superior view.



**a** view of the body with the distinct longitudinal mucosal folds (Plicae gastricae)  
**b** view of the antrum with predominantly smoother mucosa



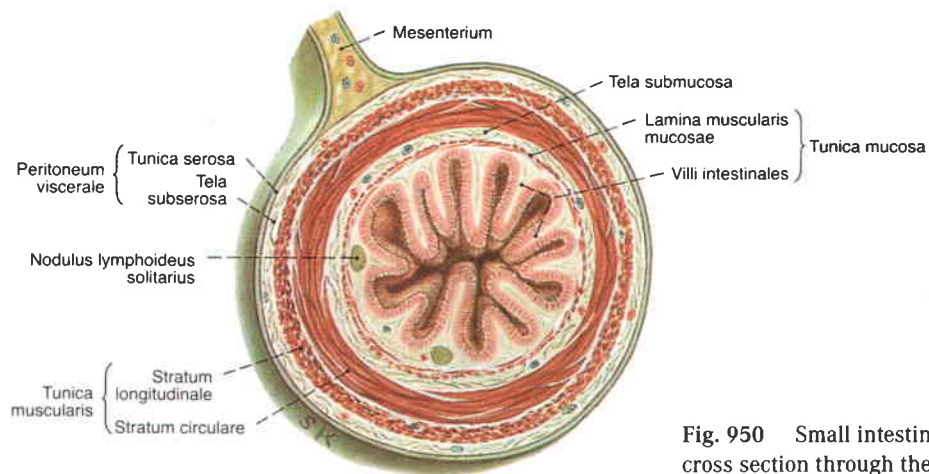


Fig. 950 Small intestine, *Intestinum tenue*; cross section through the upper small intestine.

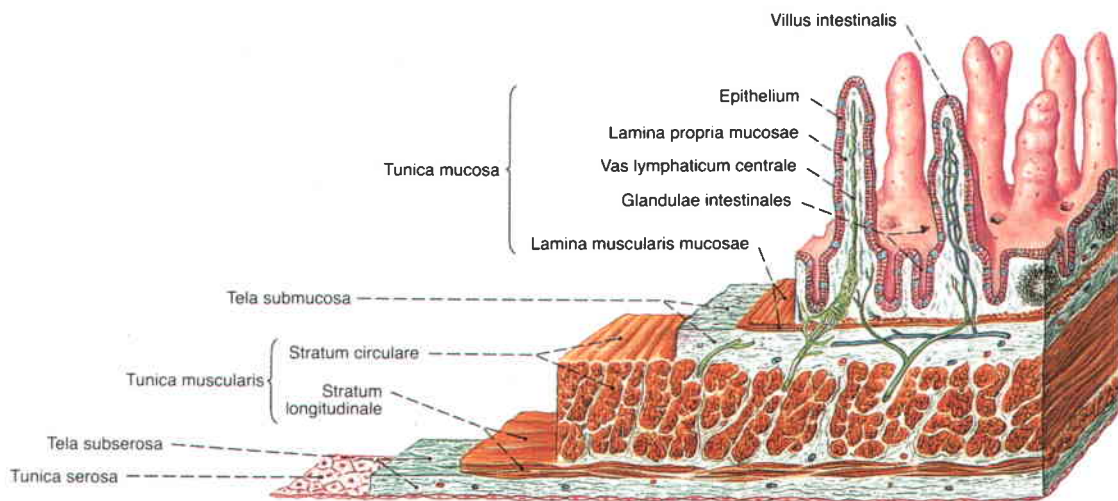


Fig. 951 Small intestine, *Intestinum tenue*; the intestinal wall has been dissected layer by layer; microscopic enlargement.

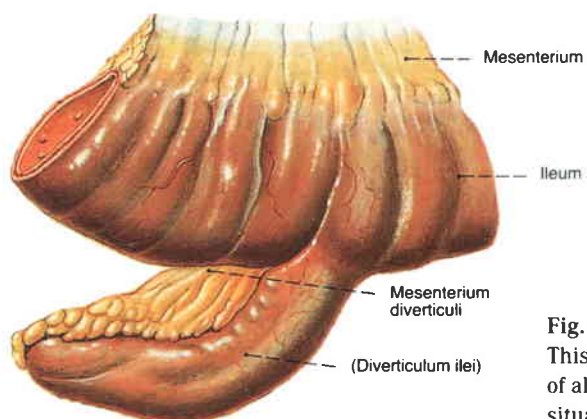
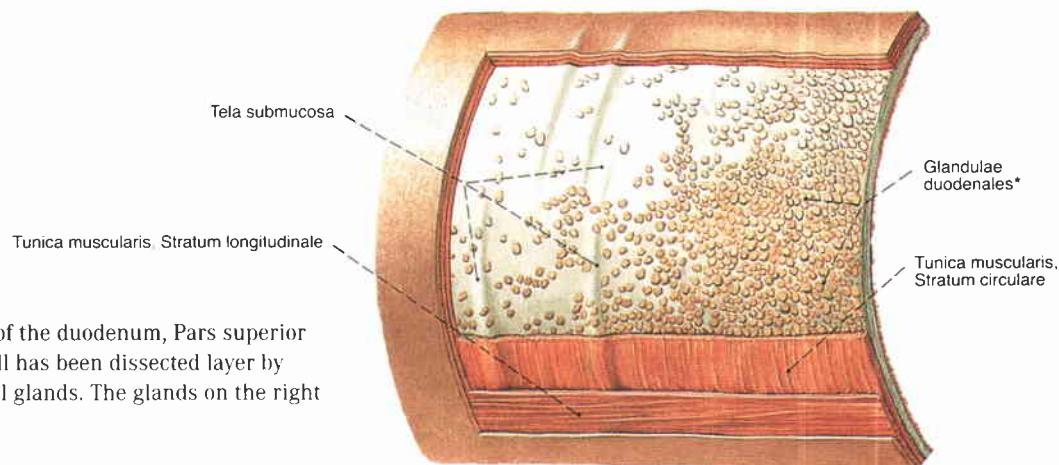
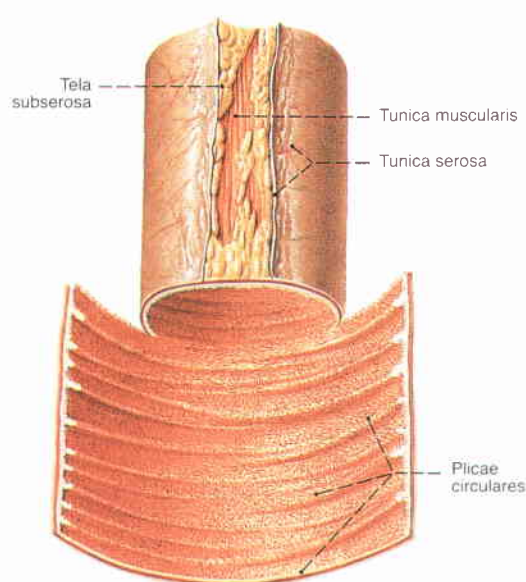


Fig. 952 MECKEL's diverticulum (*Diverticulum ilei*). This remnant of the *Ductus omphalo-entericus* occurs in 1-3% of all individuals. In 90% of the cases it is 1 to 10 cm long and situated between 30 and 70 cm oral to the ileocaecal valve.

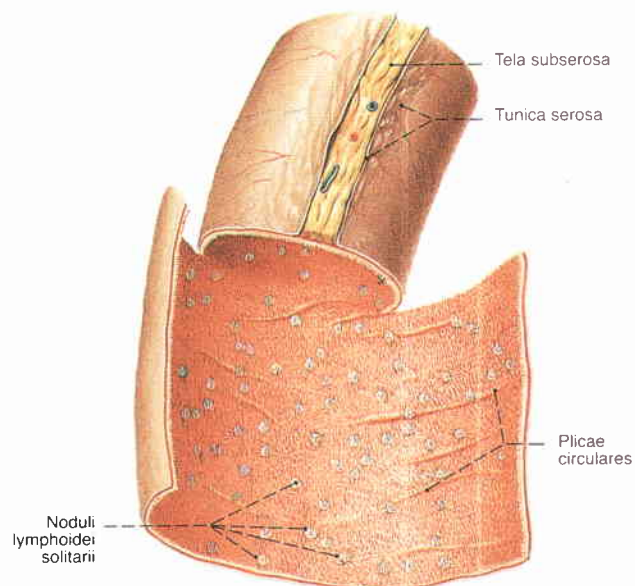


**Fig. 953** Superior part of the duodenum, Pars superior duodeni; the duodenal wall has been dissected layer by layer to show the duodenal glands. The glands on the right side are near the pylorus.

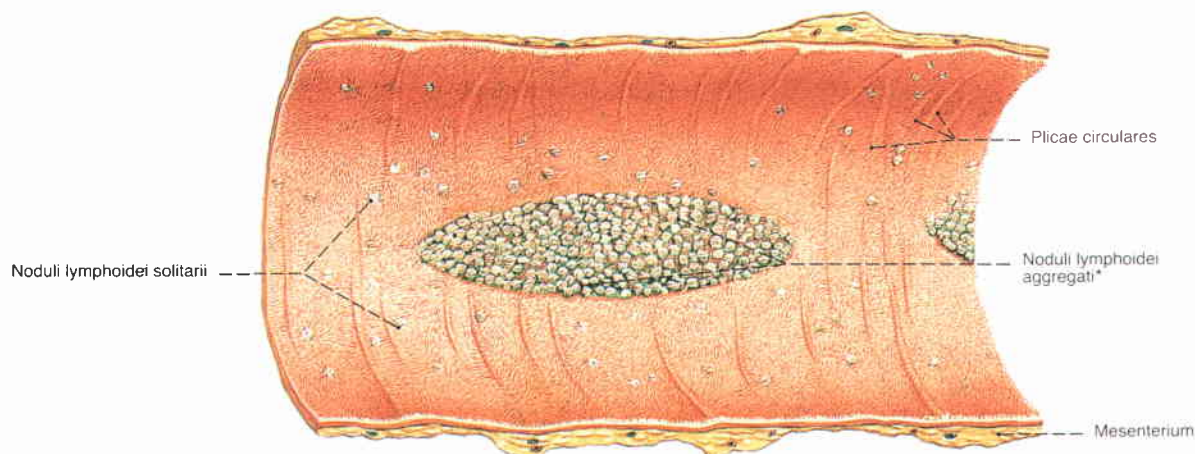
\* clinical: BRUNNER'S glands



**Fig. 954** Jejunum, Jejunum; the wall at the mesenteric insertion has been partially opened to show the mucous membrane. Compare the number of folds to Fig. 955.



**Fig. 955** Terminal ileum, Pars terminalis ilei; the wall at the mesenteric insertion has been partially opened to show the mucous membrane. Compare to Fig. 954.

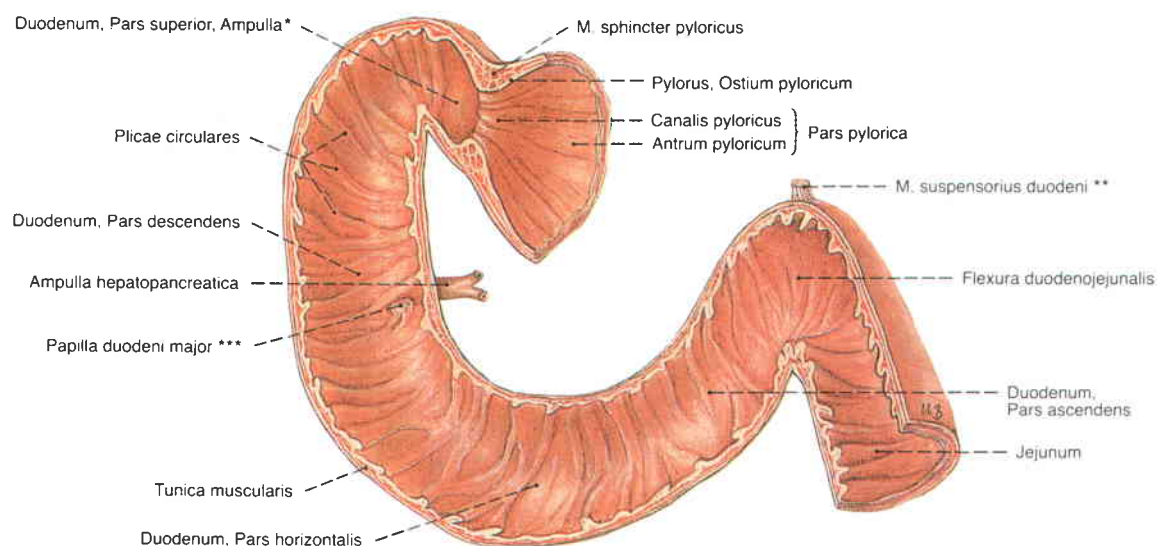


**Fig. 956** Terminal ileum, Pars terminalis ilei; portion of intestine opened at the mesenteric insertion.

PEYER'S patches are also found in the duodenum and the jejunum, and are not characteristic of the ileum.

\* clinical: PEYER'S patches

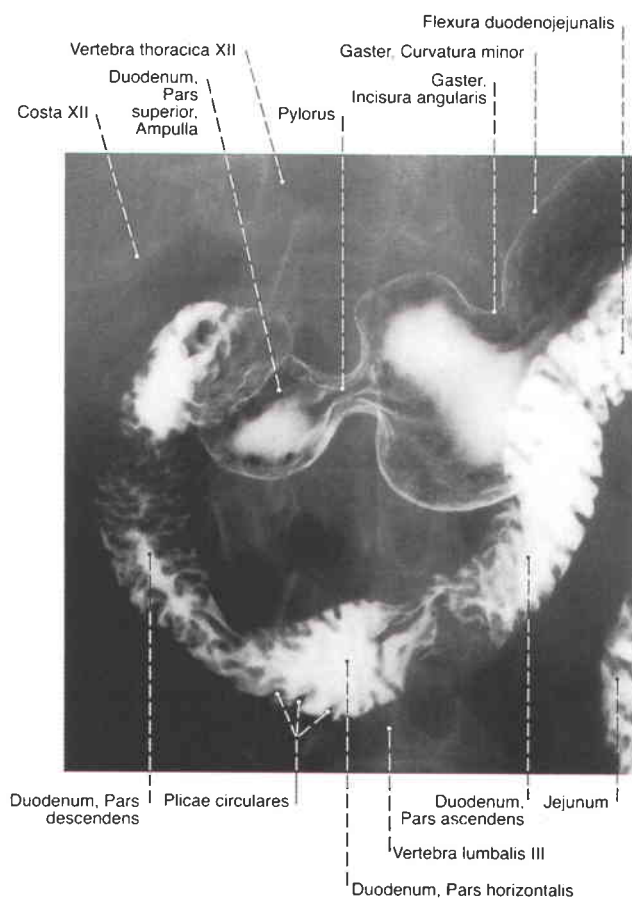




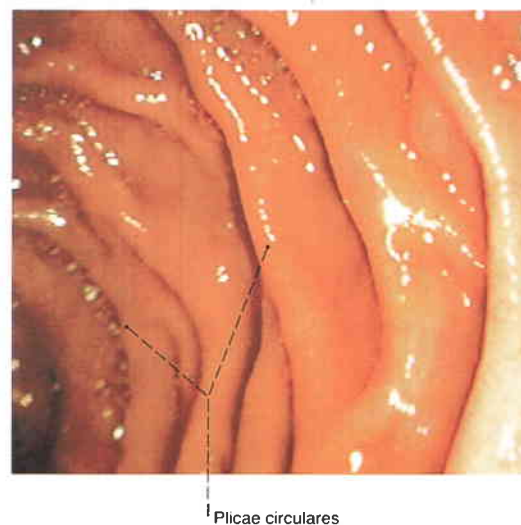
**Fig. 957** Duodenum, Duodenum; the anterior wall has been removed to show the mucous membrane; ventral view.

The superior part courses to the right dorsosuperiorly from the stomach and swings ventroinferiorly at the duodenojejunal flexure.

- \* clinical: Bulbus duodeni
- \*\* clinical: TREITZ's muscle
- \*\*\* clinical: Papilla of VATER

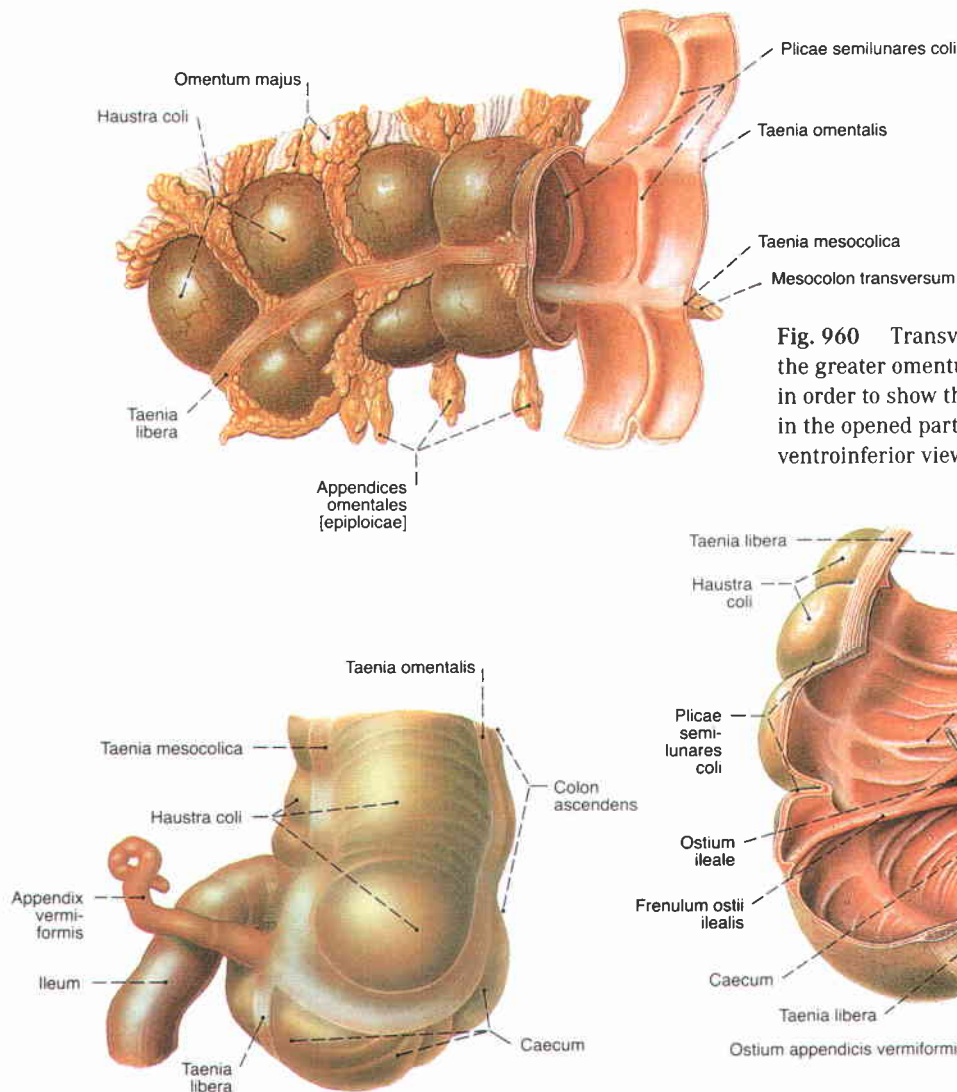


**Fig. 958** Duodenum, Duodenum; AP-radiograph after oral administration of a contrast medium; position: standing upright; ventral view.

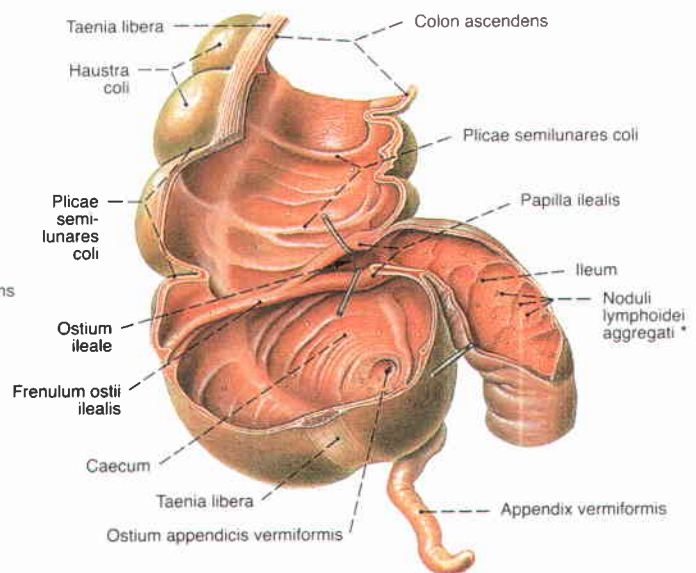


**Fig. 959** Duodenum, Duodenum; endoscopic view of the mucous membrane with the circular folds; superior view.





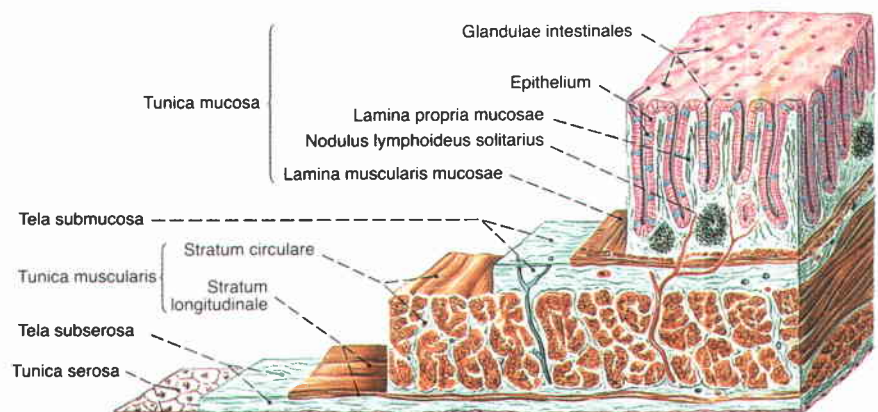
**Fig. 960** Transverse colon, Colon transversum; the greater omentum has been retracted superiorly in order to show the free taenia; the mucous folds in the opened part of the intestine can be clearly seen; ventroinferior view.



**Fig. 962** Ascending colon, Colon ascendens; caecum, Caecum; vermiform appendix, Appendix vermiformis; section of intestine opened by a frontal section to show the ileocaecal valve; hooks hold the orifice apart; ventral view.

\* clinical: PEYER's patches

**Fig. 961** Caecum, Caecum; vermiform appendix, Appendix vermiformis; terminal part of the small intestine, Pars terminalis ilei; dorsal view.



**Fig. 963** Colon, Colon; the intestinal wall has been dissected layer by layer; microscopic enlargement.

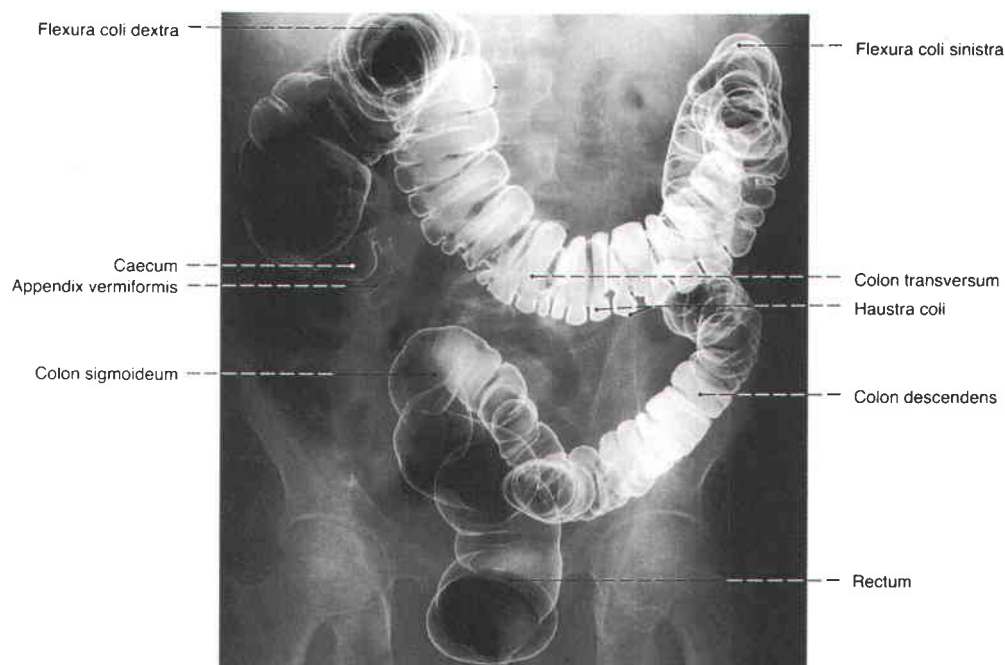
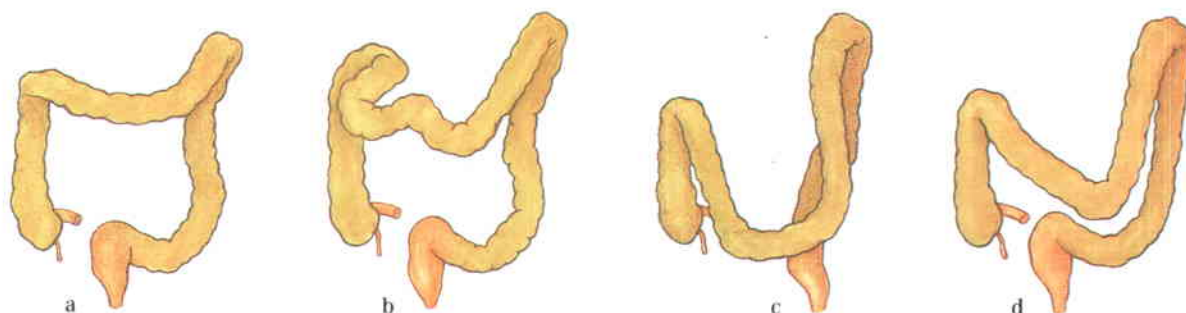


Fig. 964 Colon, Colon; rectum, Rectum;  
AP-radiograph after filling with contrast medium and air

(double contrast method).  
Compare the topography of the colon in Figs. 1005 and 1008.



Figs. 965 a–d Transverse colon, Colon transversum;  
frequent variations in position.  
a normal position, b serpentine, c U-shaped, d V-shaped

The position of the transverse colon also depends on the  
amount of contents and on the position of the body;  
ventral view.

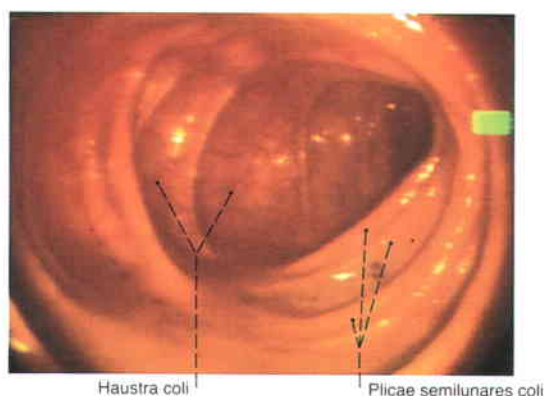


Fig. 966 Ascending colon, Colon ascendens;  
view through an endoscope which has been introduced  
through the rectum, the sigmoid, the descending colon  
and the transverse colon (colonoscopy).

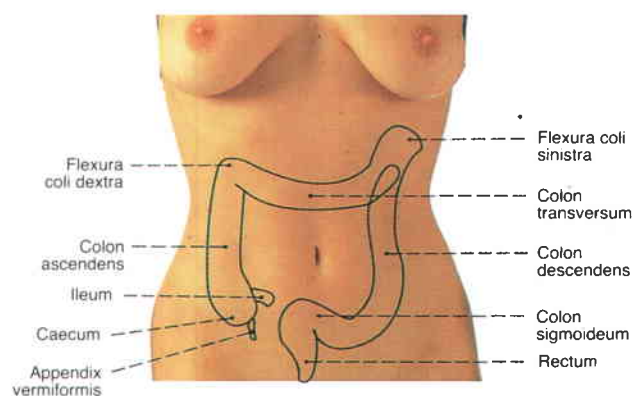
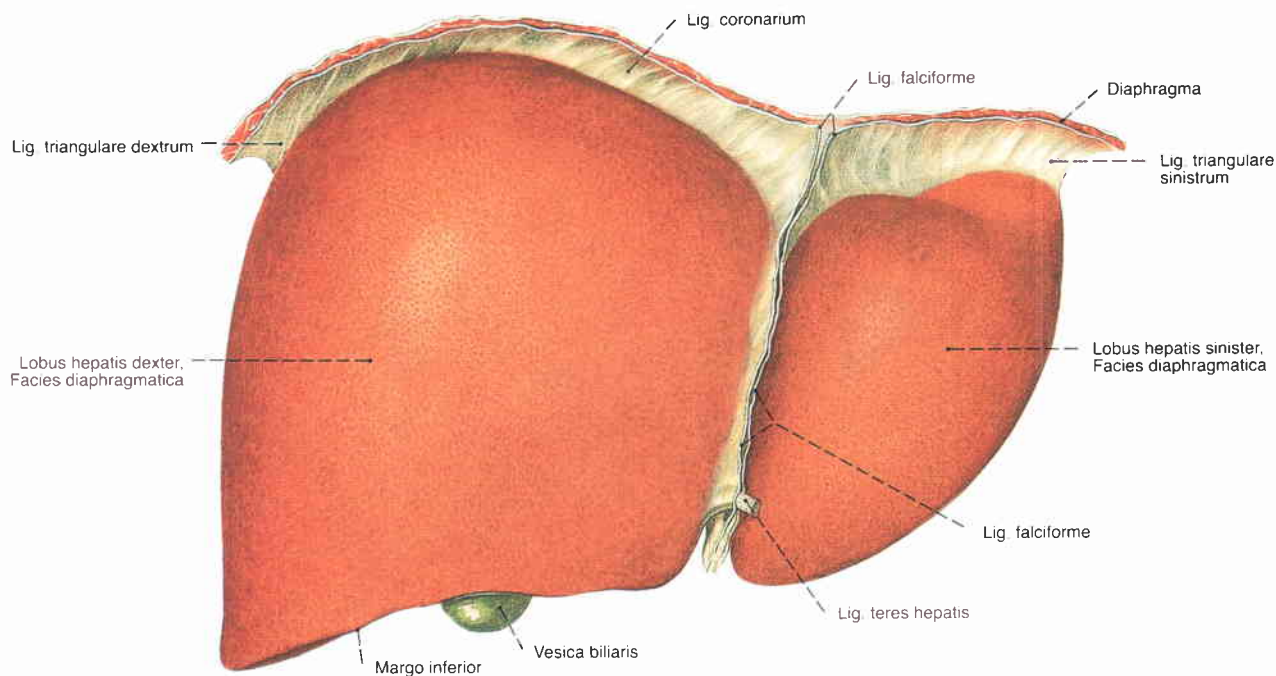
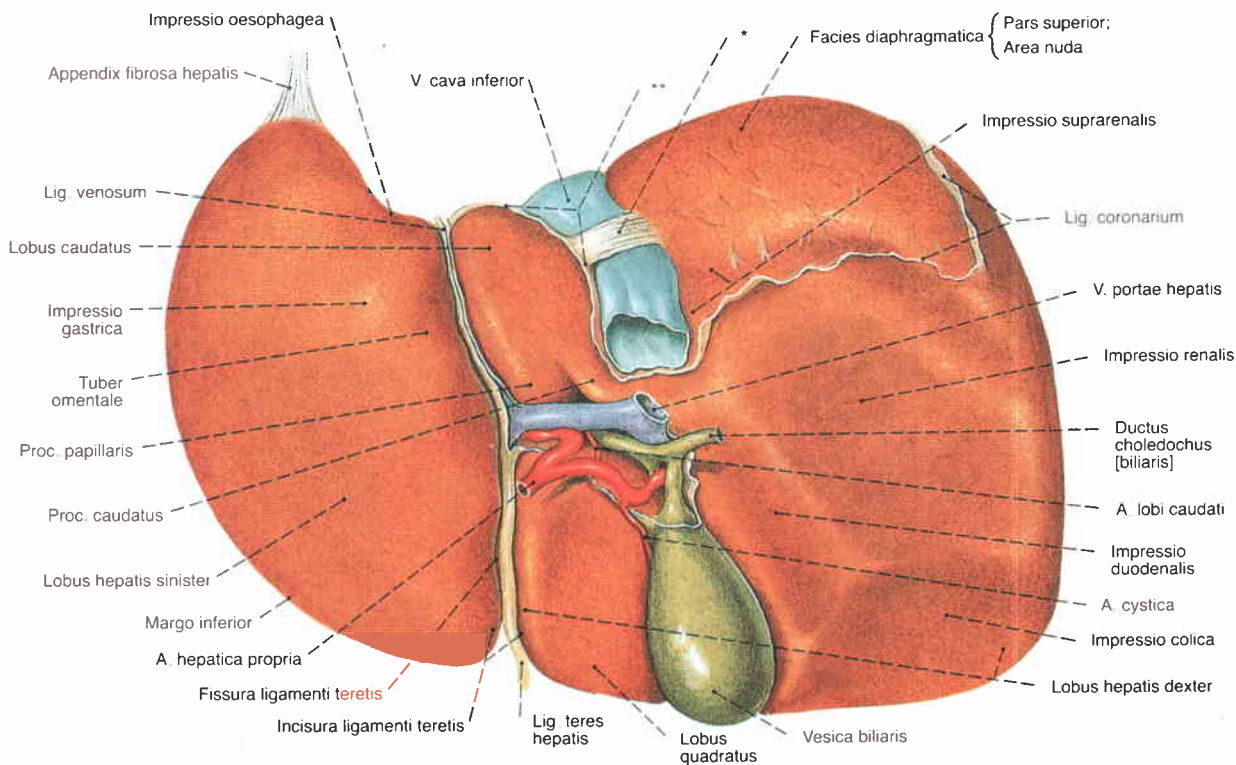


Fig. 967 Colon, Colon;  
projection onto the anterior abdominal wall;  
ventral view.  
The positions of the transverse colon and the sigmoid  
vary considerably (see Fig. 965).



**Fig. 968** Liver, Hepar; parts of the diaphragm have been preserved to show the attachment to the liver; the Lig. falciforme hepatis and the round ligament (Lig. teres hepatis) have been sectioned; ventral view.

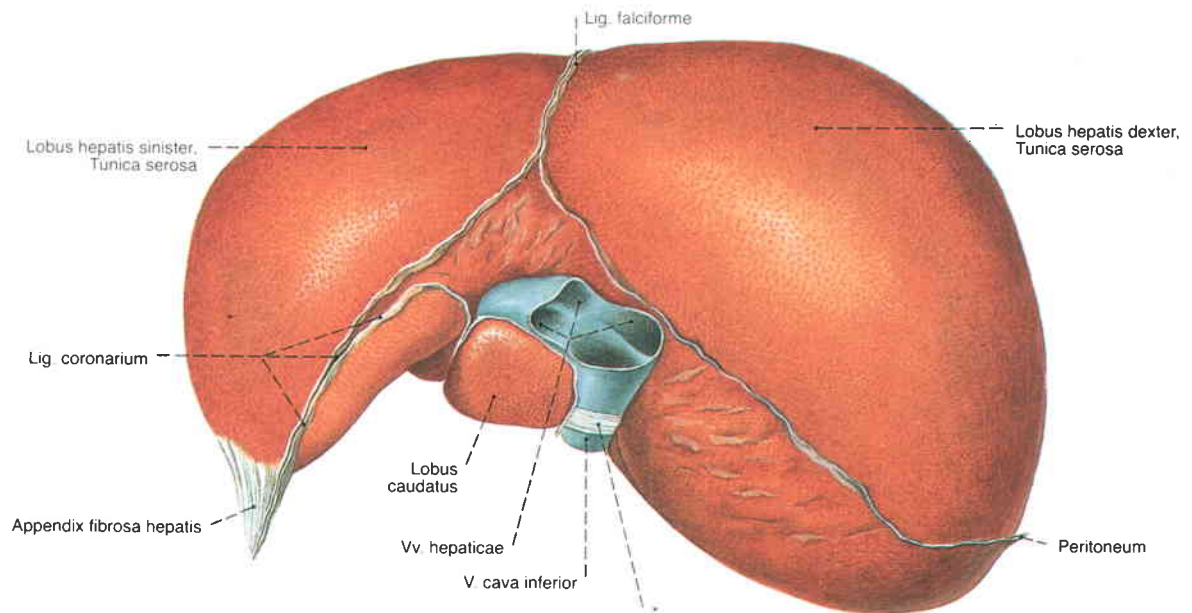


**Fig. 969** Liver, Hepar; hepatic hilum, Porta hepatis; ligamentous attachments of the liver vessels have been sectioned; dorsal view.

\* clinical: Lig. venae cavae

\*\* border of the superior recessus of the omental bursa

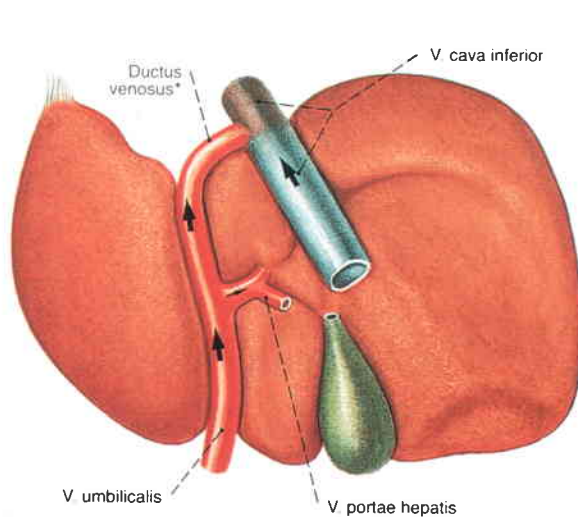




**Fig. 970** Liver, hepar; the peritoneal reflections have been sectioned; superior view.

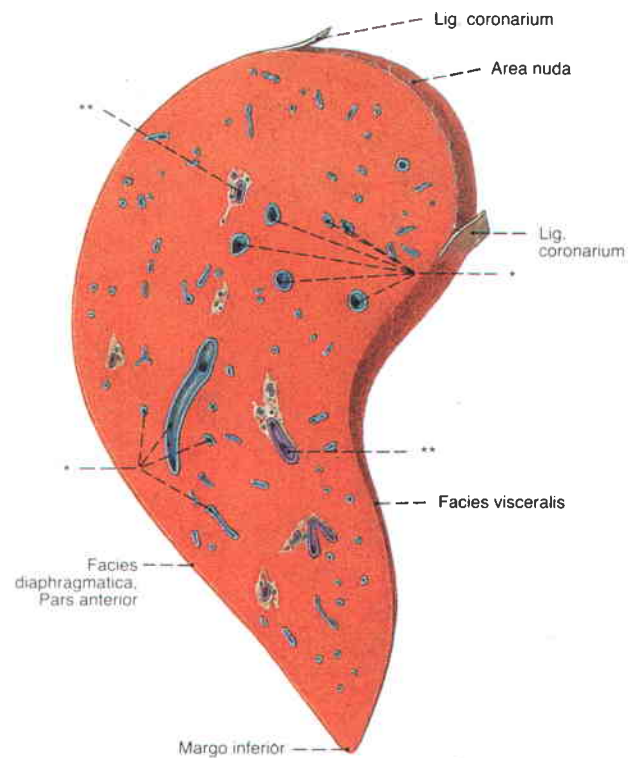
The peritoneum-free area of the liver surface, Area nuda, is discernible by its rougher texture.

\* clinical: Lig. venae cavae



**Fig. 971** Liver, Hepar, of a fetus; the oxygen contents of the blood is shown by colours, arrows indicate the direction of blood flow; dorsal view.  
The liver parenchyma is bypassed by way of the Ductus venosus which directs highly oxygenized blood from the placenta to the inferior vena cava.

\* also called Ductus ARANTII



**Fig. 972** Liver, Hepar; sagittal section through the right lobe to show the branches of the hepatic and the portal veins.

\* intrahepatic branches of the hepatic veins

\*\* intrahepatic branches of the portal vein and the hepatic artery

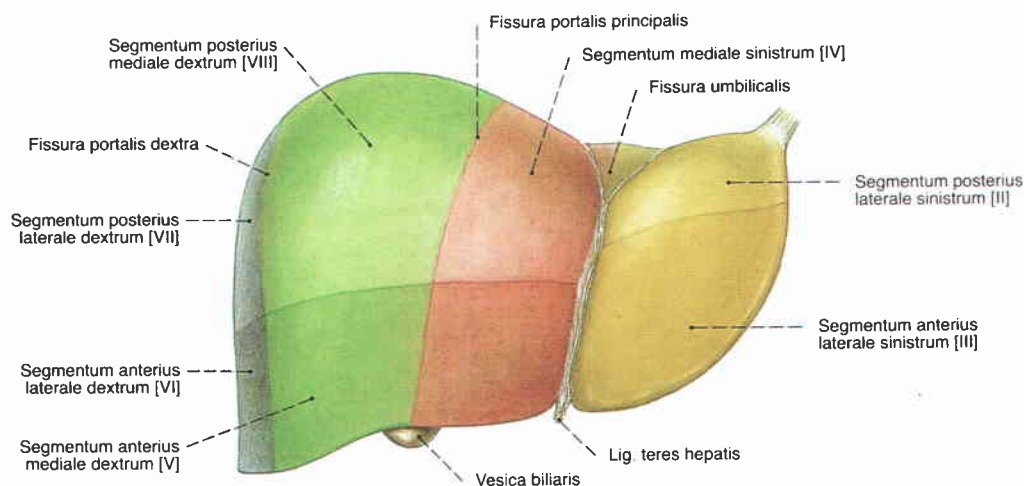


Fig. 973 Liver, Hepar;  
segments of the liver lobes are emphasized in colour;  
ventral view.

From a surgical point of view, Segmentum IV is subdivided into an upper segment (IVa) and a lower segment (IVb).

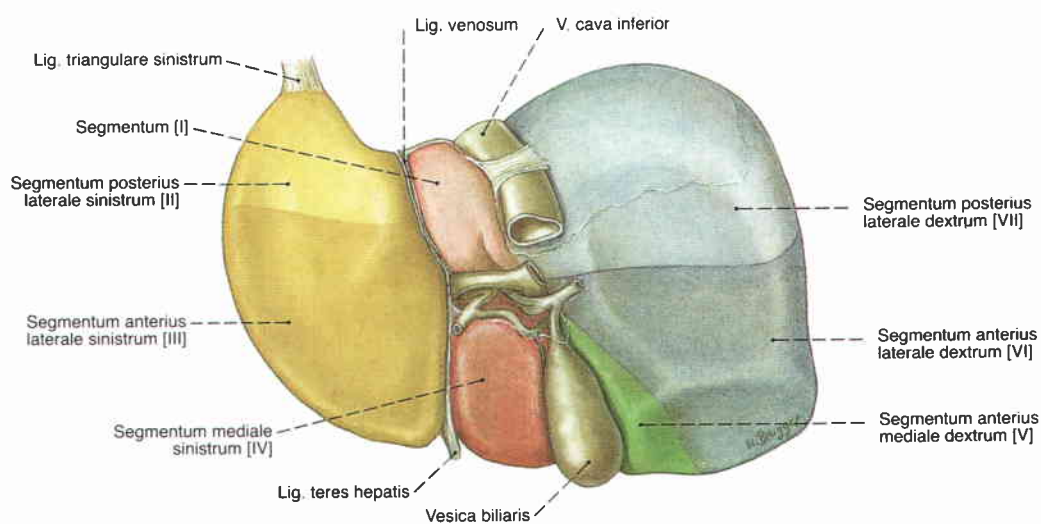


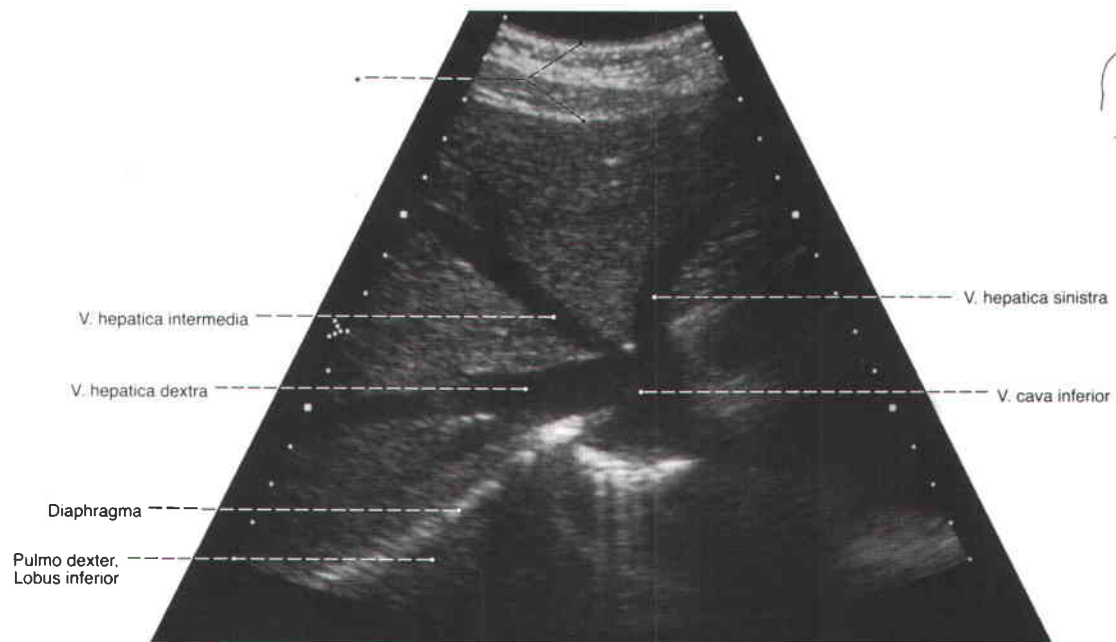
Fig. 974 Liver, Hepar;  
segments of the liver lobes are emphasized  
in colour as in Fig. 973;  
dorsal view.

### Parts of the liver, Hepar

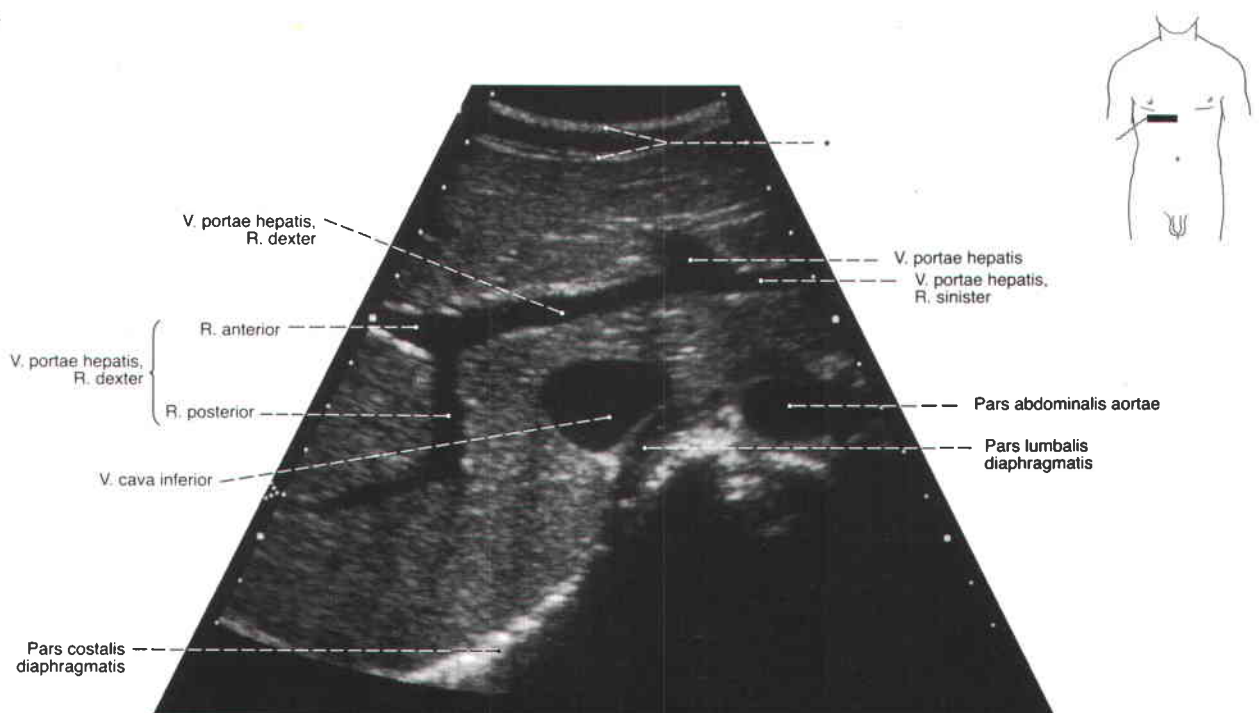
Pars hepatis sinistra	Pars posterior hepatis, Lobus caudatus	Segmentum [I]
	Divisio lateralis sinistra	Segmentum posterius laterale sinistrum [II] Segmentum anterius laterale sinistrum [III]
	Divisio medialis sinistra	Segmentum mediale sinistrum [IV]
	Divisio medialis dextra	Segmentum anterius mediale dextrum [V] Segmentum posterius mediale dextrum [VIII]
Pars hepatis dextra	Divisio lateralis dextra	Segmentum anterius laterale dextrum [VI] Segmentum posterius laterale dextrum [VII]

Based on its relation to Lig. falciforme, the liver is traditionally divided into a right and a left lobe (Lobi hepatis dexter and sinister). By contrast, the organisation of the liver into segments and divisions based on the branching of A. hepatis, V. portae and Ductus hepaticus corresponds better to practical

considerations, i.e. the requirements of surgical resection, and, moreover, takes into account developmental standpoints. The individual sections are separated by fissures which are not, however, discernible by external visible clefts.

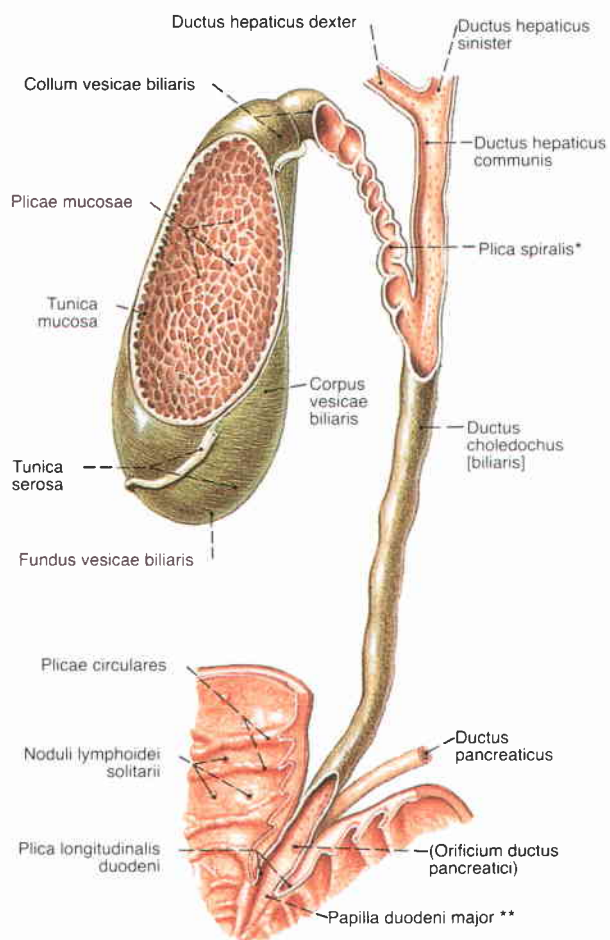


**Fig. 975** Hepatic veins, Vv. hepaticae;  
ultrasound image of the confluence of the hepatic veins  
into the inferior vena cava;  
inferior view.  
\* abdominal wall



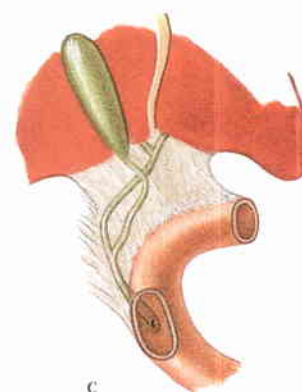
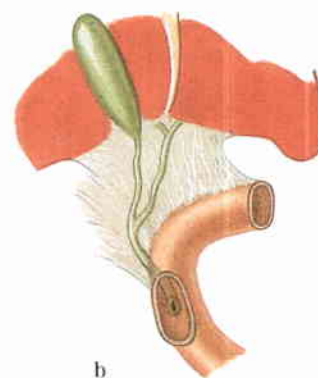
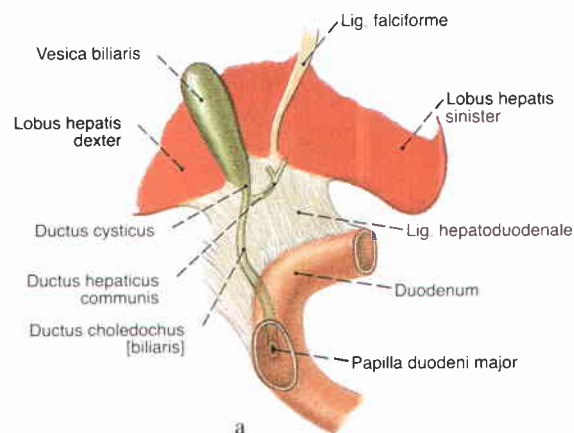
**Fig. 976** Portal vein, V. portae hepatis;  
ultrasound image of the division of the portal vein  
into its main branches;  
inferior view.  
Compare to Fig. 982.  
\* abdominal wall



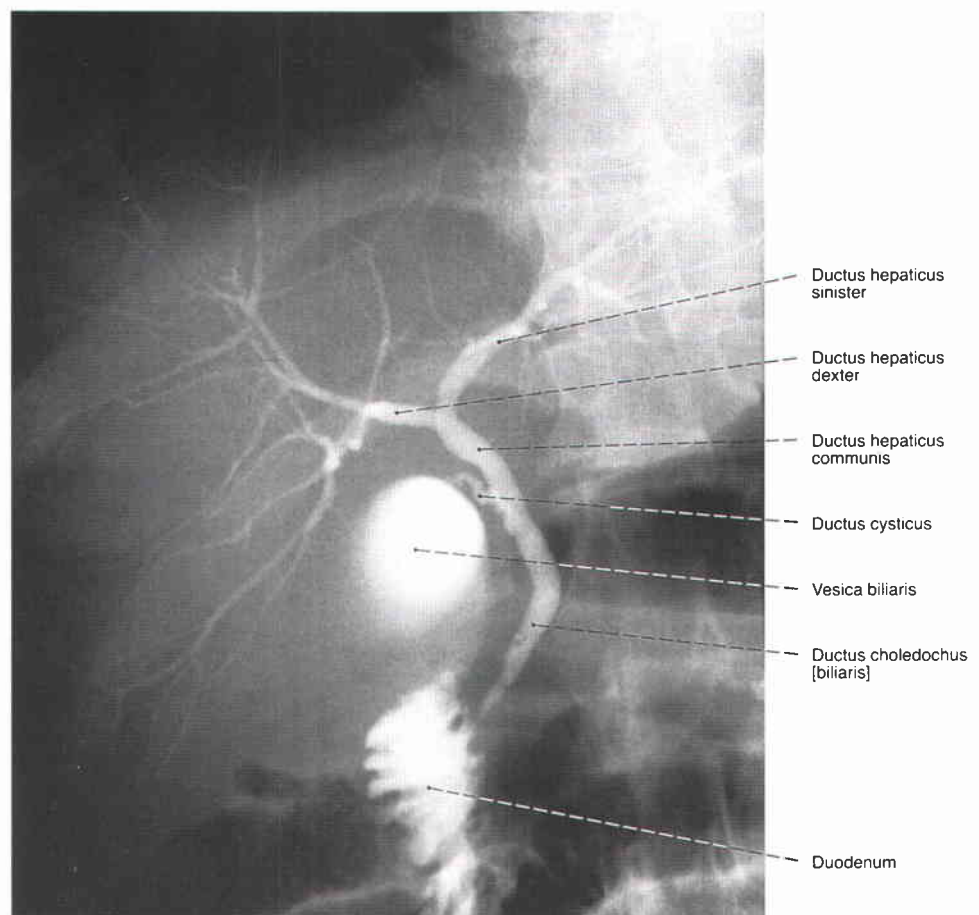


**Fig. 977** Gallbladder, Vesica biliaris [fellea], and biliary ducts; parts of the anterior wall of the gallbladder, the biliary ducts and the duodenum have been removed to show the mucous membrane; ventral view.

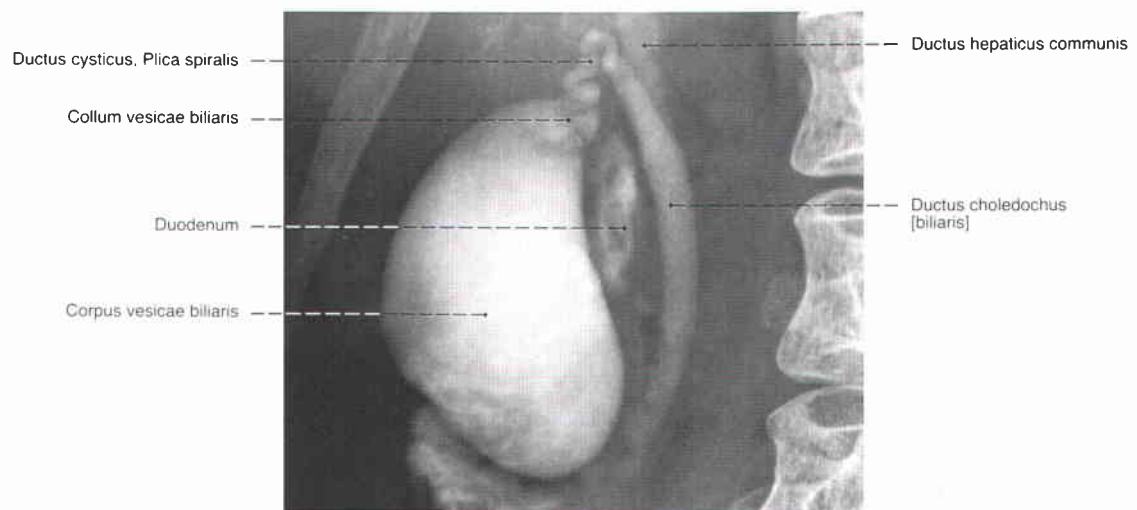
\* clinical: HEISTER's valve  
\*\* clinical: Papilla of VATER



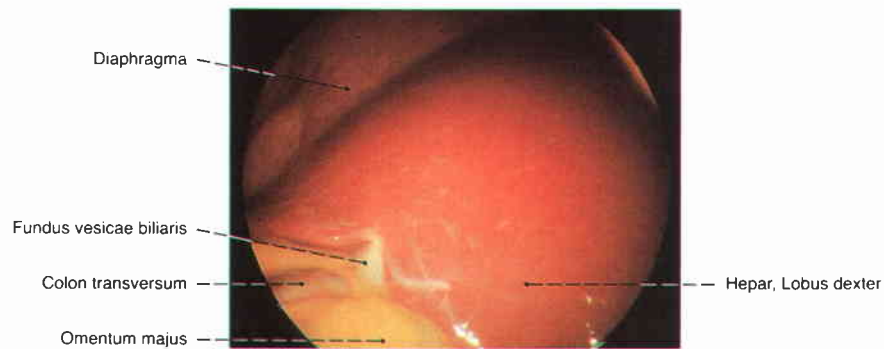
**Figs. 978 a-c** Variations of the biliary ducts; common hepatic duct, Ductus hepaticus communis, and common bile duct, Ductus choledochus.  
a high union of the common hepatic duct with the cystic duct  
b low union of the common hepatic duct with the cystic duct  
c low union with crossing of the common hepatic duct and the cystic duct



**Fig. 979** Biliary ducts;  
AP-radiograph in the upright position after  
administration of a contrast medium;  
ventral view.

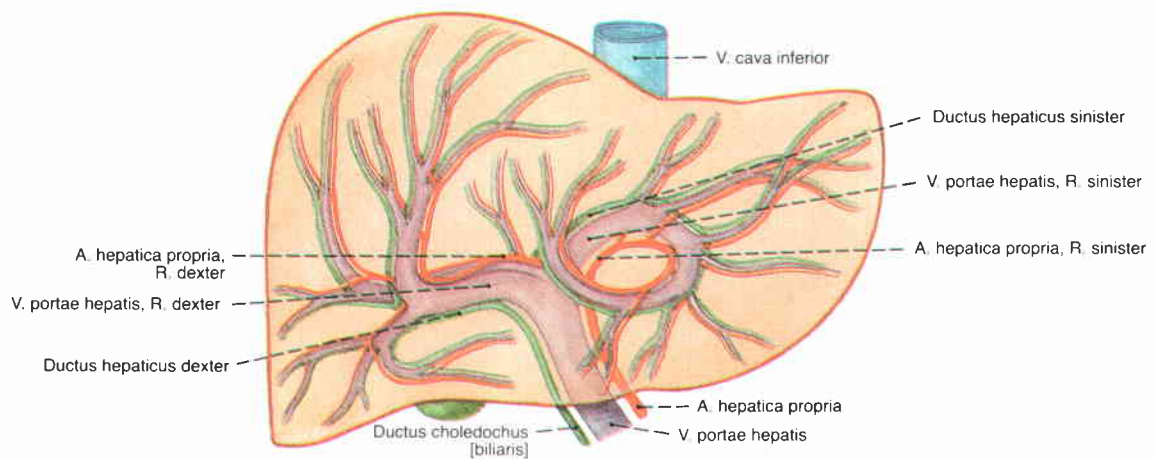


**Fig. 980** Gallbladder, Vesica biliaris [fellea],  
and biliary ducts;  
AP-radiograph in the upright position after  
administration of a contrast medium;  
the patient is standing upright;  
ventral view.

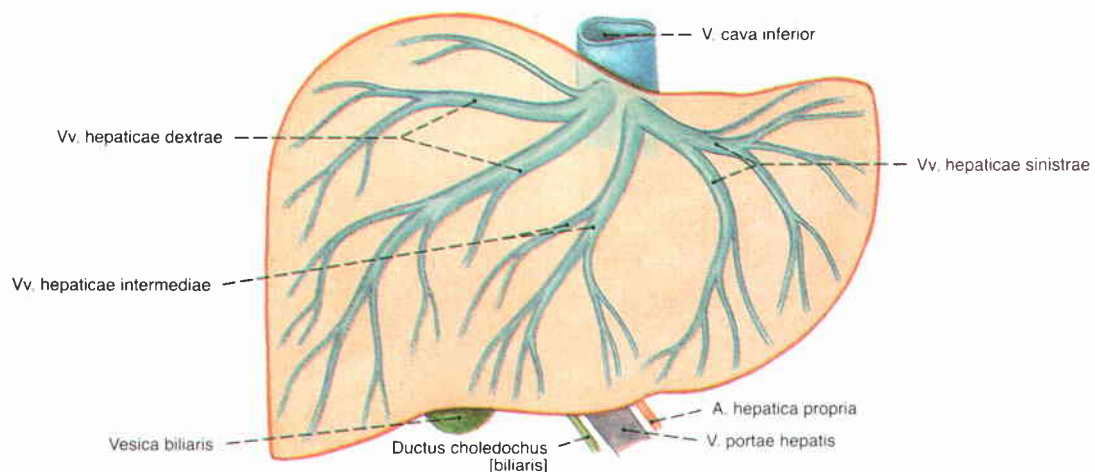


**Fig. 981** Liver, Hepar; gallbladder, Vesica biliaris; through an endoscope, the liver can be assessed in terms of colour, the surface and the shape (laparoscopy); left ventroinferior view.

Insufflation of gas into the abdominal cavity creates a space between the liver and the diaphragm, which enables a thorough examination of the liver and the gallbladder.

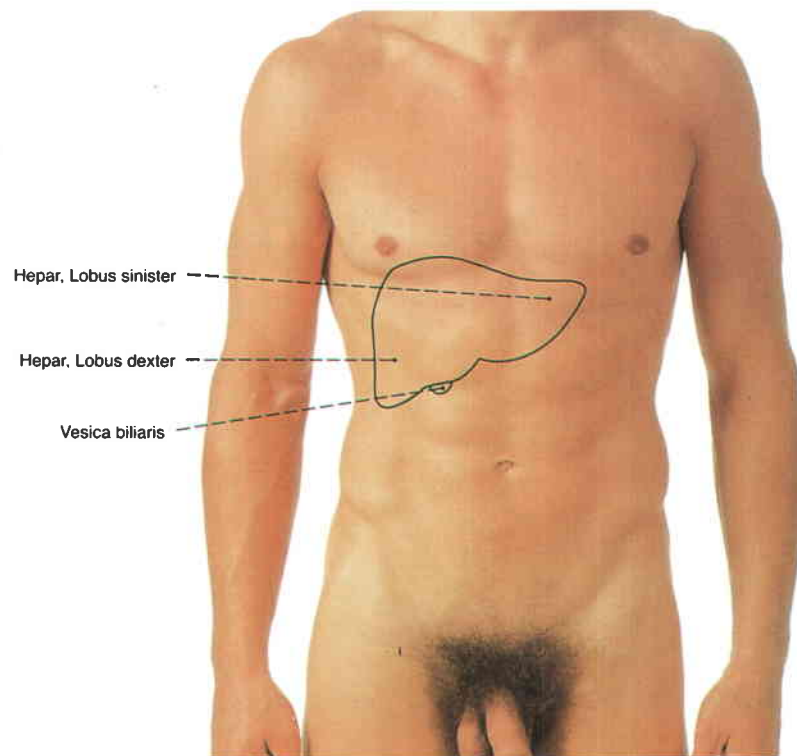


**Fig. 982** Liver, Hepar; portal vein, Vena portae hepatis; diagram of the branches of the portal vein projected onto the surface of the liver; ventral view.



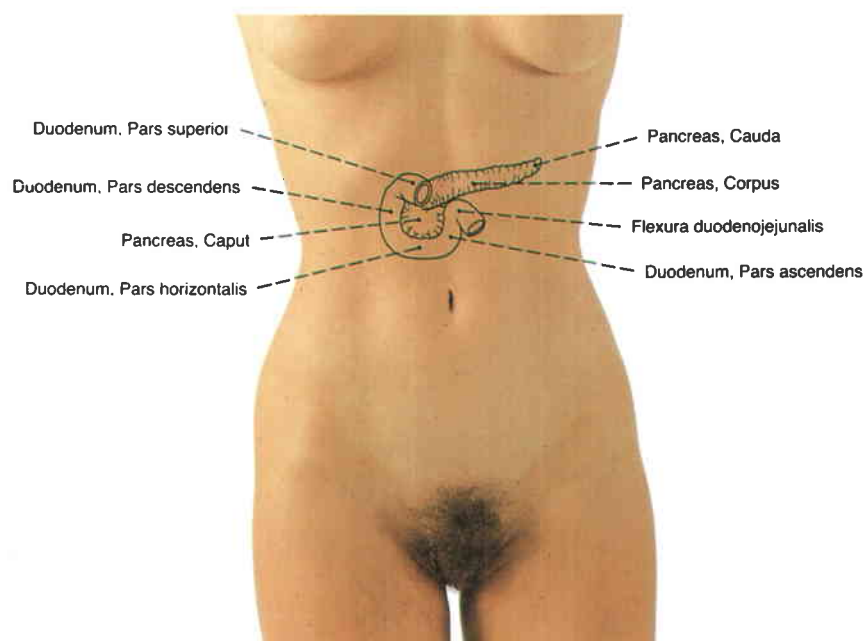
**Fig. 983** Liver, Hepar; hepatic veins, Vv. hepaticae; diagram of the branches of the hepatic veins projected onto the surface of the liver; ventral view.



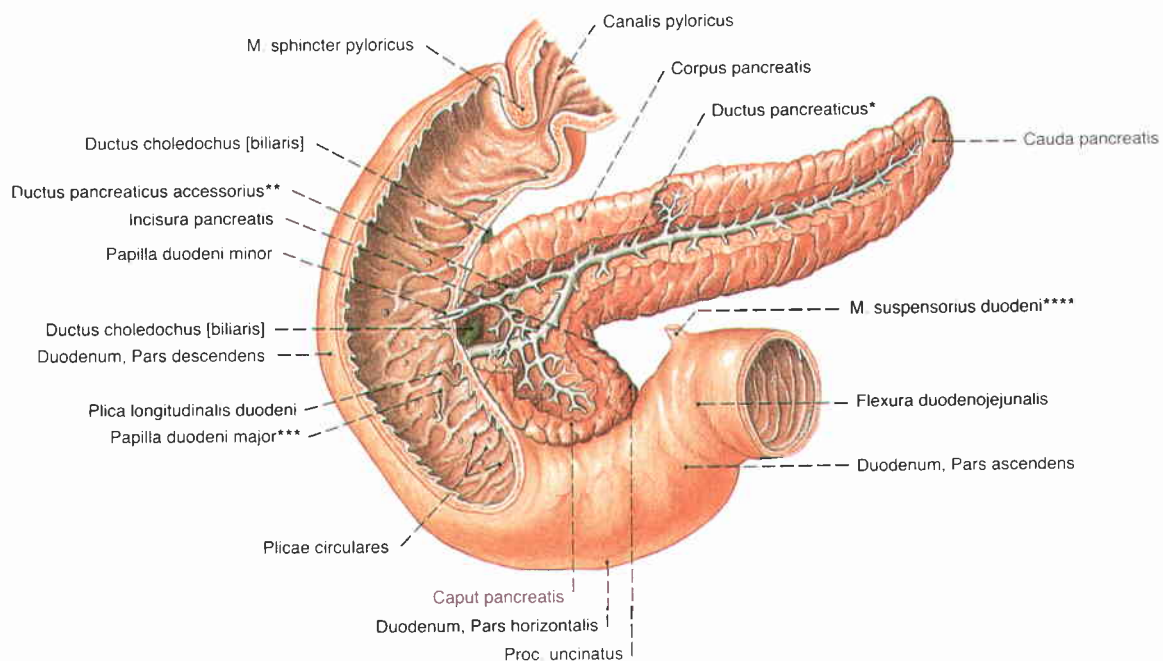


**Fig. 984** Liver, Hepar;  
projection onto the anterior abdominal wall;  
mid-respiratory phase.  
The position of the liver depends essentially on the respiratory

cycle. During inspiration, the diaphragm flattens out and the dome descends distinctly caudally. Thereby, the healthy liver is pressed inferiorly down to the costal arch and the lower border becomes palpable.



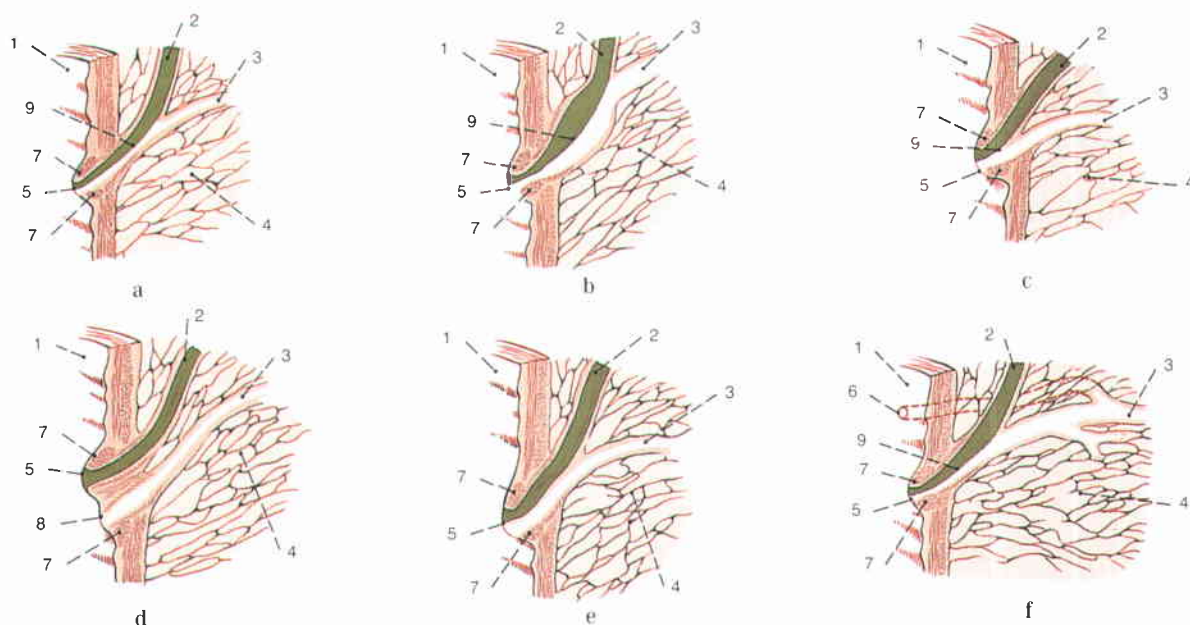
**Fig. 985** Duodenum, Duodenum;  
pancreas, Pancreas;  
projection onto the anterior abdominal wall.



**Fig. 986** Duodenum, Duodenum; pancreas, Pancreas; parts of the anterior wall of the duodenum have been removed to show the entry of the pancreatic duct; the pancreatic duct has been dissected; ventral view.

The formation and size of the accessory pancreatic duct vary considerably (in about 30% in the form of an accessory branch, in less than 10% in the form of a major excretory duct).

- \* clinical: WIRSUNG's duct
- \*\* clinical: SANTORINI's duct
- \*\*\* clinical: Papilla of VATER
- \*\*\*\* clinical: TREITZ's muscle



**Figs. 987 a-f** Variations in the confluence of the common bile duct and the pancreatic duct.

- a long common segment
- b ampullary expansion of the terminal part
- c short common segment
- d separate orifices confluence
- e single orifice with a septated common duct
- f additional duct, Ductus pancreaticus accessorius

- 1 = Duodenum
- 2 = Ductus choledochus (biliaris)
- 3 = Ductus pancreaticus
- 4 = Pancreas
- 5 = Papilla duodeni major
- 6 = Papilla duodeni minor, Ductus pancreaticus accessorius
- 7 = M. sphincter ampullae hepatopancreaticae
- 8 = Ductus pancreaticus (on "Papilla bipartita")
- 9 = Ampulla hepatopancreatica

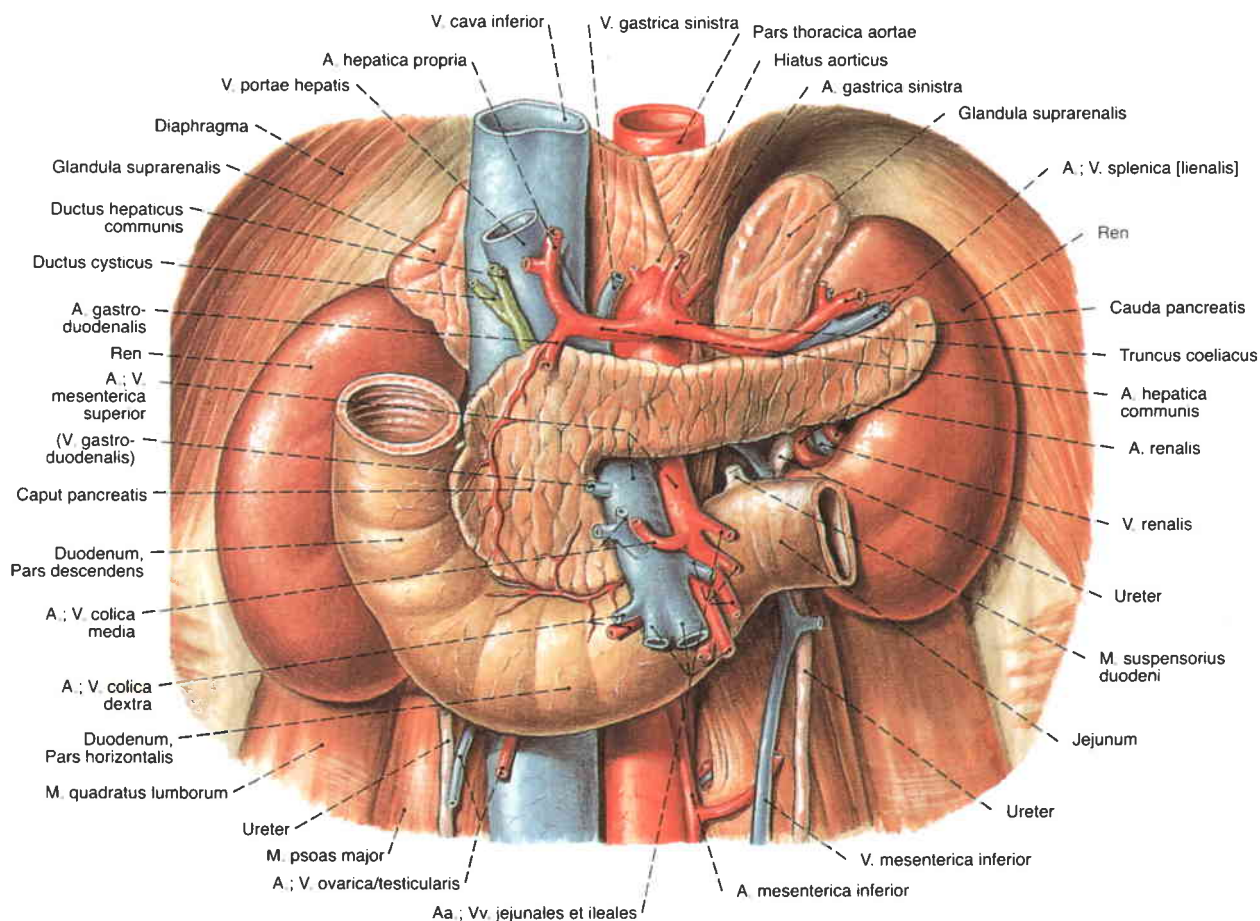


Fig. 988 Retroperitoneal organs and vessels of the upper abdomen:

ventral view.  
Lymph nodes not depicted.

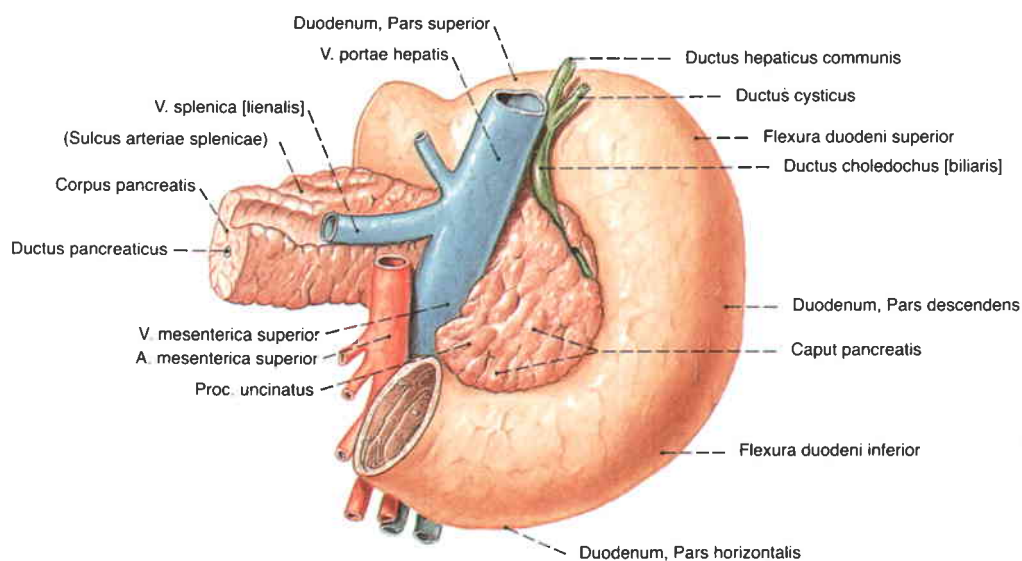
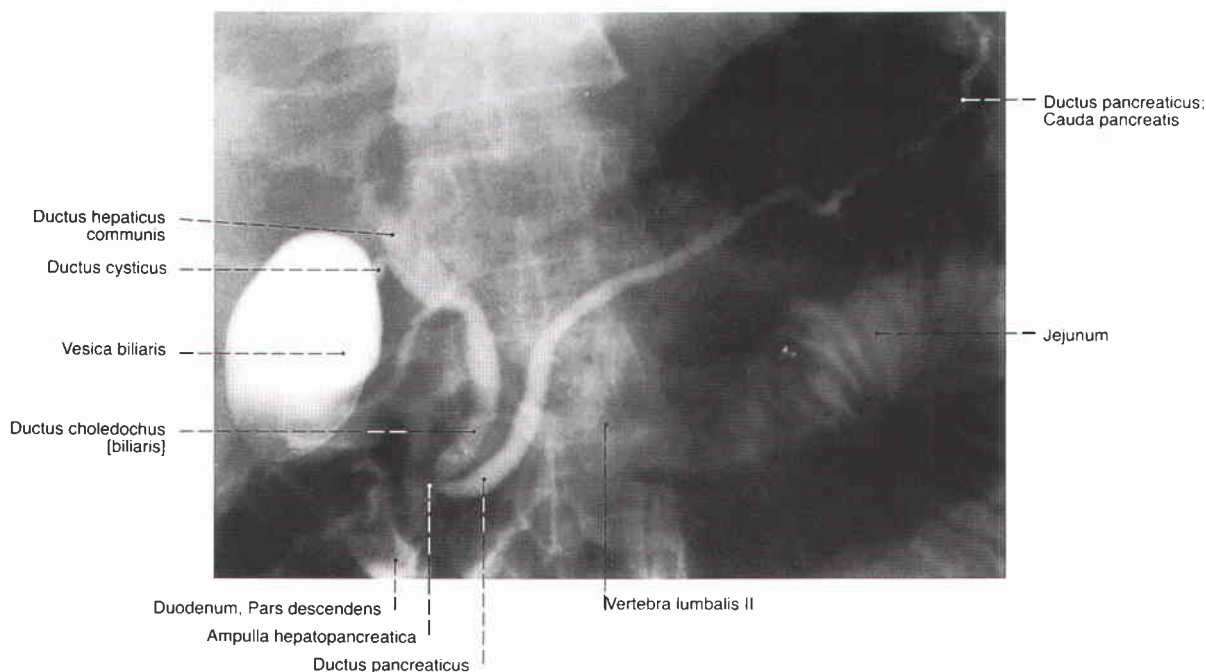


Fig. 989 Duodenum, Duodenum; pancreas, Pancreas; the body of the pancreas has been sectioned to show the pancreatic duct; dorsal view.

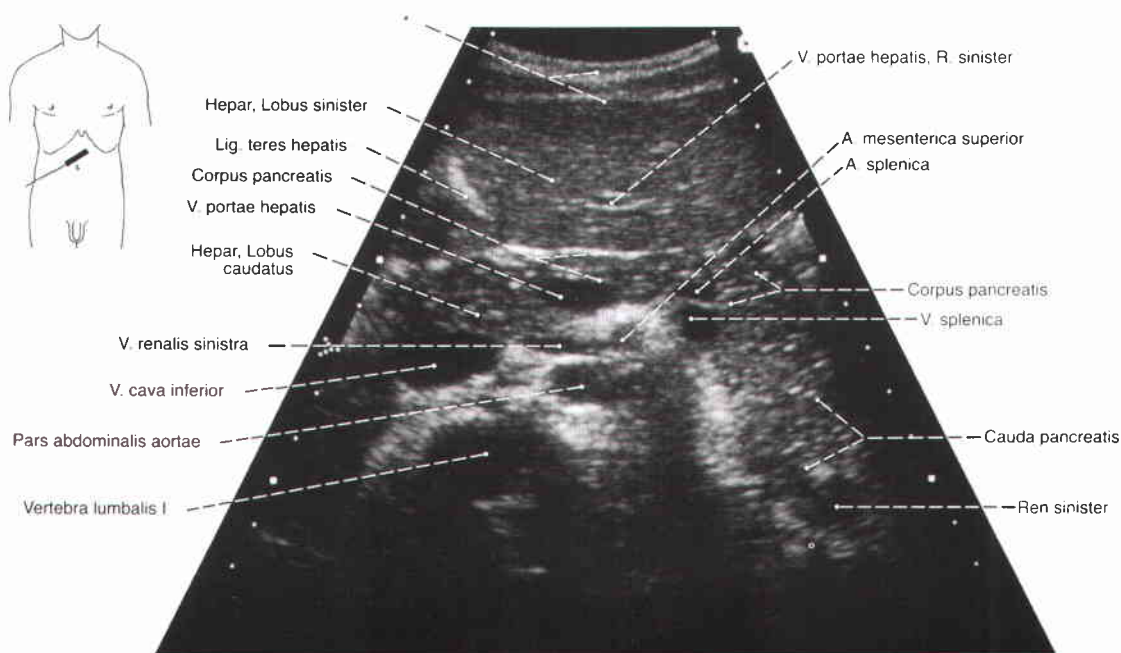
The common bile duct passes through the pancreas; the head of the pancreas reaches around the superior mesenteric vein.





**Fig. 990** Pancreatic duct, Ductus pancreaticus; common bile duct, Ductus choledochus; gallbladder, Vesica biliaris; AP-radiograph; the patient is in the supine position; a cannula has been introduced endoscopically into the common orifice of the pancreatic duct and the common bile duct and a contrast medium has been injected; ventral view.

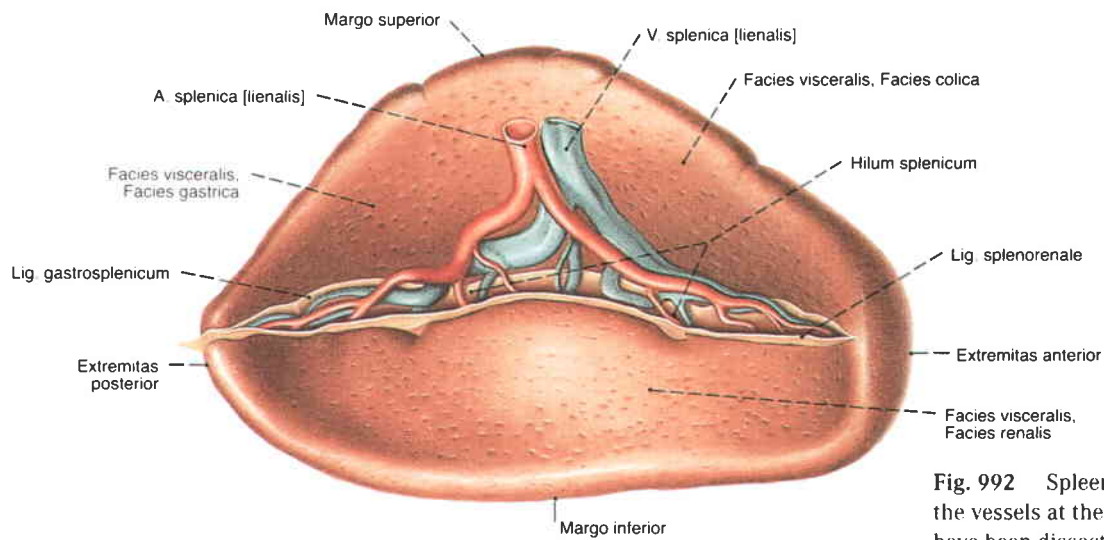
Clinical: ERCP (endoscopic retrograde cholangio-pancreatography). The whole extent of the pancreatic duct up to the hilum of the spleen is visible. It shows a typical oblique course to the left and superiorly. Some of the contrast medium has entered the small intestine and therefore parts of the duodenum and the jejunum can be seen. If the contrast medium is injected under higher pressure, the branches of the pancreatic duct may also be demonstrated (compare to Fig. 986). A danger exists however, that the pancreas could be damaged.



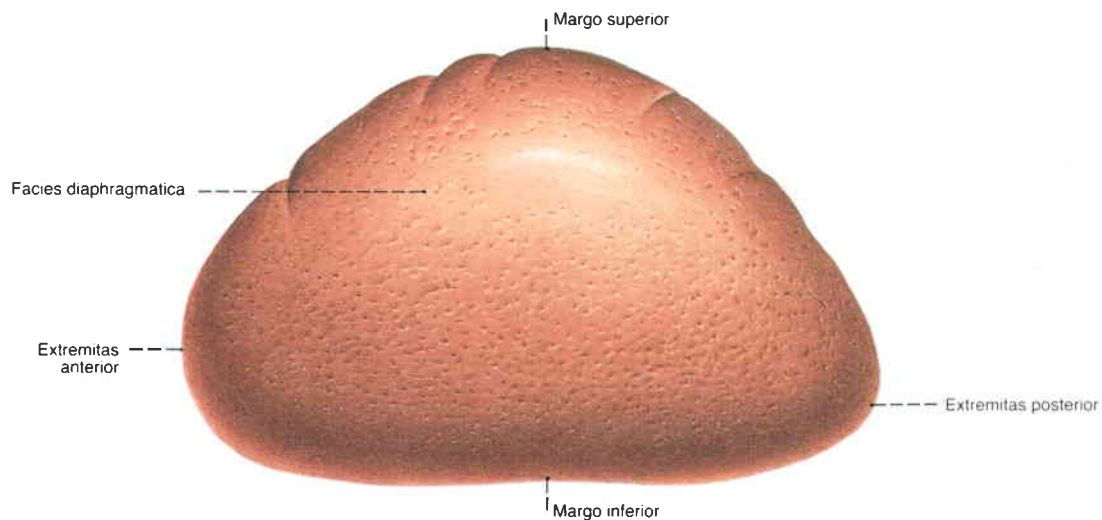
**Fig. 991** Pancreas, Pancreas; ultrasound image to show the pancreas and the adjacent great vessels during deep inspiration of the patient;

the tail of the pancreas extends quite far posteriorly; inferior view.

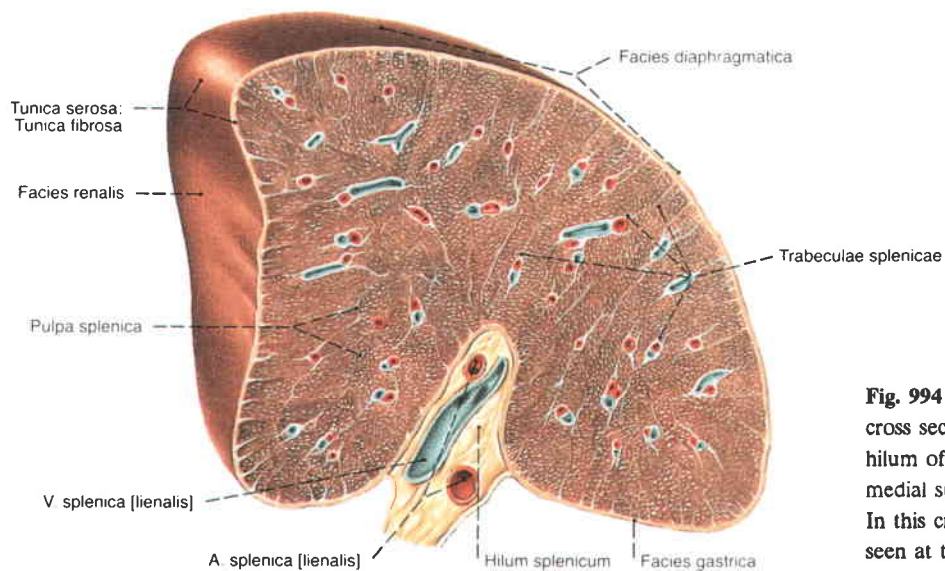
\* abdominal wall



**Fig. 992** Spleen, Splen [Lien]; the vessels at the hilum of the spleen have been dissected; ventromedial view.

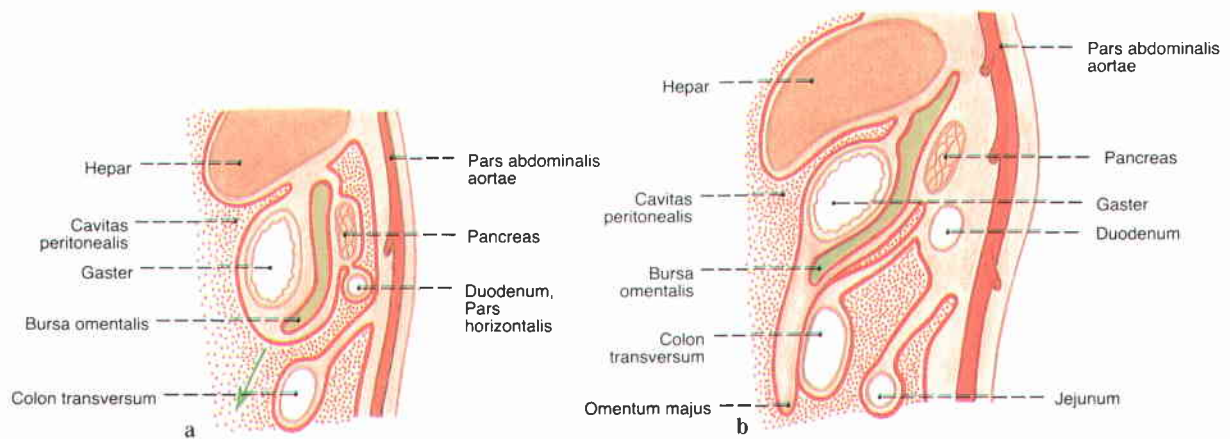


**Fig. 993** Spleen, Splen [Lien]; superolateral view.



**Fig. 994** Spleen, Splen [Lien]; cross section showing the structure and the hilum of the spleen; medial superior view.

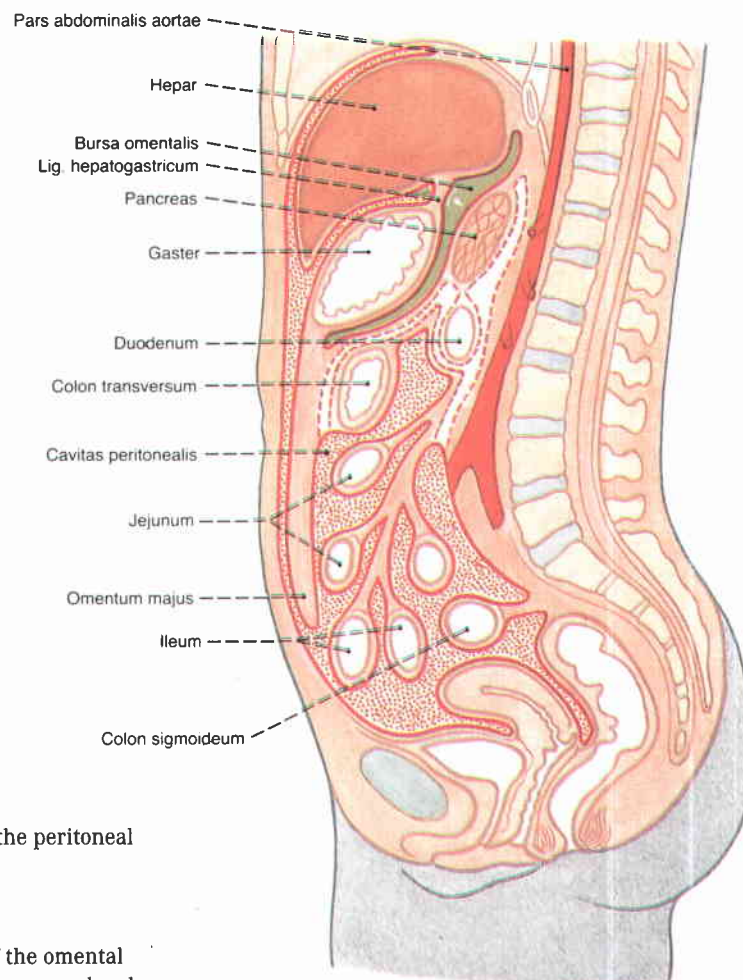
In this cross section no lymph nodes can be seen at the hilum. However, they regularly occur here and drain parts of the stomach and the tail of the pancreas as well.



**Figs. 995 a, b** Development and topography of the peritoneal cavity, Cavitas peritonealis; schematic median section; lateral view.

**a** early development

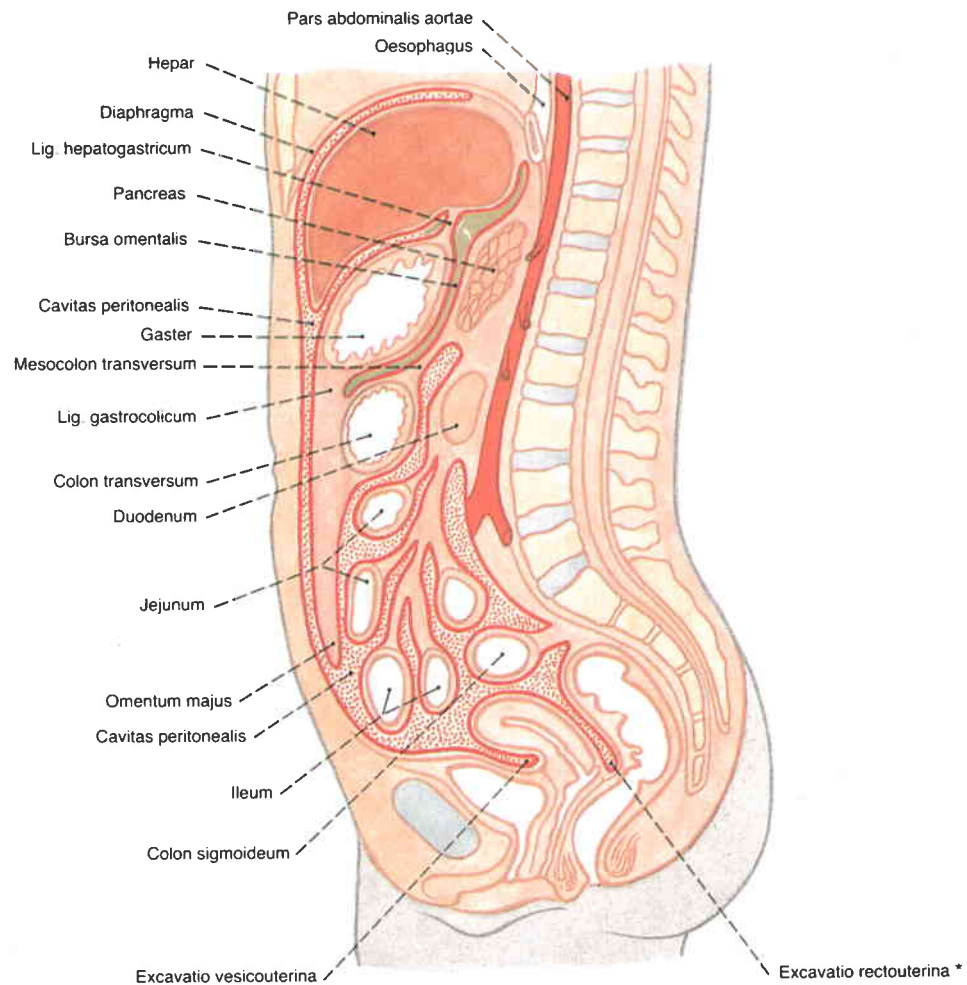
**b** development of the greater omentum



**Fig. 996** Development and topography of the peritoneal cavity, Cavitas peritonealis, in the female; schematic median section; lateral view.

The small white arrow marks the position of the omental foramen [epiploic or WINSLOW's foramen]. The arrow-head is located in the vestibule of the omental bursa.



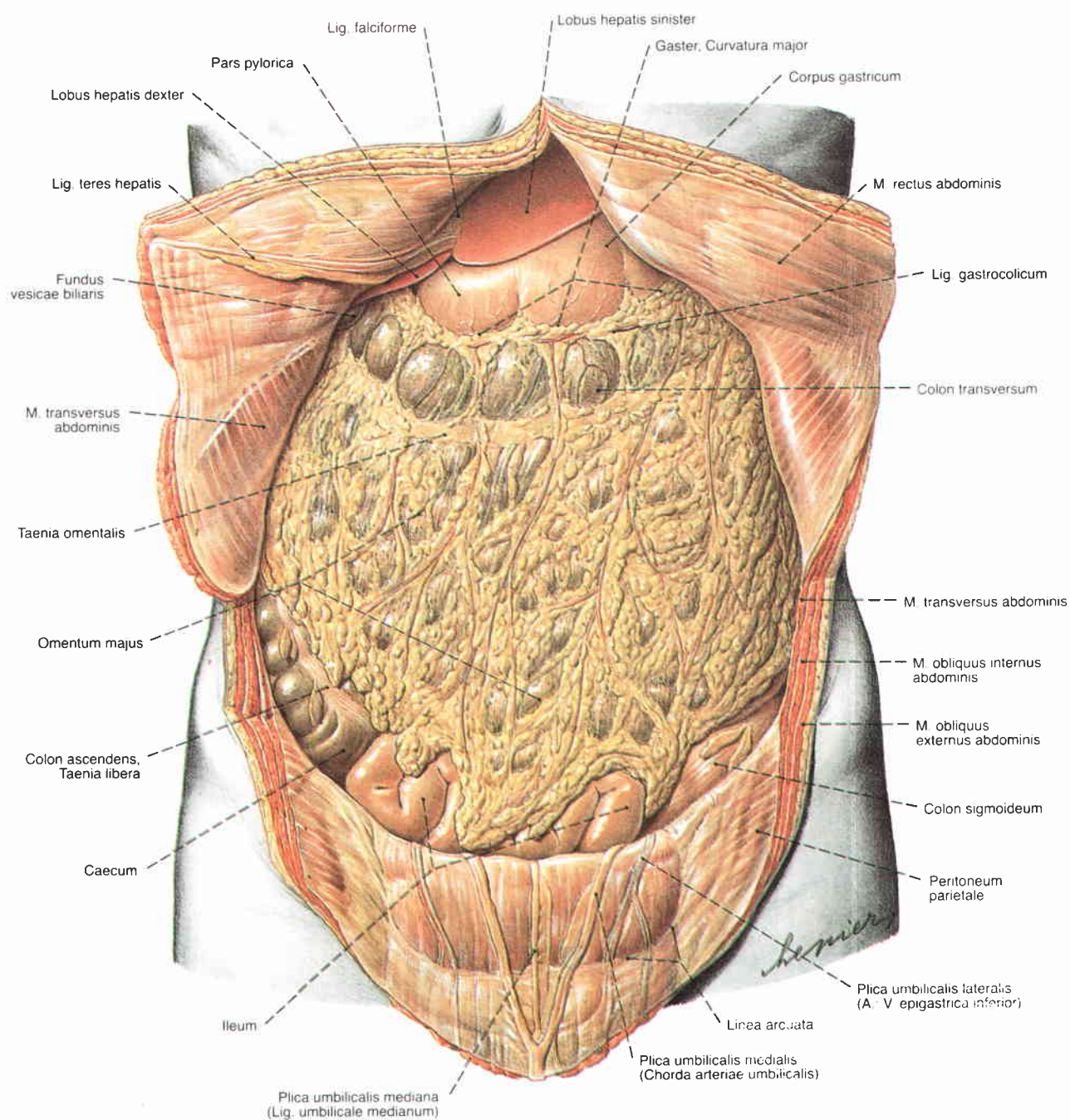


**Fig. 997** Development and topography of the peritoneal cavity, Cavitas peritonealis, in the female; final developmental stage with the adhesion of the greater omentum to the transverse colon; schematic median section; lateral view.

\* clinical: DOUGLAS's space

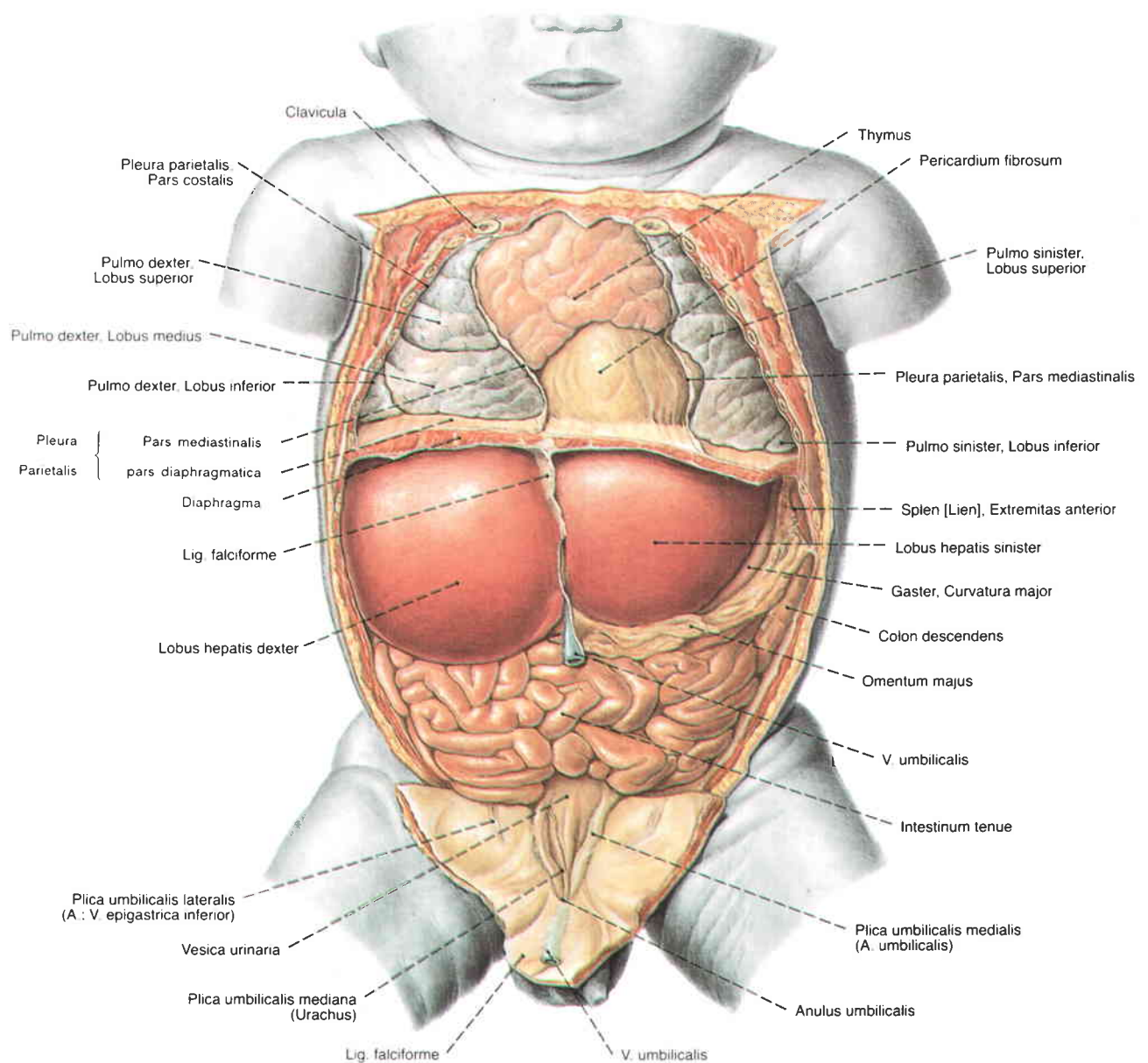
**Figs. 995-997** The development of the intestines is presented schematically. In reality many developmental stages occur concurrently. The peritoneal cavity is enlarged in the drawings for didactic reasons. Normally the viscera are very close together and are only separated by a small capillary space.

The peritoneal fluid amounts to only a few milliliters. Peritoneal cavity: red dotted area; omental bursa: olive; original course of the peritoneum: red dashed line. The arrow is in the omental foramen [Foramen epiploicum].



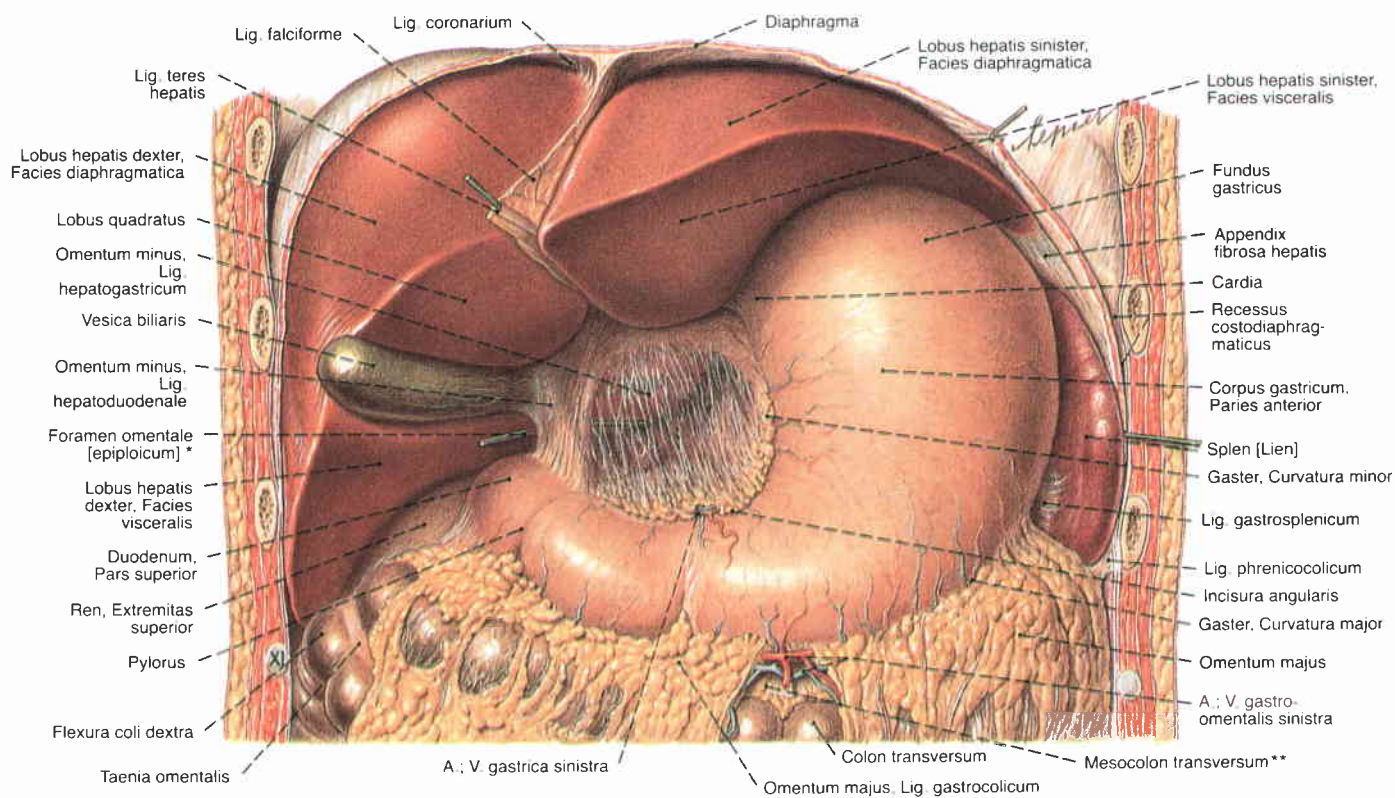
**Fig. 998** Position of the abdominal viscera, Situs viscerum; greater omentum, Omentum majus; ventral view.

The lower part of the abdominal cavity is also called the "intestinal abdomen".



**Fig. 999** Position of the abdominal viscera, Situs viscerum, in a newborn; the anterior thoracic and abdominal walls and parts of the diaphragm have been removed; ventral view.  
Note the sizes of the liver, the greater omentum, the medial umbilical folds and the umbilical vein in comparison with an adult (Fig. 998).



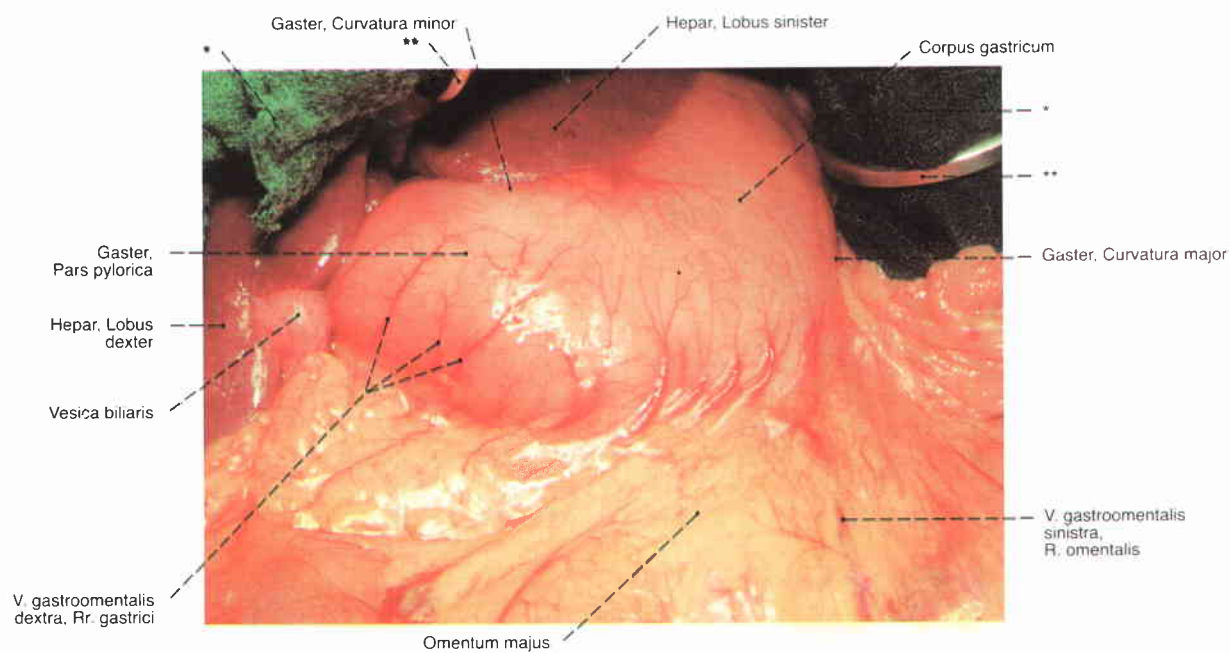


**Fig. 1000** Position of the viscera in the upper abdomen; parts of the diaphragm as well as the anterior thoracic and abdominal walls have been removed; ventral view.

This part of the abdomen is also known as the "glandular abdomen".

\* also called WINSTON'S foramen

\*\* omental bursa slightly exposed

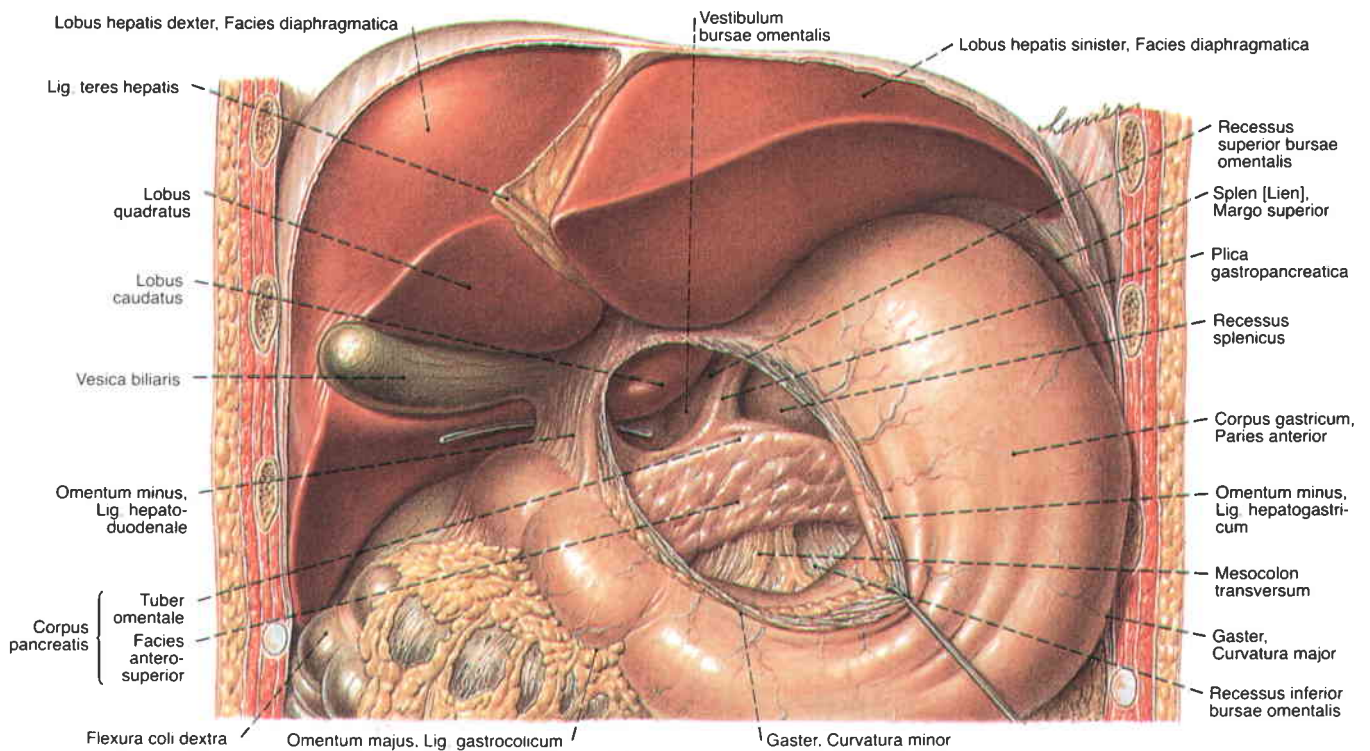


**Fig. 1001** Stomach, Gaster; greater omentum, Omentum majus; surgical photograph; the viscera are in their natural position; ventral view.

\* surgical drape

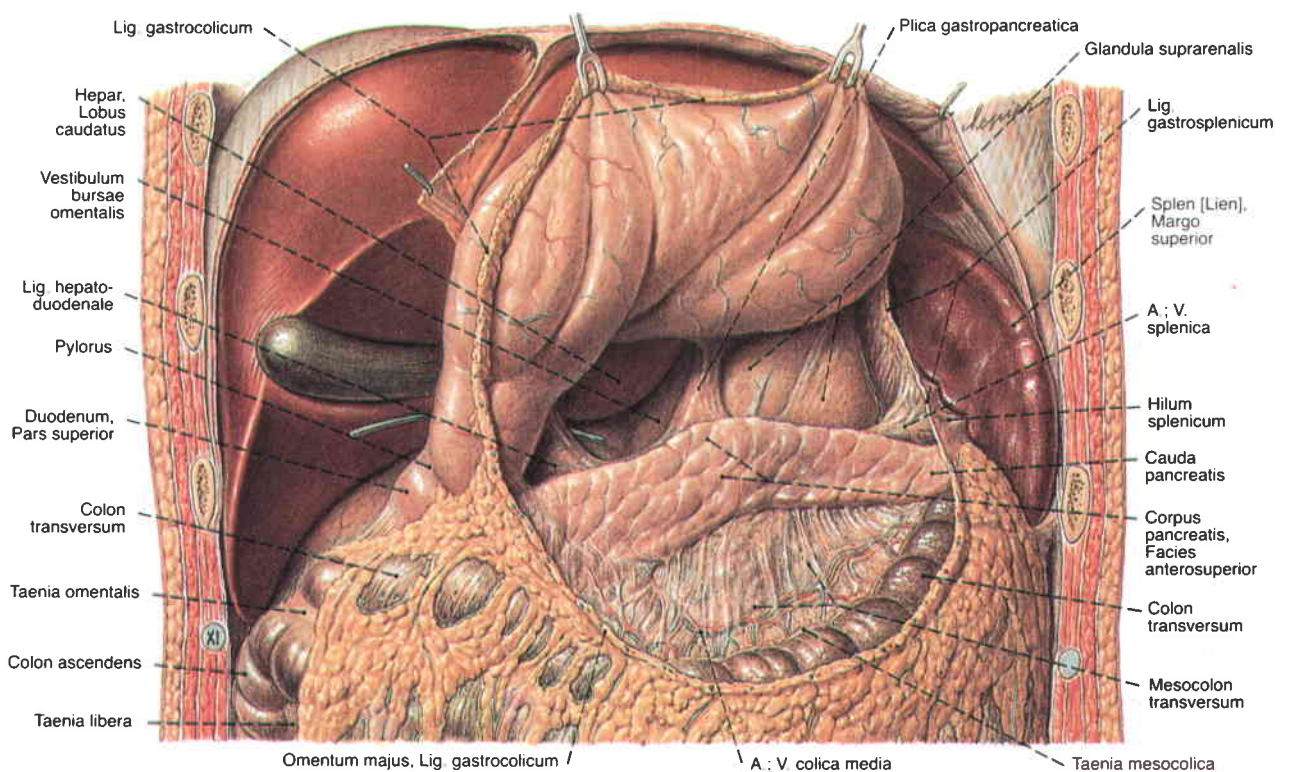
\*\* surgical retractor





**Fig. 1002** Viscera of the upper abdomen; the lesser omentum (hepatogastric ligament) has been partially removed to demonstrate the omental bursa and the body of the

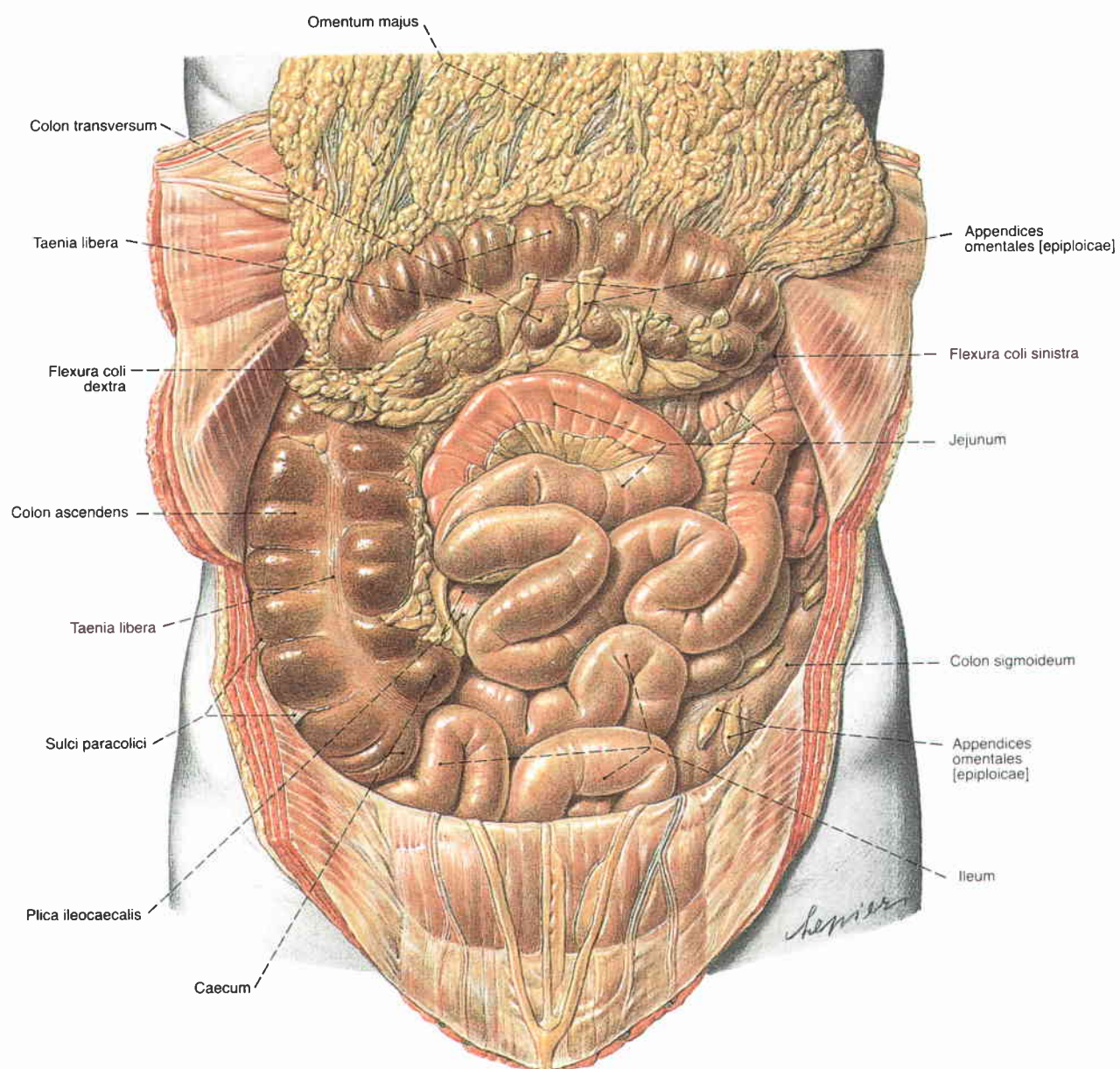
pancreas; the lesser curvature of the stomach has been retracted to the right and inferiorly; ventral view.



**Fig. 1003** Liver, Hepar; stomach, Gaster; pancreas, Pancreas; spleen, Splén; the greater omentum has been sectioned at the gastrocolic

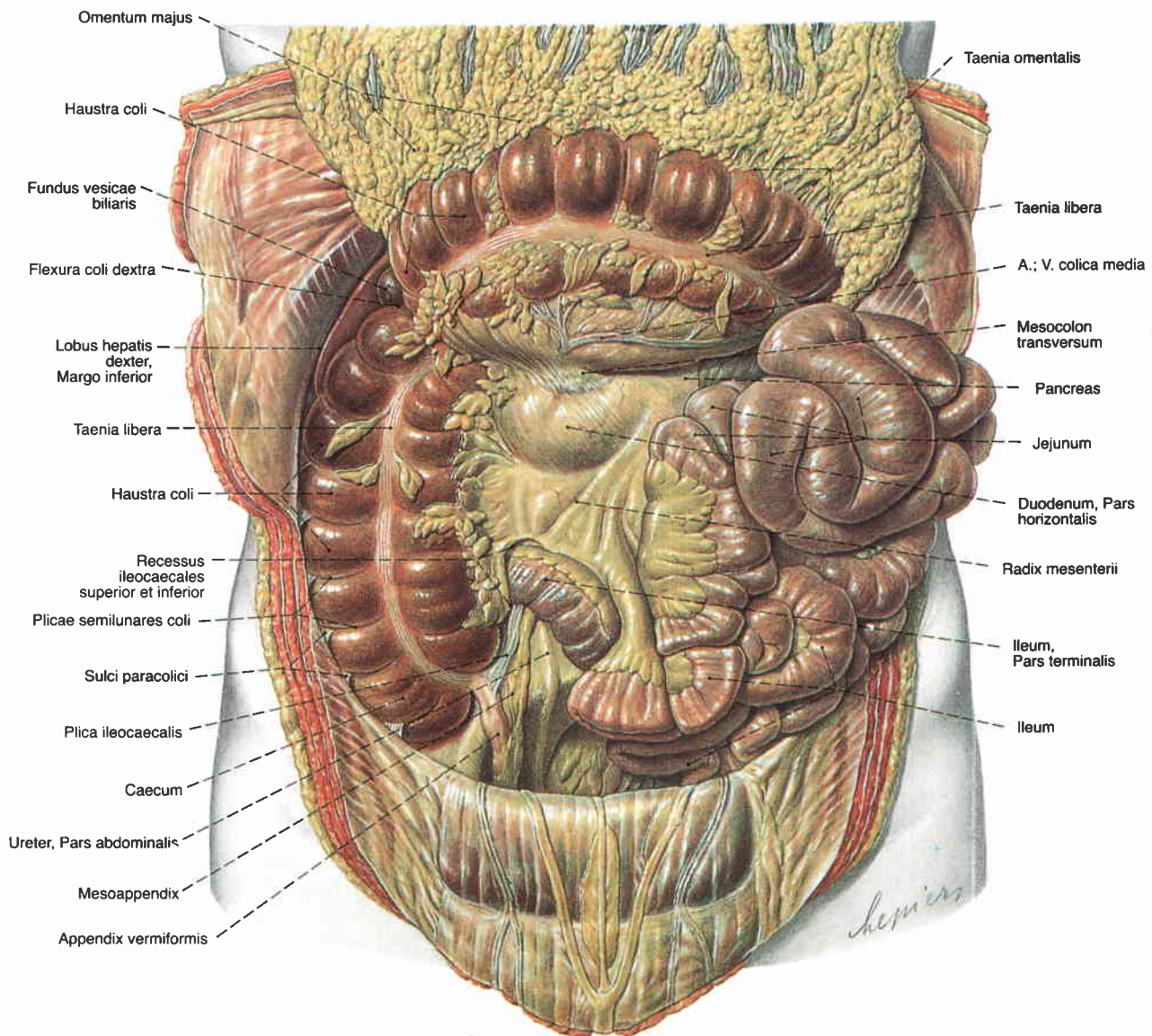
ligament; the greater curvature of the stomach has been retracted superiorly with hooks, view into the omental bursa; ventral view.



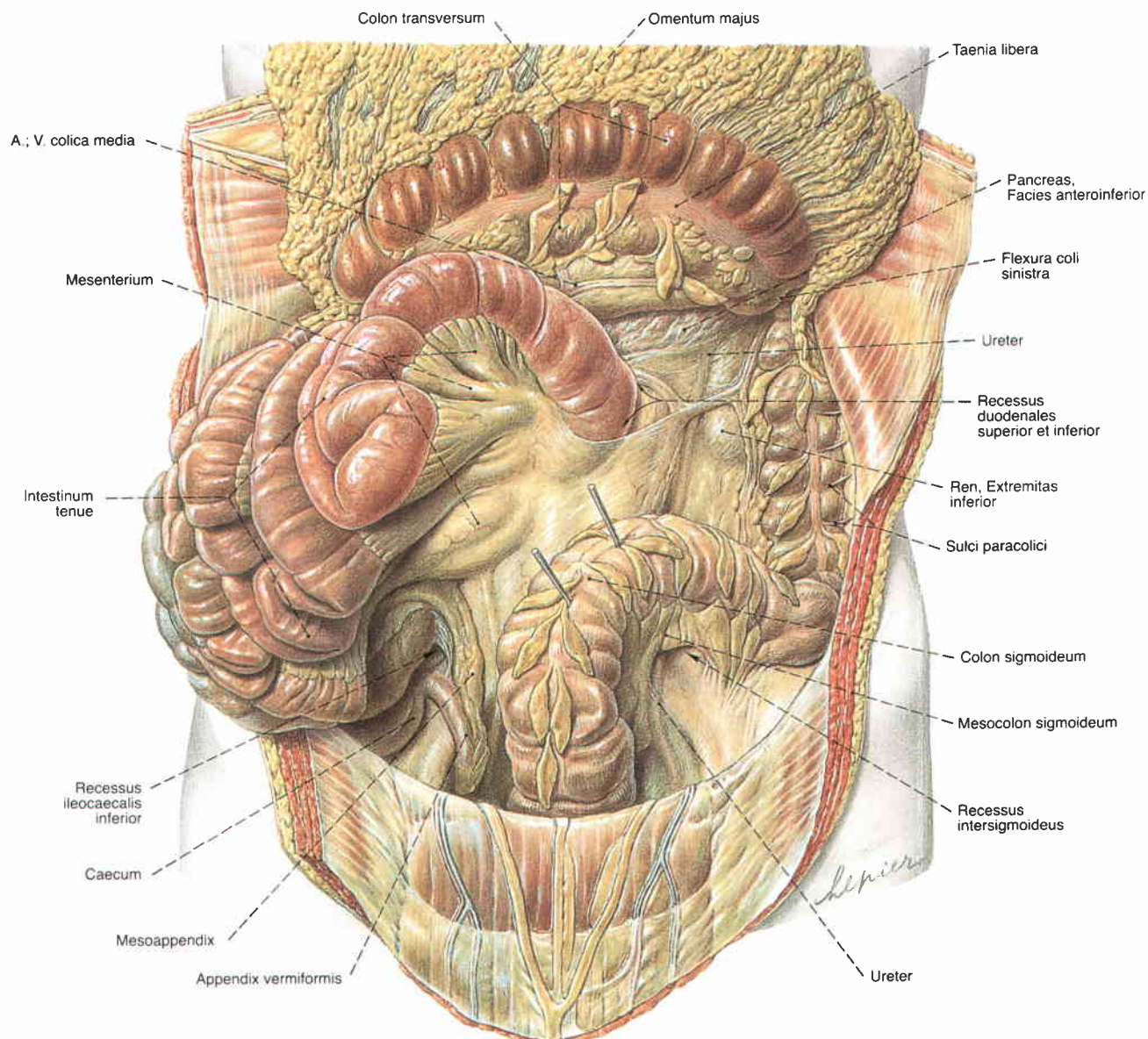


**Fig. 1004** Position of the abdominal viscera, Situs viscerum; the greater omentum and the transverse colon have been retracted superiorly; ventral view.





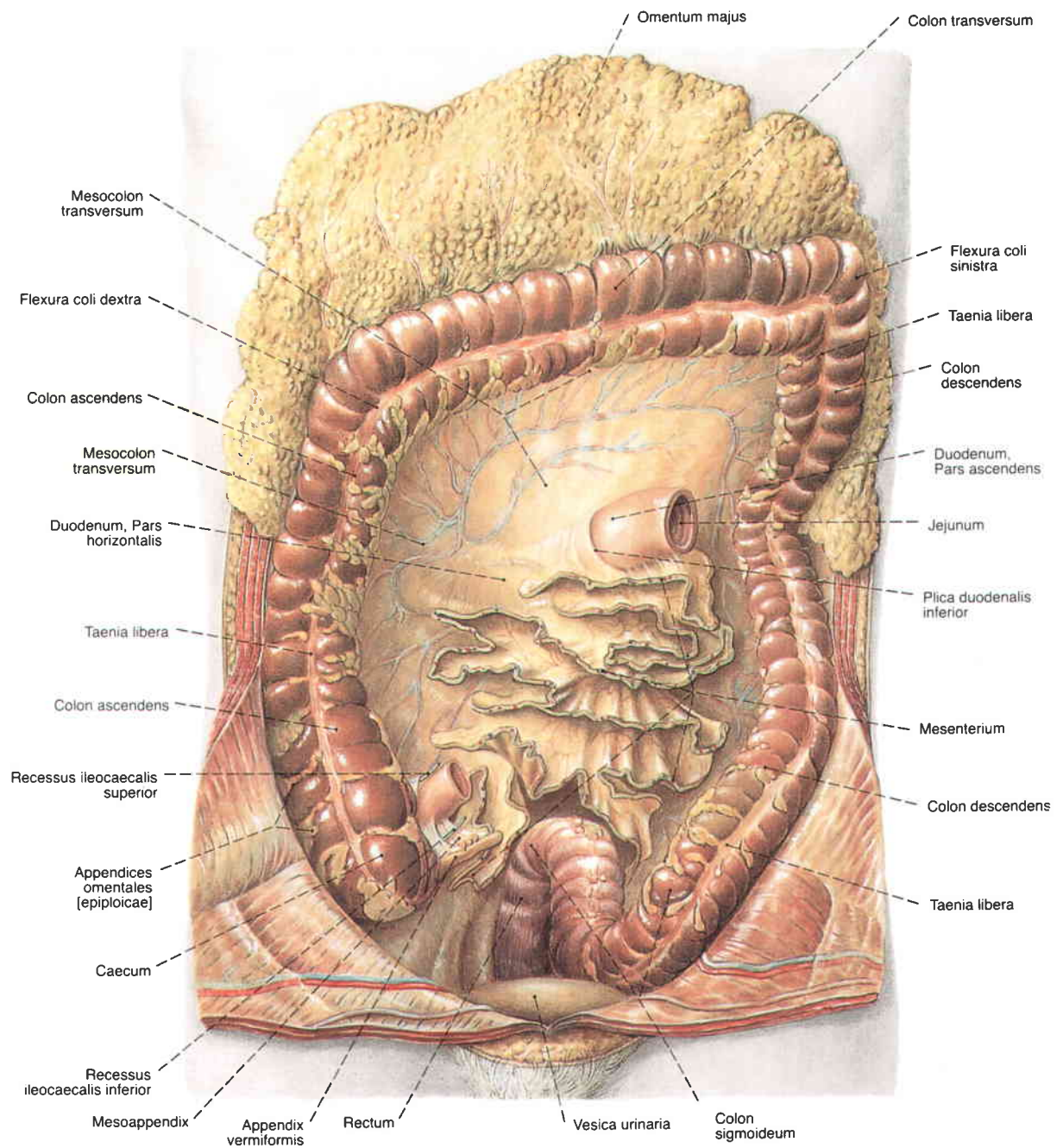
**Fig. 1005** Small intestine, *Intestinum tenue*; large intestine, *Intestinum crassum*; the greater omentum and the transverse colon have been retracted superiorly; the small intestine has been pulled to the left to show the caecum and the vermiform appendix; ventral view.  
Note the thin layer of subcutaneous fat and the fat deposits in the mesentery.



**Fig. 1006** Small intestine, *Intestinum tenue*; large intestine, *Intestinum crassum*; the greater omentum and the transverse colon have been retracted superiorly; the small intestine has been pulled to the right; the sigmoid colon has been retracted to the right by two hooks; ventral view.

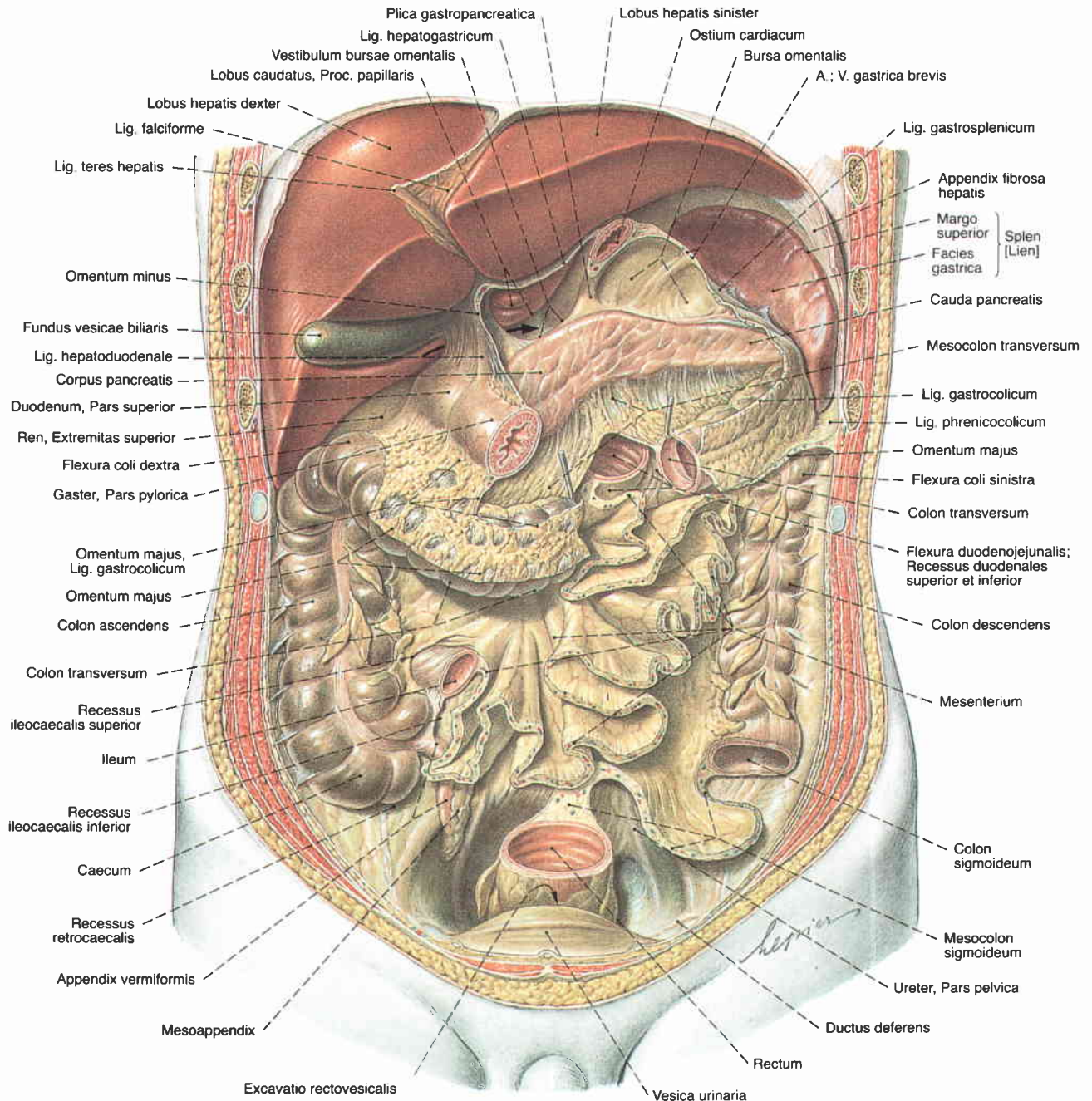
The recesses at the transitional region between the retroperitoneal and intraperitoneal parts of the intestine vary considerably between individuals.



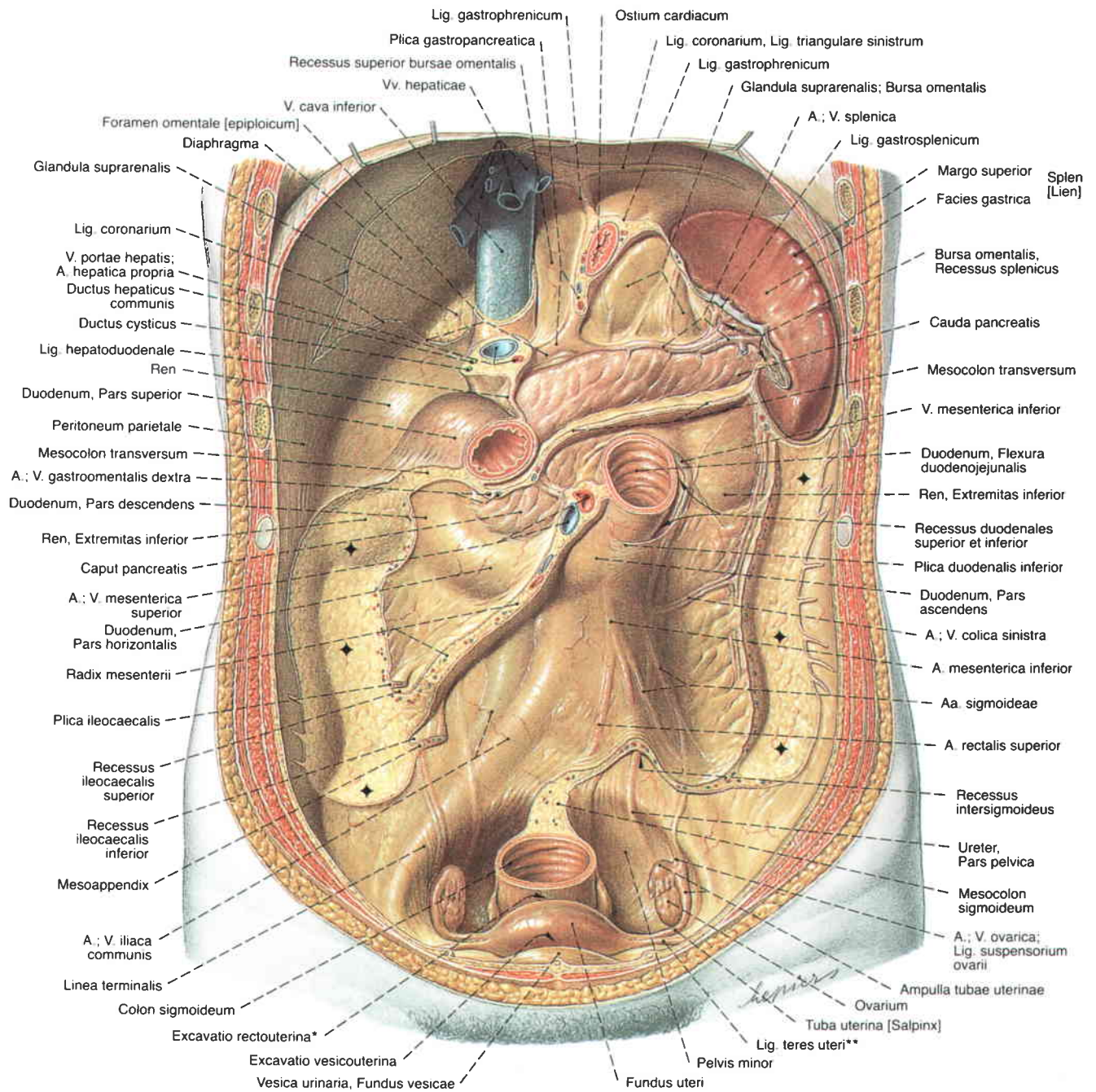


**Fig. 1007** Mesentery, Mesenterium; large intestine, Intestinum crassum; the greater omentum and the transverse colon have been retracted superiorly; the small intestine has been sectioned close to the duodenojejunal flexure, at the terminal ileum, and at the mesentery; ventral view.





**Fig. 1008** Position of the abdominal viscera, *Situs viscerum*; the stomach has been removed between the cardia and the pylorus, the small intestine between the duodenojejunal flexure and the terminal ileum; the transverse colon and sigmoid colon have been partially removed; the omental bursa is visible with all its recesses; ventral view.  
An arrow lies in the omental [epiploic] foramen.

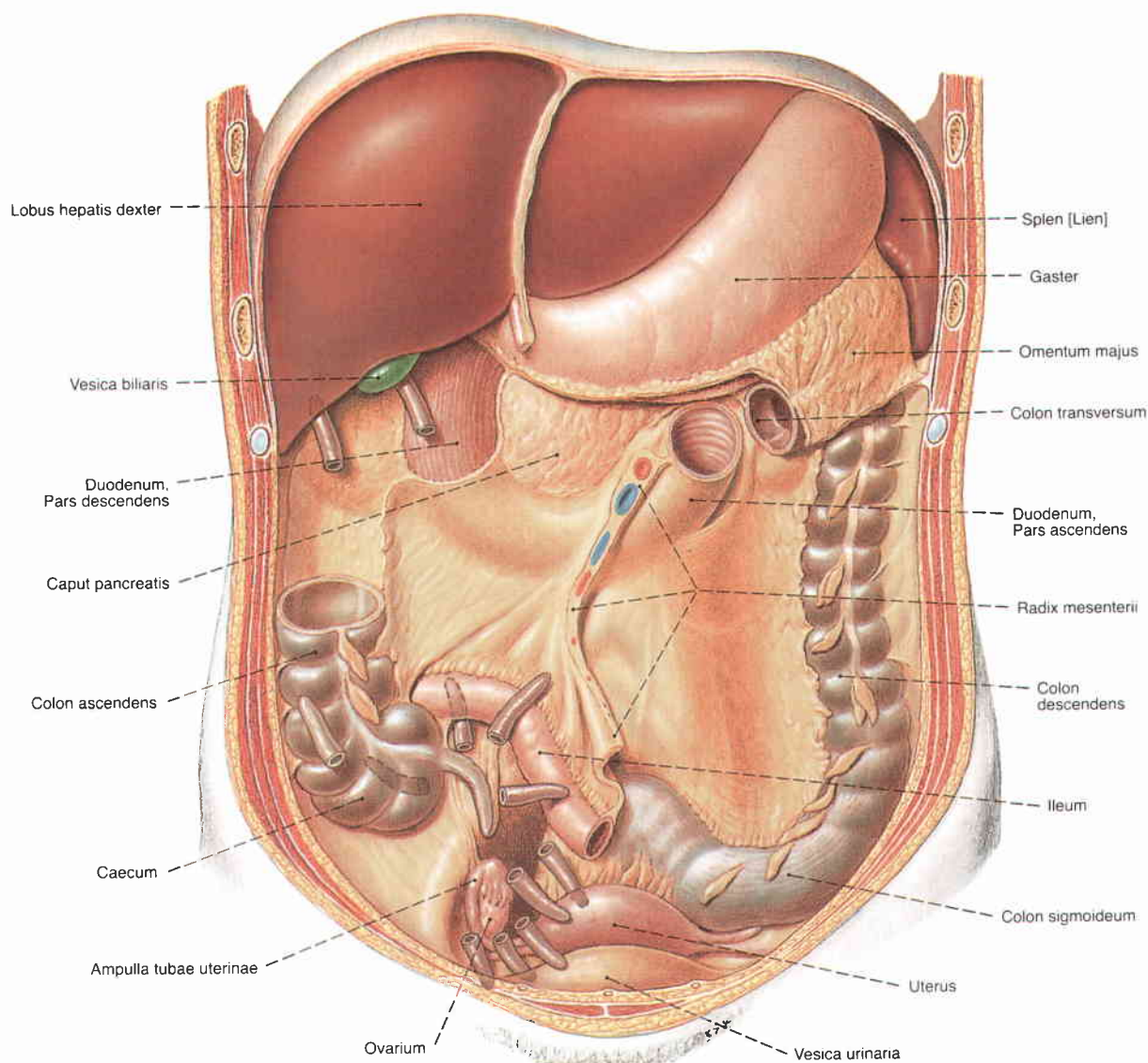


**Fig. 1009** Dorsal wall of the peritoneal cavity, *Cavitas peritonealis*, and spleen, *Splen [Lien]*, in the female; the liver, the stomach, the small intestine (except for the duodenum) and the colon have been removed to show the pancreas, the root of the mesentery as well as the fixation sites of the ascending and descending colon. The sites of fixation of the ascending and descending colon have been marked (♦).

\* clinical: DOUGLAS's space

\*\* clinical: Lig. rotundum

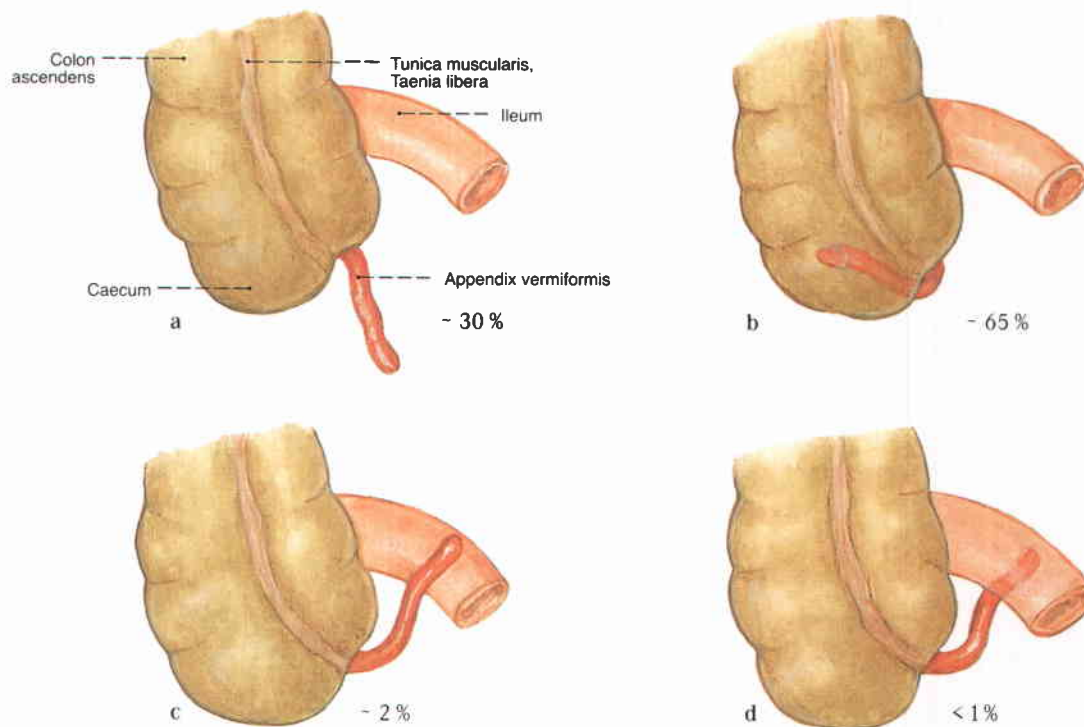




**Fig. 1010** Vermiform appendix, Appendix vermiformis, variations in position; ventral view.

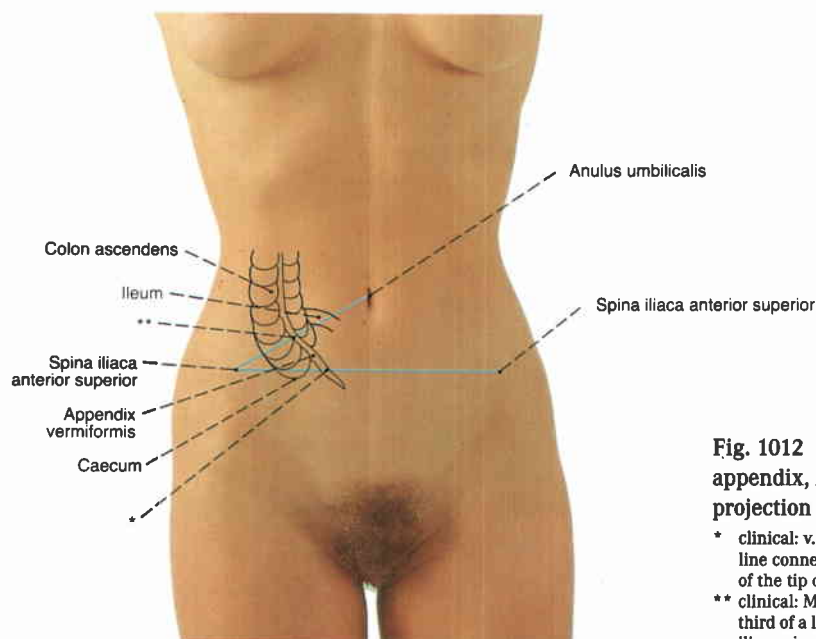
Major deviations from the normal position are usually due to an atypical position of the caecum (e.g. high caecum) or minimal peritoneal fixation of the caecum (e.g. mobile caecum).





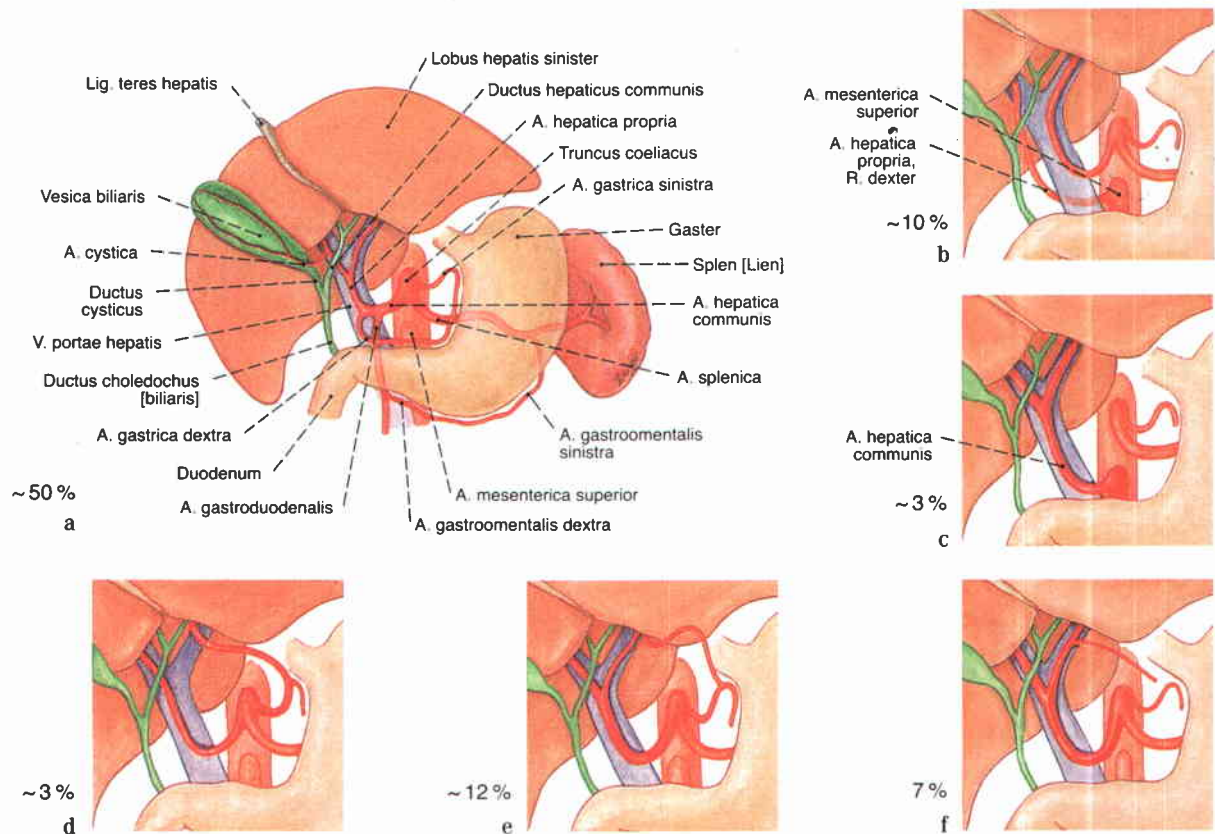
**Figs. 1011 a-d** Vermiform appendix, Appendix vermiformis, variations in position.

- a descending into the small pelvis
- b retrocaecal
- c pre-ileal
- d retro-ileal



**Fig. 1012** Caecum, Caecum, and vermiform appendix, Appendix vermiformis; projection onto the anterior abdominal wall.

- \* clinical: v. LANZ's point, the end point of the right third of a line connecting the two anterior superior iliac spines as locator of the tip of the downward hanging vermiform appendix.
- \*\* clinical: MCBURNEY's point, the beginning point of the outer third of a line connecting the navel and the right anterior superior iliac spine as locator of the base of the vermiform appendix.



**Figs. 1013 a–f** Variations in the arterial blood supply of the liver.

**a** “textbook case”

**b** The superior mesenteric artery contributes to the supply of the right lobe of the liver.

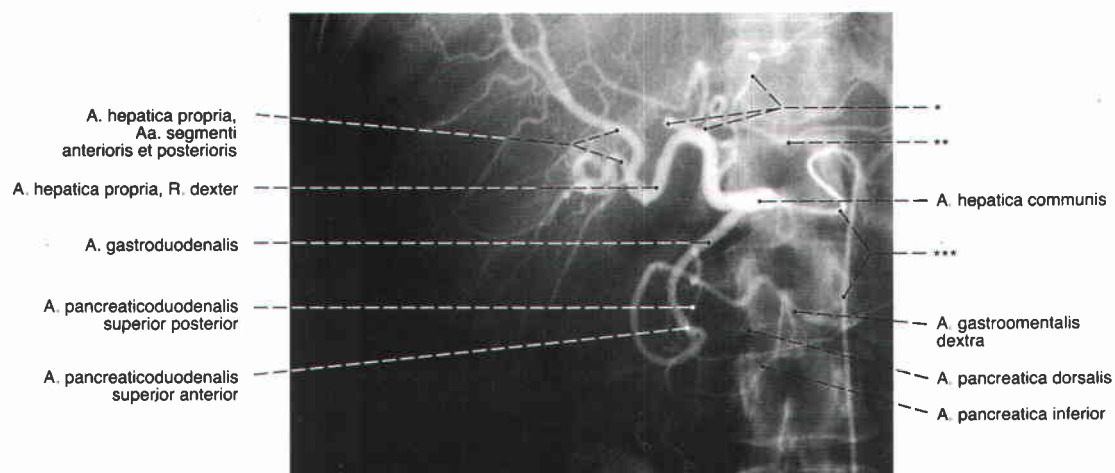
**c** The common hepatic artery originates from the superior mesenteric artery.

**d** The left gastric artery supplies the left lobe of the liver.

**e** A branch of the left gastric artery supplies the left lobe of the liver in addition to the left branch of the proper hepatic artery.

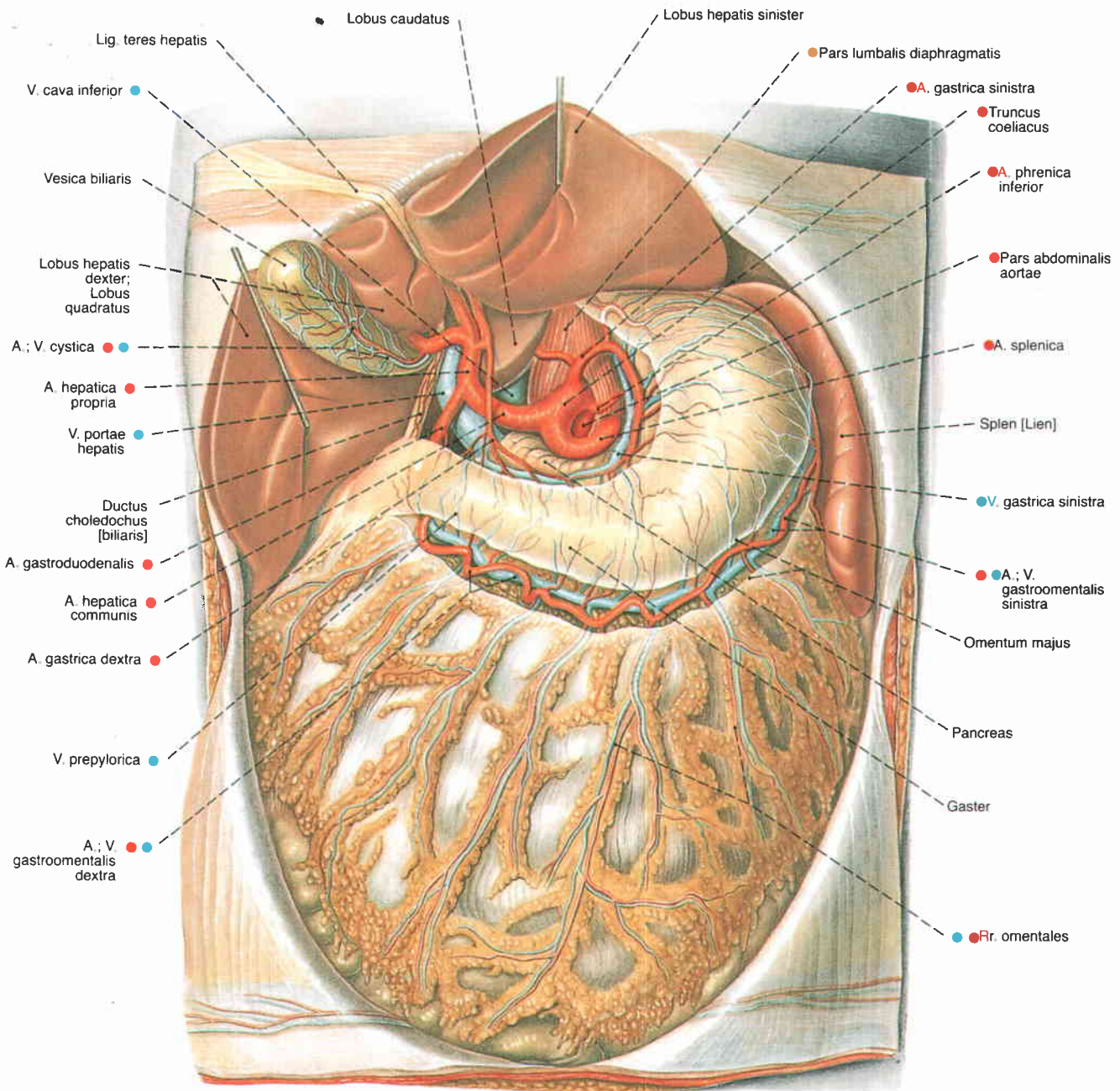
**f** An accessory branch of the proper hepatic artery supplies the lesser curvature of the stomach.

In about 25% of cases the superior mesenteric artery contributes to the arterial supply of the liver.



**Fig. 1014** Common hepatic artery, A. hepatica communis; AP-radiograph after selective injection of a contrast medium into the common hepatic artery; ventral view.

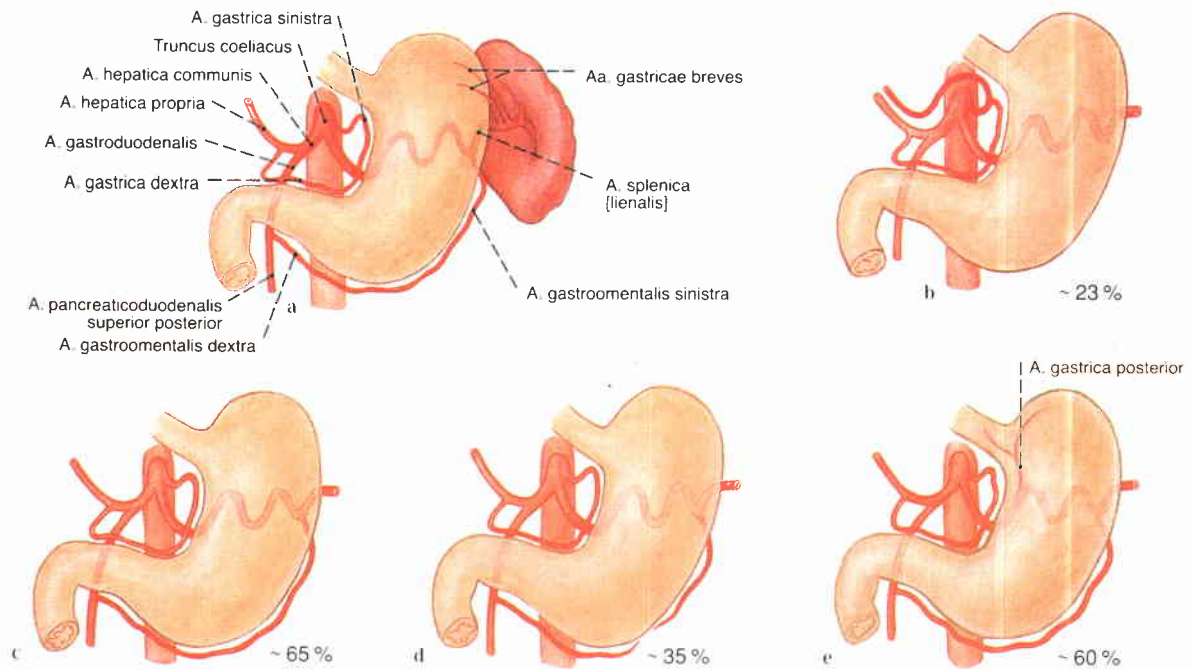
- \* branches to the left lobe of the liver instead of a left branch of the proper hepatic artery
- \*\* accessory branch from the hepatic artery to the lesser curvature of the stomach
- \*\*\* catheter in the aorta



**Fig. 1015** Vessels of the upper abdomen; the lesser omentum has been removed to show the coeliac trunk and its branches; the gastrocolic ligament and the gastro-omental arteries and veins have been dissected along the greater curvature of the stomach; the vestibule of the omental bursa has been exposed; ventral view.

The distance of the arteries from the wall of the lesser and greater curvatures of the stomach varies considerably.





Figs. 1016 a-e Variations in the arterial supply of the stomach, Gaster.

- a normal situation, "textbook case": the arterial arcades on the greater and lesser curvatures of the stomach are closed
- b contribution of the left gastric artery to the arterial supply of the left lobe of the liver
- c anastomosis between the left and the right gastroepiploic arteries at the greater curvature of the stomach (closed arterial arcade).
- d no connection between the left and the right gastroepiploic arteries at the greater curvature of the stomach (open arterial arcade).
- e a branch of the splenic artery, the posterior gastric artery, supplies parts of the posterior wall of the stomach

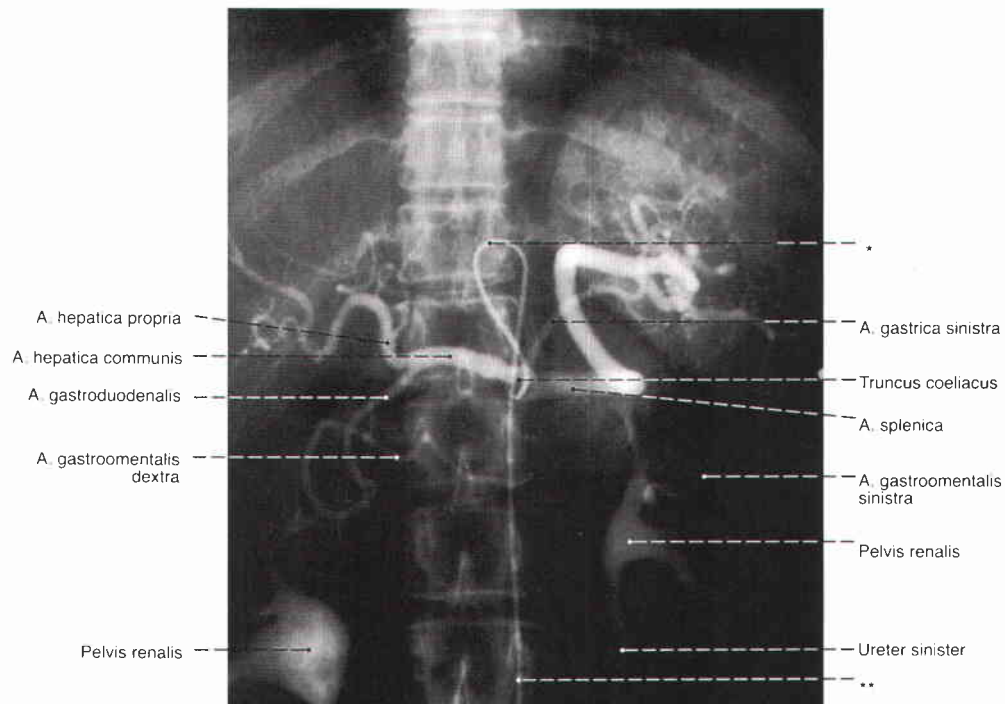
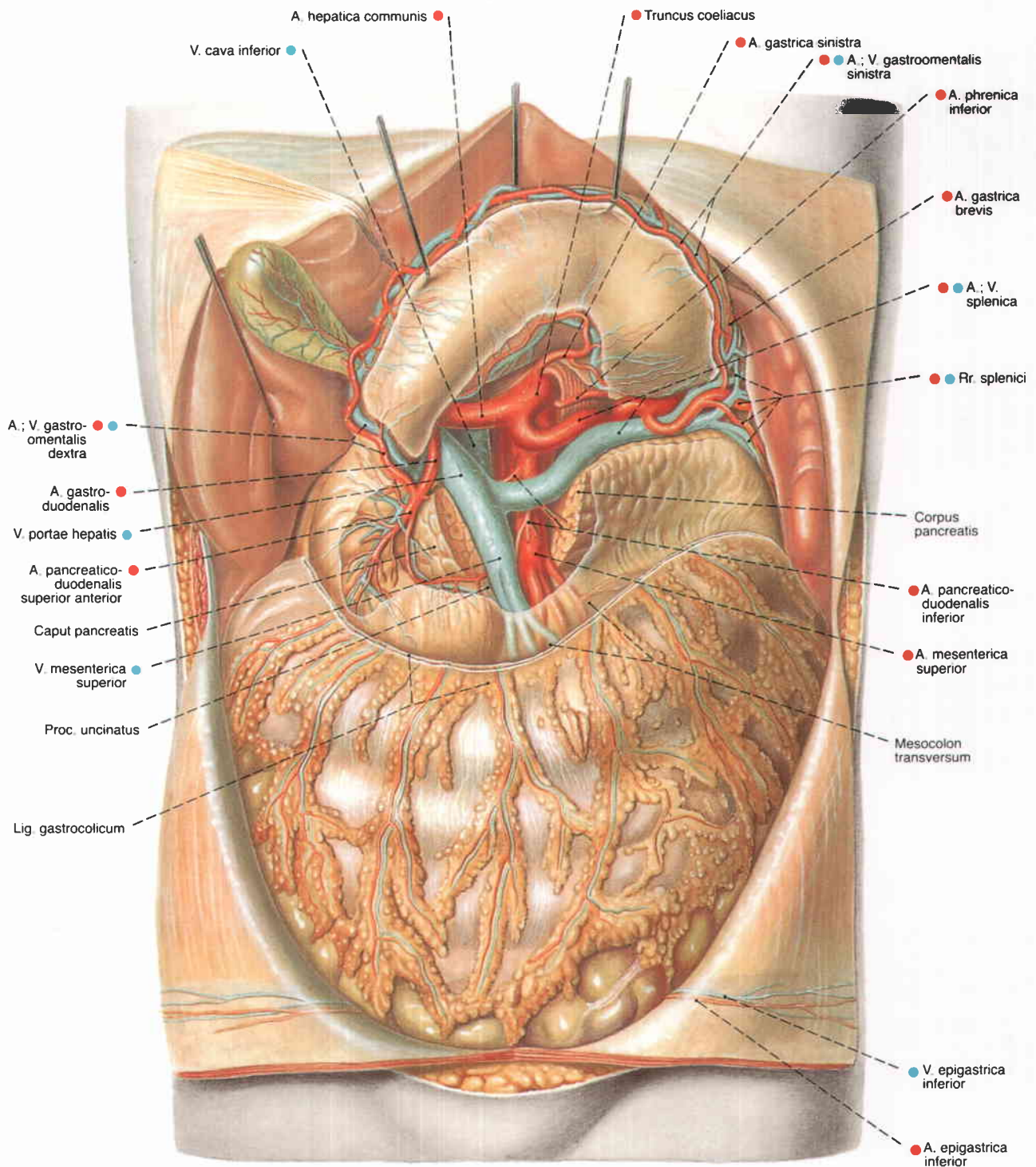


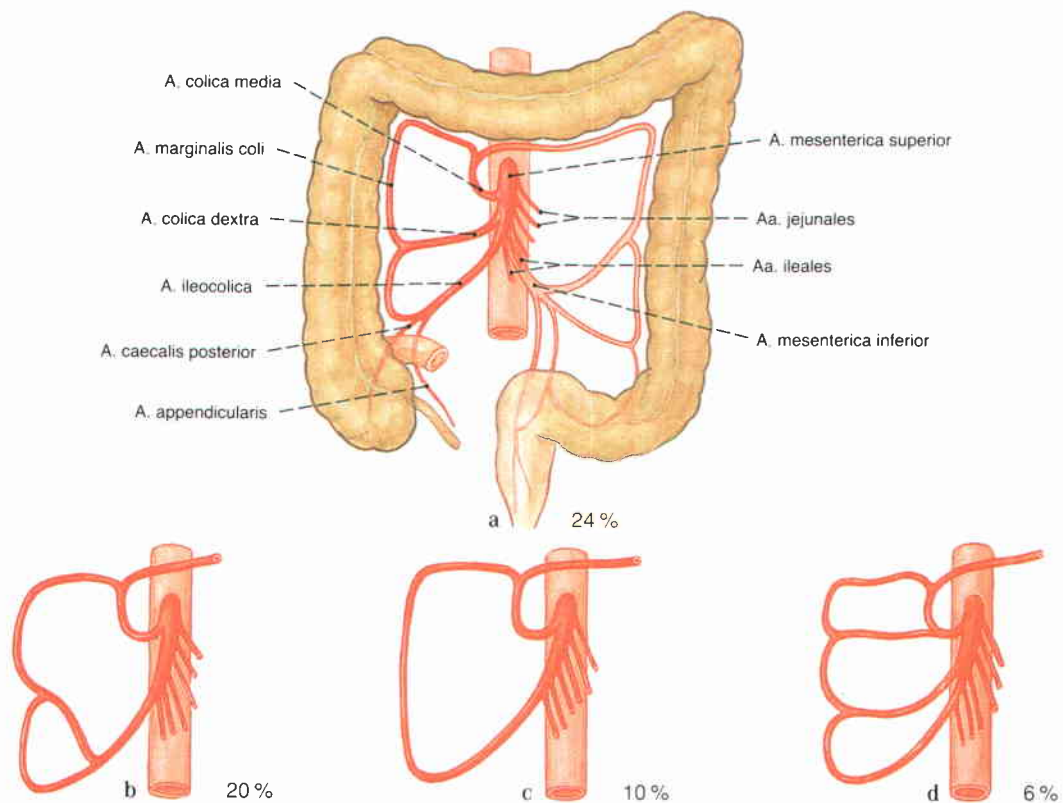
Fig. 1017 Arteries of the stomach, Gaster; spleen, Splen [Lien], and liver, Hepar;  
AP-radiograph after selective injection of a contrast medium into the coeliac trunk (coeliography) with simultaneous demonstration of the renal pelvis after intravenous injection of a contrast

medium, which can be excreted by the kidneys;  
ventral view.

- \* loop of the catheter in the aorta
- \*\* catheter in the aorta



**Fig. 1018** Vessels of the upper abdomen; the gastrocolic ligament has been sectioned; the stomach has been retracted superiorly by hooks to demonstrate the coeliac trunk; a portion of the body of the pancreas has been removed to show the junction of the splenic and the superior mesenteric veins; the omental bursa has been opened; ventral view.  
The uncinate process of the pancreas often reaches far behind the mesenteric vessels.



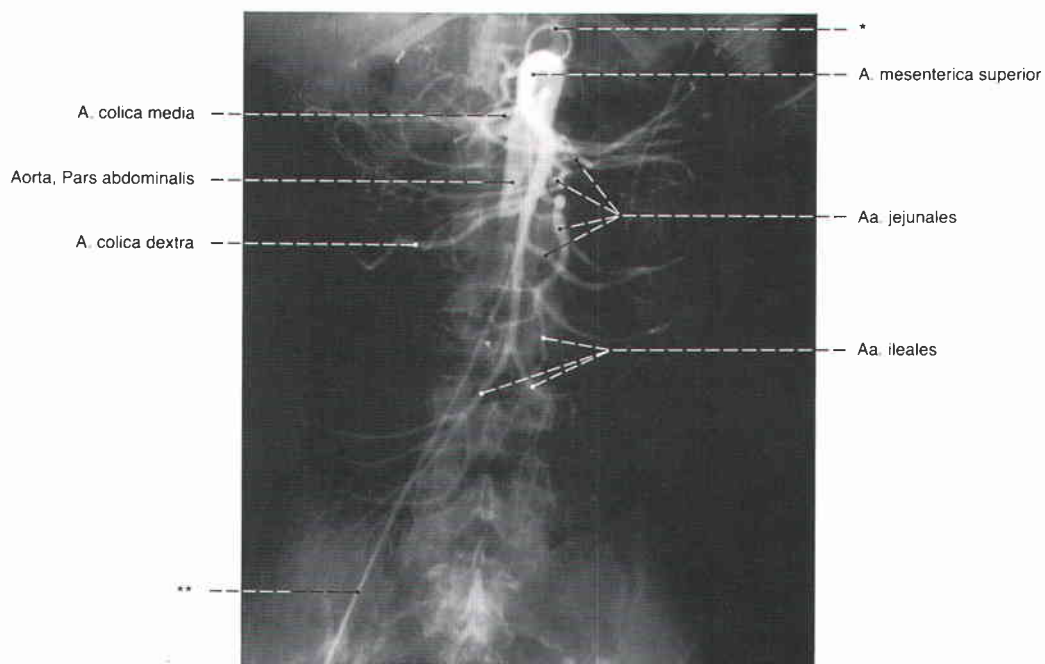
**Figs. 1019 a–d** Variations in the branches of the superior mesenteric artery to the colon.

**a** “textbook case”: the Colon ascendens and the Colon transversum are supplied by three branches.

**b** The ileocolic artery and the right colic artery share a common trunk.

**c** There are only two branches from the mesenteric artery, the right colic artery is absent.

**d** Duplication of the right colic artery



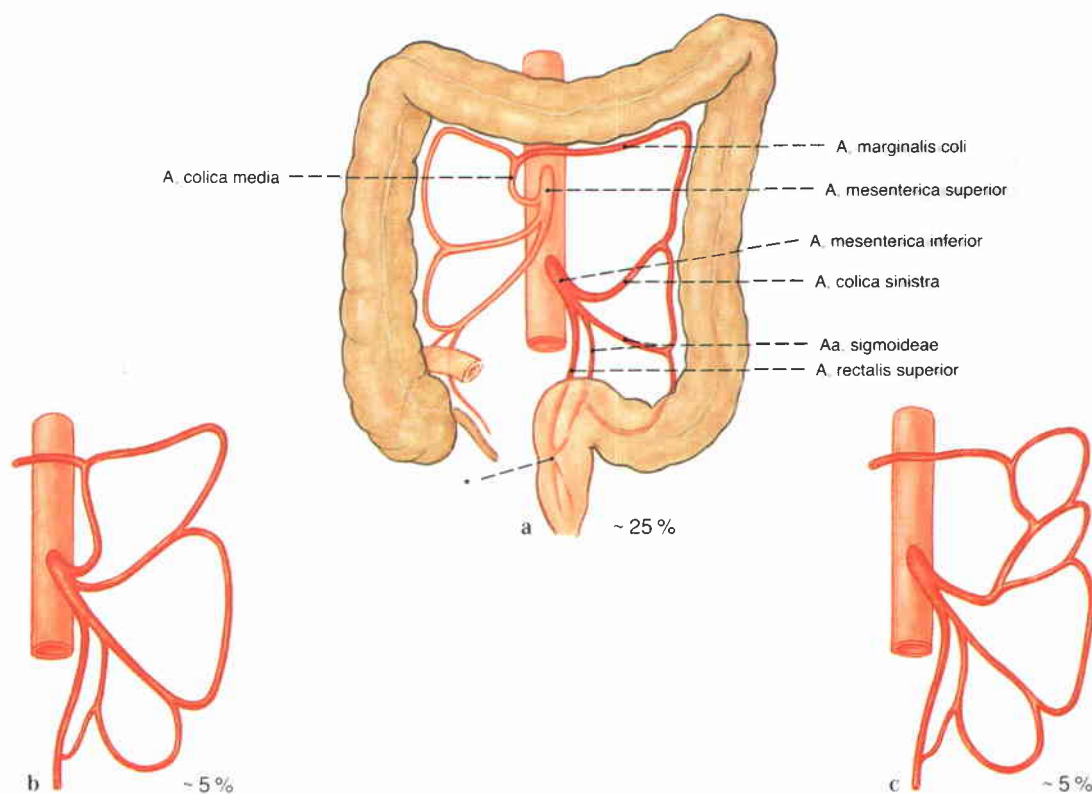
**Fig. 1020** Superior mesenteric artery, *A. mesenterica superior*; AP-radiograph after injection of a contrast medium into the origin of the superior mesenteric artery; ventral view.

\* catheter in the aorta

\*\* catheter in the common iliac artery







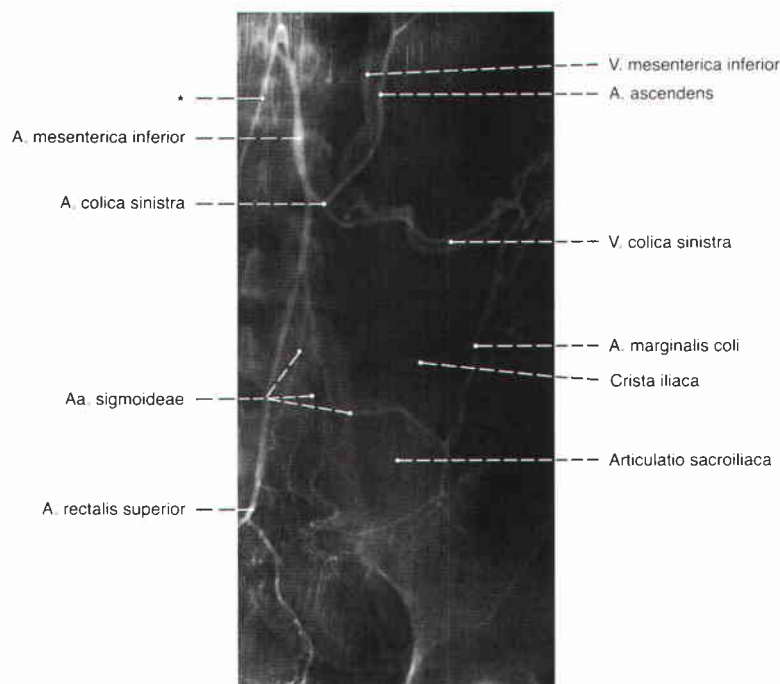
**Figs. 1022 a-c** Variations in the branches of the inferior mesenteric artery.

**a** trifurcation of the inferior mesenteric artery supplying Colon descendens, Colon sigmoideum and Rectum

**b** accessory middle colic artery from the main trunk of the inferior mesenteric artery

**c** accessory middle colic artery branching from the left colic artery

\* clinical: Sudeck's point

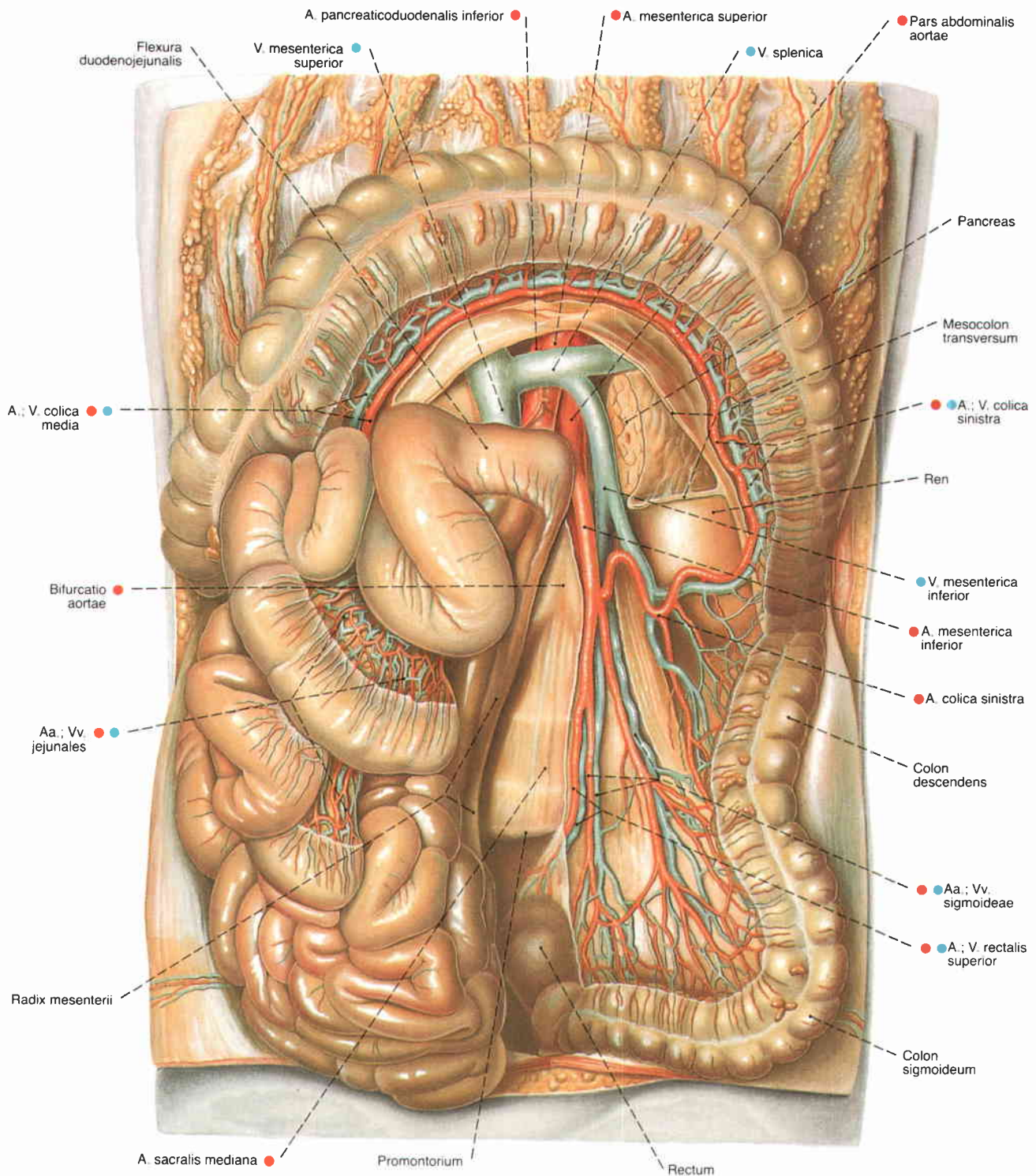


**Fig. 1023** Inferior mesenteric artery, A. mesenterica inferior; AP-radiograph after selective injection of a contrast medium into the origin of the inferior mesenteric artery; ventral view.

Some of the contrast medium has already left the colon, therefore veins are visible as well.

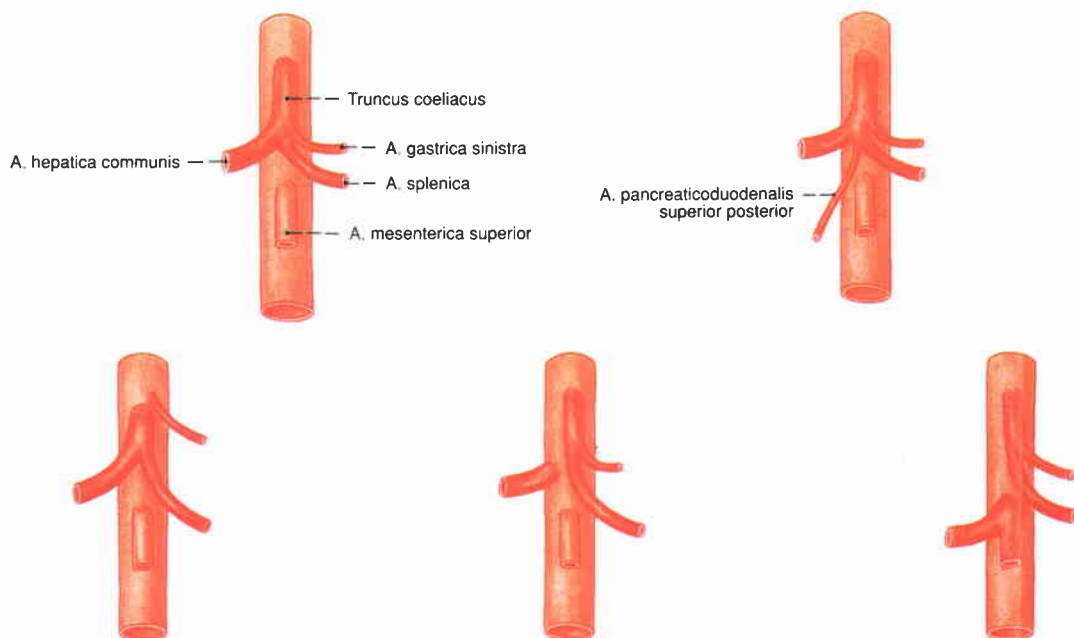
\* catheter in the aorta





**Fig. 1024** Inferior mesenteric artery and vein, A. et V. mesenterica inferior; the small intestine has been pulled to the right; the transverse colon has been reflected superiorly; the peritoneum has been removed from the descending and the sigmoid colon to show the blood vessels; ventral view. The A. marginalis coli joins the left colic artery and the middle colic artery.



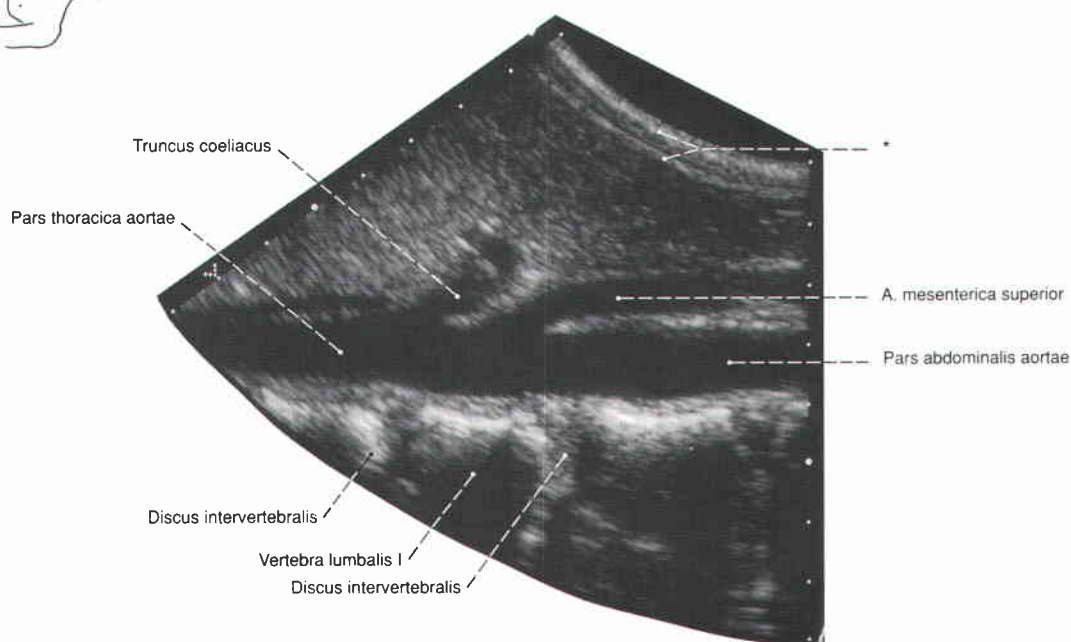


**Figs. 1025 a-e** Variations of the coeliac trunk.

- a "textbook case": coeliac trunk divided into three branches
- b trunk with four branches
- c formation of a Truncus gastrosplenicus

- d formation of a Truncus gastrosplenicus

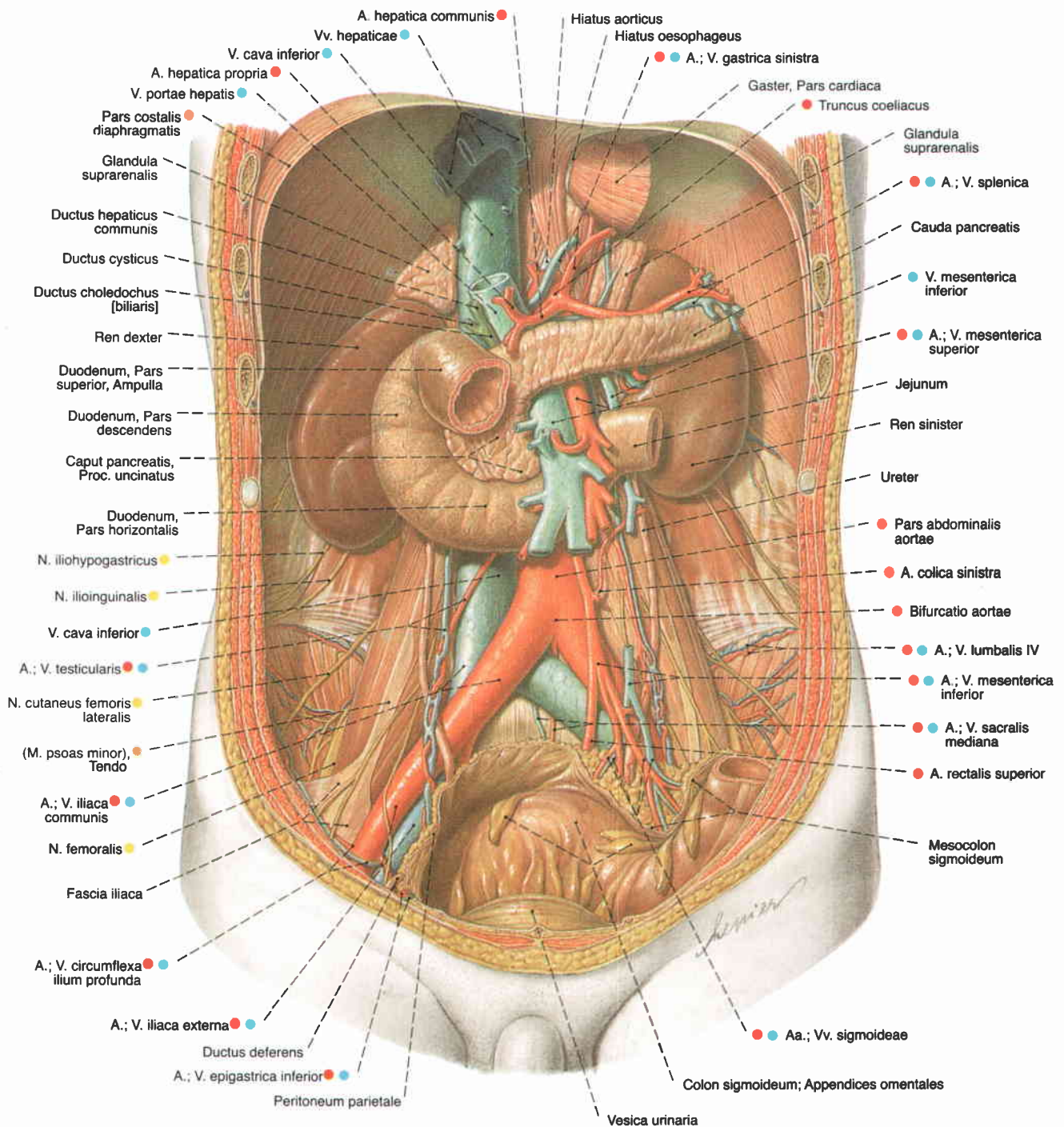
- e formation of a Truncus gastrosplenicus and Truncus hepatomesentericus



**Fig. 1026** Abdominal aorta, Pars abdominalis aortae; ultrasound image taken almost in the sagittal plane; note the close proximity between the origin of the coeliac trunk and

that of the superior mesenteric artery. The later runs a short distance parallel to the abdominal aorta.

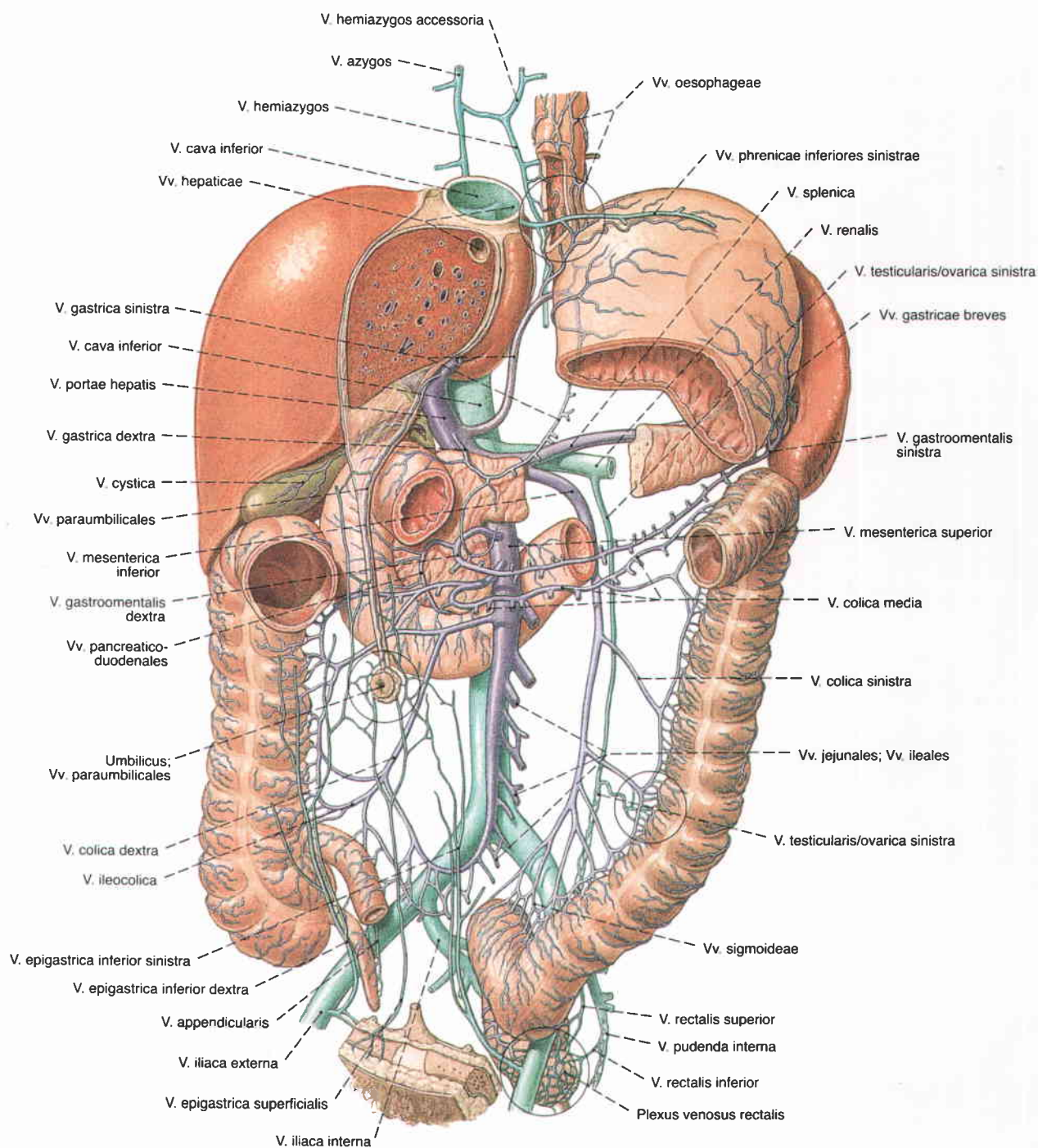
\* abdominal wall



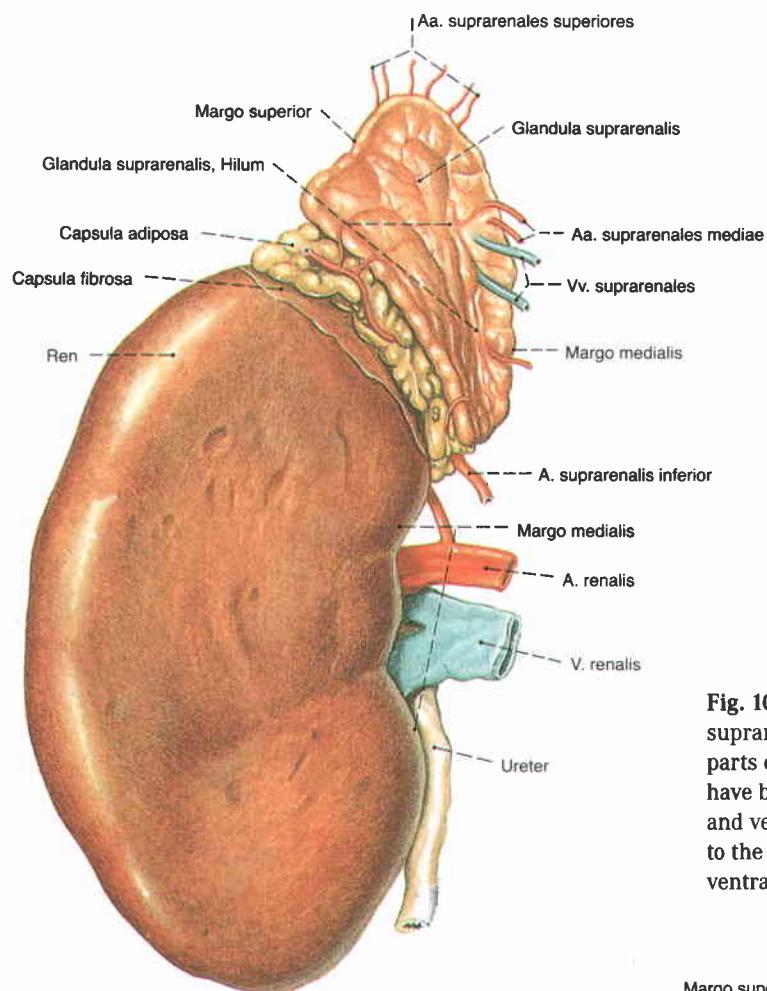
**Fig. 1027** Retroperitoneal space, Situs retroperitonealis, in the male; the parietal peritoneum has been extensively removed; ventral view.



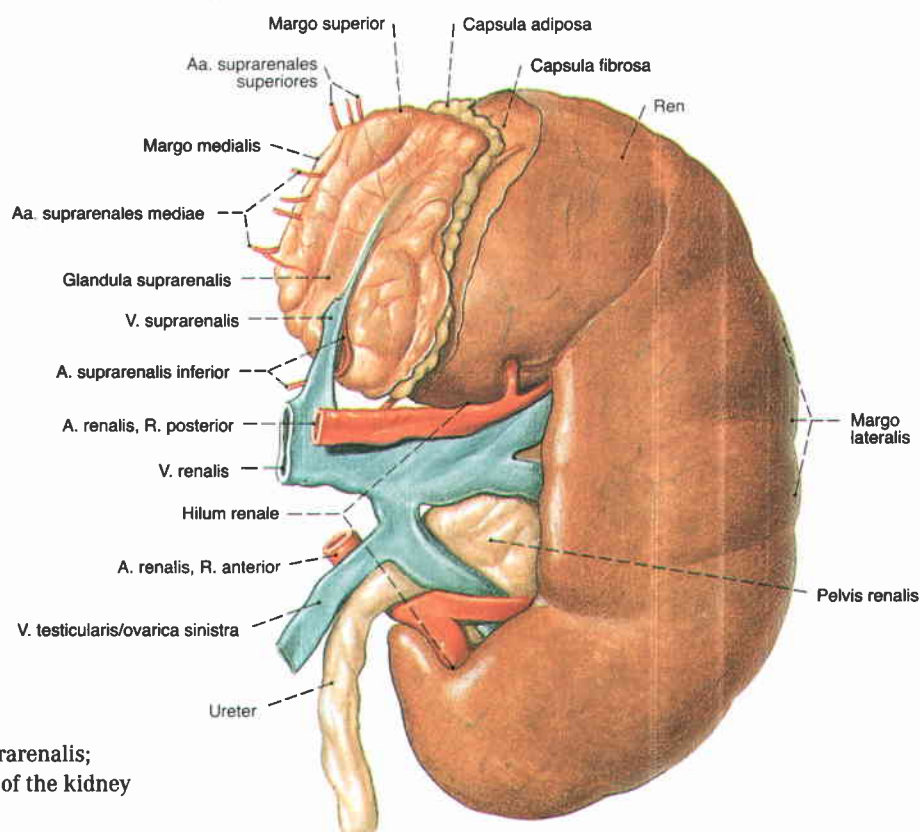




**Fig. 1029** Anastomoses between the tributary vessels of the portal vein, V. portae hepatis, and the inferior vena cava, V. cava inferior; ventral view. These anastomoses are called "portacaval anastomoses". They are marked by circles.

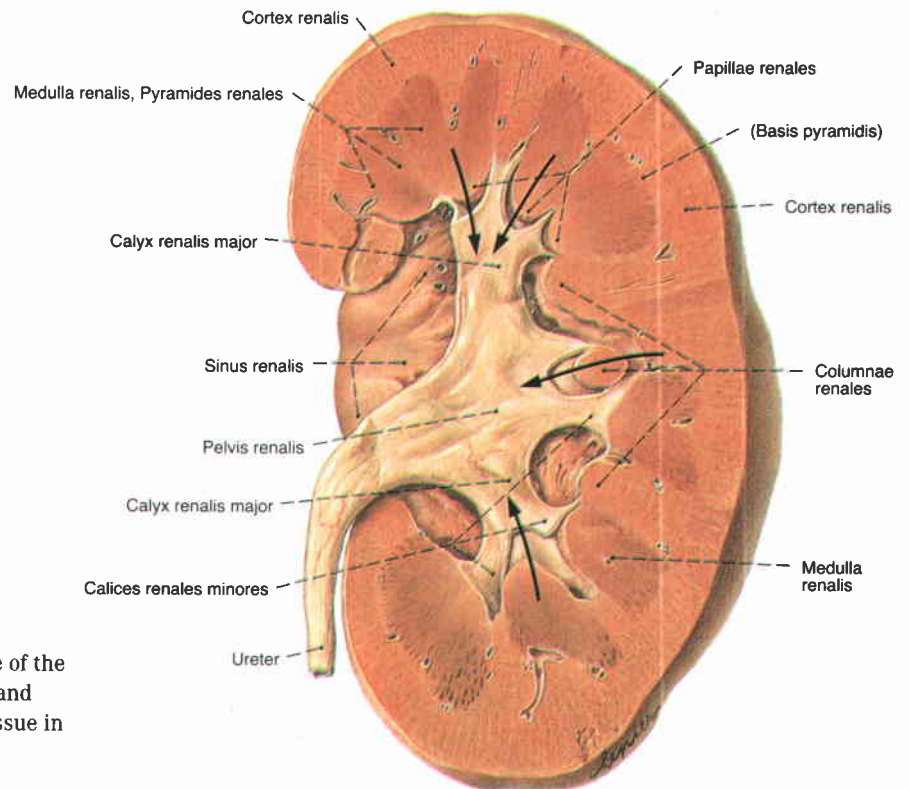


**Fig. 1030** Kidney, Ren [Nephros]; suprarenal [adrenal] gland, Glandula suprarenalis; parts of the adipose and fibrous capsules of the kidney have been preserved at its upper pole; the renal artery and vein as well as the ureter have been sectioned close to the hilum; ventral view (r.).

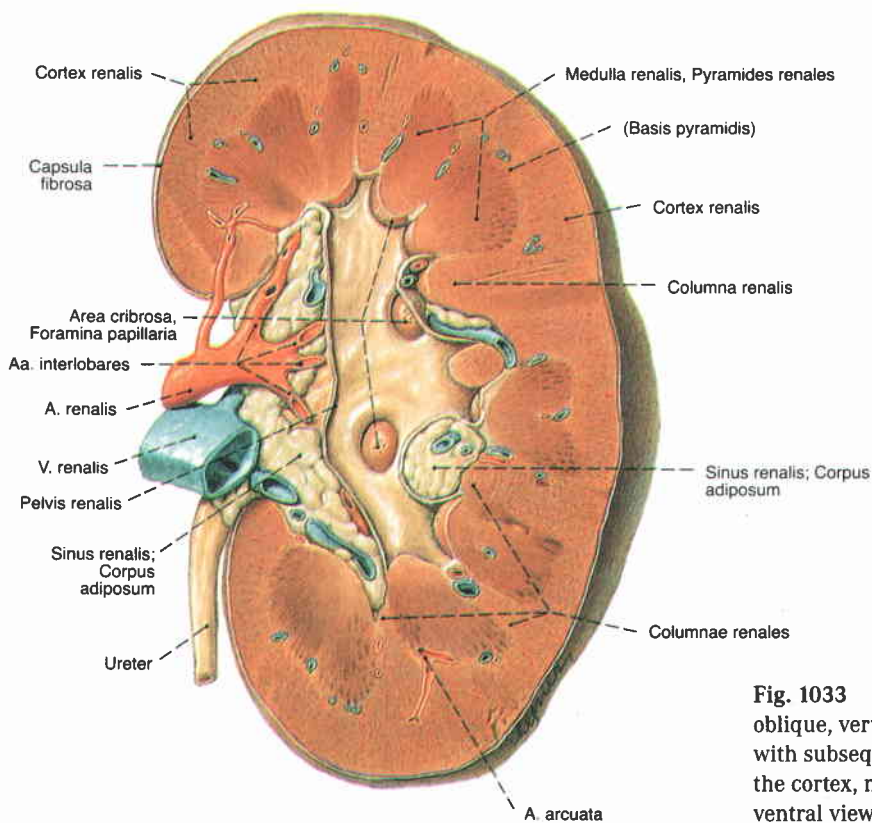


**Fig. 1031** Kidney, Ren [Nephros]; suprarenal [adrenal] gland, Glandula suprarenalis; parts of the adipose and fibrous capsules of the kidney have been preserved at its upper pole; ventral view (l.).



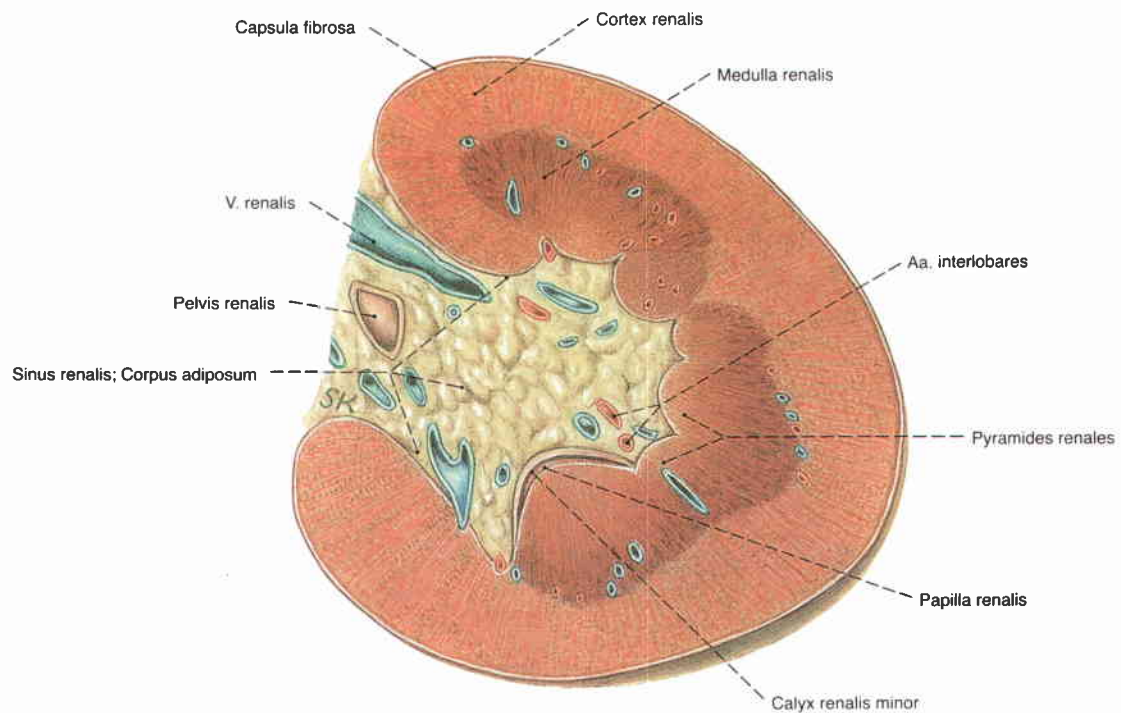


**Fig. 1032** Kidney, Ren [Nephros]; oblique, vertical section through the centre of the kidney demonstrating the cortex, medulla and renal pelvis; the vessels and the adipose tissue in the renal sinus have been removed; ventral view (l.).  
Arrows point from the renal pyramids into the renal calyces.

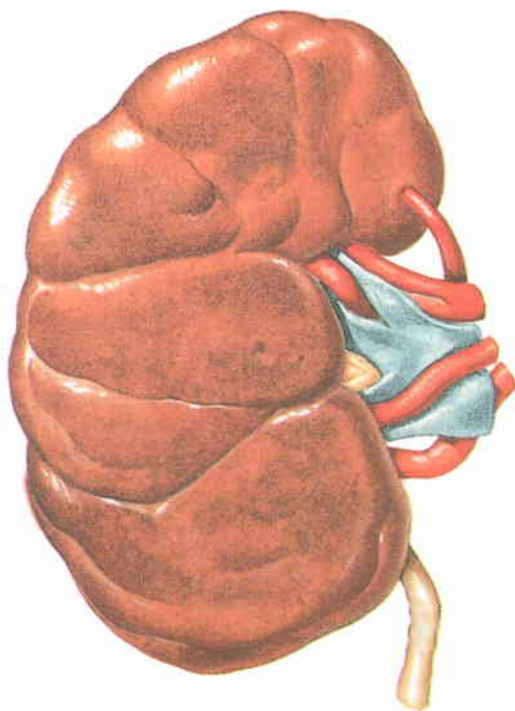


**Fig. 1033** Kidney, Ren [Nephros]; oblique, vertical section through the centre of the kidney; with subsequent opening of the renal pelvis demonstrating the cortex, medulla, pelvis and hilum of the kidney; ventral view (l.).

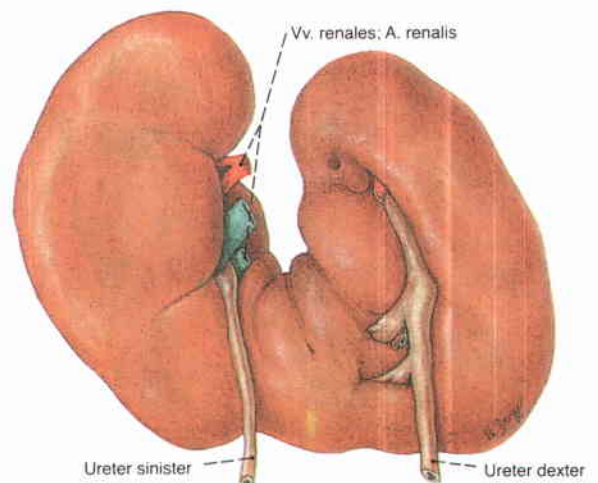




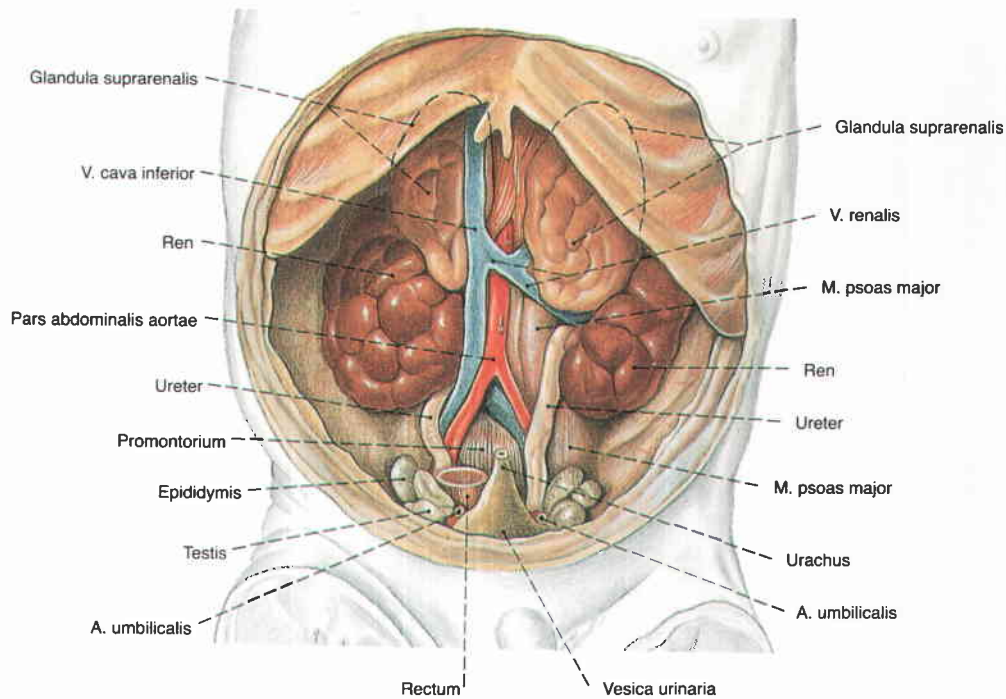
**Fig. 1034** Kidney, Ren [Nephros];  
transverse section demonstrating the renal sinus,  
Sinus renalis;  
inferior view (l.).



**Fig. 1035** Kidney, Ren [Nephros];  
ventral view (r.).  
In this specimen of an adult the fetal lobulation has  
been preserved as a variant.  
Compare to Fig. 1037.

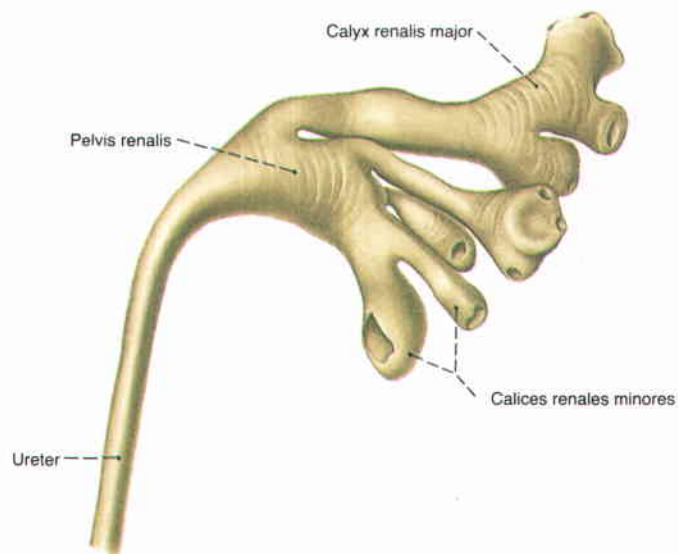


**Fig. 1036** Kidney, Ren [Nephros];  
ventral view (r.).  
The kidneys are fused at their lower poles  
(horseshoe kidney).



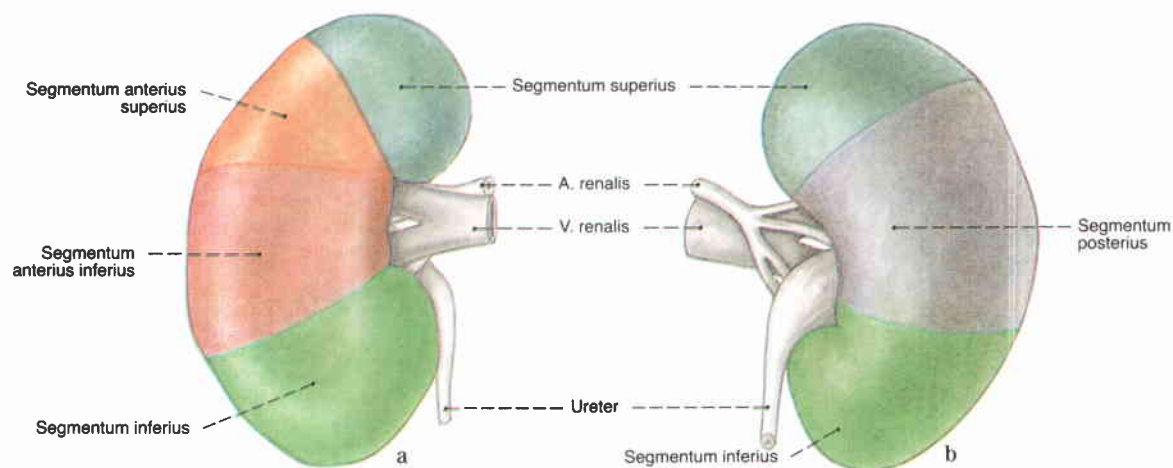
**Fig. 1037** Kidney, Ren [Nephros]; suprarenal [adrenal] gland, Glandula suprarenalis, of a 5-month-old fetus; the abdominal wall, stomach, intestine and liver have been removed; ventral view.

Typical features at this stage of development are the lobulation of the kidneys, the relative size of the suprarenal glands compared with the kidneys, the position of the testicles and the epididymis in the small pelvis as well as the conical-shaped transitional region between the bladder and the urachus.



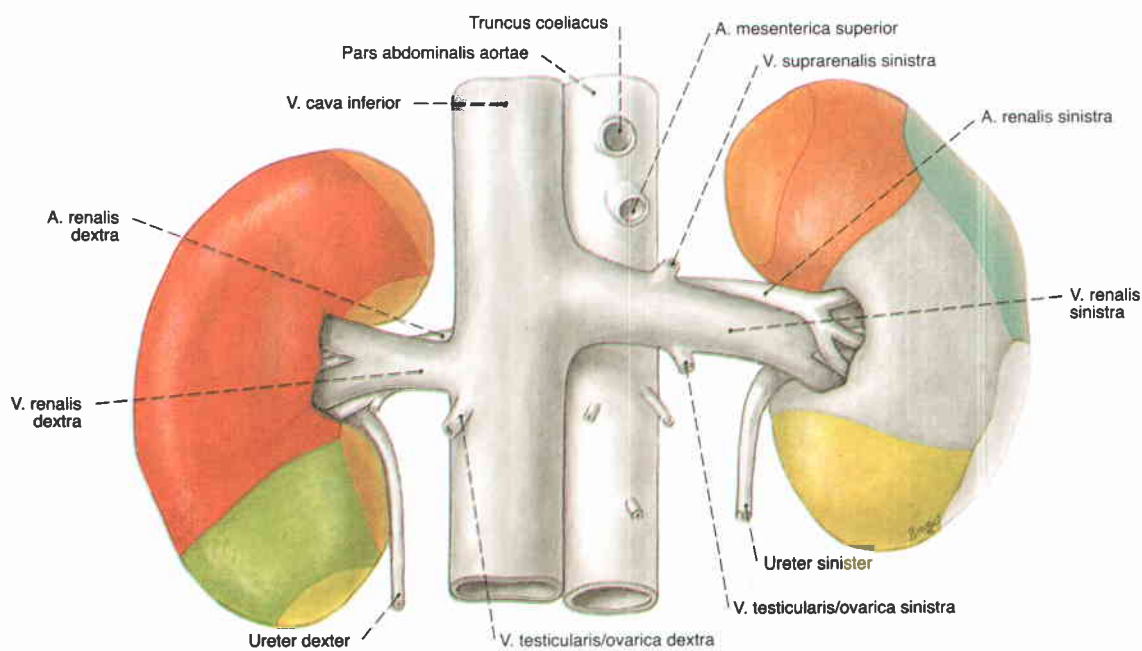
**Fig. 1038** Renal pelvis, Pelvis renalis; corrosion cast specimen; ventral view (l.).  
The renal pelvis varies considerably in shape. This figure shows

long, tree-like, branching calyces (dendritic type). The calyces can also be short, opening into a broad, sack-like renal pelvis (ampullary type). Between these two types, there are many transitional shapes possible.



**Figs. 1039 a, b** Renal segments, Segmenta renalia; the segments are indicated by different colours.

**a** right kidney, ventral view  
**b** right kidney, dorsal view



**Fig. 1040** Kidney, Ren [Nephros], and adjacent organs; ventral view (r.).

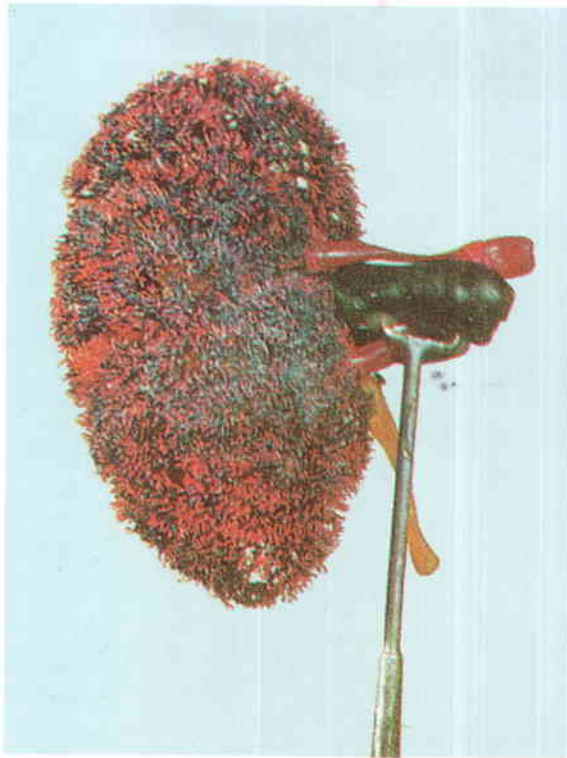
#### Areas of contact with the kidneys

	Suprarenal glands
	Liver
	Descending part of the duodenum

	Right colic flexure
	Jejunum
	Stomach

	Spleen
	Pancreas
	Descending colon

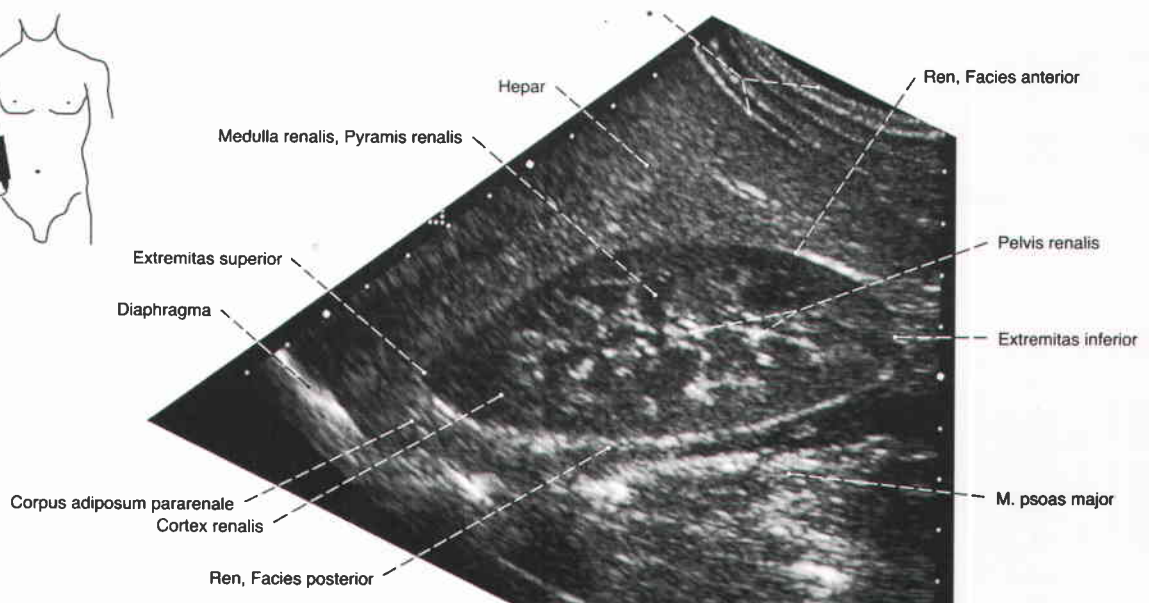




**Fig. 1041** Renal arteries, Aa. renales; renal veins, Vv. renales; renal pelvis, Pelvis renalis; corrosion cast specimen; plastic material of different colours has been injected into the renal vessels and renal pelvis (arteries: red, veins: blue, renal pelvis: yellow); ventral view (r.).



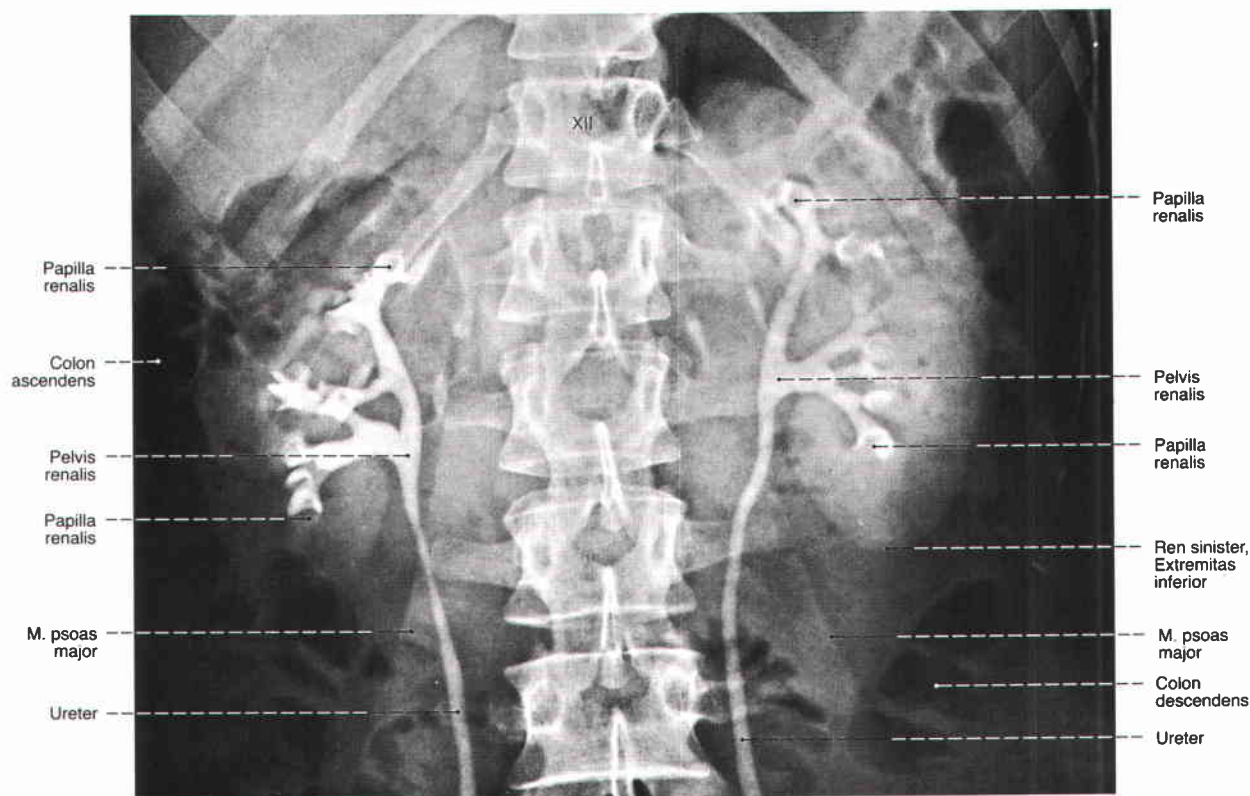
**Fig. 1042** Renal arteries, Aa. renales; renal pelvis, Pelvis renalis; corrosion cast specimen; red plastic material has been injected into the renal artery and yellow plastic material into the ureter; ventral view (r.).



**Fig. 1043** Kidney, Ren [Nephros]; ultrasound image of the kidney; the transducer is directed from ventroinferior to dorsosuperior.

The renal pelvis, the cortex and the medulla can be differentiated; lateral view (r.).

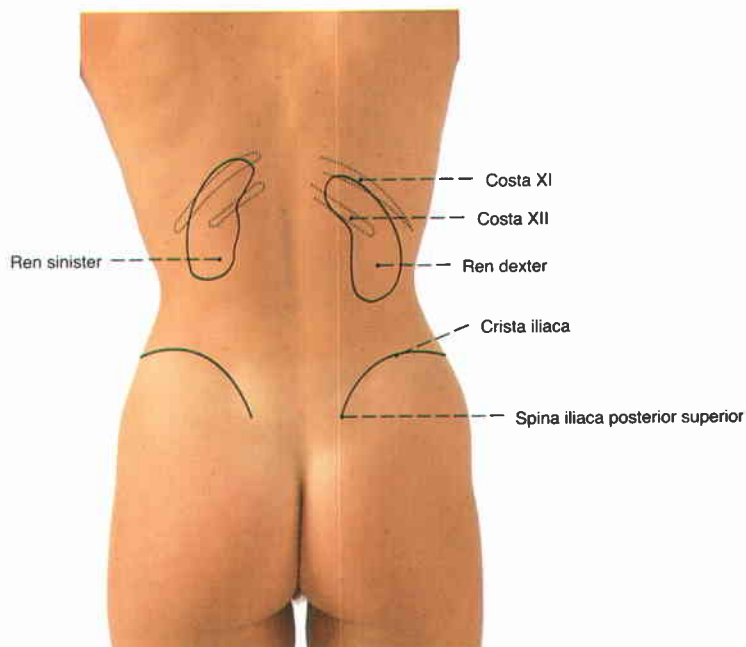
\* abdominal wall



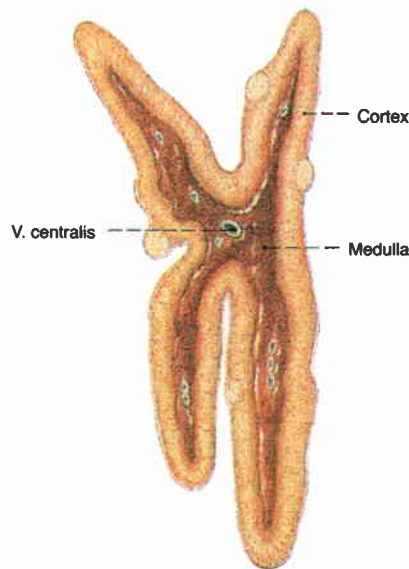
**Fig. 1044** Kidney, Ren [Nephros]; renal pelvis, Pelvis renalis; ureter, Ureter;  
AP-radiograph after retrograde injection of a contrast medium  
through both ureters, as a result of which the urine-conducting

portions of the kidney become visible as well;  
ventral view.

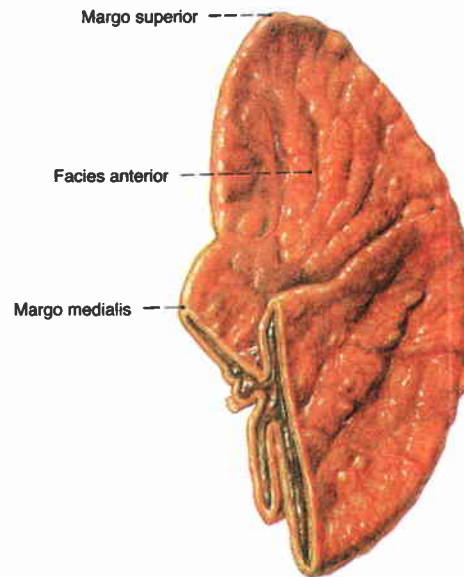
XII = Vertebra thoracica XII



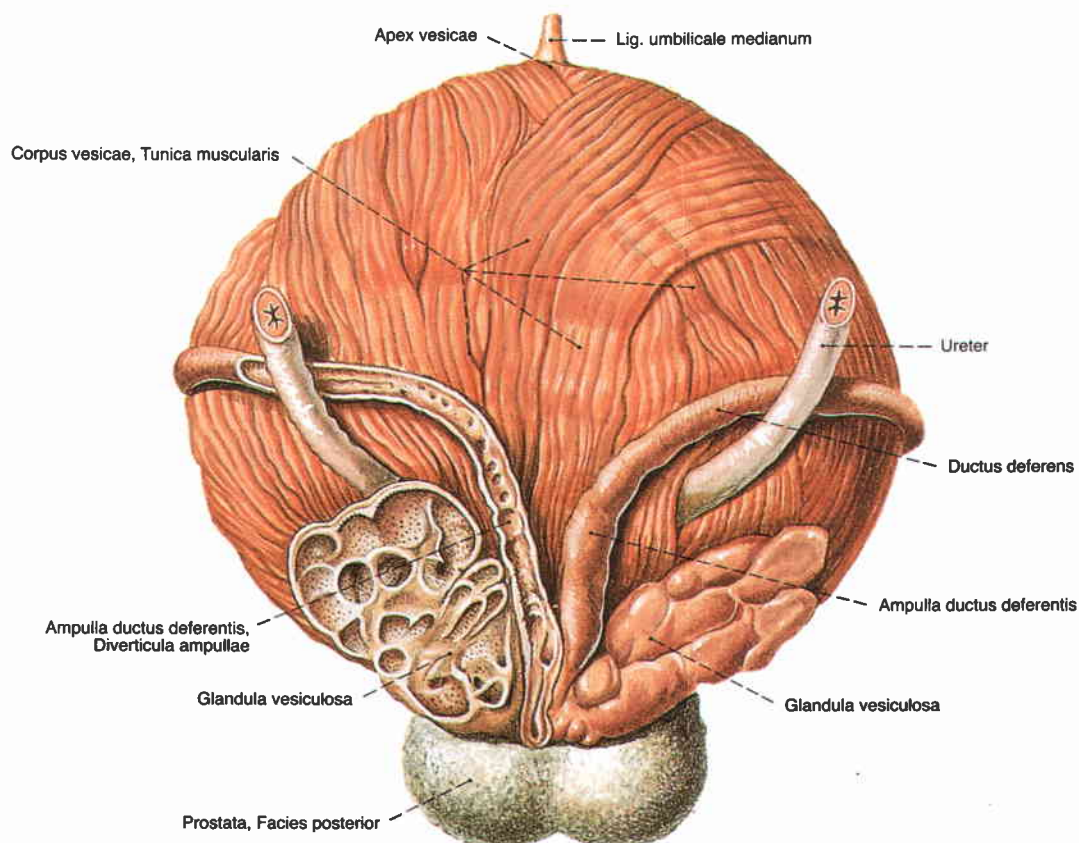
**Fig. 1045** Projection of the kidneys onto the back.  
The longitudinal axes of the kidneys diverge  
inferolaterally. The right kidney is usually located  
more inferiorly than the left.  
Compare to Fig. 1092.



**Fig. 1046** Suprarenal gland, *Glandula suprarenalis*; sagittal section; lateral view (r.). The illustration shows a fresh specimen. In preserved specimens, the differences in colour between the medulla and the cortex are less pronounced.



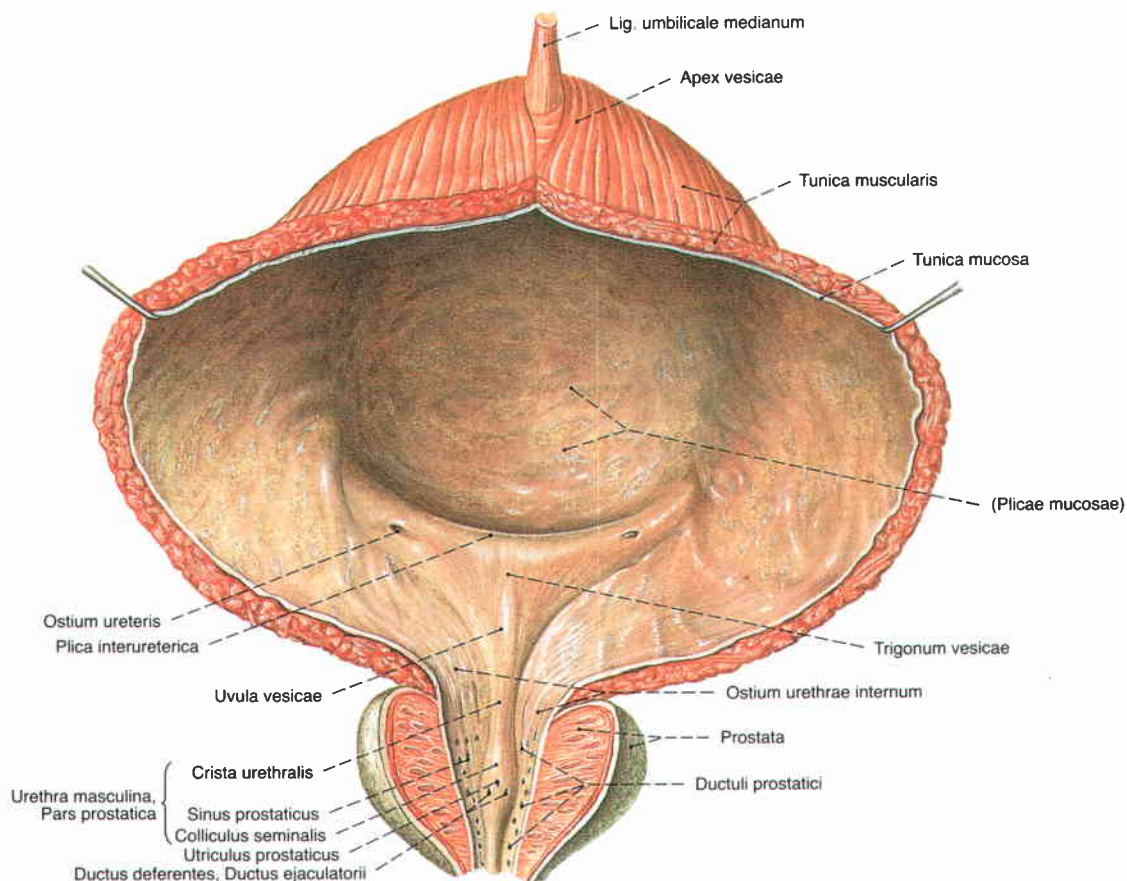
**Fig. 1047** Suprarenal gland, *Glandula suprarenalis*; the inferior part has been sectioned sagittally; ventral view (r.). See comment to Fig. 1046.



**Fig. 1048** Urinary bladder, *Vesica urinaria*; deferent duct, *Ductus deferens*; seminal vesicles, *Glandulae vesiculosae*; prostate gland, *Prostata*; the external muscular layer of the bladder has been dissected;

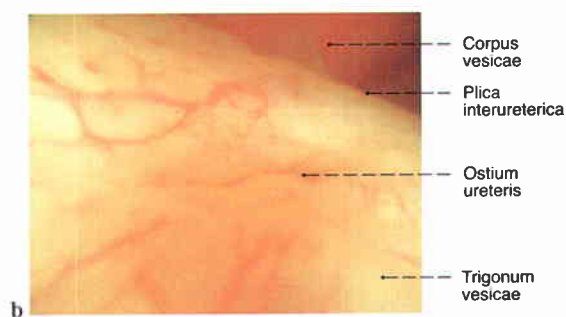
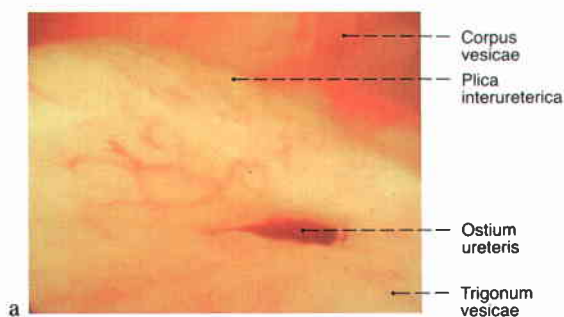
on the left the seminal vesicle and the deferent duct have been opened; dorsal view.





**Fig. 1049** Urinary bladder, Vesica urinaria; prostate gland, Prostata; urethra, Urethra; opened by a longitudinal section in the median plane;

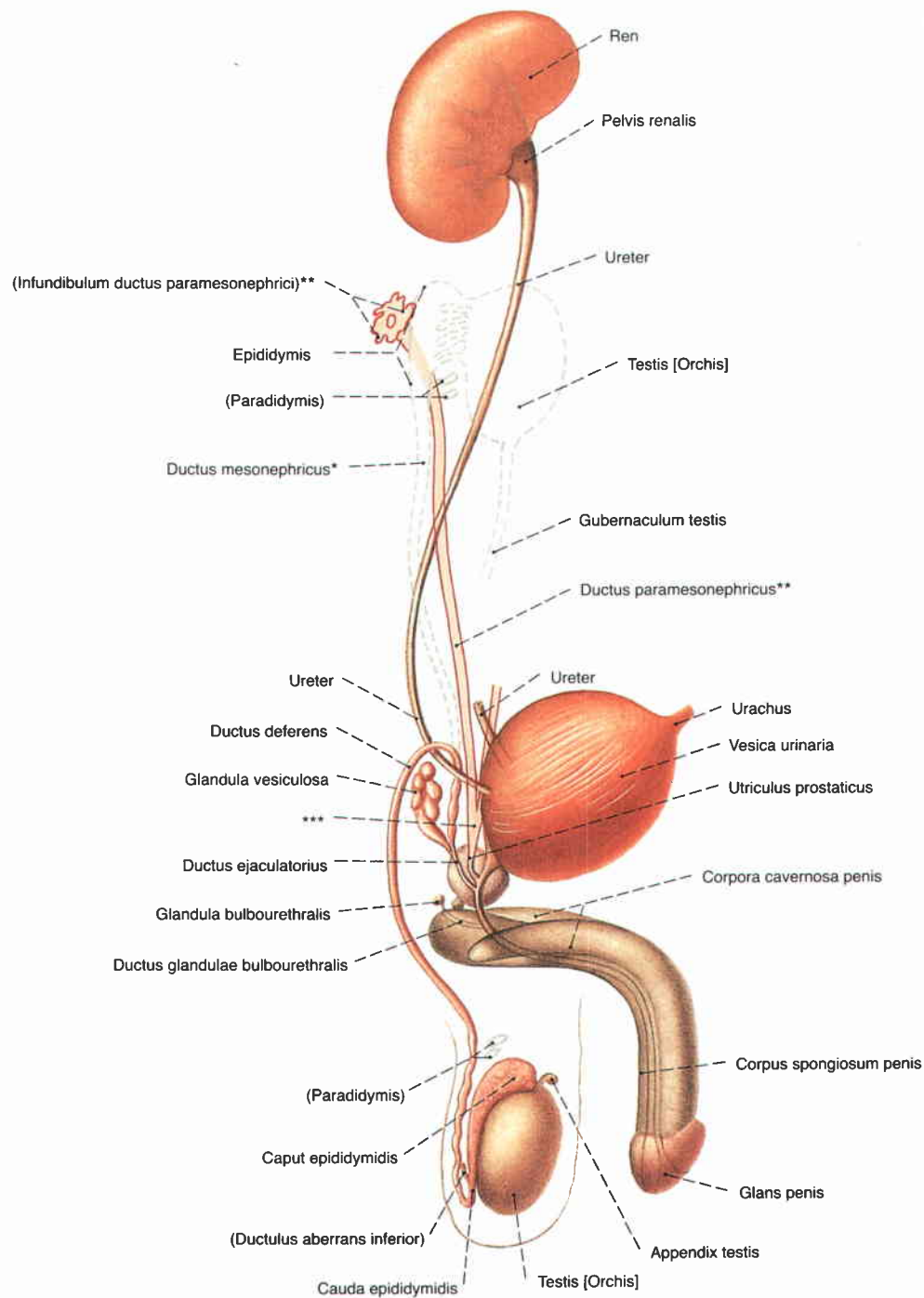
the external muscular layer of the bladder has been dissected; ventral view.



**Figs. 1050 a, b** Urinary bladder, Vesica urinaria; demonstration of the orifice of the ureter by way of an endoscope introduced through the urethra (cystoscopy).  
**a** orifice of the ureter open, a peristaltic wave transports urine into the bladder  
**b** orifice of the ureter closed



**Fig. 1051** Urinary bladder, Vesica urinaria; endoscopic image (cystoscopy) of the mucosa in the body of the bladder; inferior view.  
 In the full, healthy bladder, no mucous folds are visible.



**Fig. 1052** Male urogenital organs, Organa urogenitalia masculina; schematic depiction of development; light pink: portions which degenerate; dashed lines: location of the testicle before descending; lateral view.

Epididymis = derived from the mesonephric duct  
 Paradidymis = derived from the mesonephros  
 Compare to Fig. 1062, which shows the development in the female.

- \* Wolffian duct
- \*\* Müllerian duct
- \*\*\* junction of Müllerian ducts, Ductus paramesonephrici

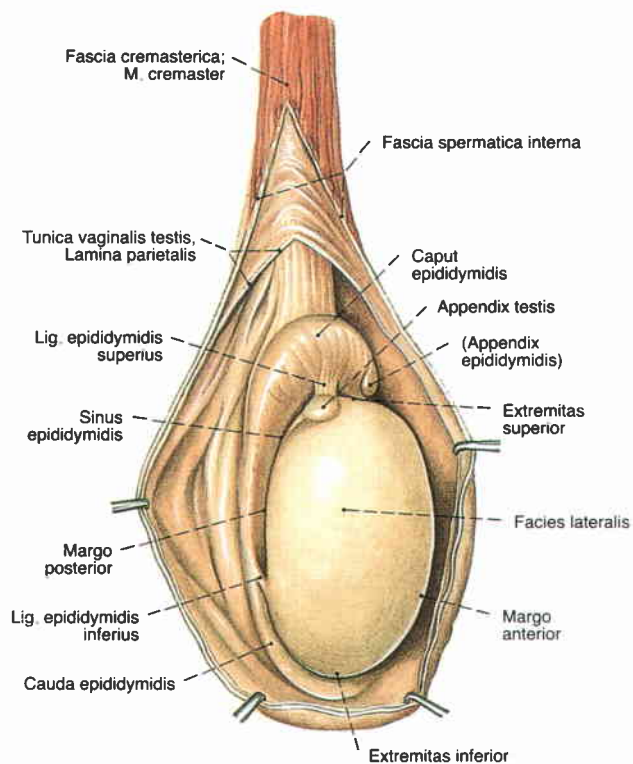


Fig. 1053 Testicle, Testis [Orchis]; epididymis, Epididymis; the scrotum has been exposed in layers; lateral view (r.).

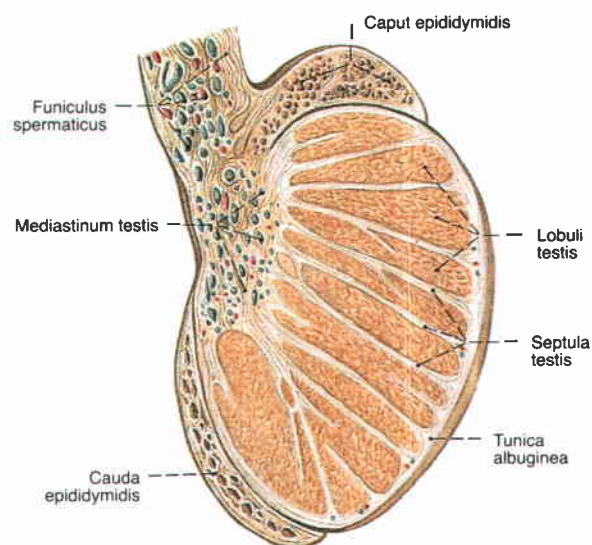


Fig. 1054 Testicle, Testis [Orchis]; epididymis, Epididymis; sagittal section; lateral view (r.).

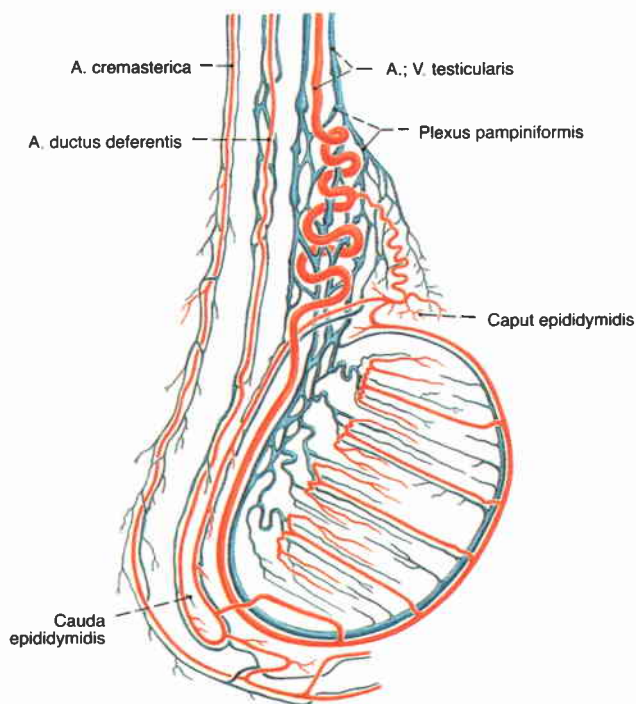


Fig. 1055 Blood vessels of the testicle, Testis [Orchis]; epididymis, Epididymis, and spermatic cord, Funiculus spermaticus; lateral view.  
The arteries form anastomoses.



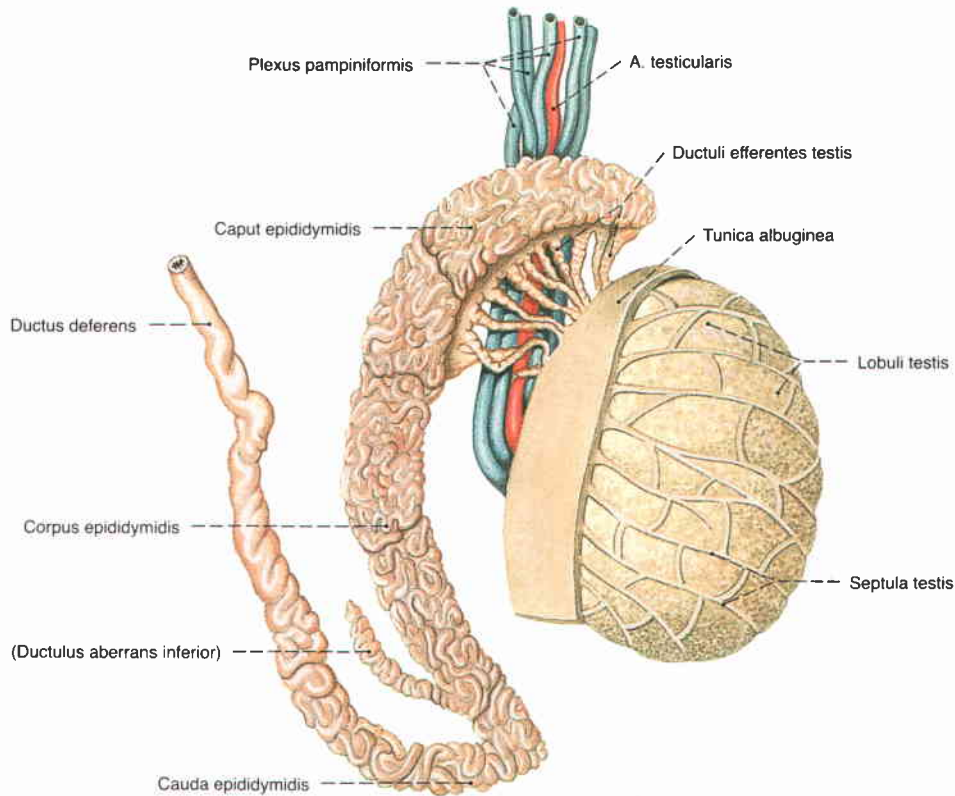


Fig. 1056 Testicle, Testis [Orchis]; epididymis, Epididymis; deferent duct, Ductus deferens; most of the tunica albuginea has been removed to show the septa of the testicle; the epididymis has been pulled away

from the testicle; its duct (Ductus epididymis) has been dissected to show its winding course (length = 5–6 m); lateral view.

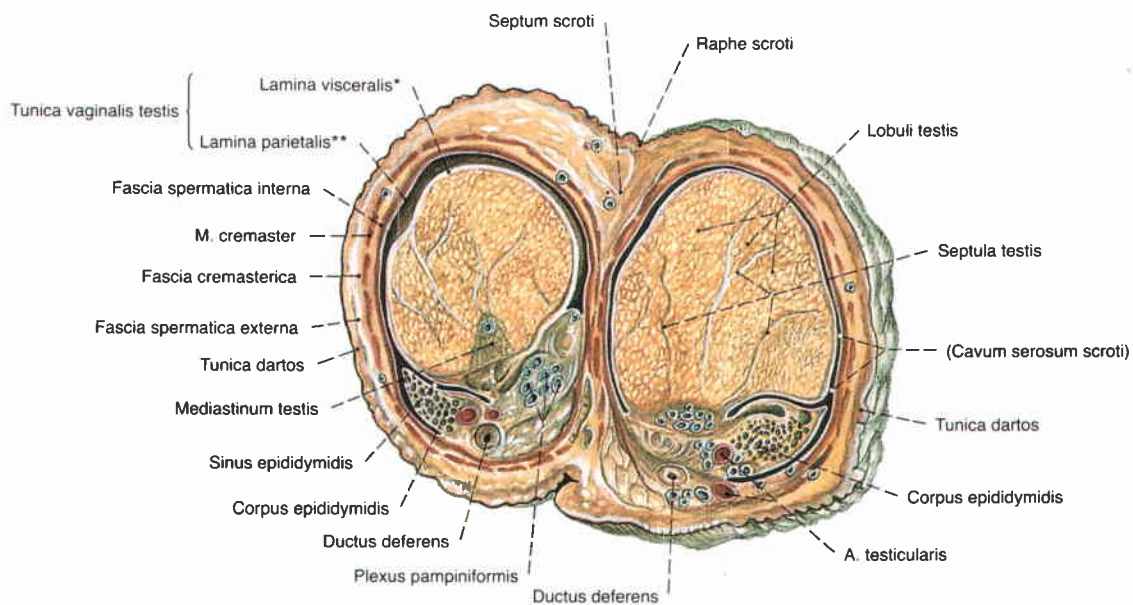
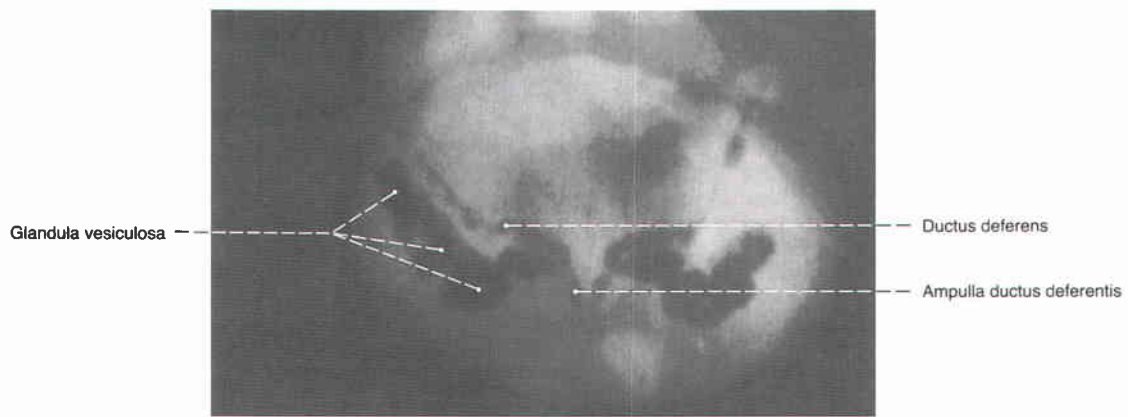


Fig. 1057 Testicle, Testis [Orchis]; epididymis, Epididymis; scrotum, Scrotum; transverse section demonstrating the layers of the scrotum and tunicae of the testicle; superior view.

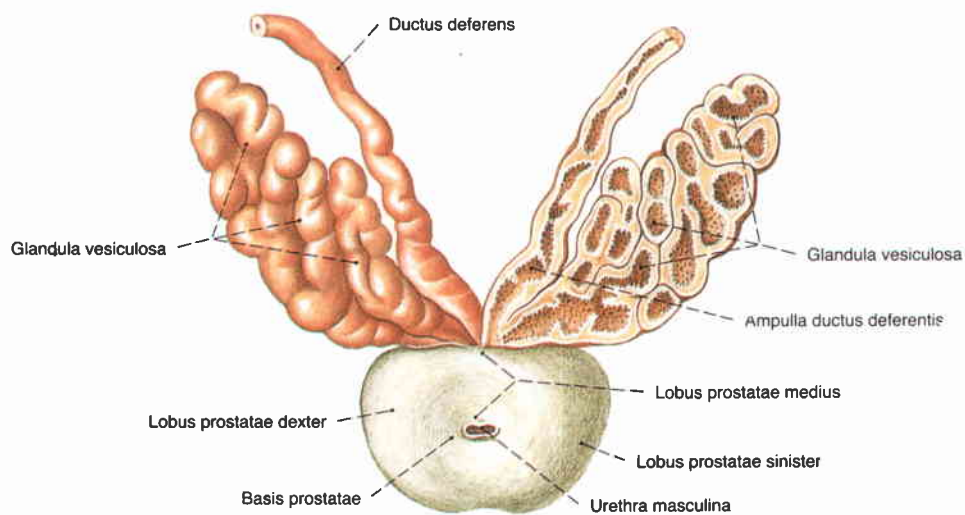
The cross-sectional areas of the testicles vary, because they are not situated at the same level in the scrotum.

\* also termed Epiorchium  
\*\* also termed Periorchium



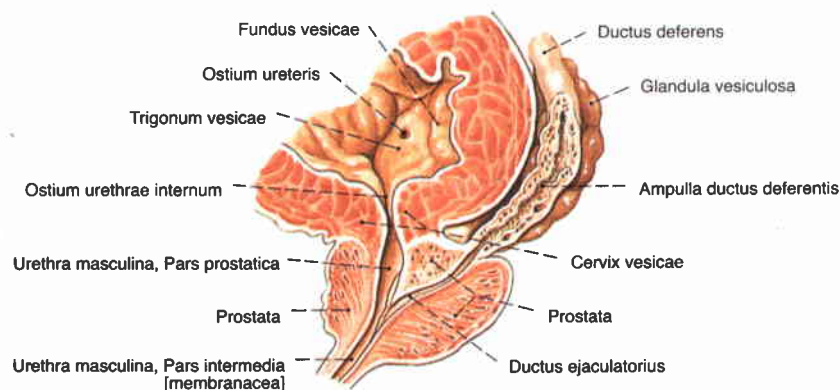
**Fig. 1058** Deferent duct (Vas deferens), Ductus deferens; seminal vesicles, Glandulae vesiculosae;

AP-radiograph after injection of a contrast medium through the ejaculatory ducts; ventral view.



**Fig. 1059** Deferent duct (Vas deferens), Ductus deferens; seminal vesicles, Glandulae vesiculosae; prostate, Prostata; representation of the prostate by sectioning the urethra

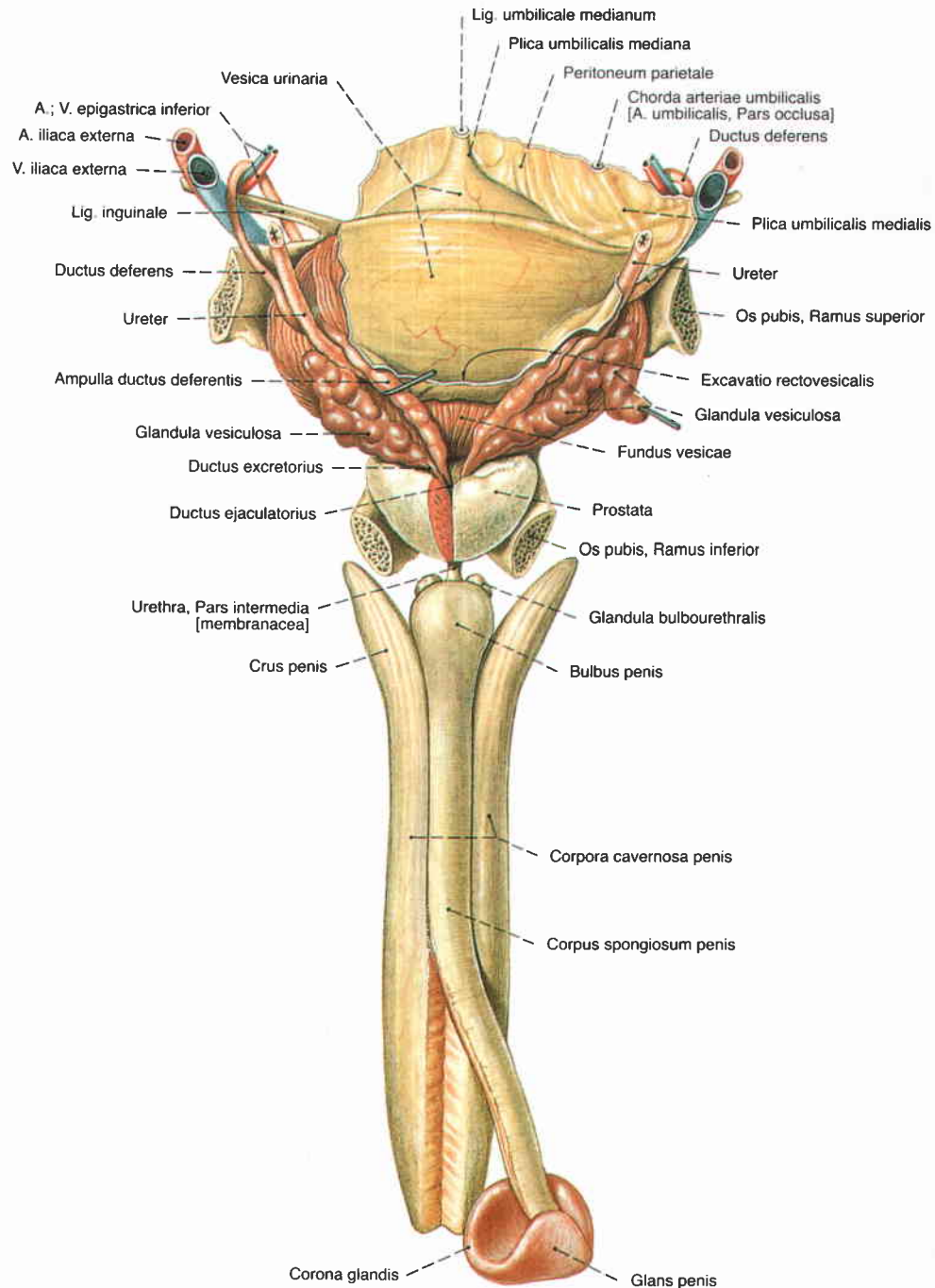
below the urinary bladder; the deferent duct and the seminal vesicles have been sectioned on the left; superior view.



**Fig. 1060** Urinary bladder, Vesica urinaria; prostate, Prostata; deferent duct, Ductus deferens; seminal vesicle, Glandula vesiculosa; oblique section showing the orifice of the left ejaculatory duct

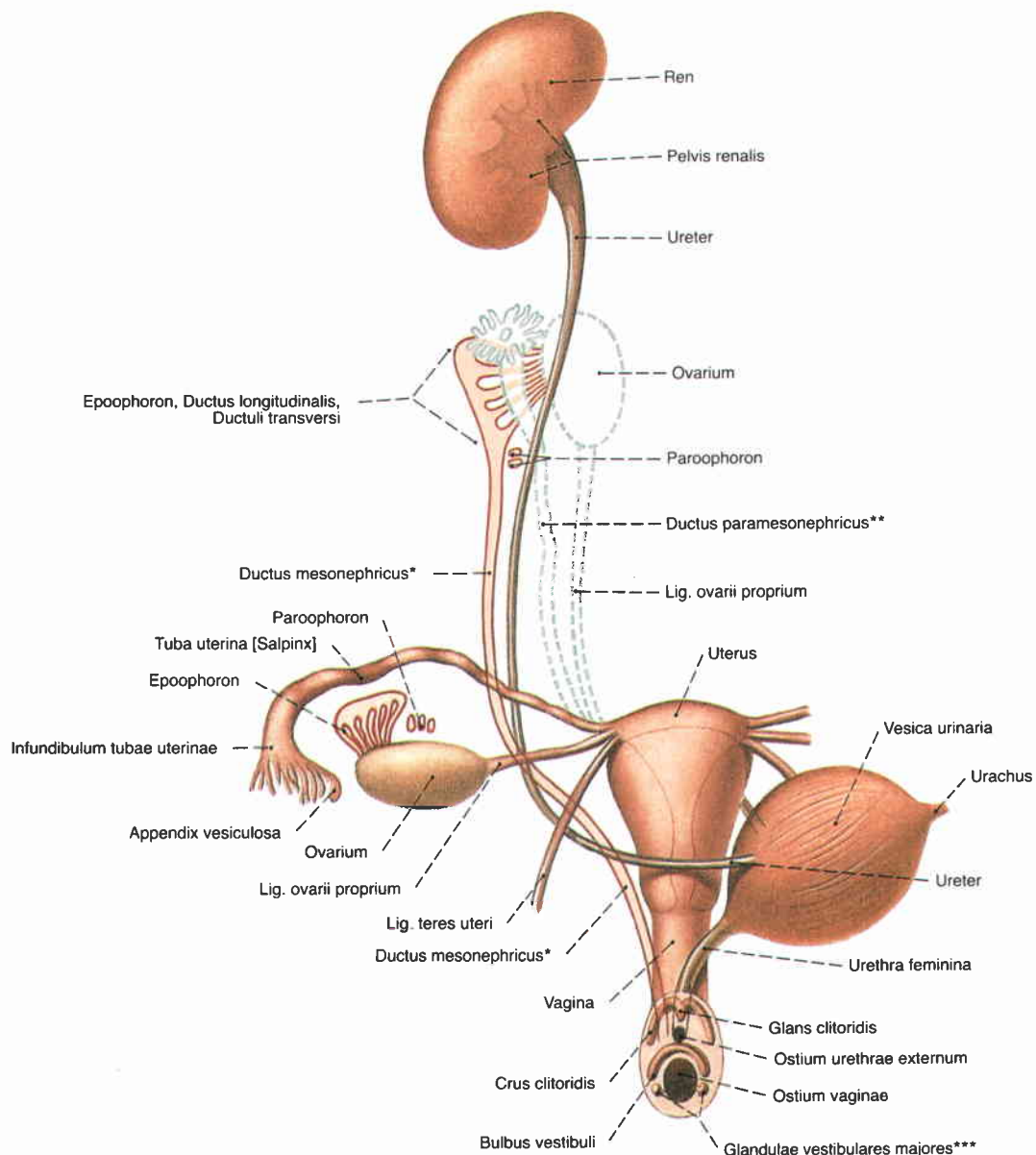
into the urethra; lateral view (r.).

The thickness of the musculature of the bladder indicates that the bladder is empty and contracted.



**Fig. 1061** Urinary bladder, Vesica urinaria; deferent duct, Ductus deferens; seminal vesicles, Glandulae vesiculosae; prostate, Prostata; male urethra, Urethra masculina; parts of the pubis have been preserved; the right seminal vesicle has been pulled apart by a hook; a wedge-shaped segment of the prostate has been removed to show the left ejaculatory duct; the distal part of the corpus spongiosum of the penis has been pulled posteriorly; dorsal view.





**Fig. 1062** Female urogenital organs, *Organa urogenitalia feminina*; diagram showing their development; light pink: parts which degenerate; broken lines: location of the organs before descending; the bladder has been pulled to the left; ventral view.

Epoophoron = derived from the cranial tubules of the mesonephros

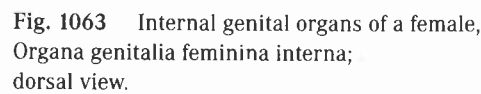
Paroophoron = derived from the caudal tubules of the mesonephros

\* Wolffian duct

\*\* Müllerian duct

\*\*\* Bartholin's glands

Compare to Fig. 1052, which shows the development in the male.

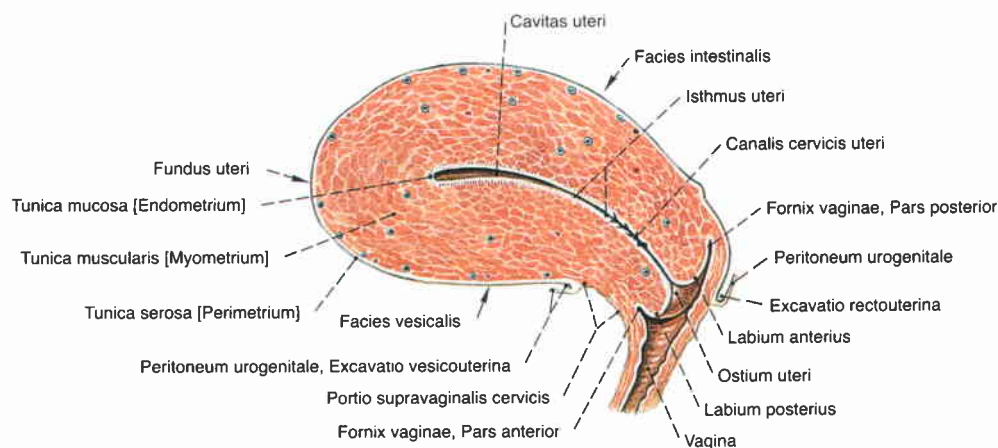


This anatomical diagram illustrates the female reproductive system in a sagittal section. The central organ is the pear-shaped uterus, which is divided into the upper fundus and the lower isthmus. The inner lining is the endometrium, and the muscular wall is the myometrium. Extending from the upper part of the uterus is the fallopian tube (uterine tube), which has finger-like projections called fimbriae at its distal end. The ovary is located at the bottom right, with its outer layer being the tunica albuginea and its internal structure containing follicles. The diagram also shows the broad ligament, which is a double-layered fold of peritoneum that supports the uterus and ovaries. Other structures shown include the vagina, cervix, and the external os of the uterus.

**Labels:**

- Lig. ovarii proprium
- Stroma ovarii
- Mesosalpinx
- Ductus longitudinalis
- Ampulla tubae uterinae
- Ductuli transversi
- Plicae tubariae
- Infundibulum tubae uterinae; Fimbriae tubae uterinae
- Appendix vesiculosa
- Fimbria ovarica
- Corpus albicans
- Vv. ovaricae; A. ovarica
- Appendix vesiculosa\*\*
- Folliculi ovarici vesiculosi\*
- Corpus luteum
- Lig. latum uteri
- Pars uterina; Ostium uterinum
- Tuba uterina (Salpinx)
- Corpus uteri
- Isthmus uteri
- Portio supravaginalis cervicis
- Ostium uteri
- Rugae vaginales
- Vagina
- Portio vaginalis cervicis
- Canalis cervicis uteri, Plicae palmatae
- Tunica muscularis [Myometrium]
- Cavitas uteri; Tunica mucosa [Endometrium]
- Tunica serosa [Perimetrium]
- Lig. ovarii proprium
- Lig. teres uteri\*\*\*
- Tuba uterina [Salpinx]
- Isthmus tubae uterinae
- Fundus uteri

- \* clinical: GRAAFian follicle
- \*\* stalked hydatid
- \*\*\* clinical: Lig. rotundum

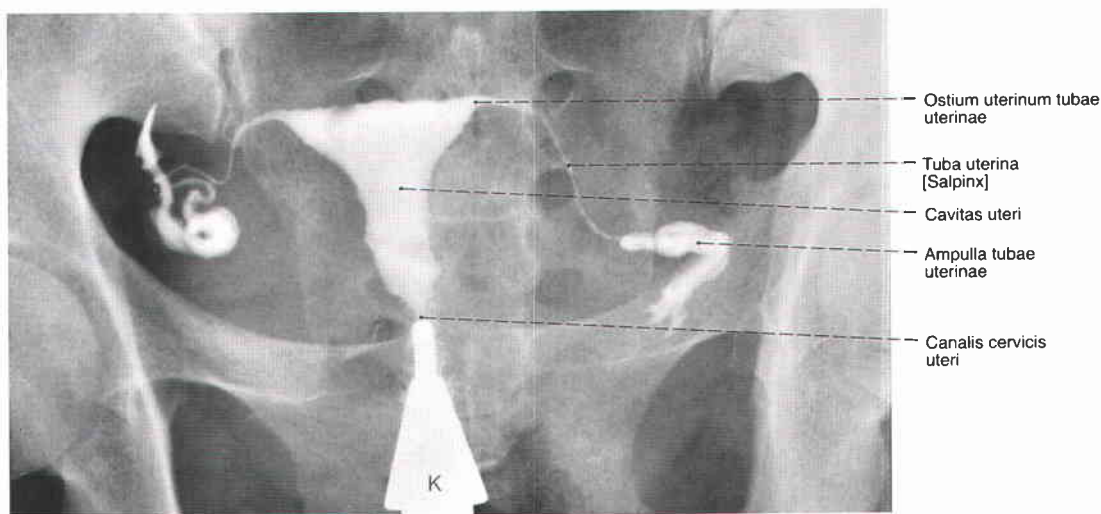
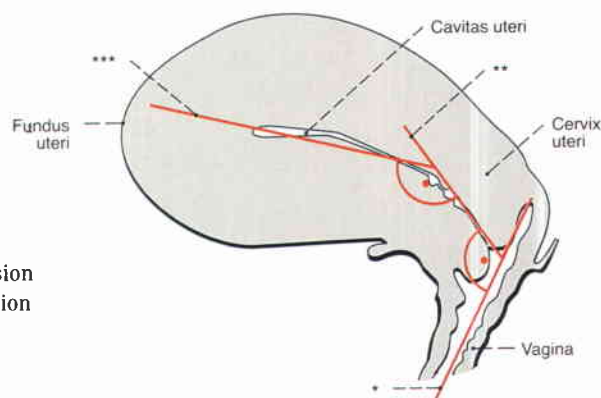


**Fig. 1065** Uterus, Uterus; vagina, Vagina, of a female of reproductive age; median section showing the lumen; lateral view.

**Fig. 1066** Uterus, Uterus; vagina, Vagina; normal angles between the vagina, the cervix and the corpus of the uterus; schematic median section; lateral view.

- \* longitudinal axis of the vagina
- \*\* longitudinal axis of the cervix of the uterus
- \*\*\* longitudinal axis of the corpus of the uterus

Angle between the vagina and the cervix of the uterus = version  
 Angle between the cervix and the corpus of the uterus = flexion  
 Normal situation of the uterus: anteversion, anteflexion  
 Position relative to the median plane = position  
 Compare to Fig. 1067 where the uterus is in dextroposition.

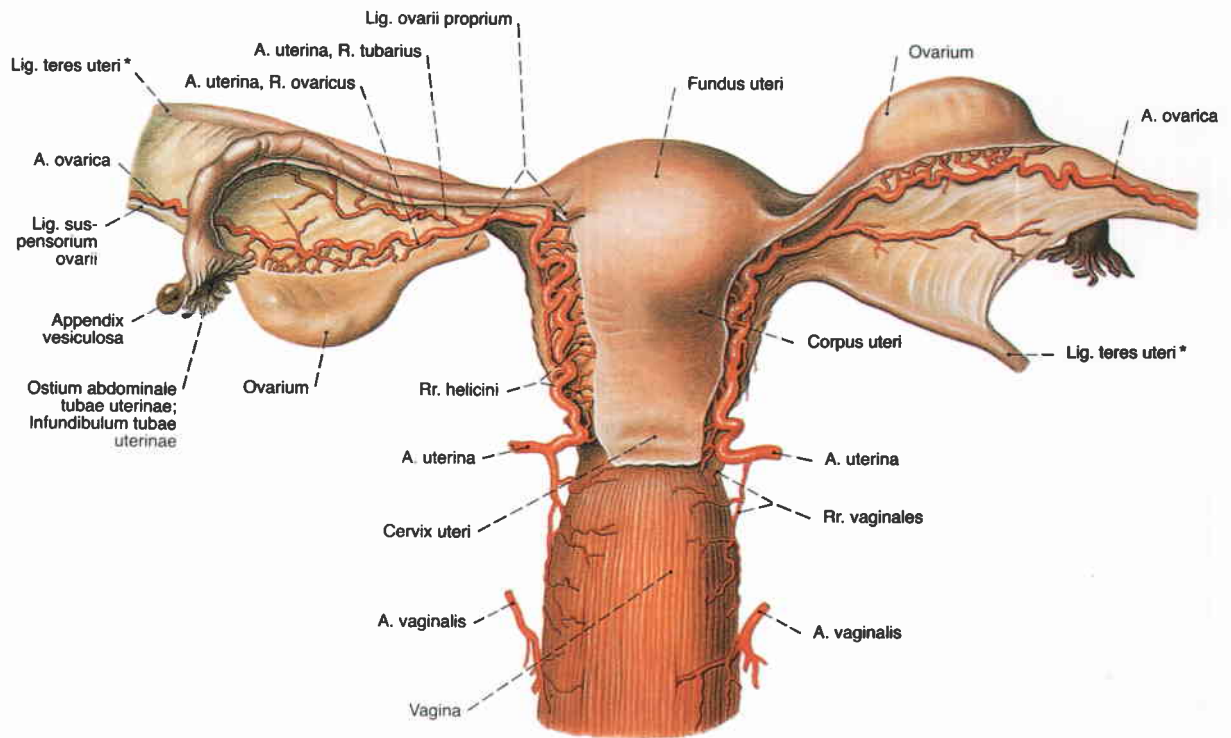


**Fig. 1067** Uterus, Uterus; uterine (fallopian) tube, Tuba uterina; AP-radiograph after injection of a contrast medium through the cervix of the uterus (hysterosalpingography); ventral view.

This clinical method has formerly been used to check for luminal obstruction in the uterine tube.

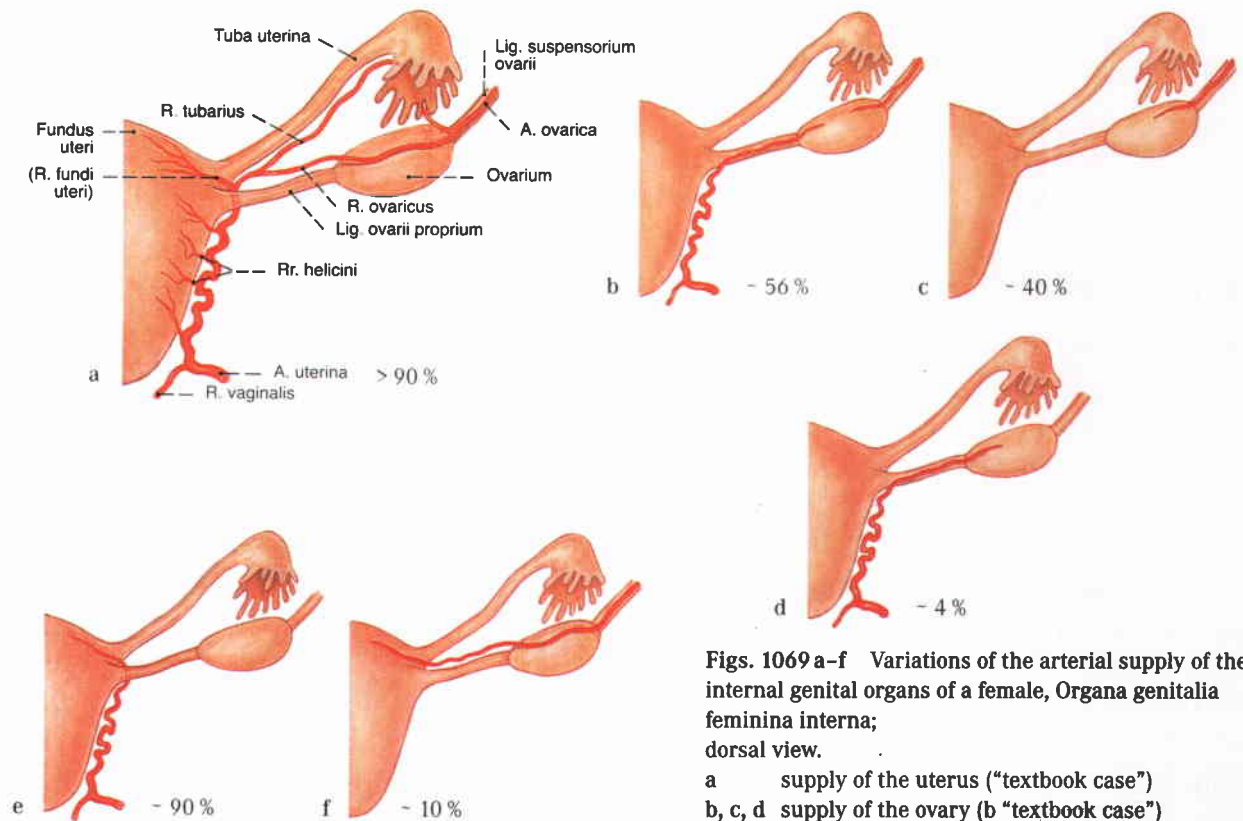
K = adapter of the injection tube for the contrast medium





**Fig. 1068** Arteries of the internal genital organs of a female, *Organa genitalia feminina interna*; the broad ligament (*Lig. latum*) has widely and the peritoneum has partially been removed; on the left a part of the ovarian ligament has been removed; dorsal view.

\* clinical: round ligament

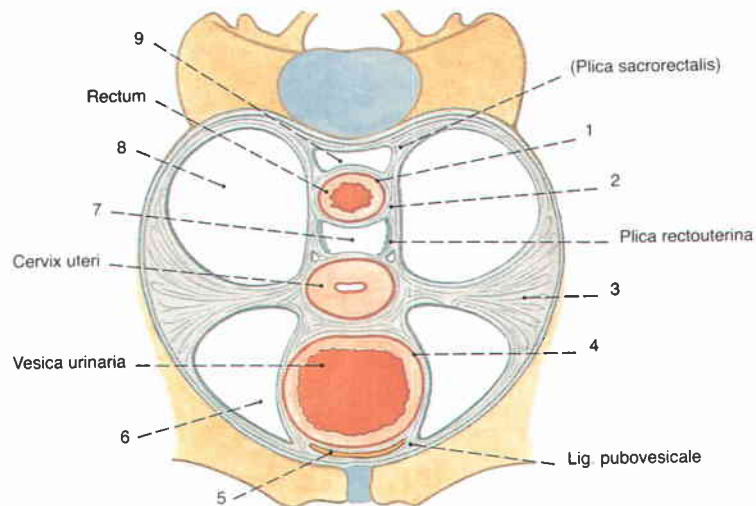


**Figs. 1069 a-f** Variations of the arterial supply of the internal genital organs of a female, *Organa genitalia feminina interna*; dorsal view.

a supply of the uterus ("textbook case")

b, c, d supply of the ovary (b "textbook case")

e, f supply of the fundus of the uterus (e "textbook case")

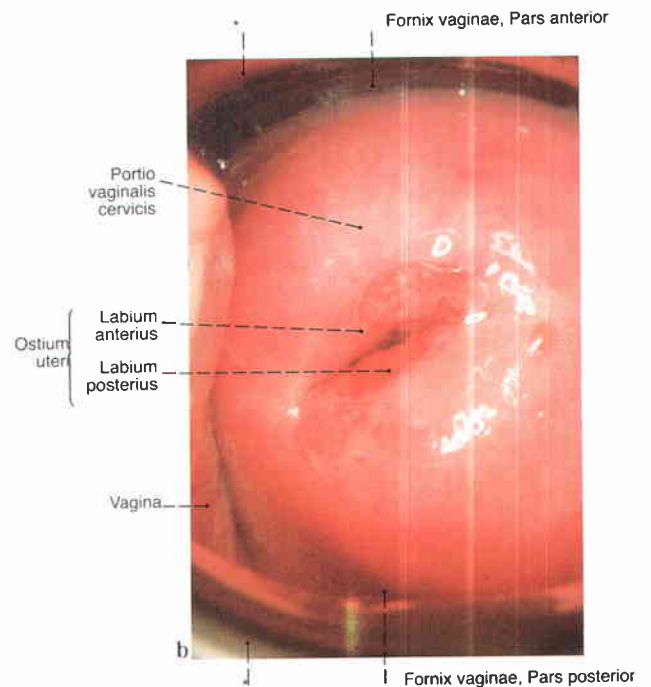
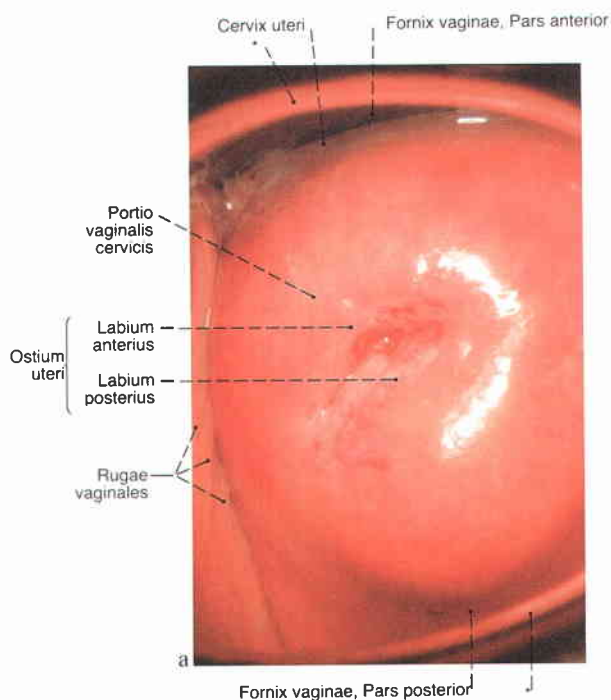


**Fig. 1070** Uterus, Uterus;  
diagram of the supporting ligaments and connective tissue  
spaces in the small pelvis; transverse section through the cervix  
of the uterus;  
superior view.

Recent anatomical studies have questioned the existence of solid fibrous ligaments  
between the uterus and the lateral wall of the pelvis, which have up to now been  
termed the cardinal ligament.

clinical terms:  
1 = rectal fascia  
2 = sacro-uterine ligament  
3 = cardinal ligament, Parametrium  
4 = vesical fascia  
5 = retropubic space  
(= Spatium prevesicale  
= Retzius's space)

6 = paravesical space,  
Paracystium  
7 = recto-uterine pouch  
(= DOUGLAS's space)  
8 = pararectal space,  
Paraproctium  
9 = retrorectal space



**Figs. 1071 a, b** Vaginal part of the cervix of the uterus,  
Portio vaginalis cervicis.  
a photograph of a young female, who has not yet given birth  
(Nullipara)  
b photograph of a young female, who has born two children

To inspect the vaginal part of the cervix of the uterus, the  
normally slit-like shaped vagina has been opened wide by two  
specula (\*);  
inferior view.  
The cervix of the uterus clearly bulges into the vagina.



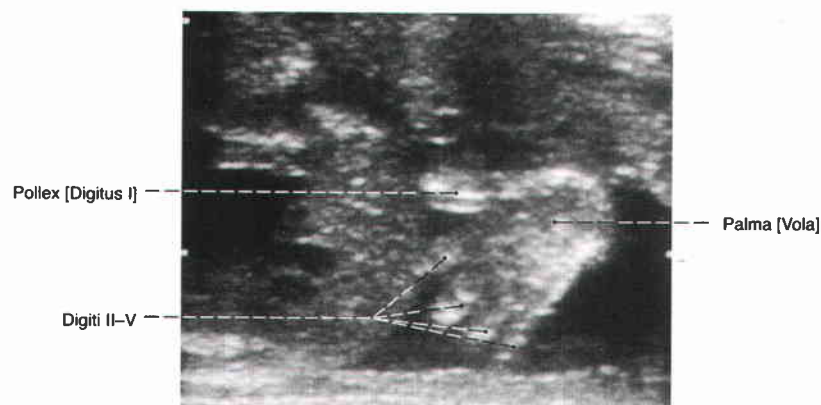
**Fig. 1072** Uterus, Uterus, with embryo;  
ultrasound image through the abdominal wall in the 10th week  
of pregnancy.

The embryo swims in the amniotic fluid of the chorionic cavity;  
lateral view (r.).



**Fig. 1073** Uterus, Uterus, with fetus;  
ultrasound image in the 28th week of pregnancy;  
lateral view (l.).

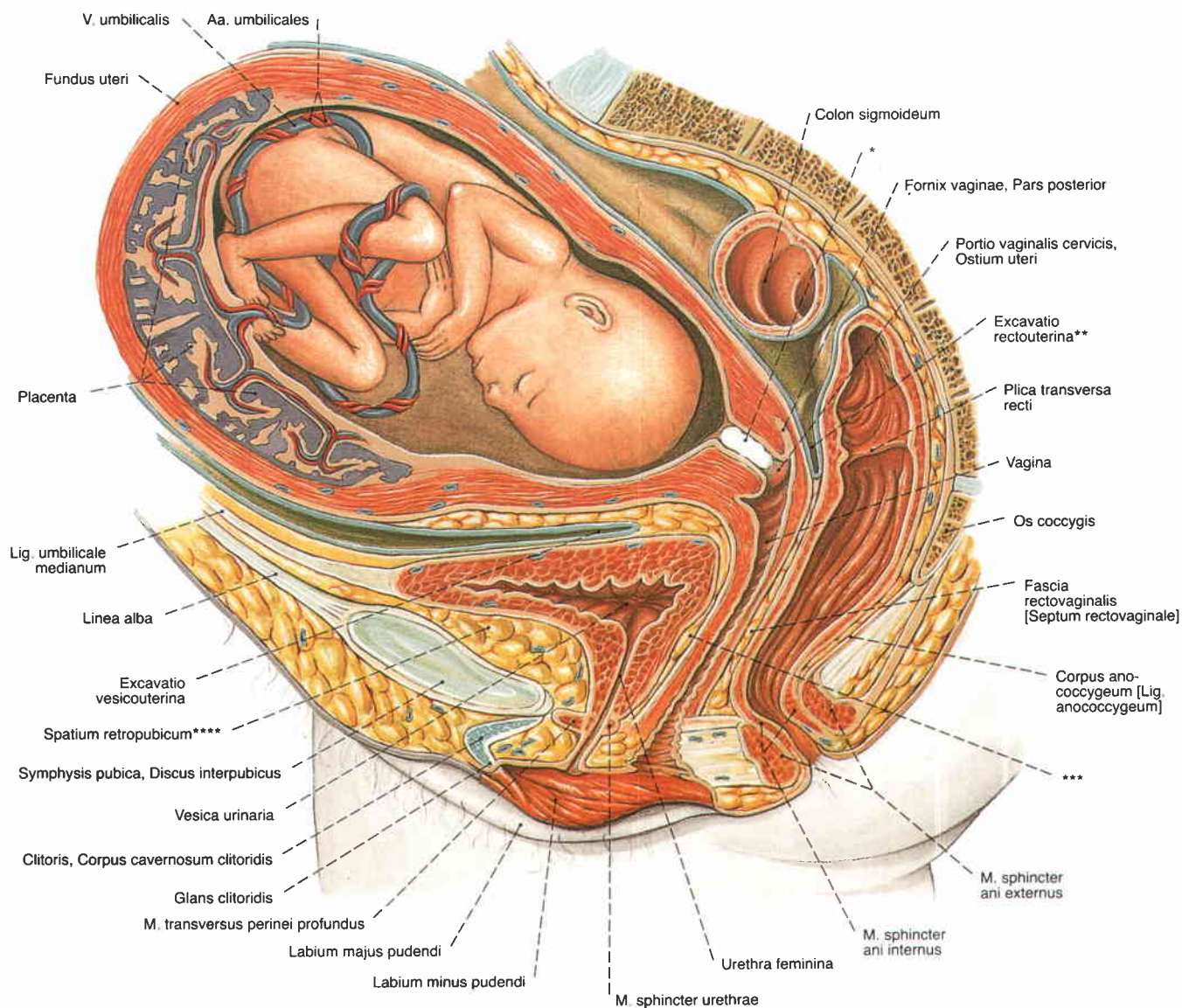
During sonographic examination the movement of the limbs  
and the opening of the mouth can be assessed.



**Fig. 1074** Hand, Manus, of a fetus;  
ultrasound image in the 24th week of pregnancy;

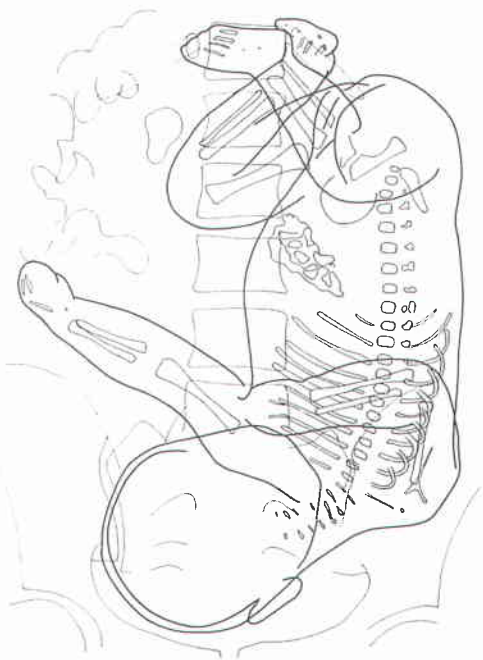
details such as the fingers can be assessed;  
lateral view.



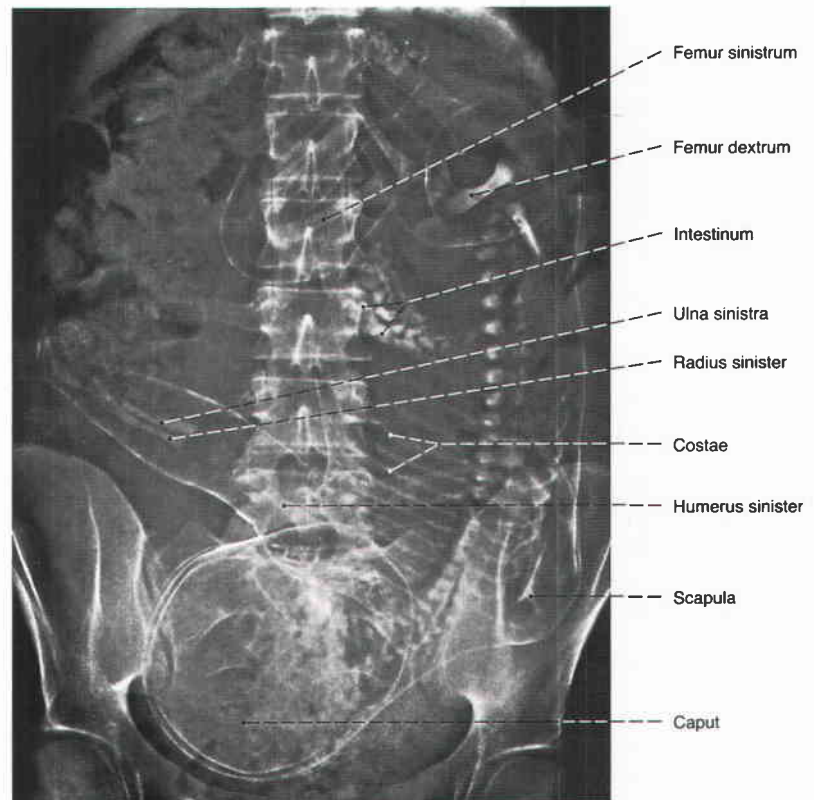


**Fig. 1075** Uterus, Uterus, with fetus; the pelvis has been sectioned in the median plane; lateral view (l.).  
The wall of the uterus is extremely thin at the end of pregnancy.

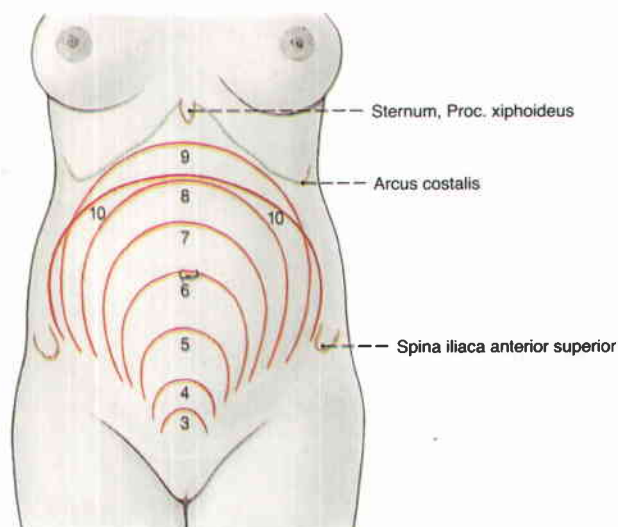
- \* KRISTELLER's mucous plug in the cervical canal
- \*\* clinical: DOUGLAS's space
- \*\*\* clinical: vesicovaginal septum
- \*\*\*\* clinical: RETZIUS's space



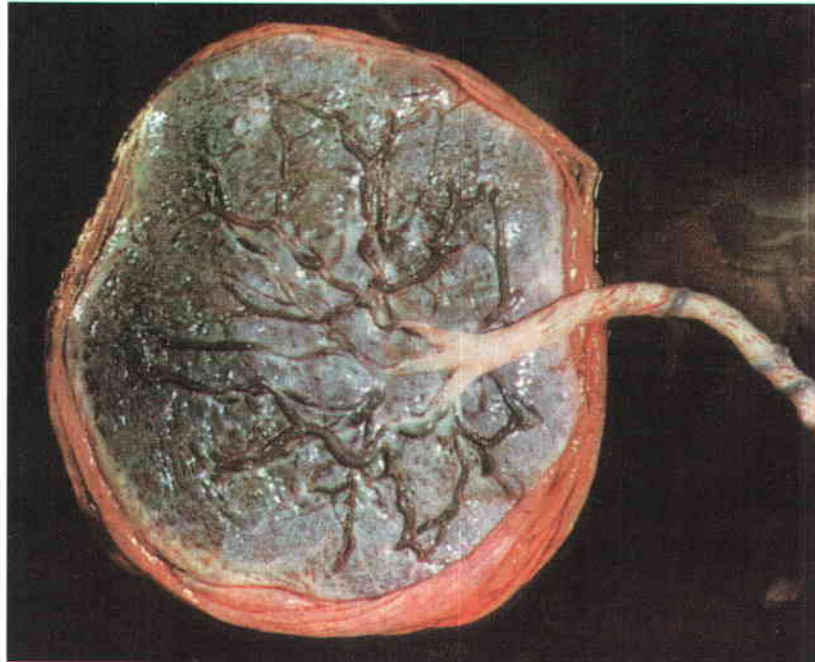
**Fig. 1076** Fetus;  
AP-radiograph shortly before birth;  
ventral view.



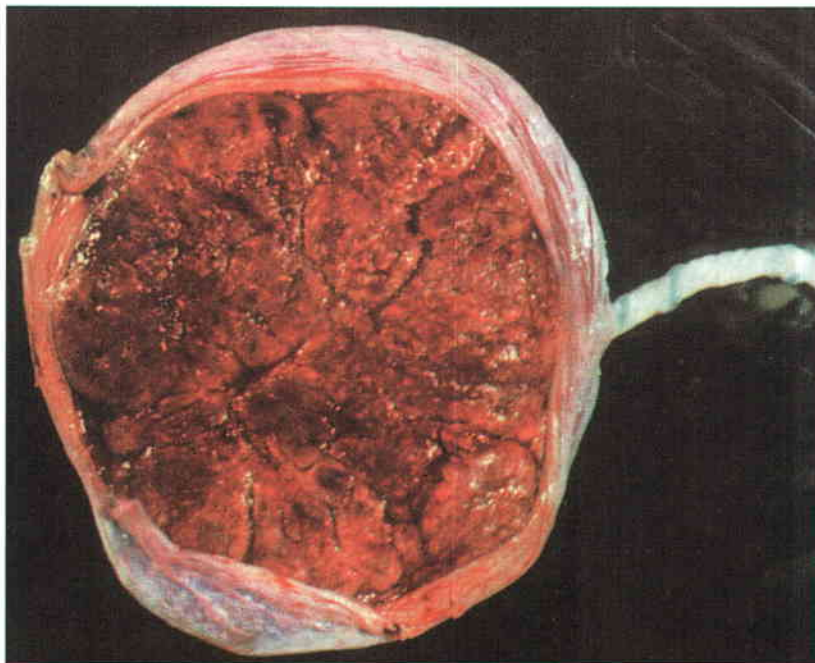
Formerly this radiograph was sometimes used to  
compare the size of the pelvis to the size of the child's  
head.



**Fig. 1077** Uterus, Uterus;  
position of the fundus of the uterus during pregnancy;  
the figures indicate the end of the respective month of  
pregnancy (= 28 days); during the last month the fundus  
of the uterus descends.



a



b

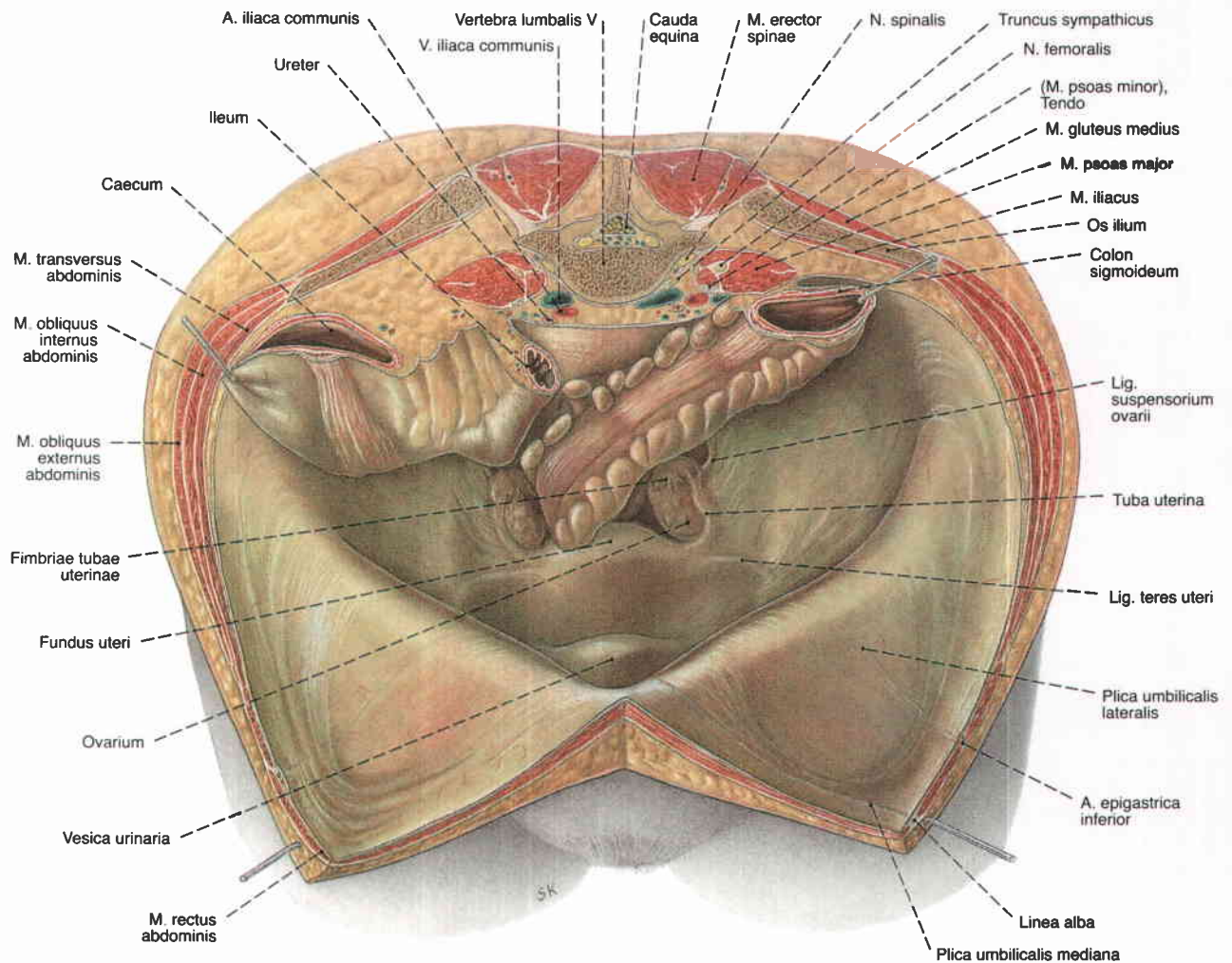
Figs. 1078 a, b Placenta, Placenta;  
umbilical cord, Funiculus umbilicalis.

a view of the fetal side

b view of the maternal side of a mature placenta at the  
end of term

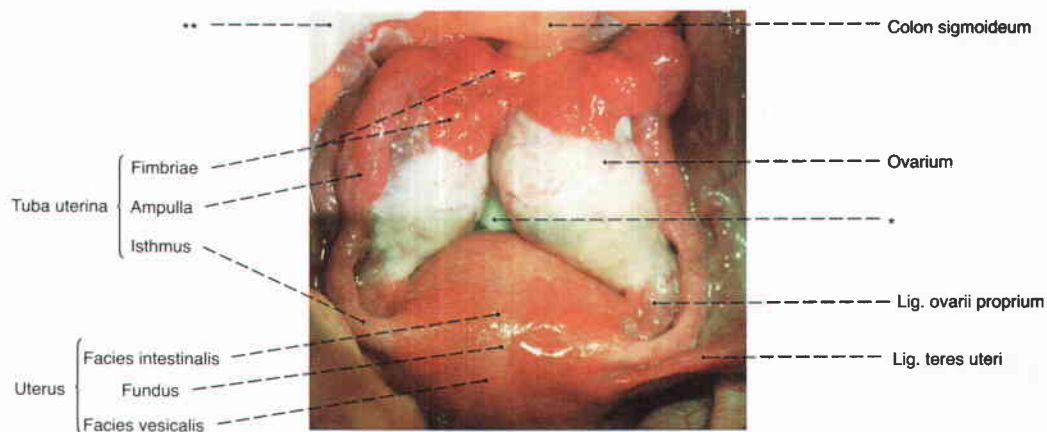
The fetal side has a smooth surface due to the amnion,  
while the maternal side is structured by cotyledons and of  
red colour due to the blood.





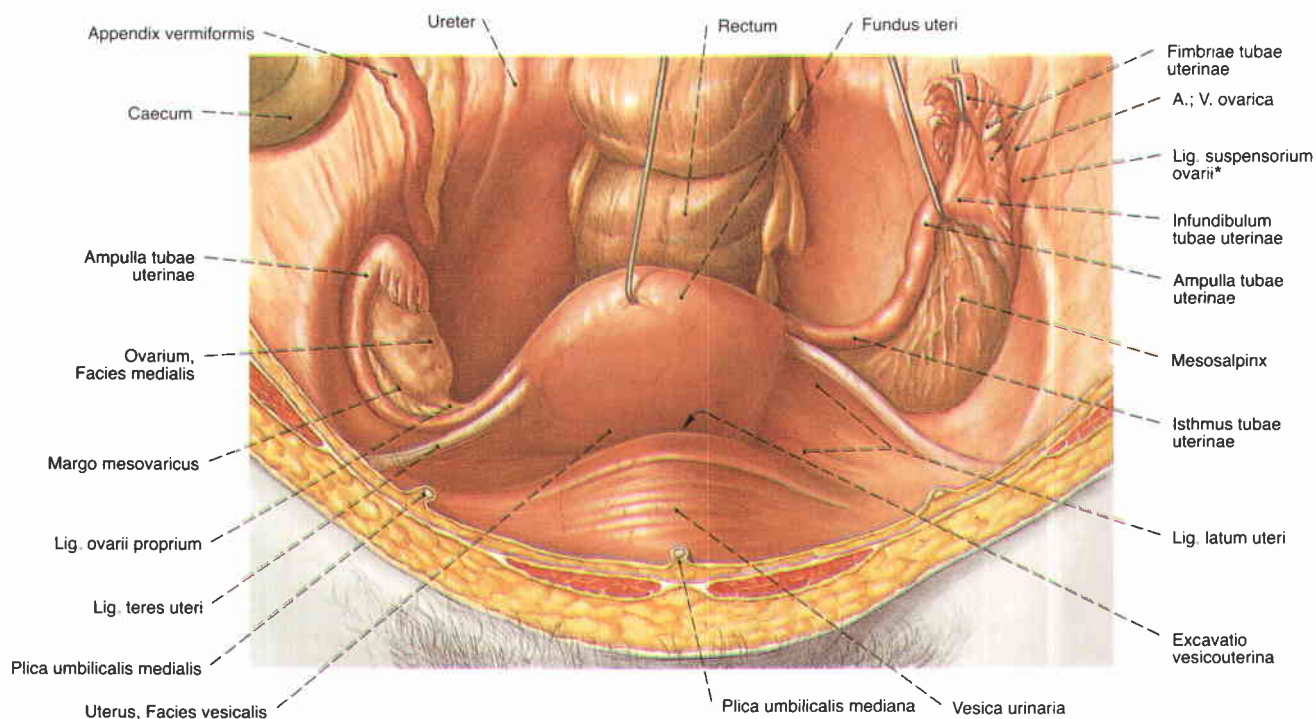
**Fig. 1079** Internal genital organs of a female, *Organa genitalia feminina interna*; horizontal section through the fifth lumbar vertebra; the anterior abdominal wall has been longitudinally sectioned in the right rectus abdominis muscle and has been retracted

laterally by hooks; the caecum and the sigmoid colon have been pulled superiorly by hooks; ventrosuperior view.



**Fig. 1080** Internal genital organs of a female, *Organa genitalia feminina interna*; operation site of a young female; ventrosuperior view.

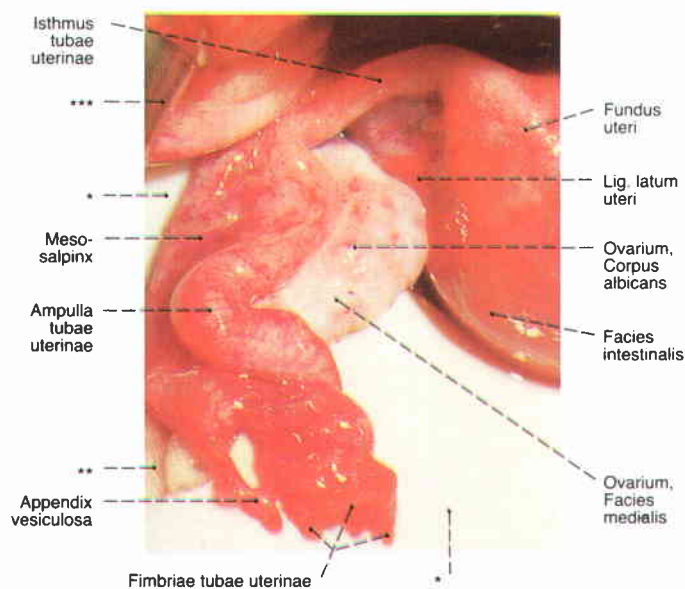
\* The ovaries have been pushed superomedially by compresses.  
\*\* tampon



**Fig. 1081** Internal genital organs of a female, *Organa genitalia feminina interna*; the uterus has been lifted by hooks to show the vesico-uterine pouch and the broad ligament (*Lig. latum uteri*); the left uterine (fallopian) tube has been pulled superiorly to demonstrate the mesosalpinx (suspensory ligament of the ovary); ventral view.

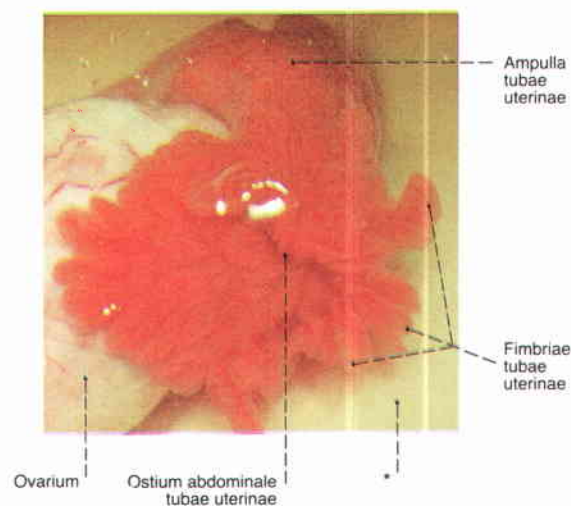
The close topographical relationship between the right adnexa (ovary and uterine tube) and the vermiform appendix can cause considerable problems in the differential diagnosis of inflammation in these organs.

\* clinical: *Lig. infundibulopelvicum*



**Fig. 1082** Uterine (fallopian) tube, *Tuba uterina*; ovary, *Ovarium*; operation site in a young female; dorsosuperior view.

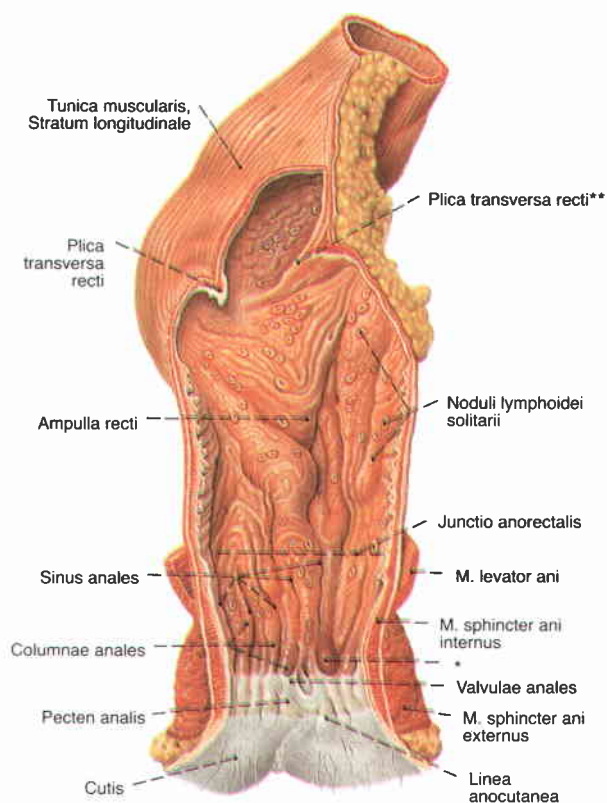
\* plastic tray to support the ovary and the uterine tube  
\*\* tampon  
\*\*\* surgical hook



**Fig. 1083** Orifice of the uterine (fallopian) tube, *Ostium abdominale tubae uterinae*; operation site of a young female; the pelvic cavity has been filled with saline solution to demonstrate the fimbriae; dorsosuperior view.

\* plastic tray to support the uterine tube

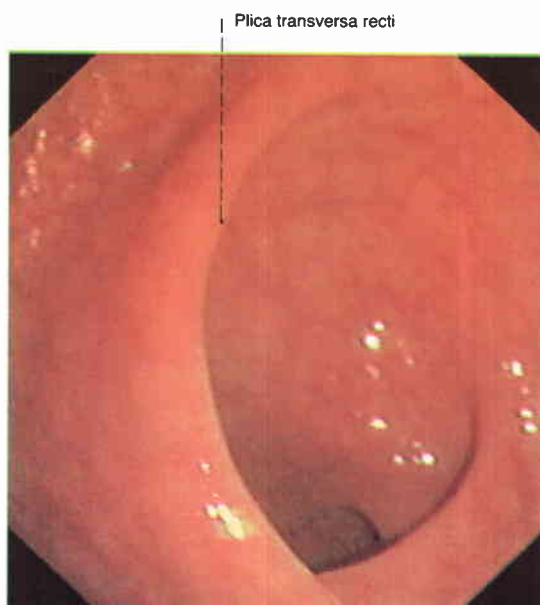




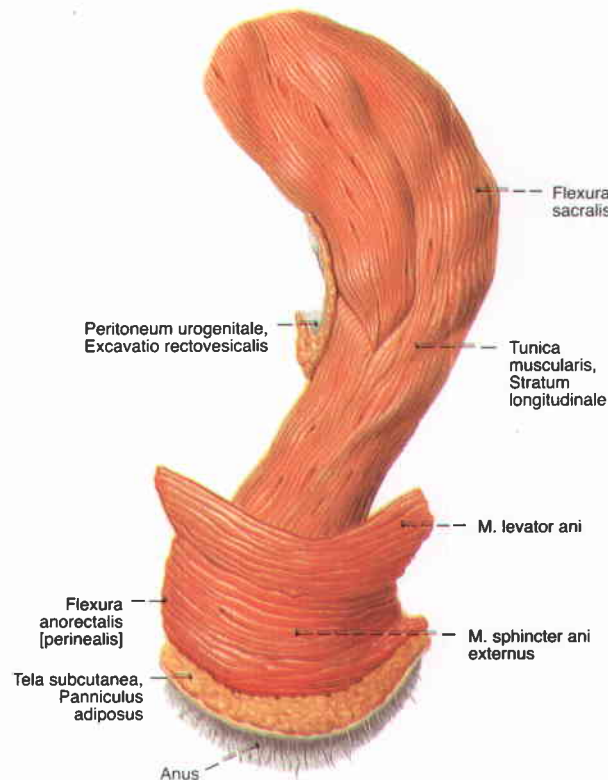
**Fig. 1084** Rectum, Rectum; anus, Anus; frontal section showing the mucosa and the sphincter muscles; ventral view.

\* Nodus haemorrhoidalis

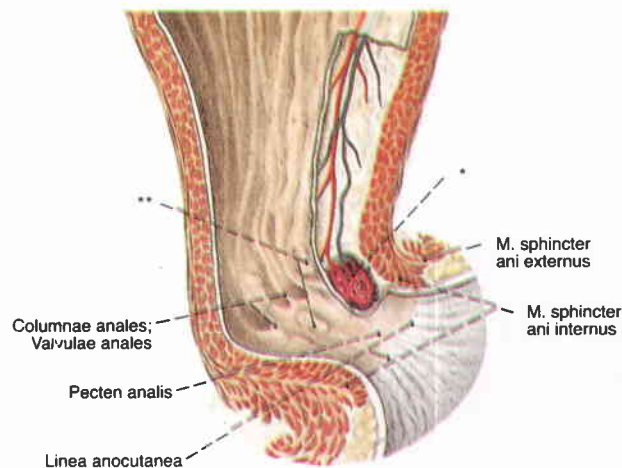
\*\* KOHLRAUSCH's fold



**Fig. 1086** Rectum, Rectum; view through an endoscope which has been introduced via the anal canal into the rectal ampulla (rectoscopy) to assess the mucosa; inferior view.



**Fig. 1085** Rectum, Rectum; most of the surrounding tissue has been removed to demonstrate the musculature; lateral view (r.).



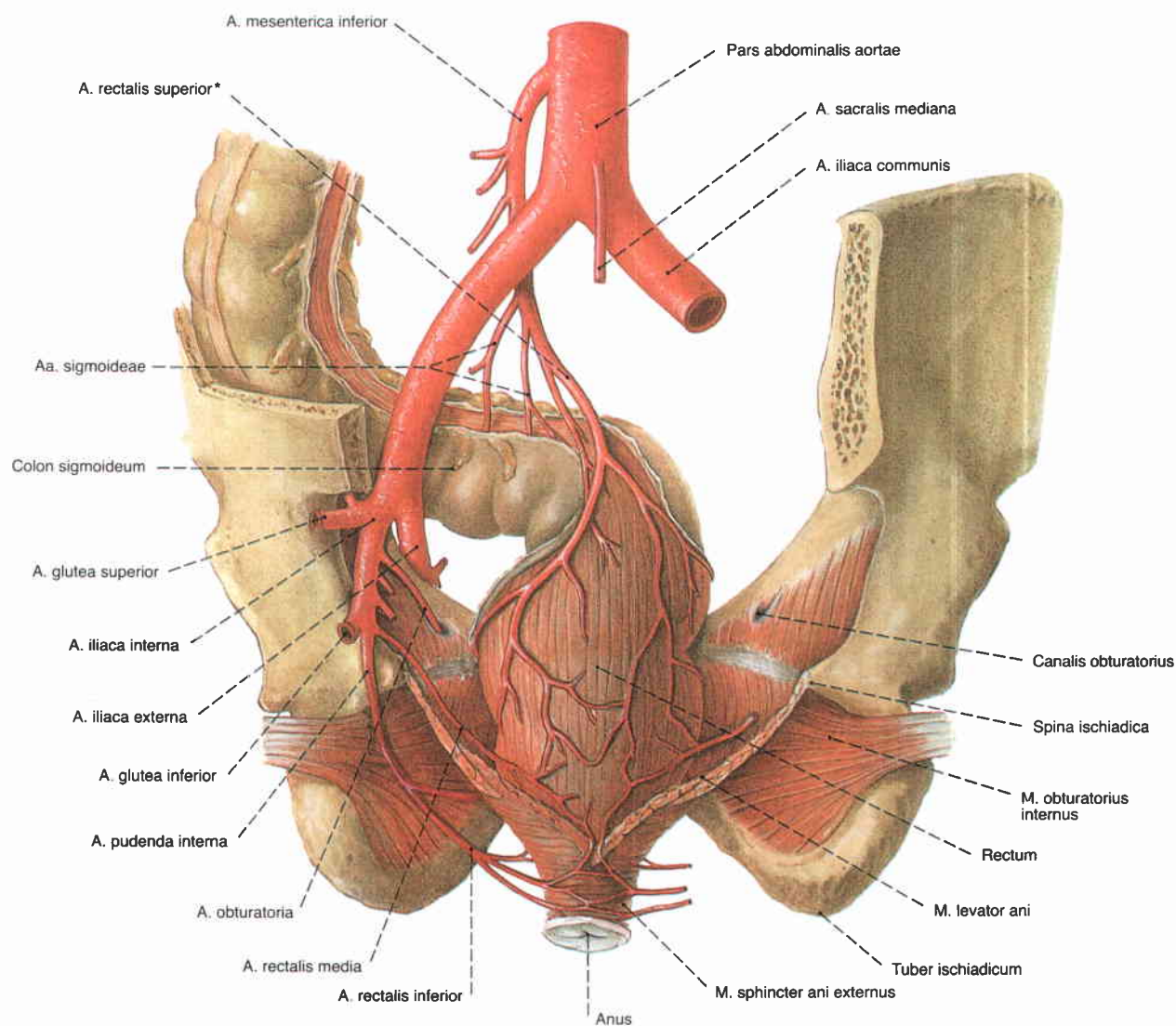
**Fig. 1087** Rectum, Rectum; median section showing the arteriovenous anastomoses in the anal folds; the mucosa has been partially removed; lateral view (l.).

The muscles (Mm. sphincter ani internus et externus, M. levator ani) and the mucous folds (anal valves) covering the erectile type arteriovenous anastomoses make it possible for the anus to close.

\* Glomerulus rectalis, numerous arteriovenous anastomoses in the Corpus cavernosum recti

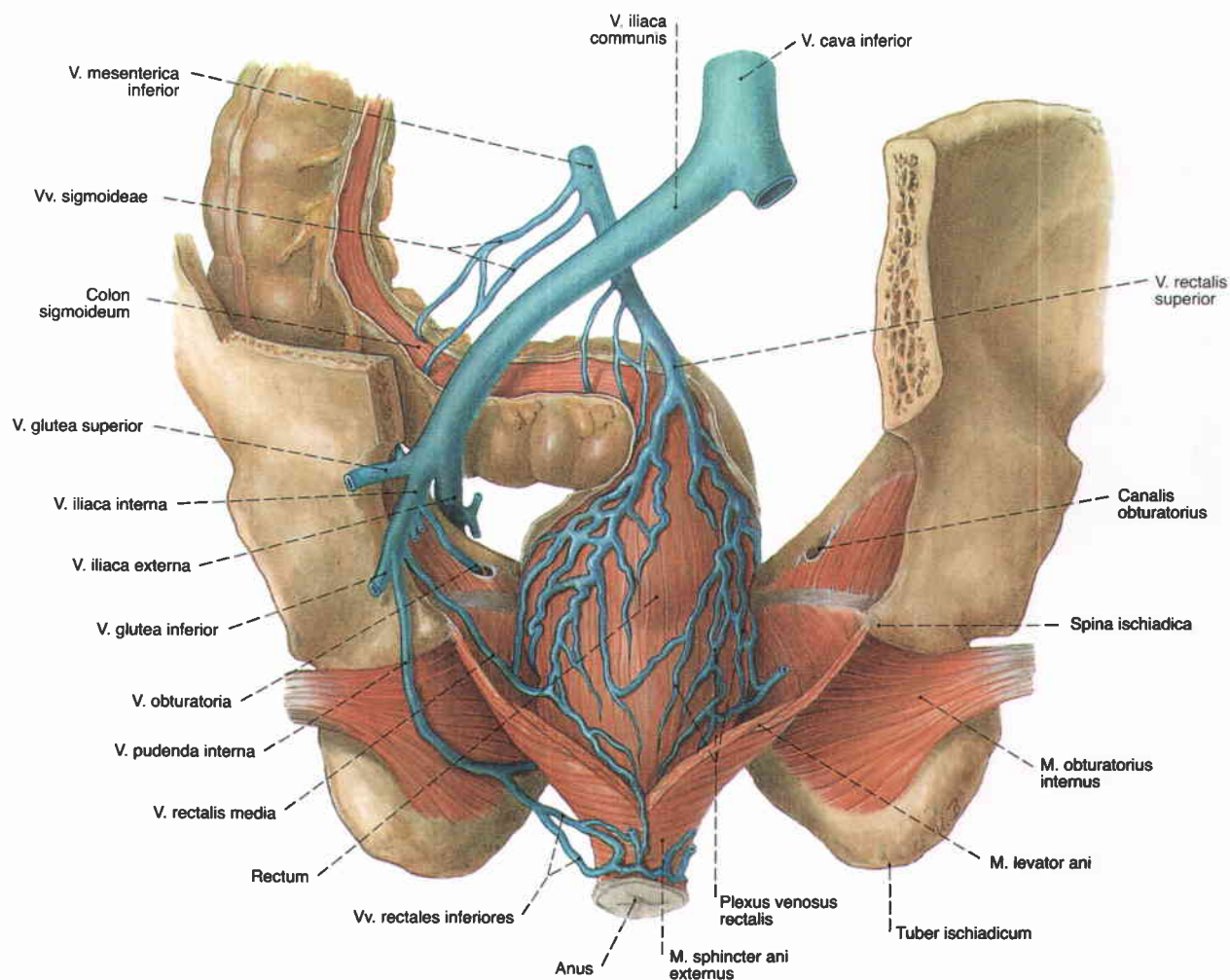
\*\* clinical: Zona haemorrhoidalis





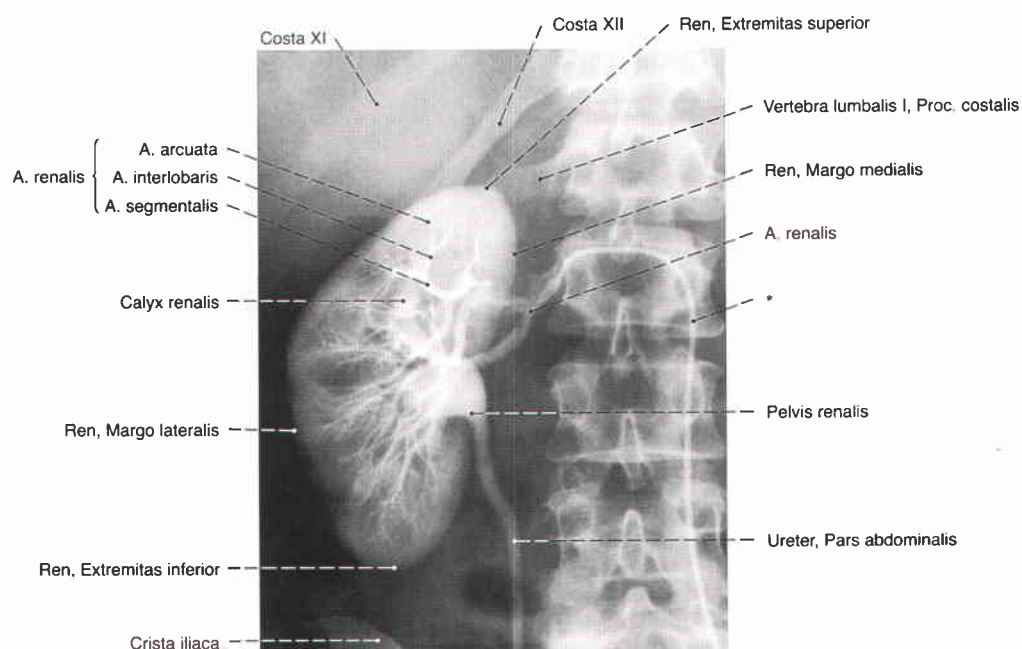
**Fig. 1088** Arteries of the rectum, Aa. rectales; the iliac artery with its most important branches on the left; dorsal view.

\* clinical: SUDECK'S point (from this point on there are no further anastomoses with the sigmoid arteries)



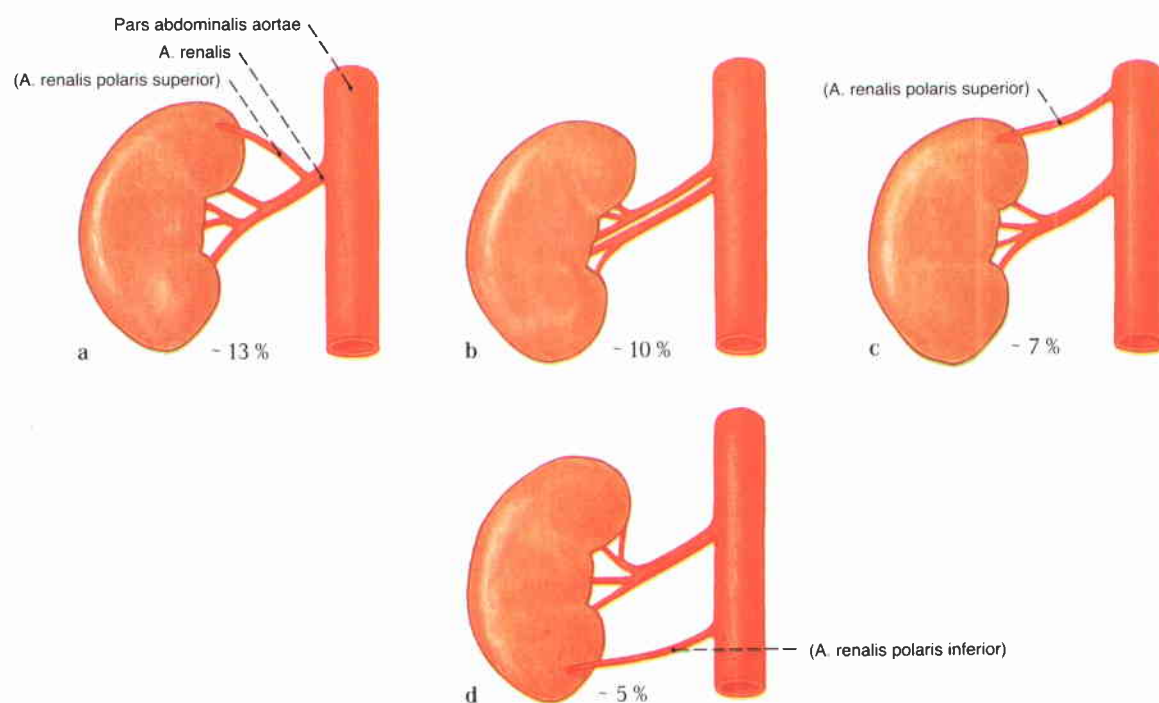
**Fig. 1089** Veins of the rectum, Vv. rectales; diagram with parts of the pelvis and the pelvic floor; dorsal view.

Many of the small veins exist in pairs but have been drawn here as one vessel for clarity. The venous plexus below the rectal mucosa is not shown. There are numerous connections between the vessels which drain into the portal vein (superior rectal vein) and the vessels which drain into the inferior vena cava (medial and inferior rectal veins). These are called portacaval anastomoses and are of considerable clinical importance.



**Fig. 1090** Kidney, Ren;  
AP-radiograph; a contrast medium has been injected  
intravenously and is excreted by the kidneys (intra-  
venous pyelography) making the renal pelvis and

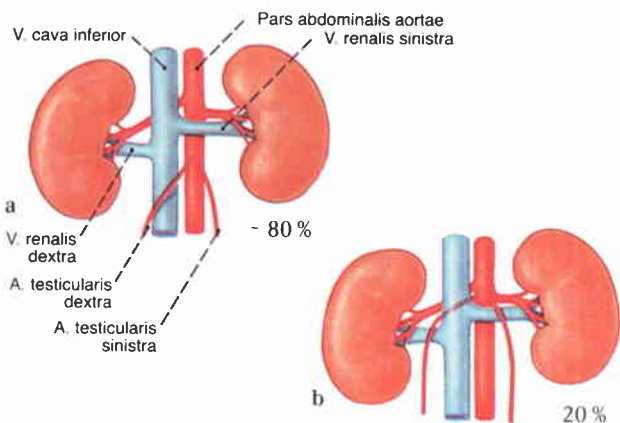
the ureter visible; simultaneous demonstration of the arteries  
by a contrast medium which has been injected into the renal  
artery via a catheter (\*) introduced through the aorta  
(arteriography).



**Figs. 1091 a–d** Variations of the renal arterial supply.

- a** one renal artery with a branch to the upper renal pole
- b** two renal arteries to the renal hilum
- c** two renal arteries, one of which supplies the upper pole
- d** two renal arteries, one of which supplies the lower pole

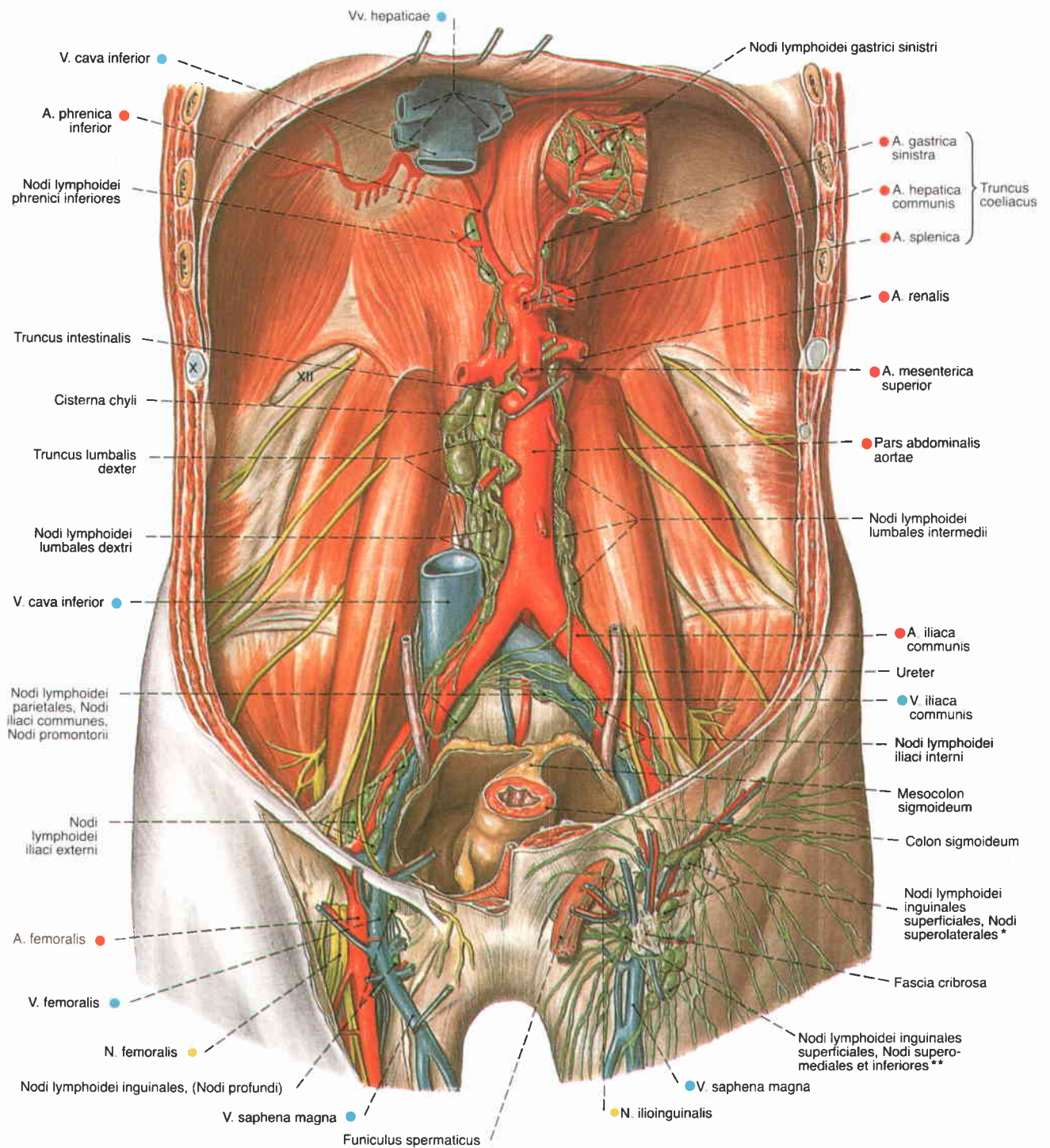




Whereas the left testicular vein drains into the left renal vein, the right testicular vein drains directly into the inferior vena cava. The same applies for the ovarian veins.

- a normal ("textbook") case
- b both testicular arteries branch off above the renal veins; the A. testicularis then runs behind the inferior vena cava. on the left it is in front of the left renal vein.



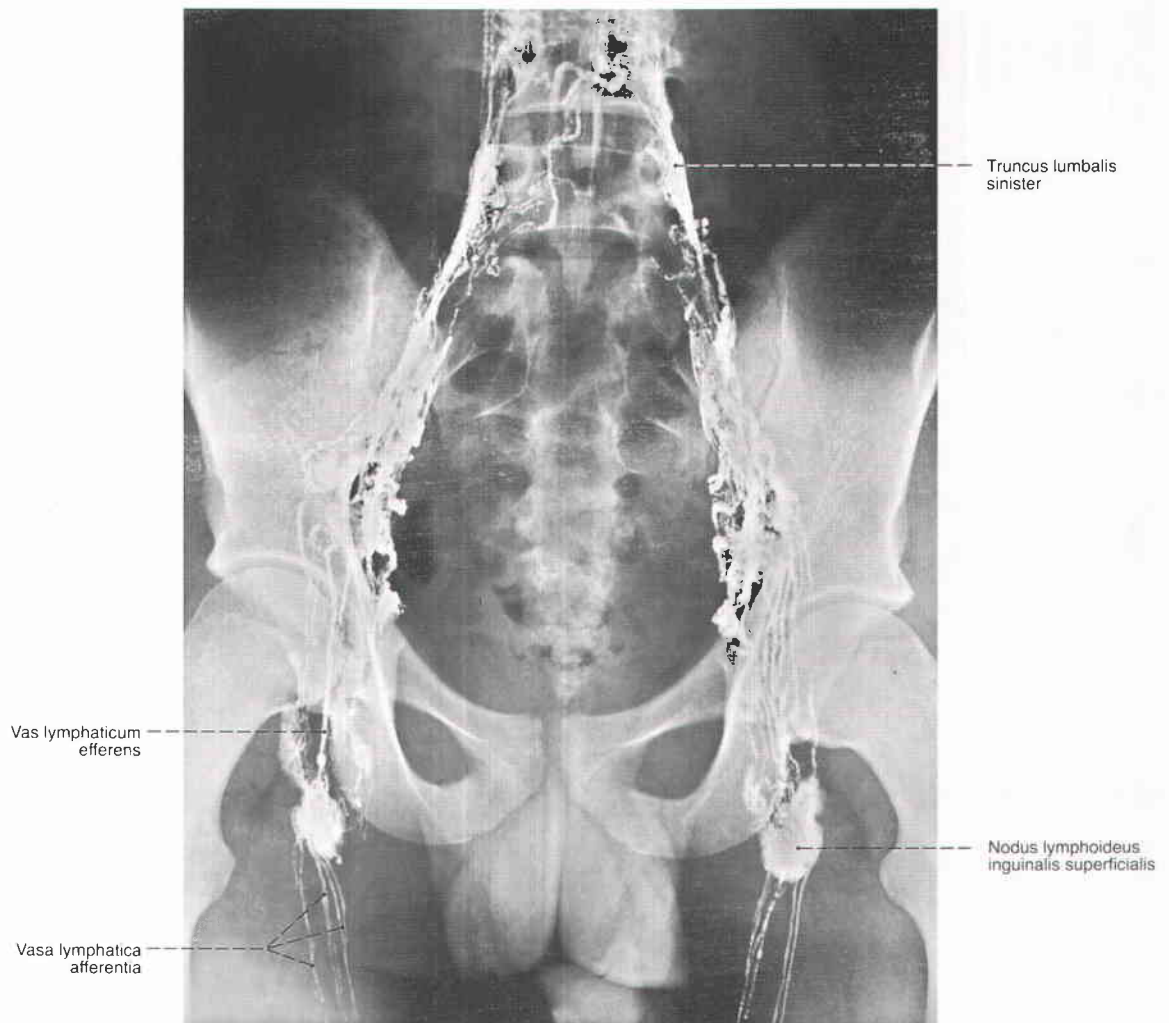


**Fig. 1094** Lymph nodes, Nodi lymphoidei; lymphatic vessels, Vasa lymphatica, of the posterior abdominal wall and the inguinal area; the abdominal viscera, the retroperitoneal fat and the skin of the thigh have been partially removed; ventral view.

X and XII = Ribs

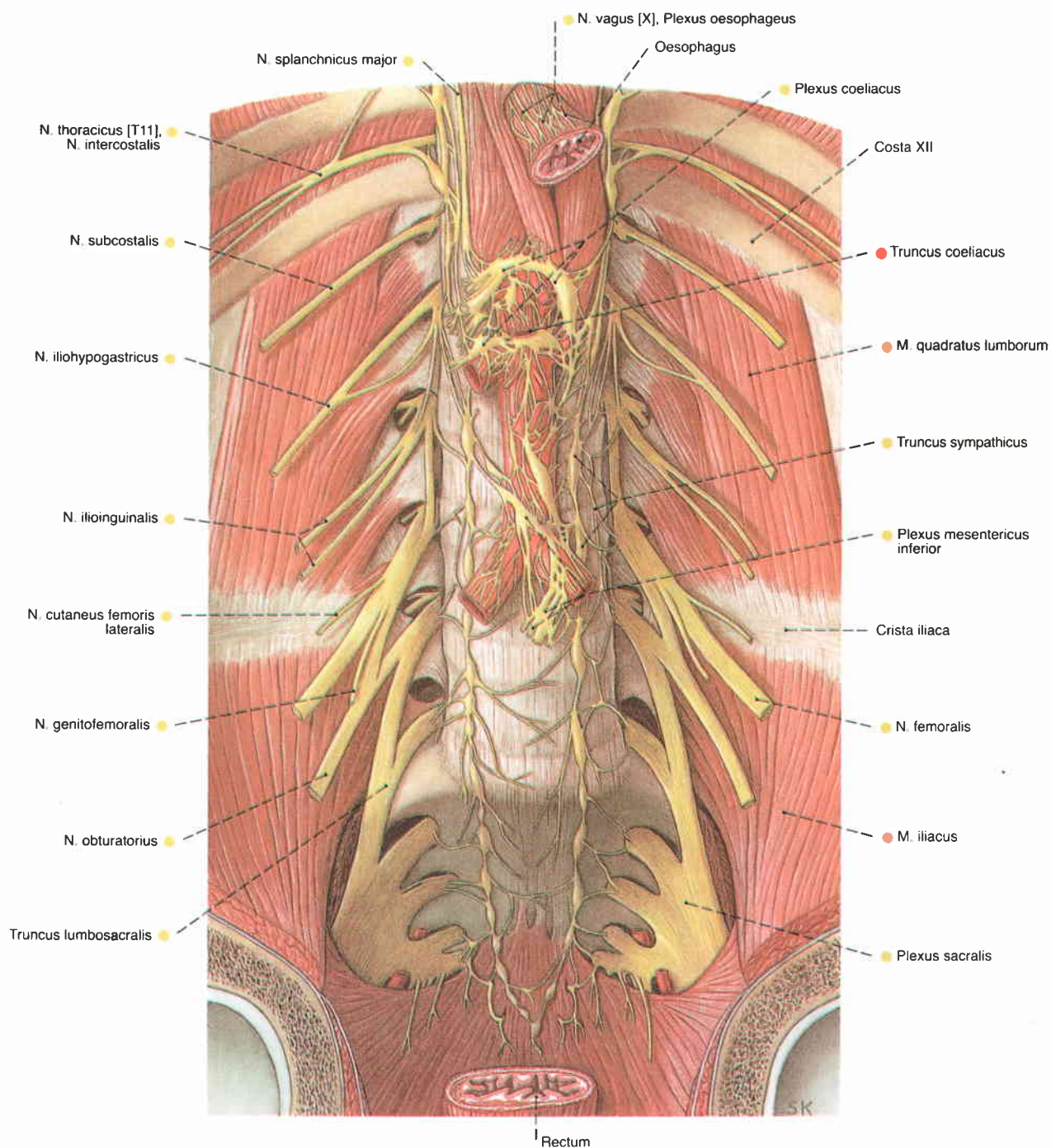
\* clinical: "horizontal chain", which drains the lower abdominal wall, the gluteal region, the perineum and the external genitalia

\*\* clinical: "vertical chain", which drains the lower limb

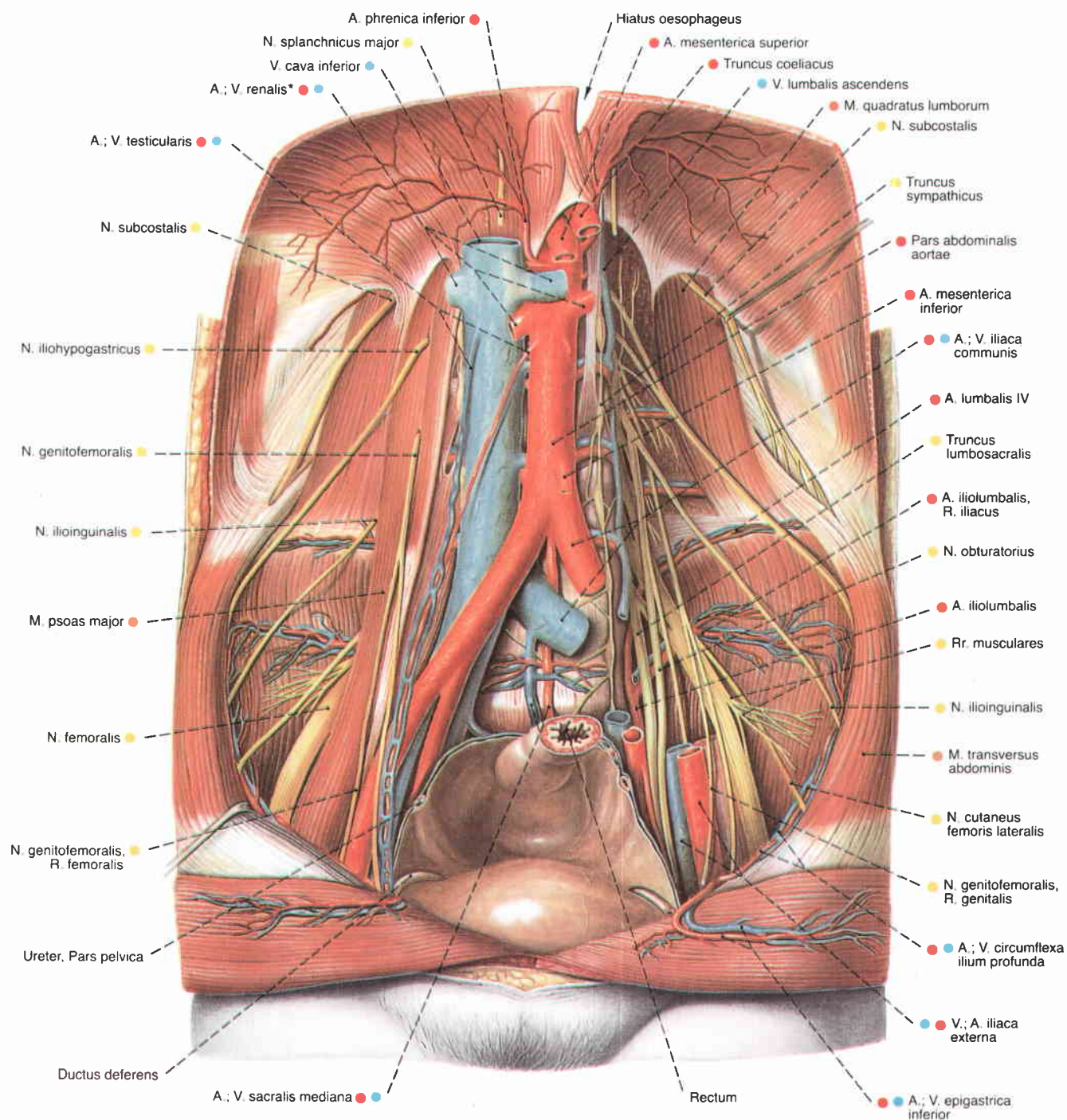


**Fig. 1095** Lymphatic vessels, Vasa lymphatica; lymph nodes, Nodi lymphoidei, of the inguinal, pelvic and lumbar regions;  
AP-radiograph after injection of a contrast medium into the lymphatic vessels of both feet (lymphography).  
The segments between the valves in the lymphatic vessels can be clearly seen as a string of pearls. The storage of the contrast medium begins in the inguinal lymph nodes.





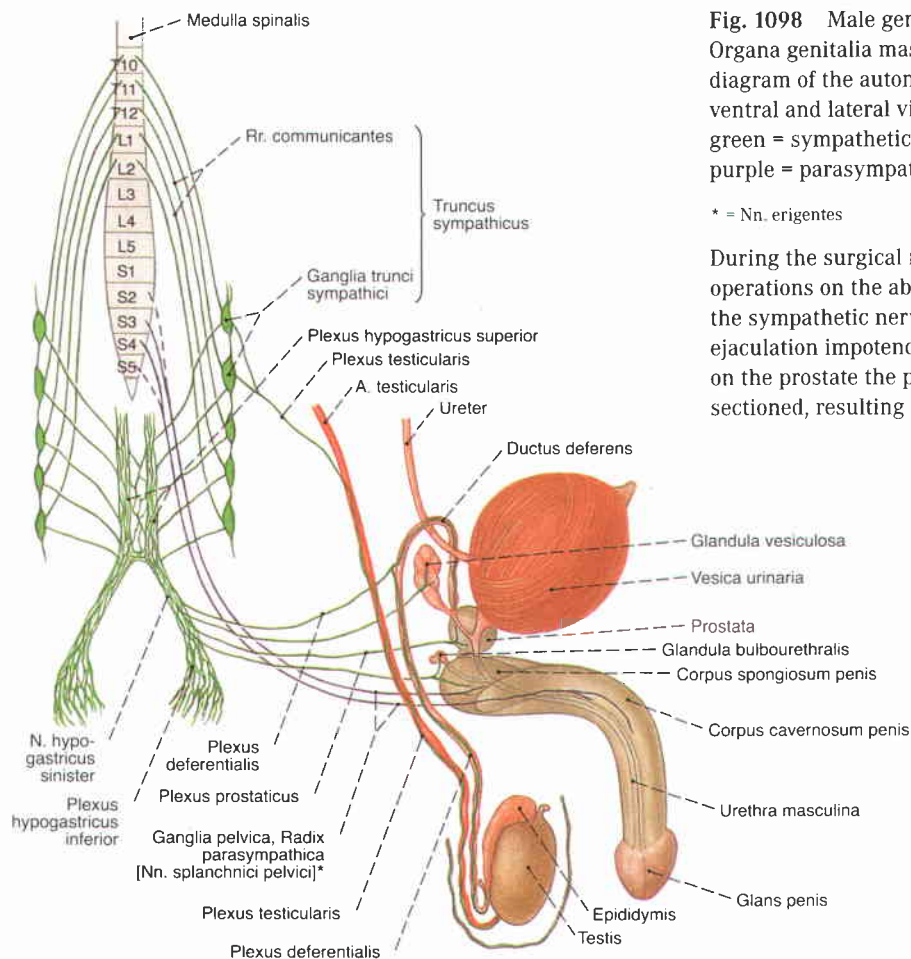
**Fig. 1096** Nerves of the posterior abdominal wall, Plexus lumbosacralis, Pars abdominalis autonómica; the viscera, the vessels and the psoas muscle have been removed; ventral view.



**Fig. 1097** Vessels and nerves of the posterior abdominal wall in the male; on the left the psoas major muscle and the iliac arteries and veins have been largely removed to demonstrate the lumbar plexus; ventral view.

\* In about 10% of the cases the left renal vein runs posterior to the aorta.





**Fig. 1098** Male genital organs, Organa genitalia masculina; diagram of the autonomic innervation on the left side; ventral and lateral view.  
green = sympathetic part  
purple = parasympathetic part

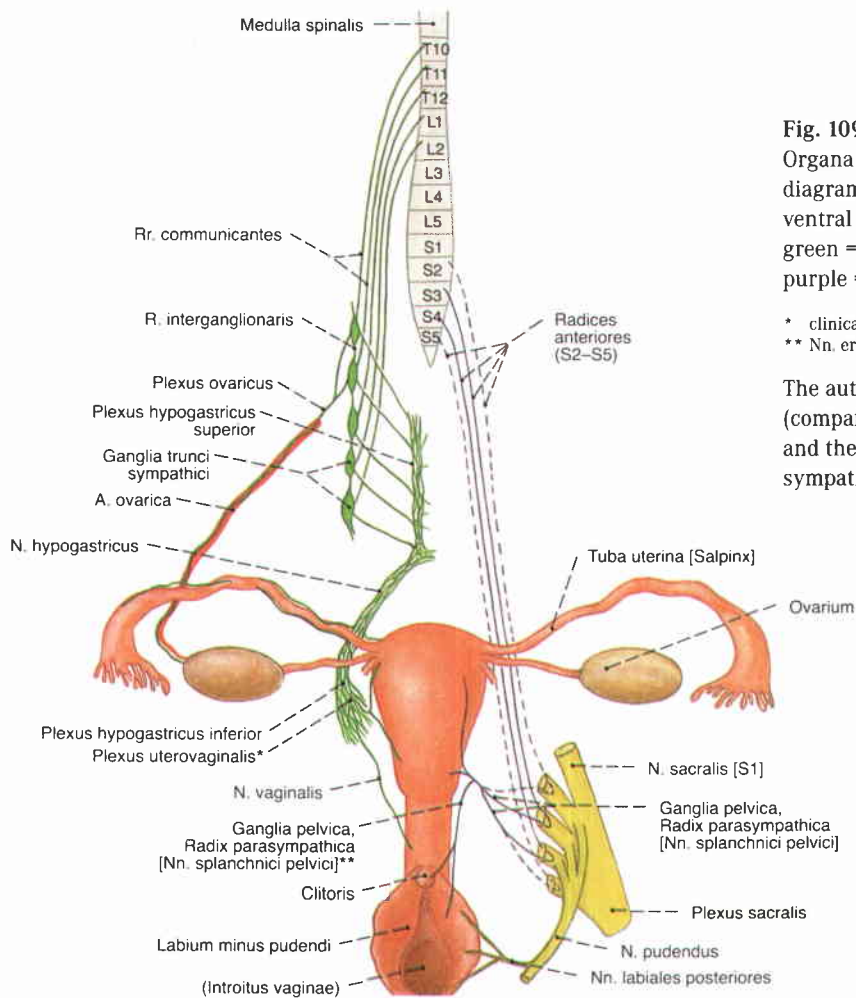
\* = Nn. erigentes

During the surgical removal of the para-aortal lymph nodes or operations on the abdominal aorta and major pelvic arteries the sympathetic nervous system may be damaged, resulting in ejaculation impotence (Impotentia generandi). During operations on the prostate the parasympathetic fibres to the penis may be sectioned, resulting in erectile impotence (Impotentia coeundi).

### Innervation of the male genital organs

	Origin	Course	Organ	Function
<b>Parasympathetic part</b>	Sacral spinal cord (S2 - S4)	Ganglia pelvica, Radix parasympathica [Nn. splanchnici pelvici]	Penis Erectile tissue	Vasodilatation Erection
<b>Sympathetic part</b>	Thoracic spinal cord (Th10 - Th12)	Plexus mesenterici superior et inferior ↓ Truncus sympathicus ↓ Plexus testicularis ↓	Testis	Regulation of the blood supply
		Lumbar spinal cord (L1 - L2)		
		Plexus hypogastricus superior ↓ N. hypogastricus ↓ Plexus hypogastricus inferior	Glandula bulbo-urethralis Ductus deferens Glandula vesiculosa Prostata	Expulsion of its fluid Contraction, transport of the semen into the urethra Expulsion of its contents into the urethra
	Sacral spinal cord (S2 - S4)	N. pudendus	(M. sphincter vesicae)	Closure of the urinary bladder stops retrograde ejaculation
<b>Somatomotoric Somatosensory</b>		Nn. scrotales posteriores N. dorsalis penis	M. ischiocavernosus M. bulbospongiosus Skin of the scrotum Skin of the penis	Expulsion of the semen out of the urethra





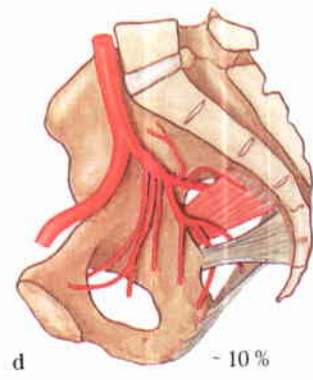
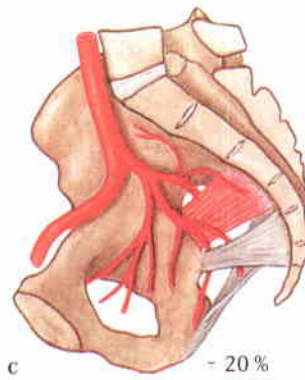
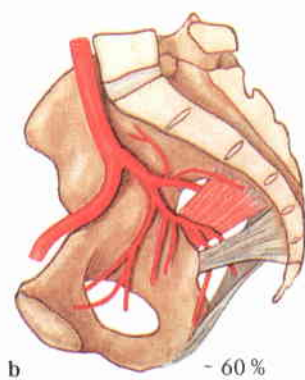
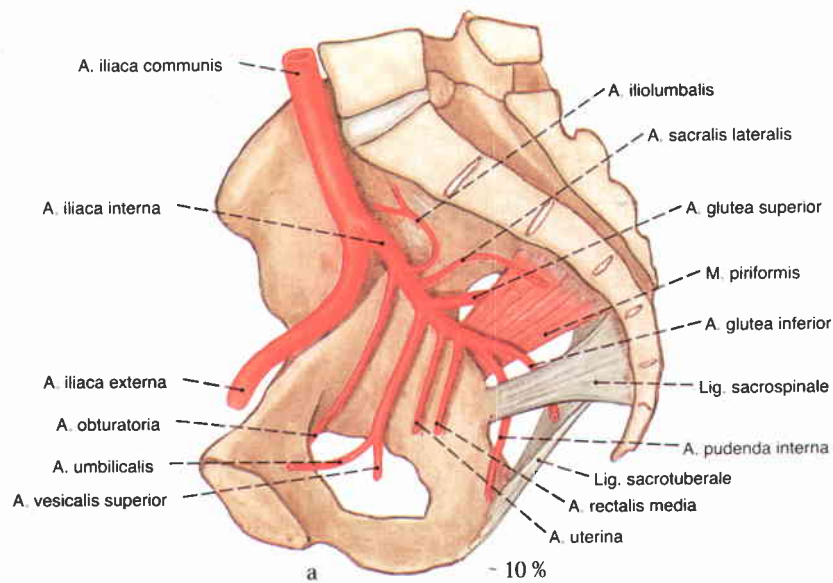
**Fig. 1099** Female genital organs, Organa genitalia feminina; diagram of the autonomic innervation; ventral view.  
green = sympathetic part  
purple = parasympathetic part

\* clinical: FRANKENHÄUSER'S plexus  
\*\* Nn. erigentes

The autonomic plexus is interspersed with ganglia (compare to Figs. 50 and 51). The hypogastric plexus and the uterovaginal plexus contain fibres of the sympathetic as well as the parasympathetic part.

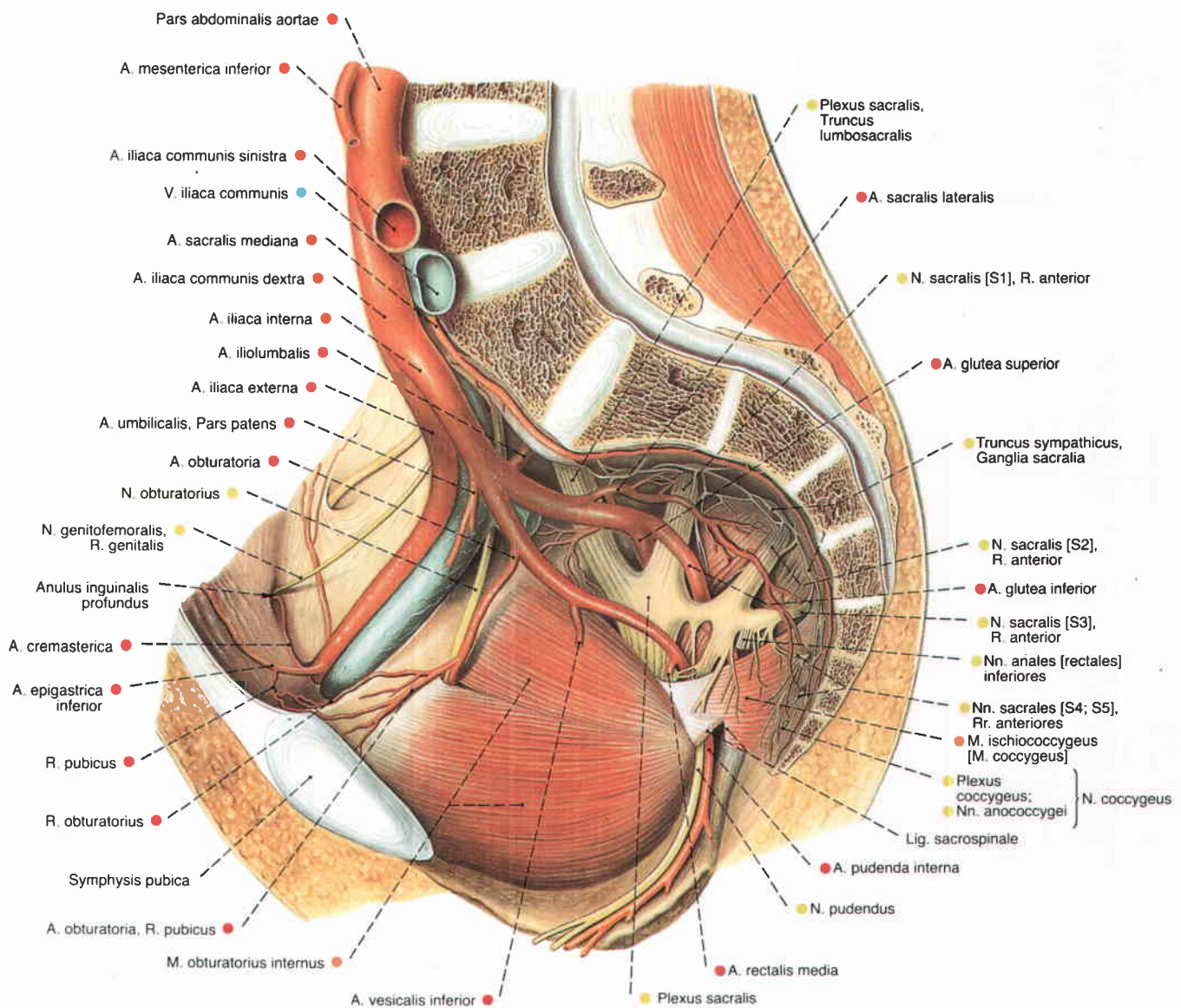
### Innervation of the female genital organs

	Origin	Course	Organ	Function
<b>Parasympathetic part</b>	Sacral spinal cord (S2 – S4)	Ganglia pelvica, Radix parasympathica [Nn. splanchnici pelvici] ↓ Nn. cavernosi clitoridis	Tuba uterina Uterus  Vagina Clitoris	Vasodilatation Vasodilatation  Transudation Erection
<b>Sympathetic part</b>	Thoracic spinal cord (Th10 – Th12)  Lumbar spinal cord (L1 – L2)	Plexus mesentericus superior ↘ Plexus ovaricus Plexus renalis Truncus sympathicus ↓ Plexus hypogastricus superior ↓ N. hypogastricus Plexus hypogastricus inferior ↓ Plexus uterovaginalis (FRANKENHÄUSER'S Plexus)	Ovary     Tuba uterina Uterus Vagina	Vasoconstriction     Contraction
<b>Somatomotoric Somatosensory</b>	Sacral spinal cord (S2 – S4)	N. dorsalis clitoridis N. pudendus ↗ Nn. labiales posteriores	Clitoris  Labia majora M. ischiocavernosus M. bulbospongiosus	Contraction



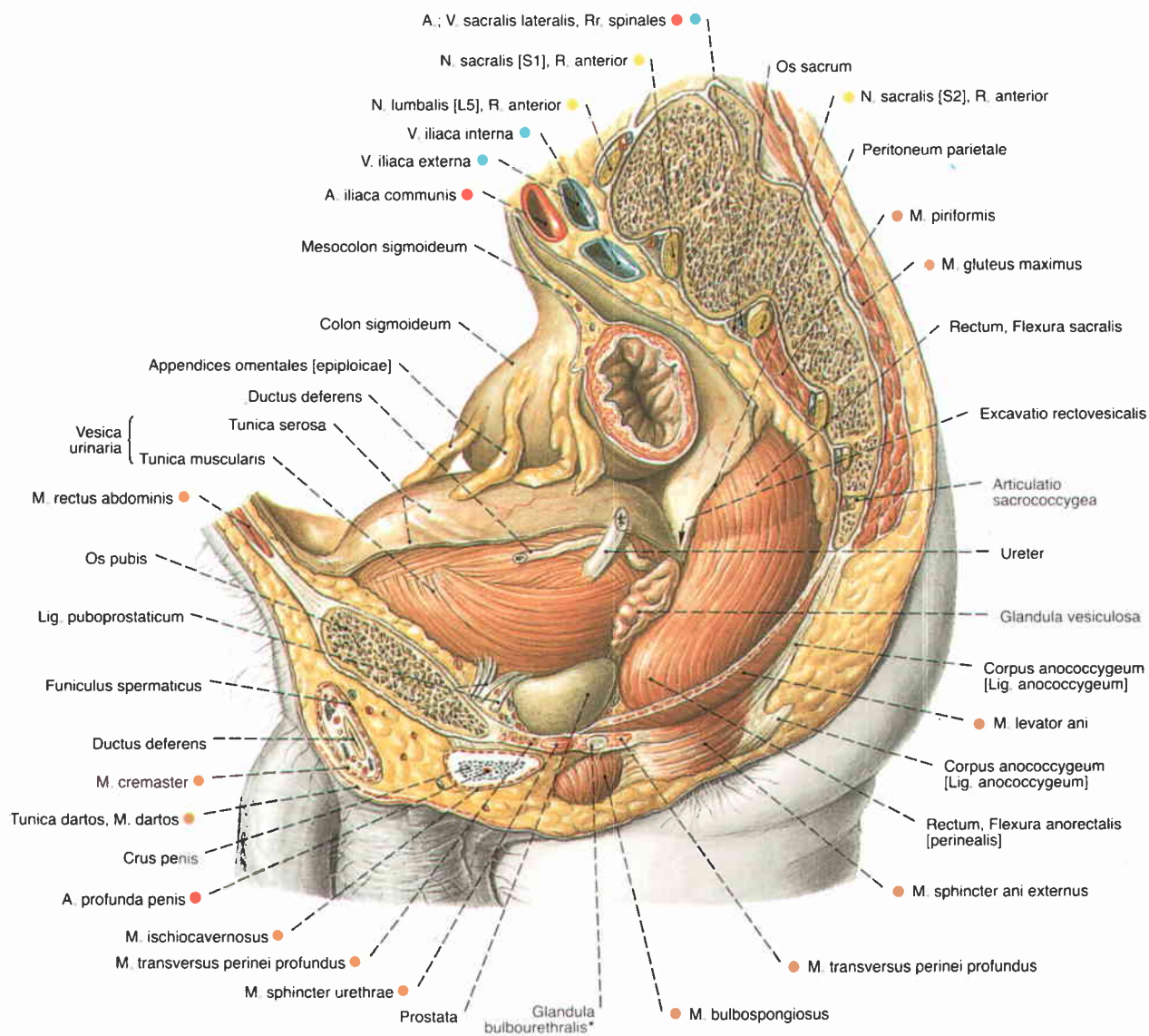
**Figs. 1100 a-d** Variations of the branching of the internal iliac artery, A. iliaca interna; lateral view (r.).

- a all branches have their origin in one trunk
- b the internal iliac artery has two main trunks (normal, "textbook case")
- c the internal iliac artery has three main trunks
- d the internal iliac artery has more than three main trunks



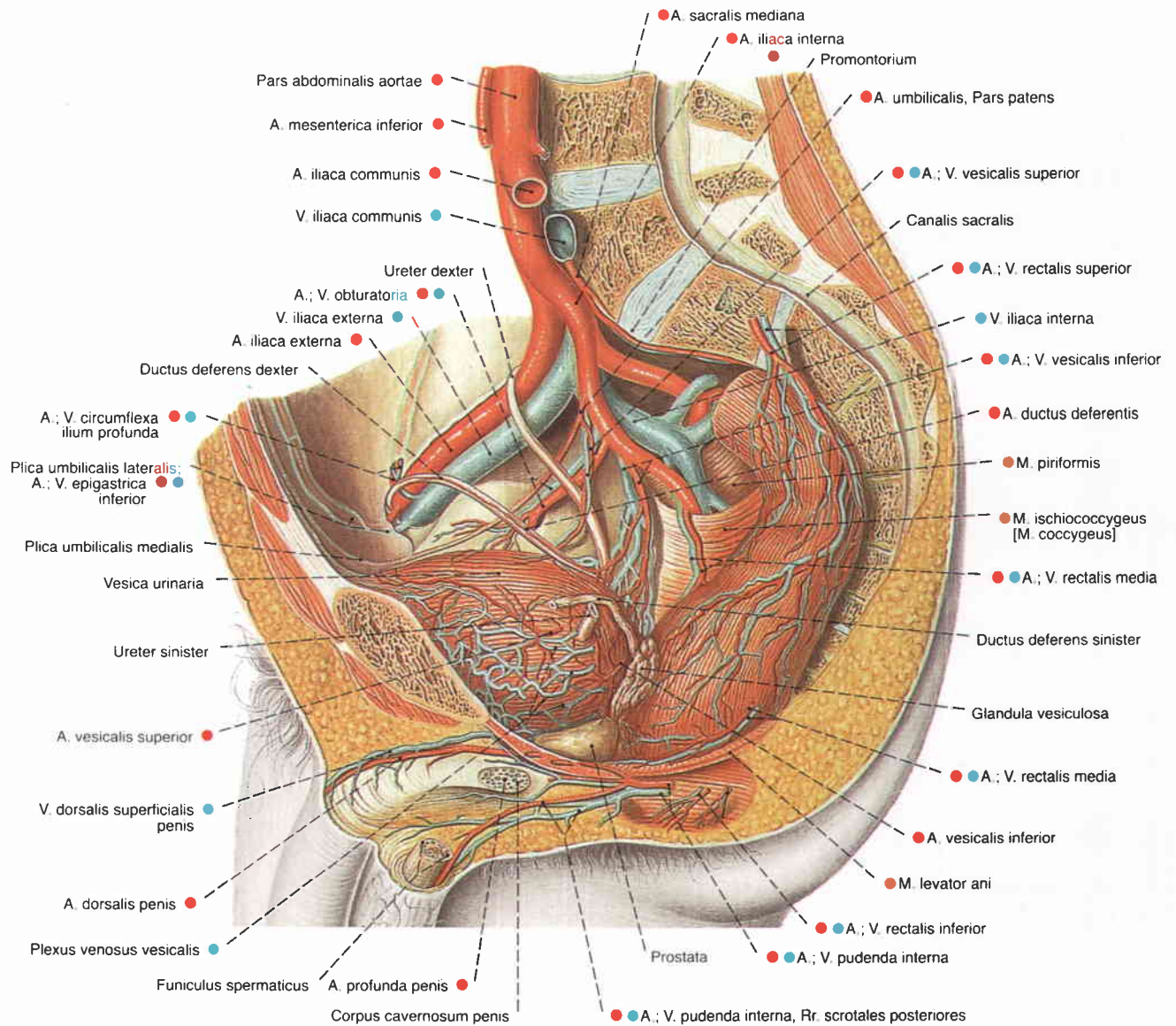
**Fig. 1101** Internal iliac artery, *A. iliaca interna*; sacral plexus, Plexus sacralis; demonstration of its branches in the pelvis, median section; the viscera and fasciae have been removed; the sacrospinal ligament has been partially sectioned to show the course of the internal pudendal artery; lateral view (r.). Compare to Fig. 1100.





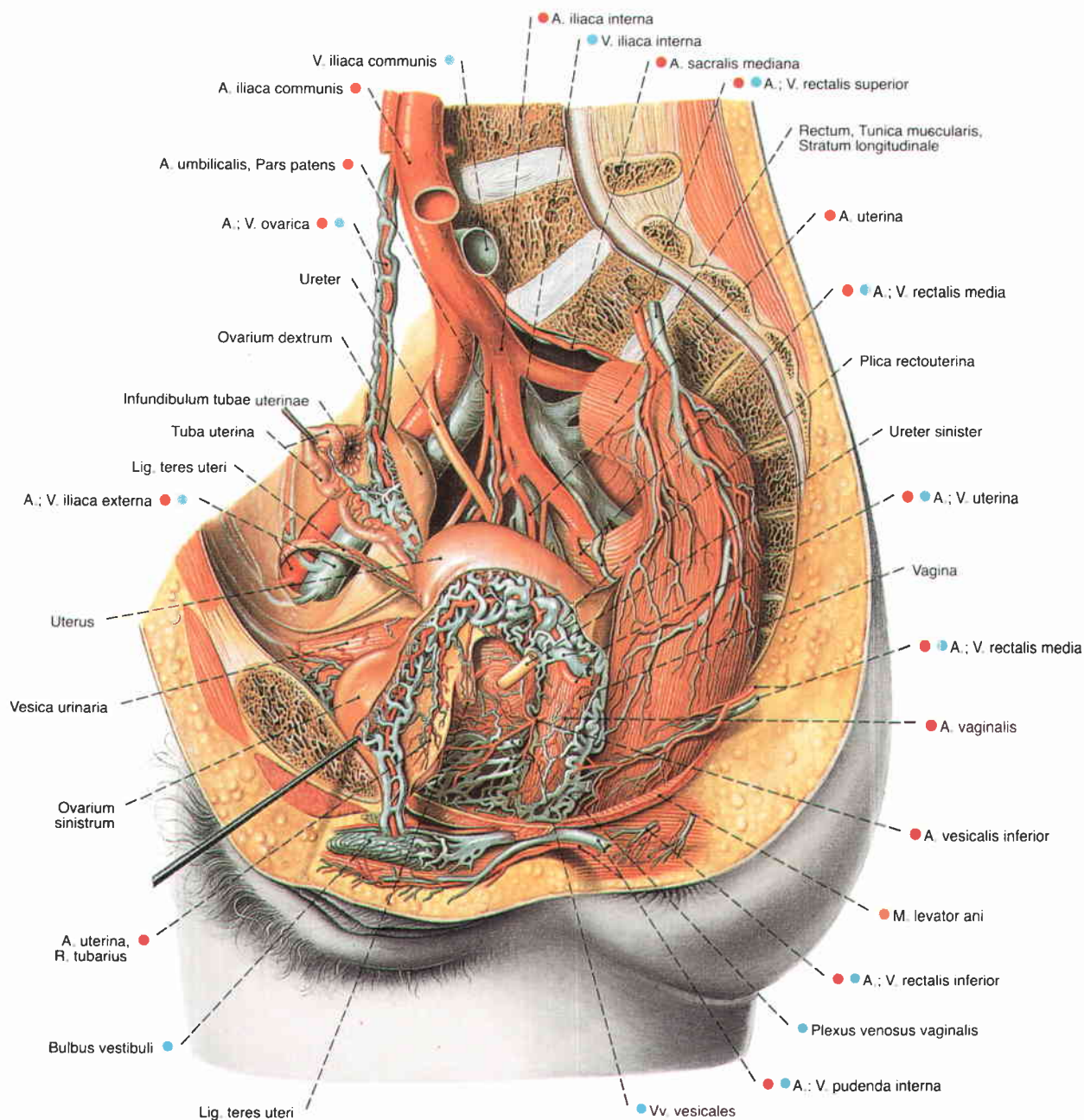
**Fig. 1102** Pelvic viscera of a male; paramedian section on the left; the peritoneum has been partially removed from the lateral surface of the urinary bladder to show the course of the ureter and the deferent duct; lateral view (r.).

\* clinical: COWPER's gland



**Fig. 1103** Arterial supply of the pelvic viscera of a male; paramedian section on the left; most of the peritoneum has been removed; lateral view (r.).





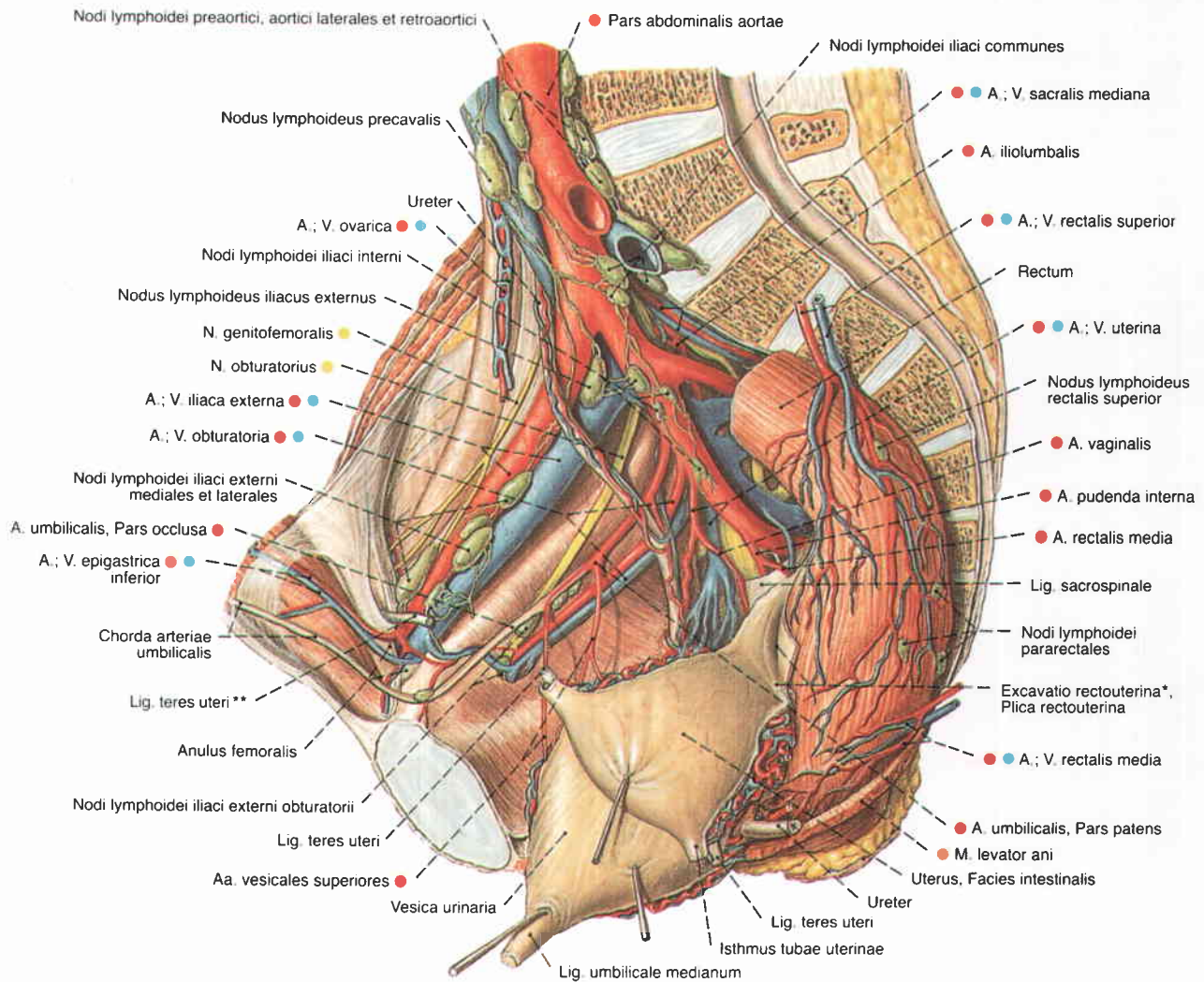
**Fig. 1104** Arterial supply of the pelvic viscera of a female;

paramedian section on the left; the peritoneum has been partially and the intestine completely removed; the right ovary has been retracted superiorly and the left ovary ventroinferiorly to show the supplying vessels; lateral view (r.).

There is an extensive venous plexus around the pelvic viscera.

In the old female the ovarian artery is frequently atrophied and difficult to dissect.



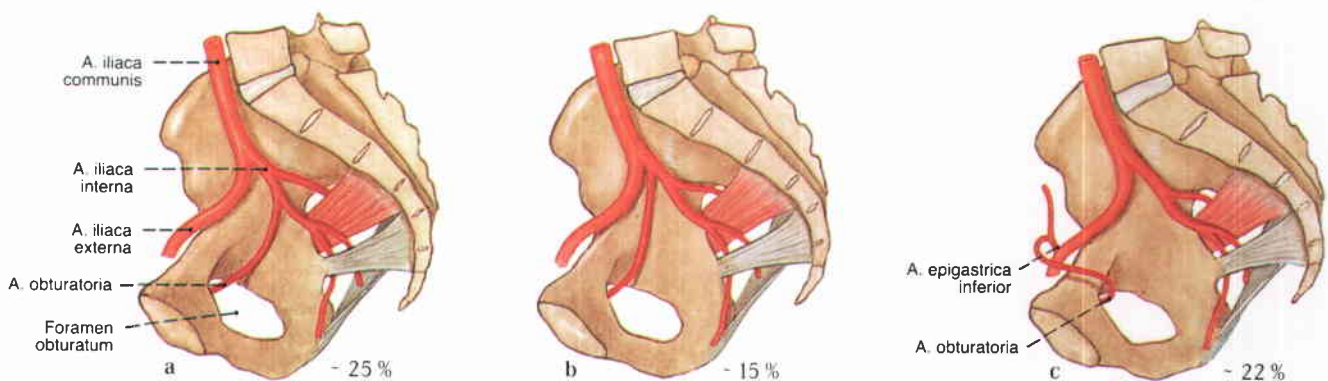


**Fig. 1105** Lymphatic vessels, Vasa lymphatica, lymph nodes, Nodi lymphoidei, of the pelvic wall in the female; the pelvis has been sectioned in the median plane; the uterus has been pulled sinistroventrally; most of the peritoneum has been removed; lateral view (r.).

The lymph nodes shown here are often much smaller but always present. Via the lymphatic vessels in the round ligament (Lig. teres uteri) tumour cells may spread from the uterus to the superficial inguinal lymph nodes.

\* clinical: DOUGLAS's space

\*\* clinical: round ligament



**Figs. 1106 a-c** Variations of the origin of the obturator artery; lateral view (r.).

**a** origin from the anterior branch of the A. iliaca interna (normal, "textbook" case)

**b** origin from A. iliaca interna directly

**c** origin from A. iliaca externa

Only in 75% of the cases the A. obturatoria is a branch of the A. iliaca interna.

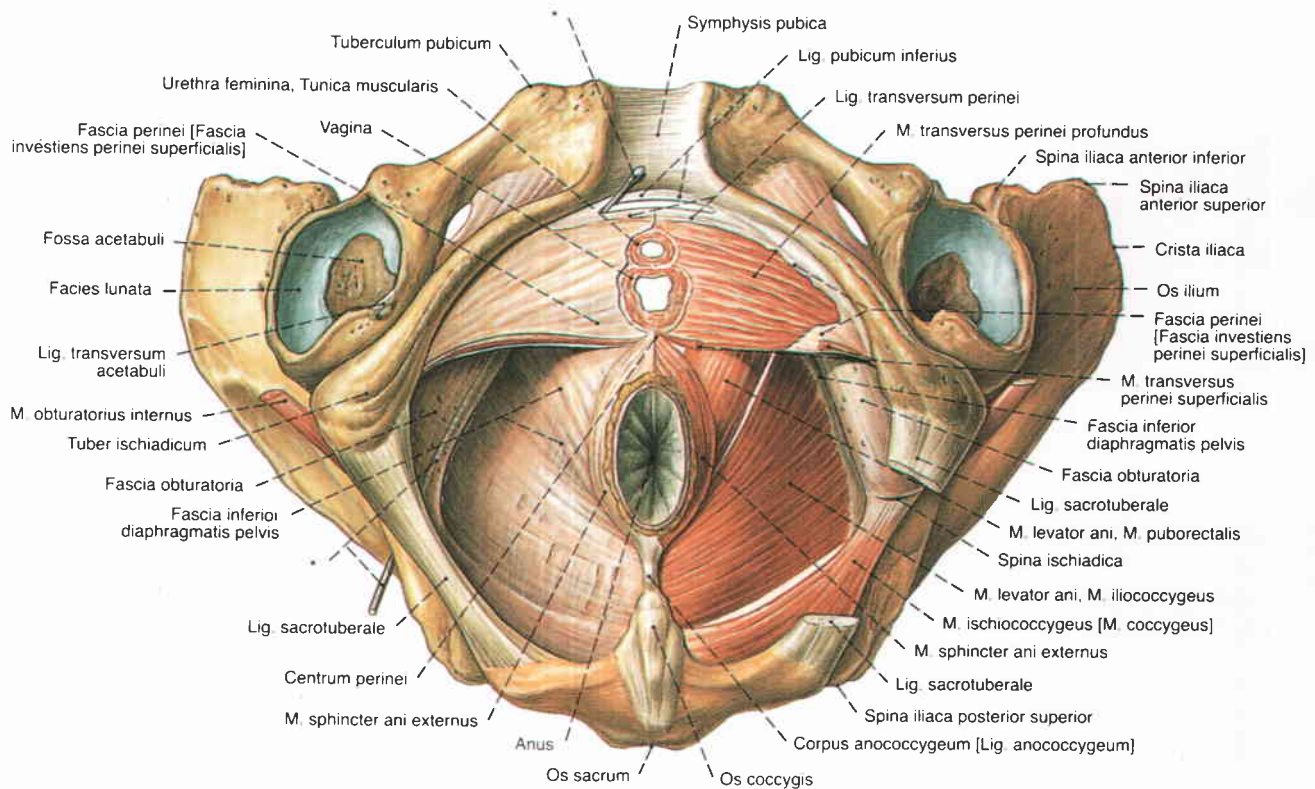
**Diaphragma pelvis and urogenitale (Figs. 1107, 1108, 1115–1118, 1126, 1128)**

The floor of the pelvis is constructed of two partially overlapping muscle layers. The Diaphragma pelvis is formed by *M. levator ani* and *M. ischiococcygeus*.

The Diaphragma urogenitale extends as a triangular plate between the two inferior rami of *Os pubis*. Its fibres are oriented transversely and support the urogenital hiatus. Muscles belonging to the urogenital diaphragm are: *M. transversus perinei profundus*, *M. sphincter urethrae* (together referred to as *M. compressor urethrae*), and *M. transversus perinei superficialis*. In the male only the urethra passes through the urogenital diaphragm, in the female, the urethra and vagina.

Muscle / Innervation	Origin	Insertion	Function
<b>1. <i>M. levator ani</i></b> <i>Branches of N. sacralis [S3 and S4]</i> Consists of the following parts: <i>M. pubococcygeus</i> , <i>M. levator prostatae</i> , <i>M. pubovaginalis</i> , <i>M. puborectalis</i> , <i>M. iliococcygeus</i>	<b><i>M. pubococcygeus</i>:</b> <i>Os pubis</i> (inner surface close to the symphysis), <i>Arcus tendineus musculi levatoris ani</i> , <i>Spina ischiadica</i>  <b><i>M. iliococcygeus</i>:</b> <i>Arcus tendineus musculi levatoris ani</i> (posterior third)	<i>Centrum tendineum perinei</i> (prerectal fibres), in the male: fascia of the prostate ( <i>M. levator prostatae</i> ), in the female: wall of the vagina ( <i>M. pubovaginalis</i> ), digitates into <i>M. sphincter ani externus</i> , forms a sling with fibres of the opposite side posterior to the anus ( <i>M. puborectalis</i> ), <i>Corpus anococcygeum</i> , <i>Os coccygis</i>	Slings around the rectum, its free medial border forms the urogenital hiatus through which, in the male, the urethra passes, in the female, urethra and vagina. It also supports the pelvic diaphragm
<b>2. <i>M. ischiococcygeus</i></b> <i>Branches of N. sacralis [S4 and S5]</i>	<i>Spina ischiadica</i> (inner surface; adhesion with <i>Lig. sacrospinale</i> )	<i>Os sacrum</i> (lateral border of the lower segments), <i>Os coccygis</i>	Supports the pelvic floor
<b>3. <i>M. sphincter ani externus</i></b> <i>N. pudendus (Plexus sacralis)</i>	<b><i>Pars subcutanea</i>:</b> Dermis and Subcutis surrounding the anal orifice  <b><i>Pars superficialis</i>:</b> <i>Centrum tendineum perinei</i>  <b><i>Pars profunda</i>:</b> muscular sling to the <i>M. levator ani</i>	Dermis and Subcutis surrounding the anal orifice, <i>Lig. anococcygeum</i>	Constrictor muscle of the anus
<b>4. <i>M. transversus perinei profundus</i></b> <i>N. pudendus (Plexus sacralis)</i>	<i>Ramus ossis ischii</i> , connective tissue of the <i>Vasa pudenda interna</i> (stretches between the <i>Arcus pubis</i> or <i>Angulus subpubicus</i> , supplemented by <i>Lig. pubicum inferius</i> and <i>Lig. transversum perinei profundum</i> )	Trapezoidal shaped muscle with openings for the urethra (male) or urethra and vagina (female).	Strengthens the urogenital hiatus
<b>5. <i>M. transversus perinei superficialis</i></b> <i>N. pudendus (Plexus sacral.)</i> (variable muscle)	Superficial part of <i>M. transversus perinei profundus</i>	Digitation into <i>Centrum tendineum perinei</i>	Supports <i>M. transversus perinei profundus</i>
<b>6. <i>M. sphincter urethrae</i></b> <i>N. pudendus (Plexus sacral.)</i> Surrounds the <i>Pars membranacea urethrae</i>	Circular fibres	Circular fibres	Strengthens the urogenital hiatus, assists in urinary continence. Also functions during ejaculation to close the urethra
<b>7. <i>M. ischiocavernosus</i></b> <i>N. pudendus (Plexus sacralis)</i>	<i>Ramus ossis ischii</i>	<i>Tunica albuginea corporum cavernosorum</i>	Fixes the crura of the penis (male) or clitoris (female) to the <i>Ramus inferior ossis pubis</i> and <i>Ramus ossis ischii</i> and to the urogenital diaphragm; assists in ejaculation and orgasm
<b>8. <i>M. bulbospongiosus</i></b> <i>N. pudendus (Plexus sacralis)</i> Surrounds the <i>Bulbus penis</i> (male) or <i>Bulbus vestibuli</i> (female)	<i>Centrum tendineum</i> , in the male also inferior part of <i>Corpus spongiosum penis</i> ( <i>Raphe penis</i> )	In the male: extends on the side of <i>Corpus spongiosum penis</i> to the <i>Fascia urogenitalis</i> inferior to the back of the penis; in the female: fibres extend to the <i>Corpus cavernosum clitoridis</i> and to the <i>Fascia diaphragmatis urogenitalis inferior</i>	Fixes the bulb of the penis (male) or the vestibular bulb (female) to the urogenital diaphragm; assists in ejaculation and orgasm

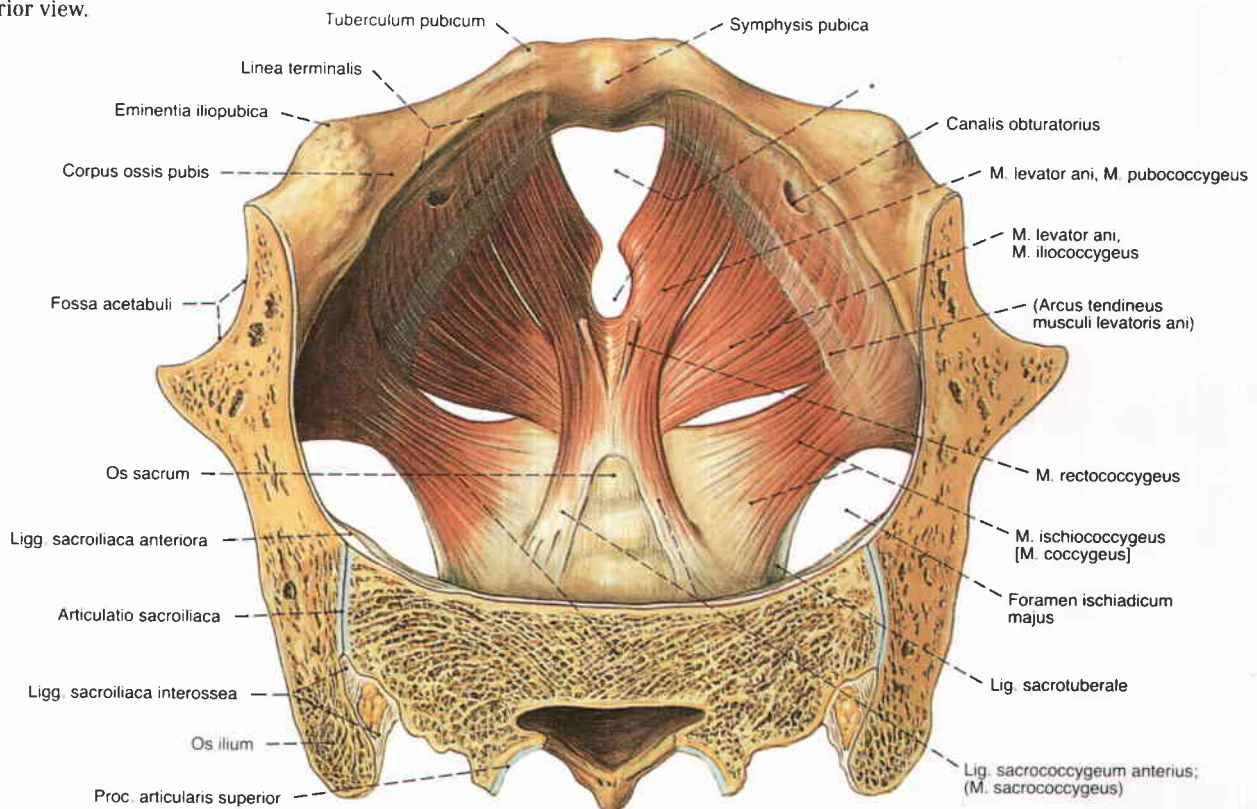




**Fig. 1107** Muscles of the perineum, *Mm. perinei*; pelvic floor, *Diaphragma pelvis*, of a female; the sacrotuber ligament has been partially removed on the left to demonstrate the *M. ischiococcygeus*; inferior view.

In the old woman the transversus perinei superficialis muscle often consists of only a few muscular fibres.

\* probe in the pudendal canal (ALCOCK's canal)

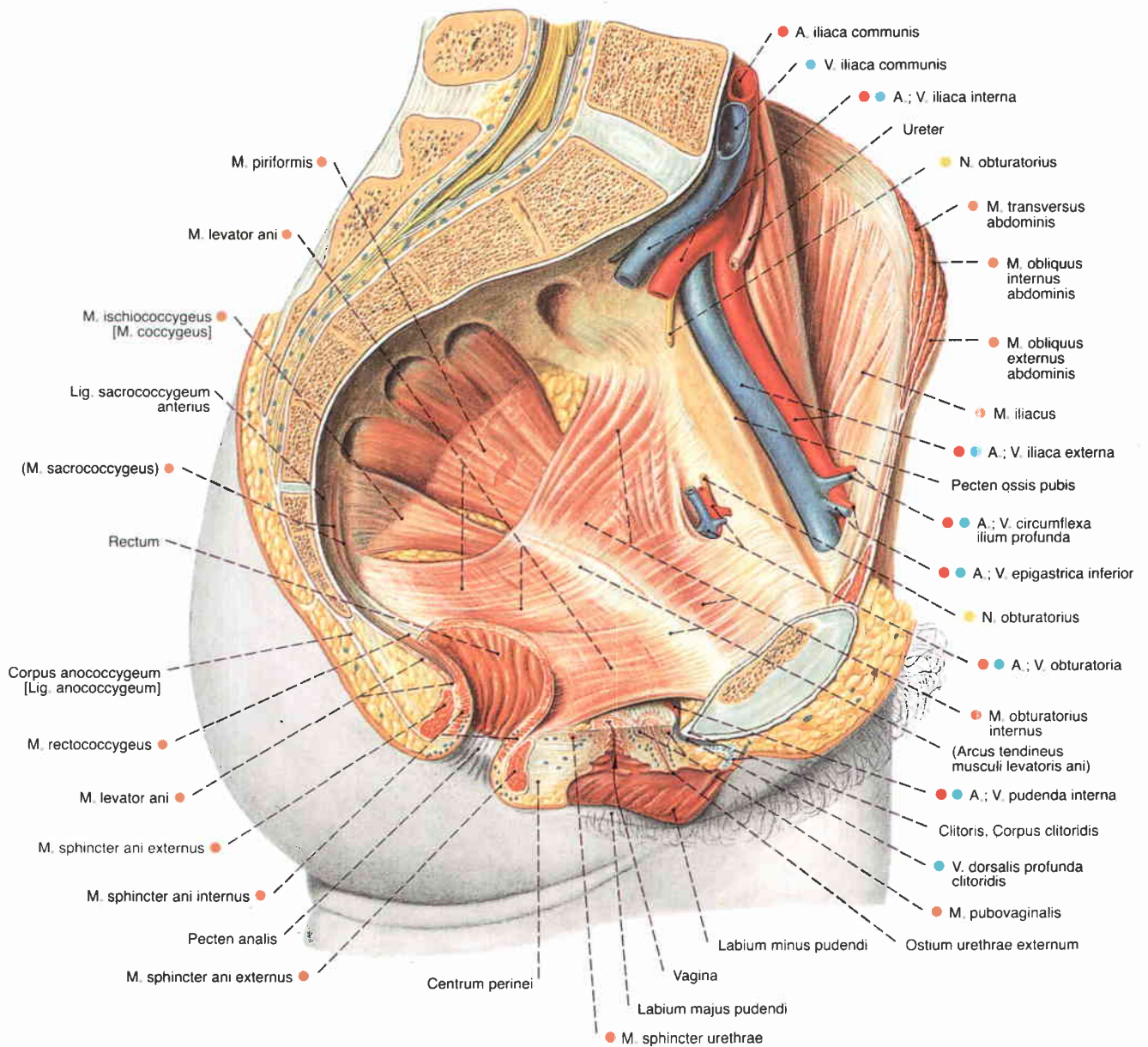


**Fig. 1108** Pelvic floor, *Diaphragma pelvis*, of a female; the superior part of the pelvic bones has been sectioned in the transverse plane; superior view.

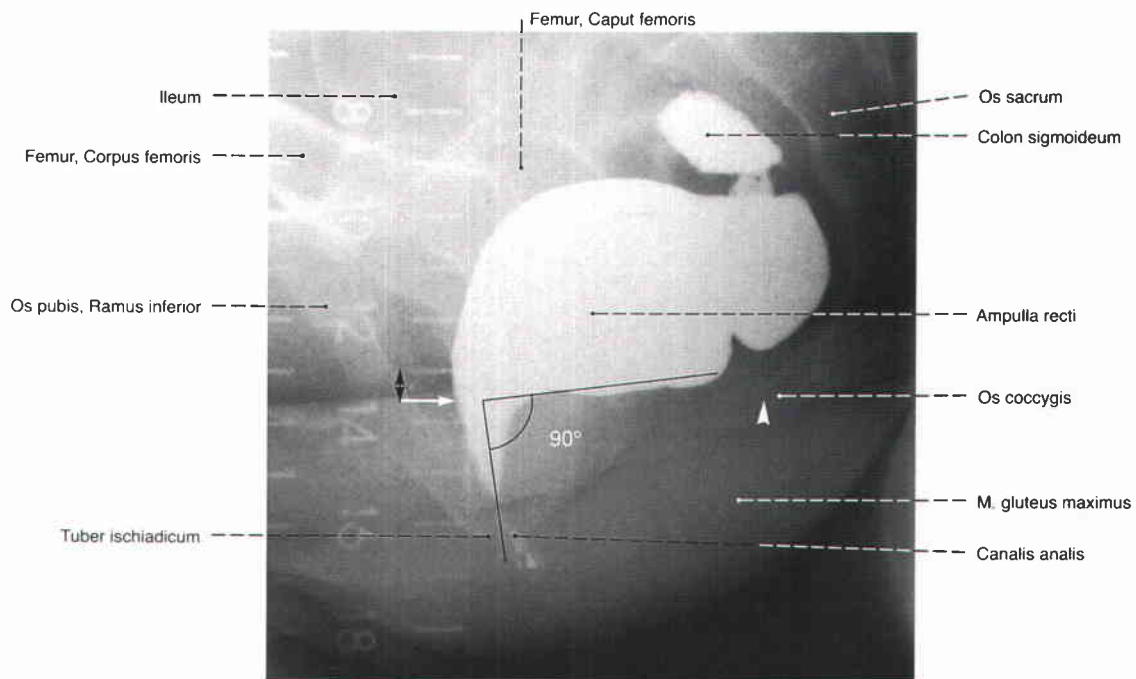
The ischiococcygeal and the sacrococcygeal muscles often consist of only a few muscular fibres, which cover the respective ligaments.

\* clinical: levator hiatus (*Hiatus urogenitalis et ani*)



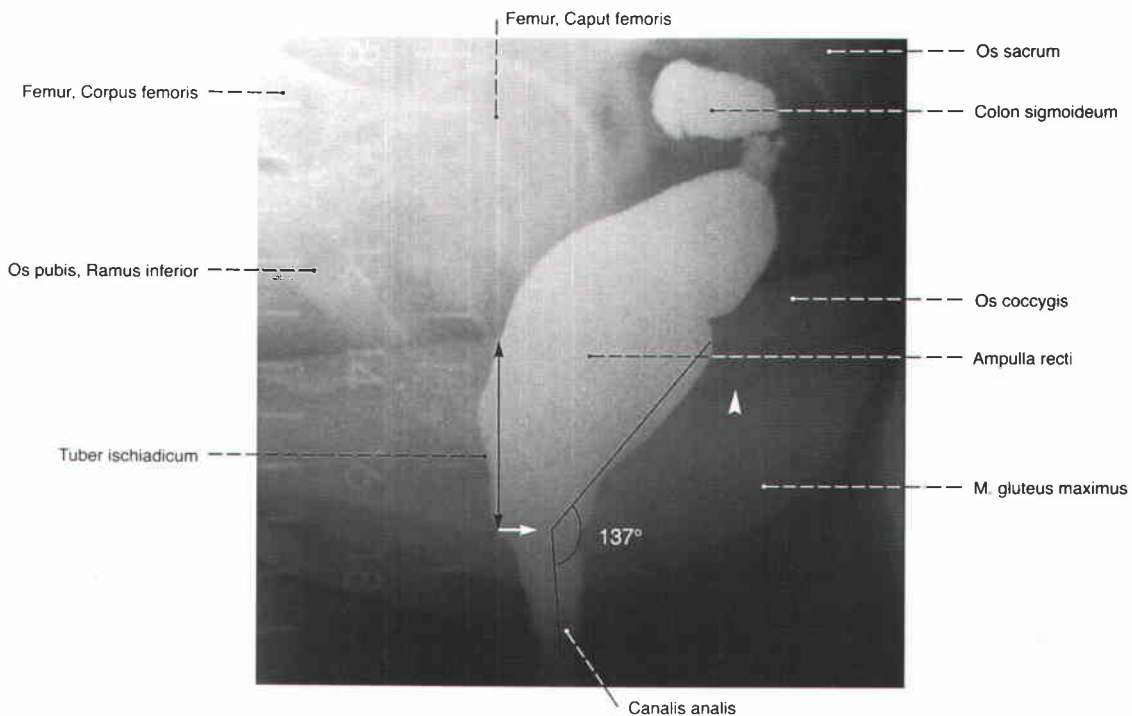


**Fig. 1109** Muscles of the pelvic floor, Diaphragma pelvis, of a female; median section through the pelvis; the viscera have been completely removed, the vessels and nerves have been partially removed to show the musculature; lateral view (l.).



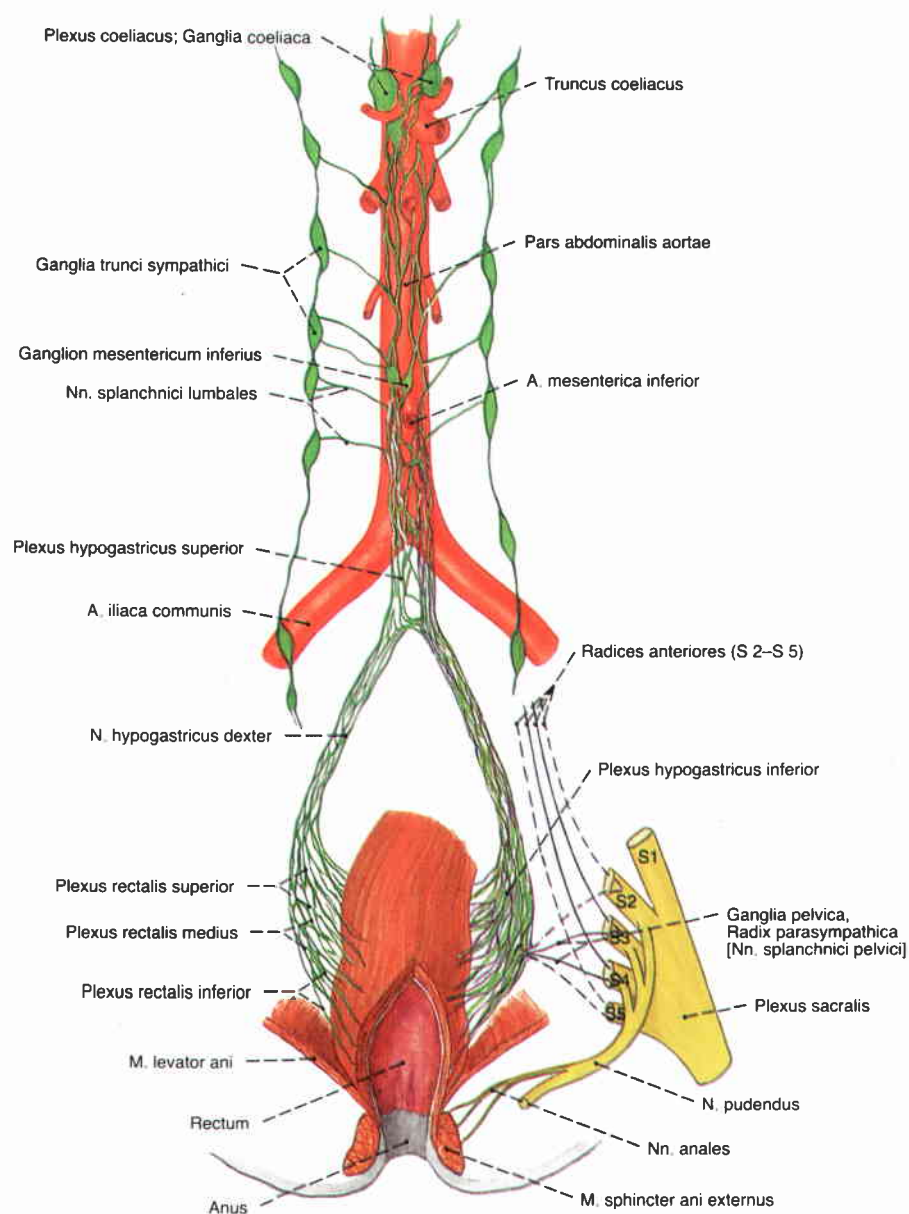
**Fig. 1110** Rectum, Rectum; lateral radiograph taken during voluntary closure of the anus (defaecography). The transition from the anus to the rectum (arrow) is located at the level of the tip of the coccygis (white triangle);

the rectum has been filled with a contrast medium. The angle between the longitudinal axis of the anus and the rectum is 90°. This angulation is caused by the loop of the levator ani muscle (puborectal muscle). The scale is in cm.



**Fig. 1111** Rectum, Rectum; lateral radiograph taken during defaecation (defaecography), the rectum has been filled with a contrast medium.

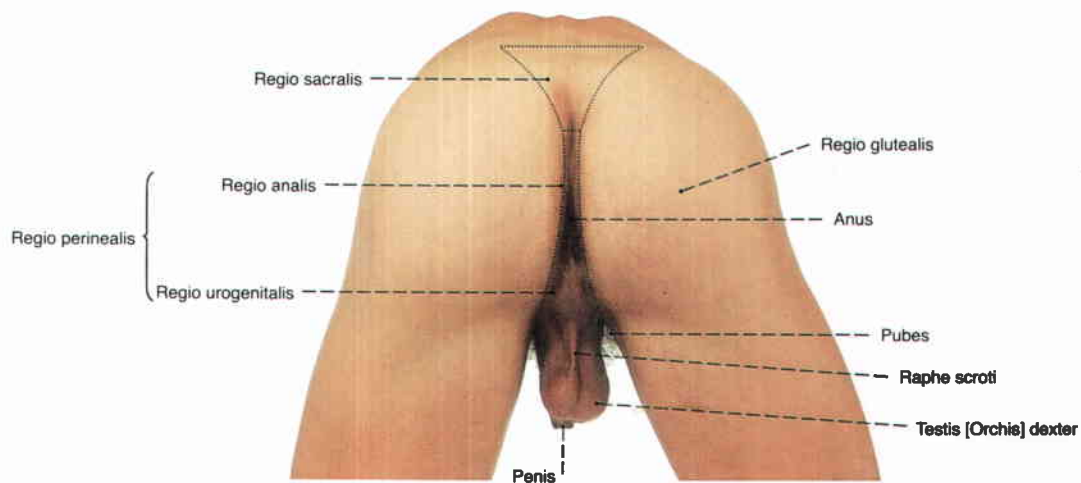
In contrast to Fig. 1110 the transitional region between the rectum and the anus is lower. The angle has increased to 137°, because the loop of the levator ani muscle is relaxed. The original angulation, which serves as a valve, has now diminished so that the faecal column to be excreted presses directly upon the anal canal.



**Fig. 1112** Rectum, Rectum;  
diagram of its innervation;  
ventral view.  
green: sympathetic system  
purple: parasympathetic system

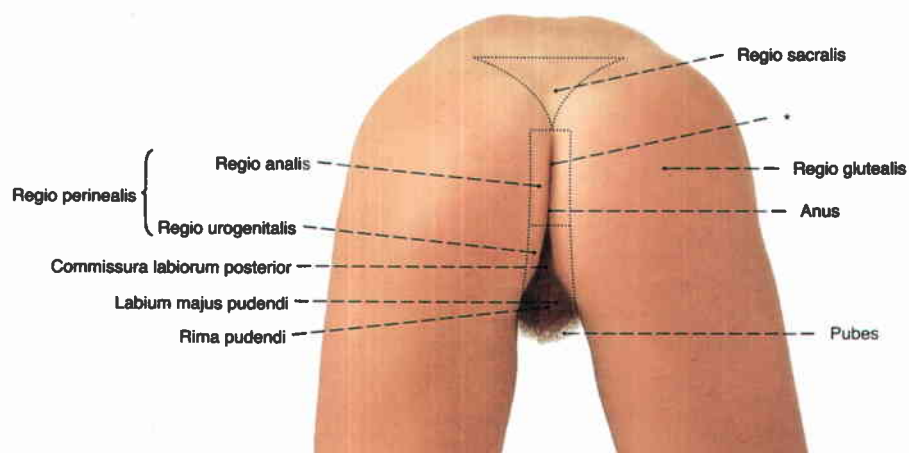
The fibres of the parasympathetic part run through the hypogastric plexus to the pelvic viscera and within the hypogastric nerve further superiorly. The inferior hypogastric plexus accommodates fibres of both the sympathetic and the parasympathetic parts and their respective ganglia (Ganglia pelvica).





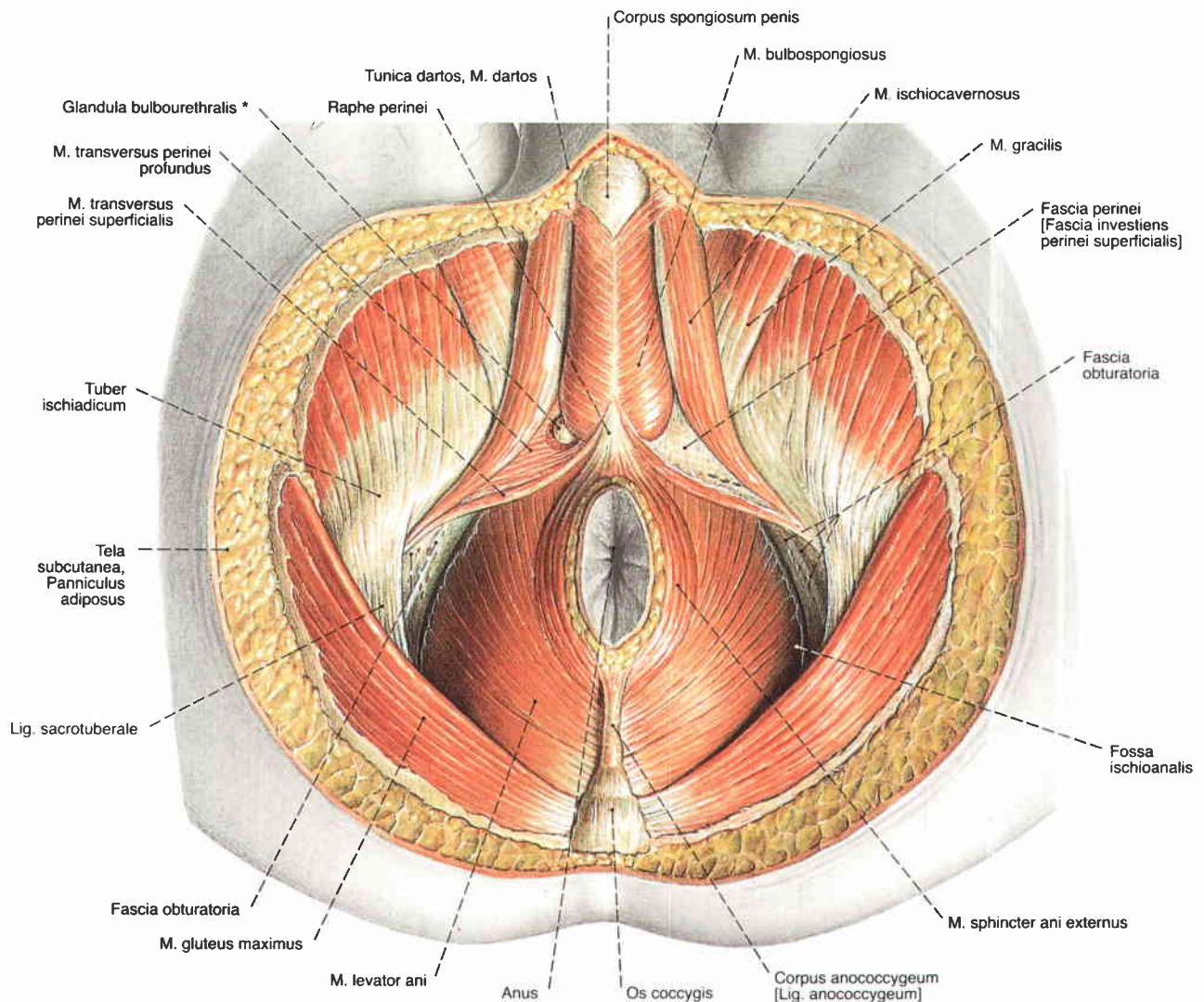
**Fig. 1113** Gluteal region, Regio glutealis; perineal region, Regio perinealis, of a male; dorsal view.

When it is cold the cremaster muscle contracts and pulls the scrotum towards the perineum.



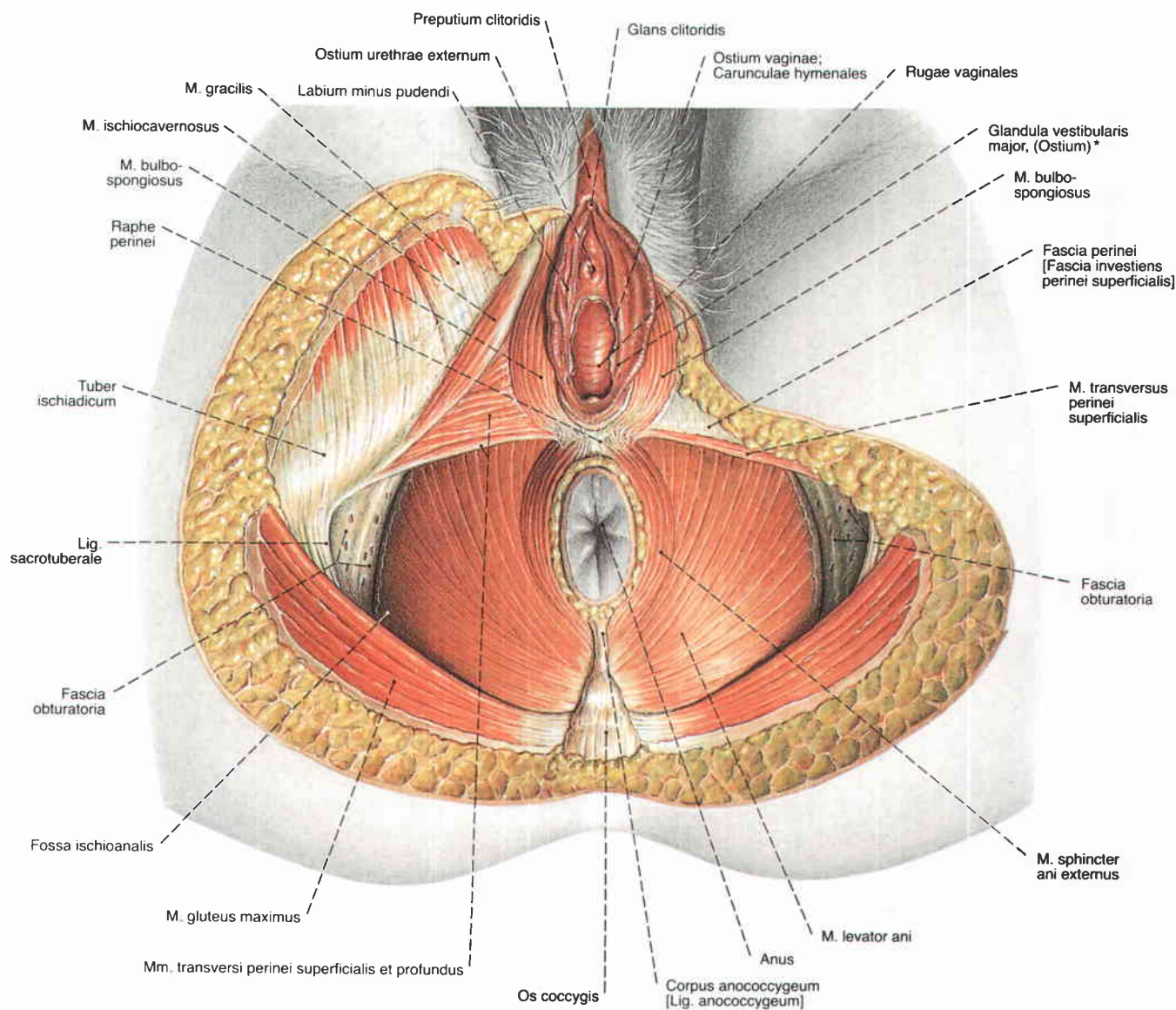
**Fig. 1114** Gluteal region, Regio glutealis; perineal region, Regio perinealis, of a female; dorsal view.

\* clinical: Rima ani



**Fig. 1115** Perineum, Perineum; pelvic floor, Diaphragma pelvis, of a male; the fat has been removed from the ischio-anal fossa; on the right the lower fascia of the urogenital diaphragm has been dissected to demonstrate the bulbo-urethral gland; inferior view.

\* also: COWPER'S gland

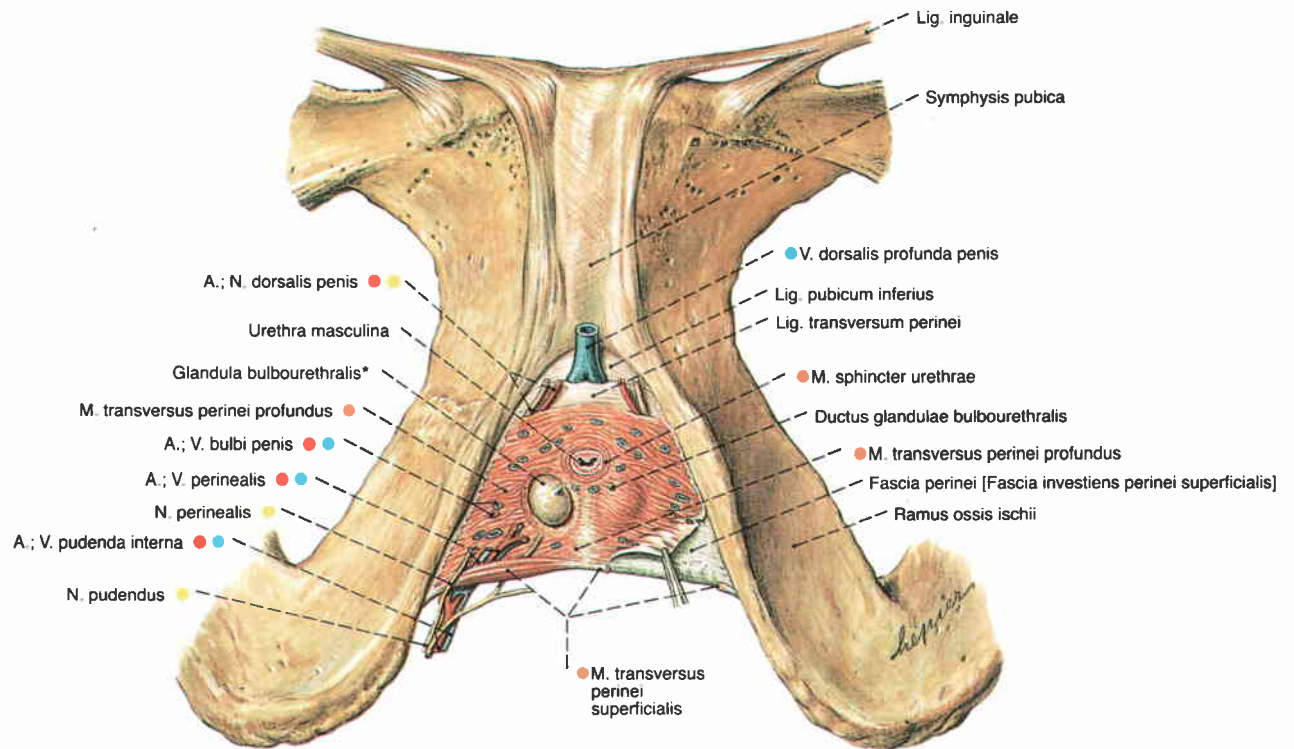


**Fig. 1116** Perineum, Perineum; pelvic floor, Diaphragma pelvis; external genital organs of a female, Organa genitalia feminina externa; the fat has been removed from the ischio-anal fossa; inferior view.

\* also: BARTHOLIN'S gland

Topographically the vaginal orifice and the anus lie close together. During birth there may be tearing of the skin and musculature of the perineum reaching the sphincter muscles of the anus (first- to third-degree laceration of the perineum). Extensive tearing can be avoided by a lateral or median incision (lateral or medial episiotomy).

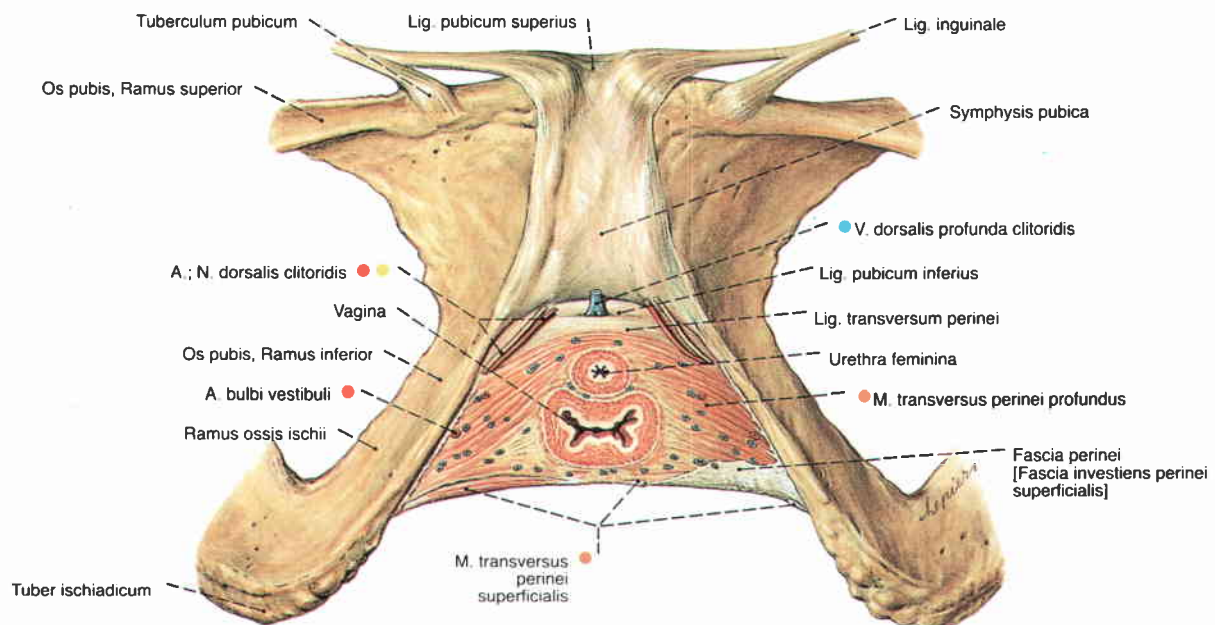




**Fig. 1117** Anterior part of the pelvic floor, Diaphragma urogenitale, of a male; most of the lower fascia has been removed; on the right the bulbo-urethral gland has been dissected; inferior view.

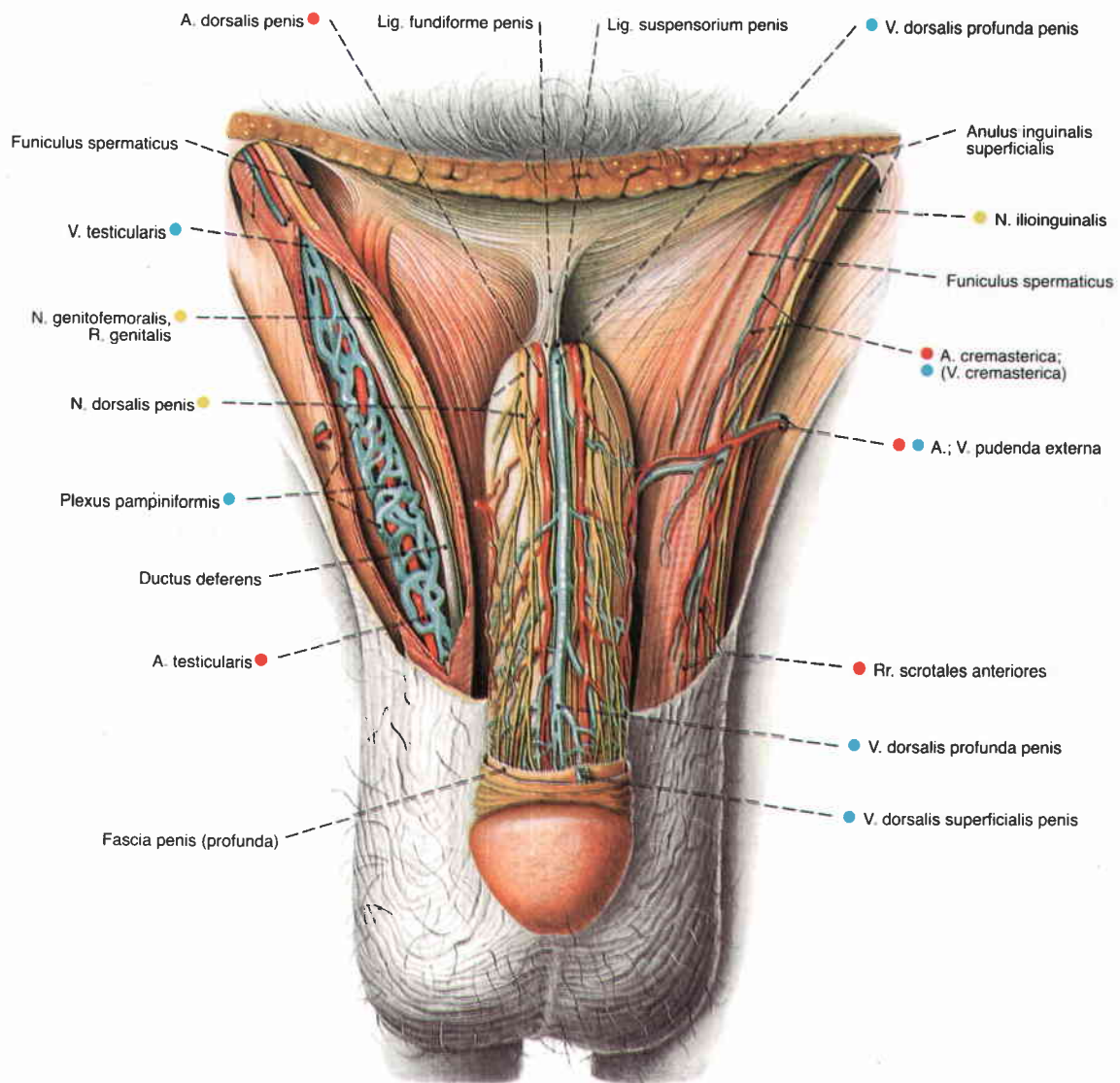
Compare to Fig. 1118.

\* also: COWPER'S gland

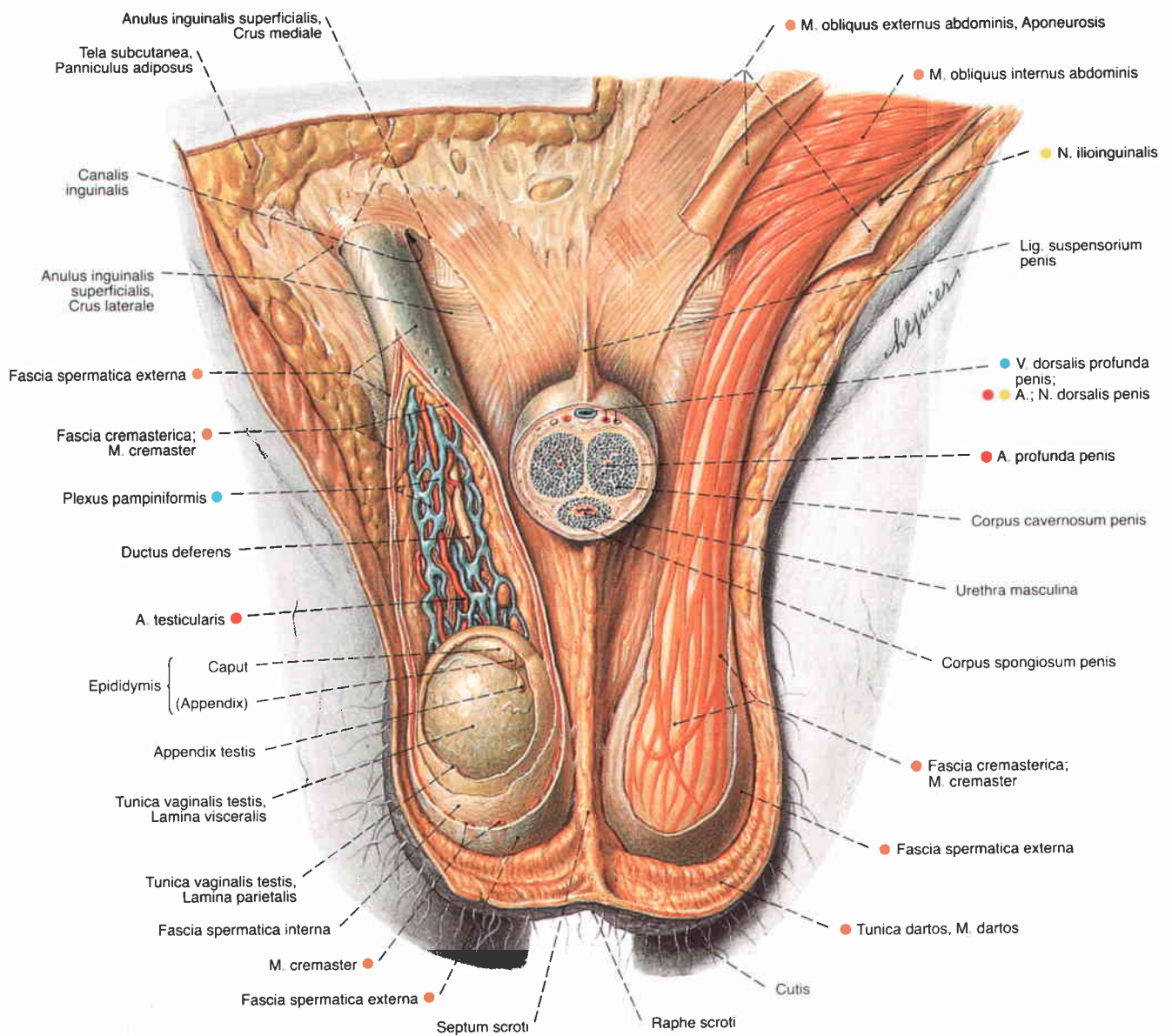


**Fig. 1118** Anterior part of the pelvic floor, Diaphragma urogenitale, of a female; most of the lower fascia has been removed; inferior view.

Compare to Fig. 1117.

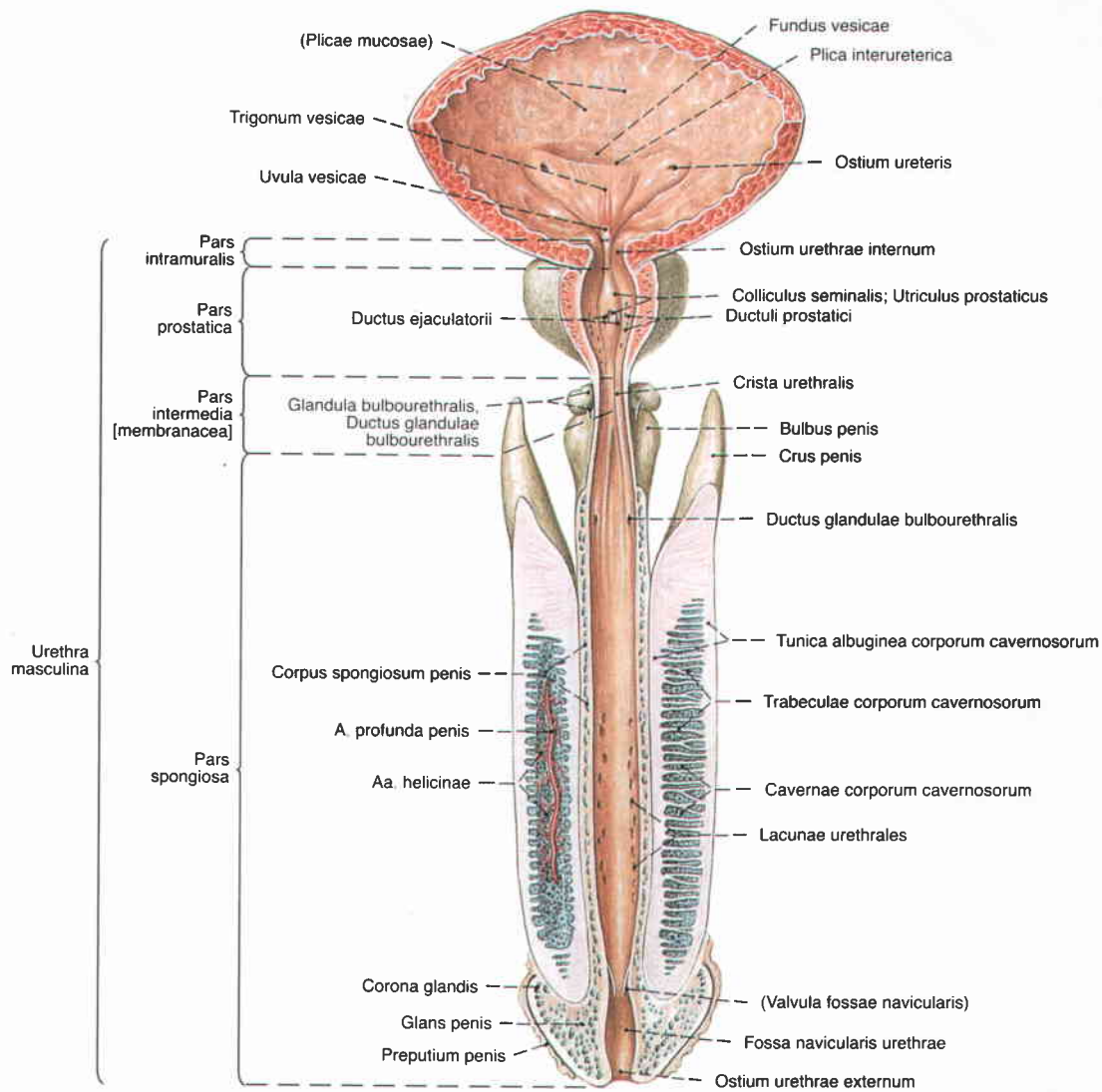


**Fig. 1119** External genital organs of a male,  
*Organa genitalia masculina externa*;  
 most of the skin and the superficial fascia of the penis  
 has been removed to demonstrate the vessels and nerves;  
 on the right the fasciae of the spermatic cord have  
 been sectioned;  
 ventral view.  
 The venous plexus around the testicular artery (Plexus  
 pampiniformis) is always very prominent.

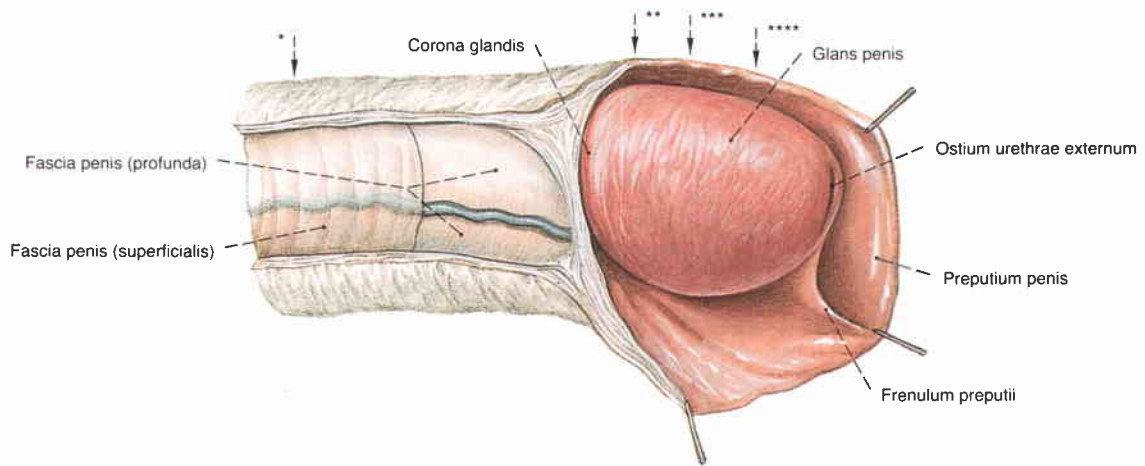


**Fig. 1120** Male genital organs,  
Organa genitalia masculina;  
the abdominal skin and parts of the scrotal skin have  
been removed;  
the body of the penis has been sectioned; on the right  
the fasciae of the spermatic cord and the testicles have  
been dissected;  
ventral view.  
Compare to Figs. 824 to 827, on the origin of M. cremaster  
and of the fasciae of the abdominal wall.



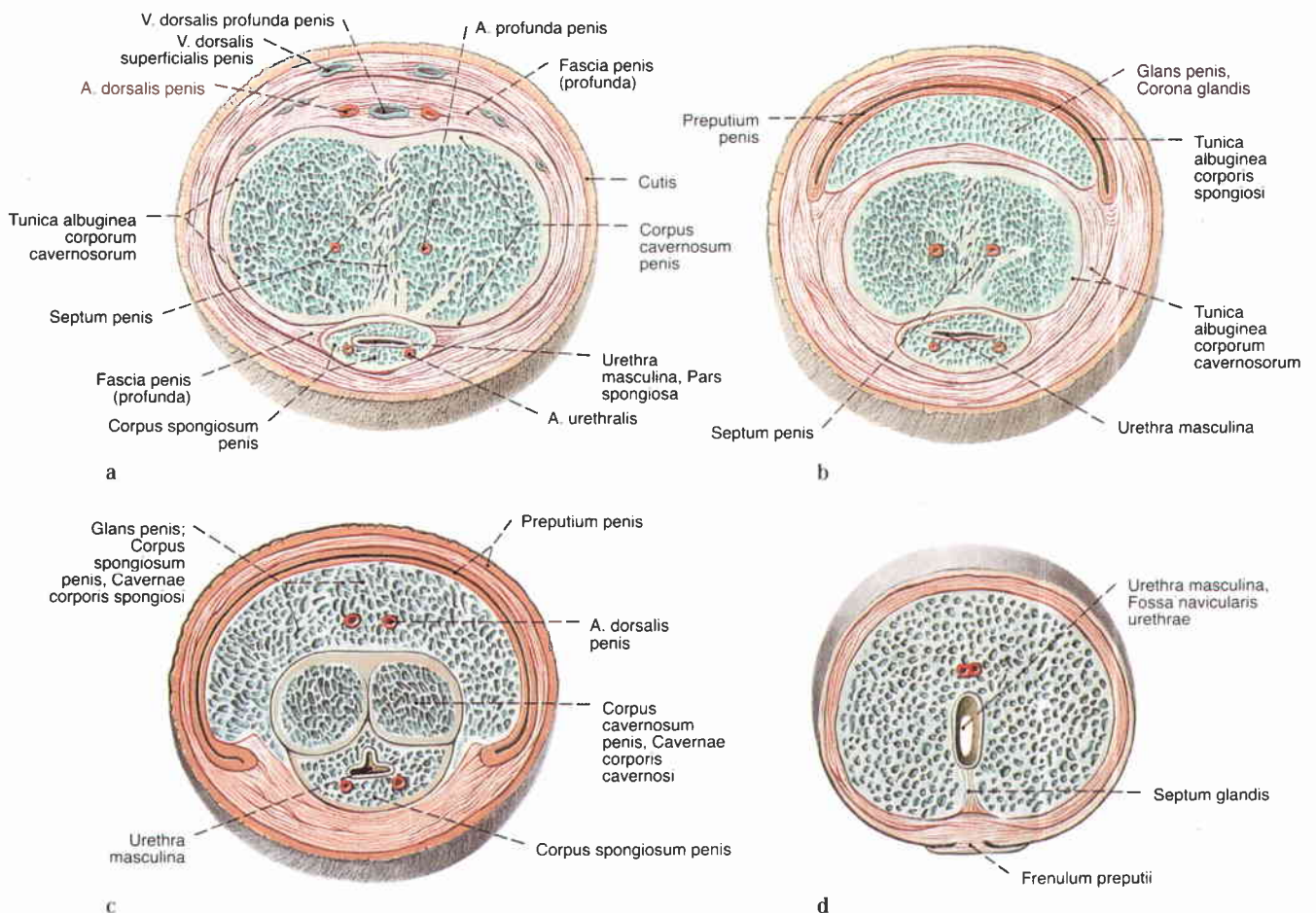


**Fig. 1121** Urinary bladder, Vesica urinaria; prostate, Prostata; male urethra, Urethra masculina; the urinary bladder and the urethra have been exposed to show their lumen; most of the skin of the penis has been removed; ventral view.  
Physiologically the urethra is curved. Compare to Fig. 1145.



**Fig. 1122** Penis, Penis, with glans, Glans, and foreskin, Preputium; the skin and the superficial fascia of the penis have been removed in layers; lateral view.

\* level of the section in Fig. 1123a  
 \*\* level of the section in Fig. 1123b  
 \*\*\* level of the section in Fig. 1123c  
 \*\*\*\* level of the section in Fig. 1123d



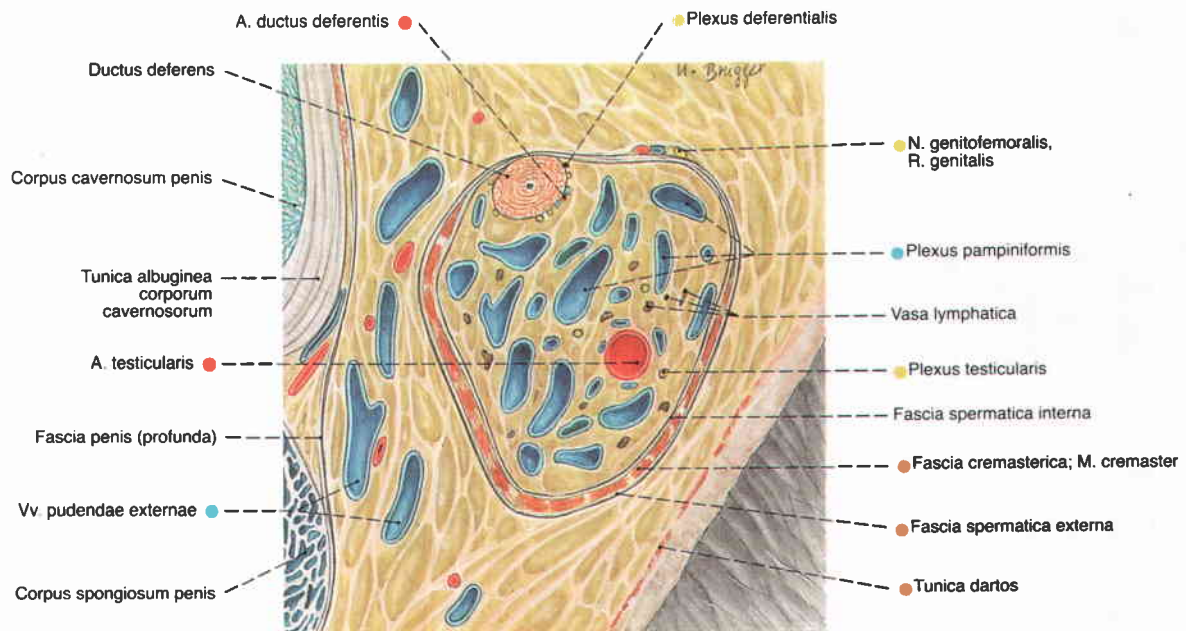
**Figs. 1123 a–d** Penis, Penis; cross sections; the levels of section are shown in Fig. 1122; ventral view.

**a** Section through the middle of the body of the penis. Note that the two cavernous bodies are incompletely separated by the septum of the penis.

**b** section through the proximal circumference of the Glans penis

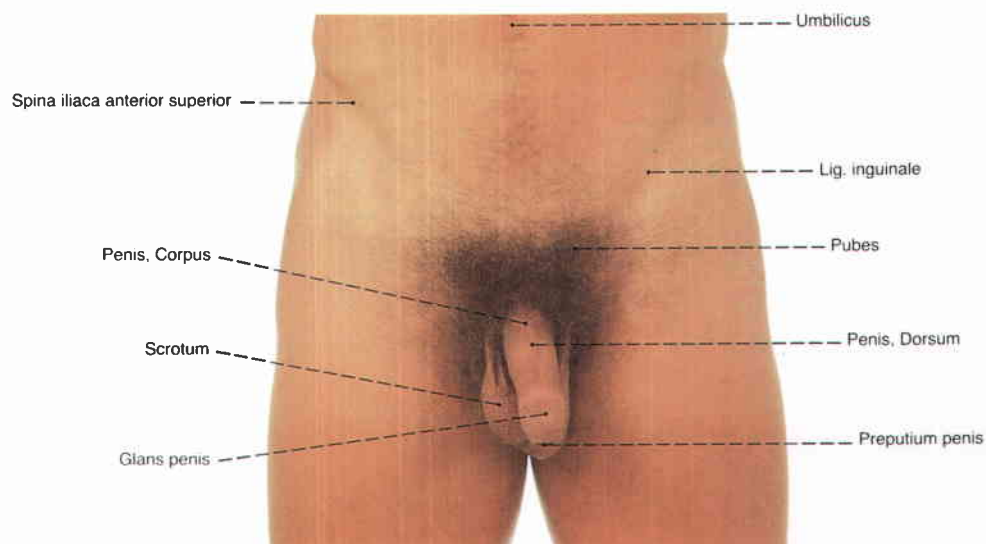
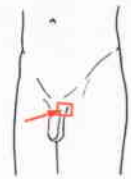
**c** section through the middle of the Glans penis

**d** section through the distal end of the Glans penis



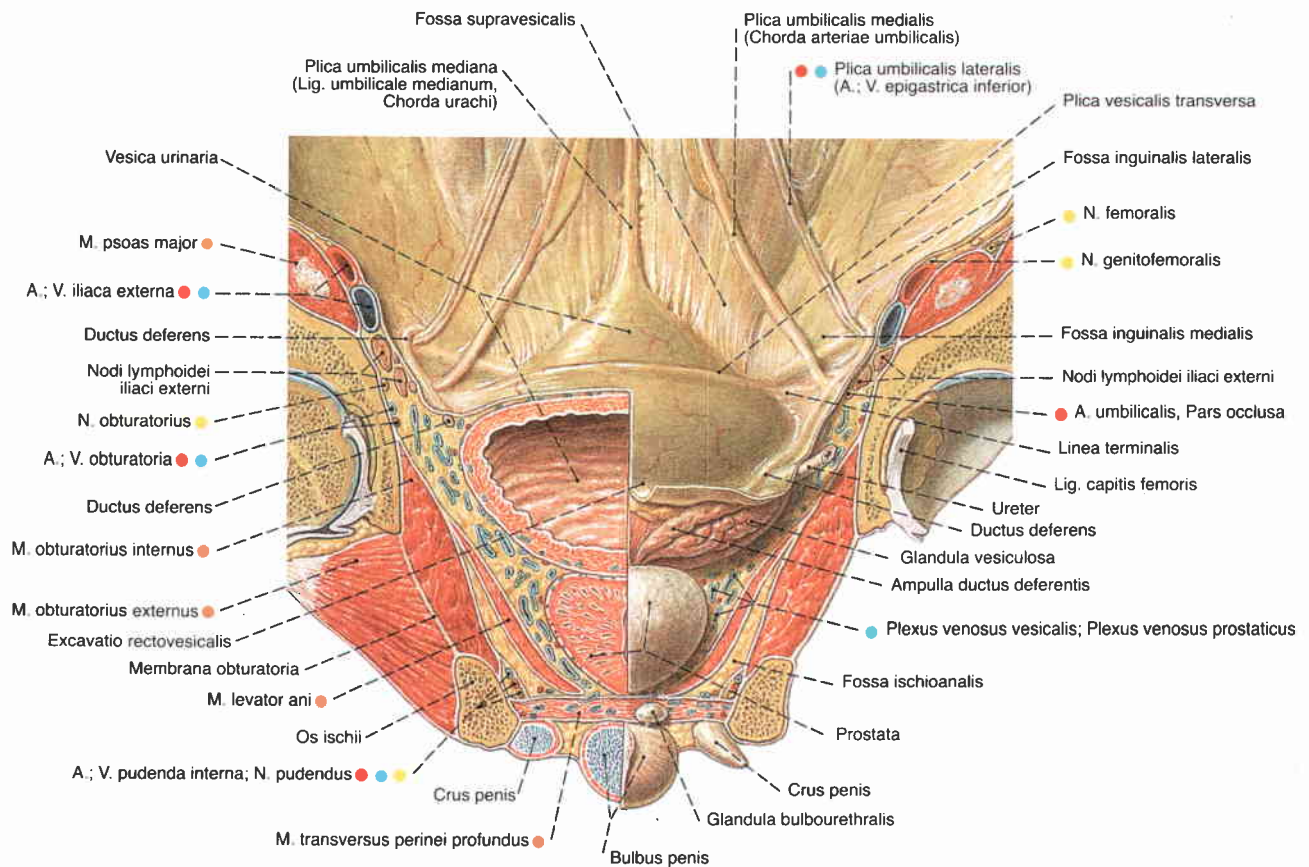
**Fig. 1124** Spermatic cord, Funiculus spermaticus; frontal section; ventral view (1., 250%).

The development of the cremaster muscle, the pampiniform plexus and the position of the deferent duct within the spermatic cord are extremely variable.

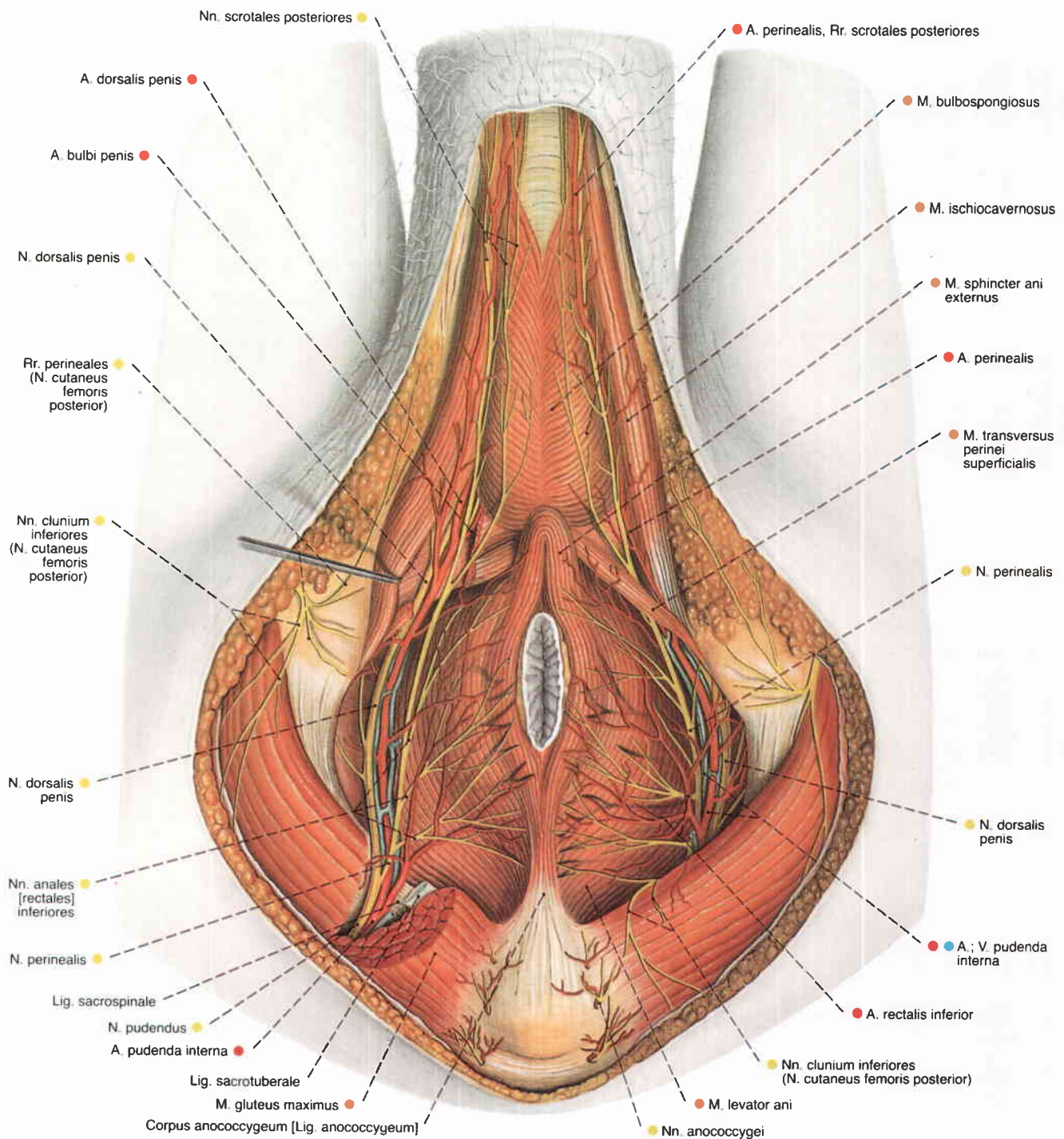


**Fig. 1125** External genital organs of a male, Organa genitalia masculina externa.



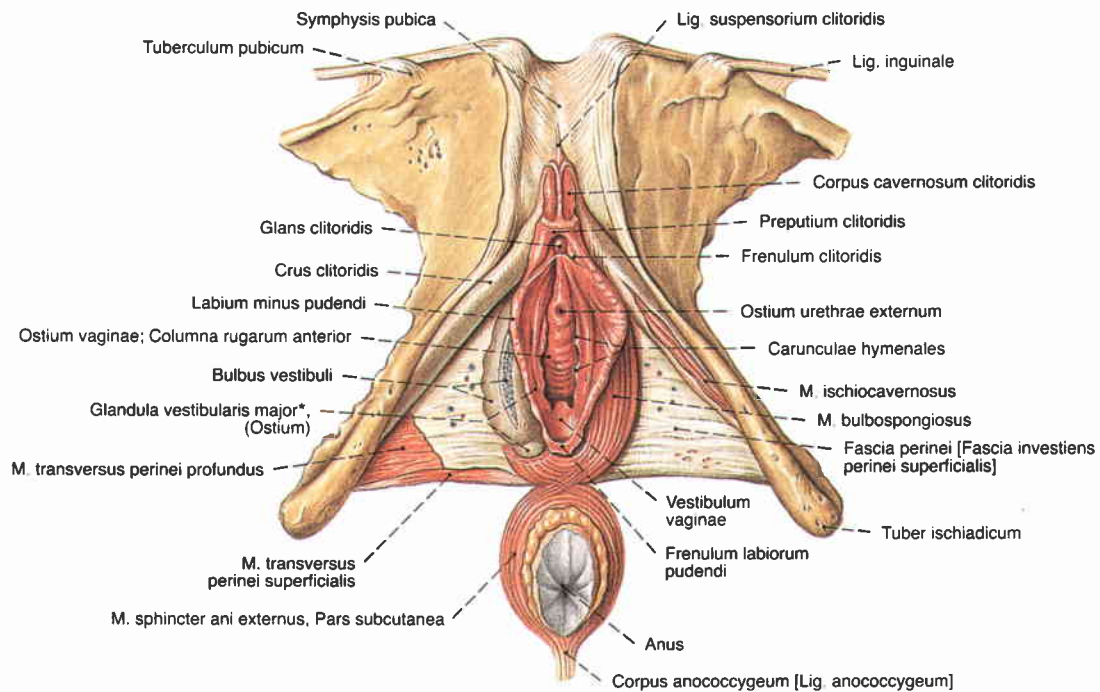


**Fig. 1126** Pelvic floor, Diaphragma pelvis; pelvic viscera and abdominal wall, Organa abdominis et pelvis, in the male; on the left the specimen has been sectioned in the frontal plane through the head of the femur and the urinary bladder; on the right the urinary bladder and the prostate have been preserved; dorsal view.



**Fig. 1127** Vessels and nerves of the perineal region, Regio perinealis, and the external genital organs of a male, Organa genitalia masculina externa; the fat in the ischio-anal fossa has been removed; on the right the gluteus maximus muscle has been sectioned to demonstrate the course of the pudendal nerve and the internal pudendal artery; inferior view.

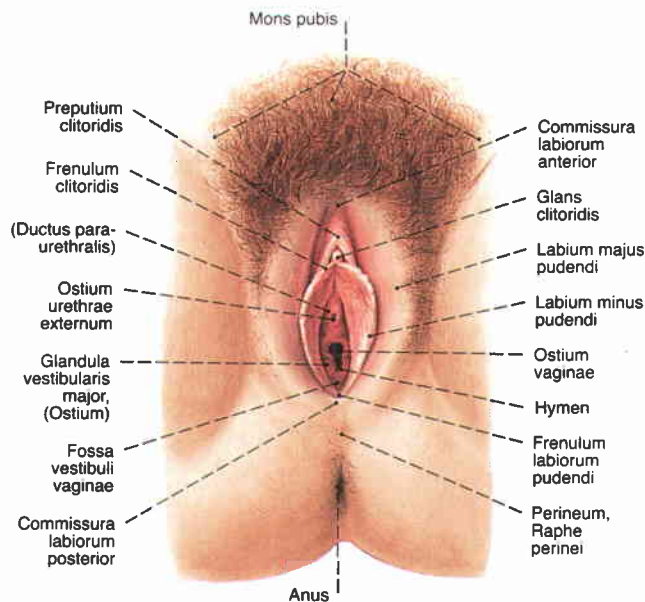




**Fig. 1128** External genital organs of a female, *Organa genitalia feminina externa*; parts of the pelvic floor, *Diaphragma urogenitale*; most of the lower fascia of the urogenital diaphragm has been removed;

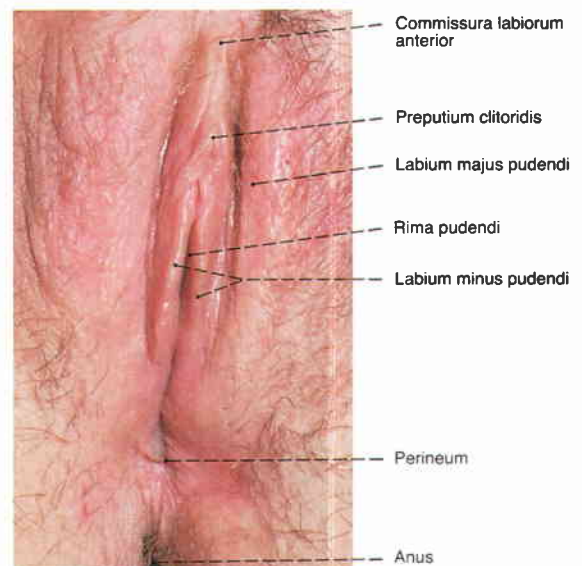
on the left the ischiocavernosus muscle has been dissected; on the right the bulbospongiosus muscle has been removed to show the erectile tissue of the vestibular bulb; ventroinferior view.

\* clinical: BARTHOLIN'S gland



**Fig. 1129** External genital organs of a female, *Organa genitalia feminina externa*; inferior view.

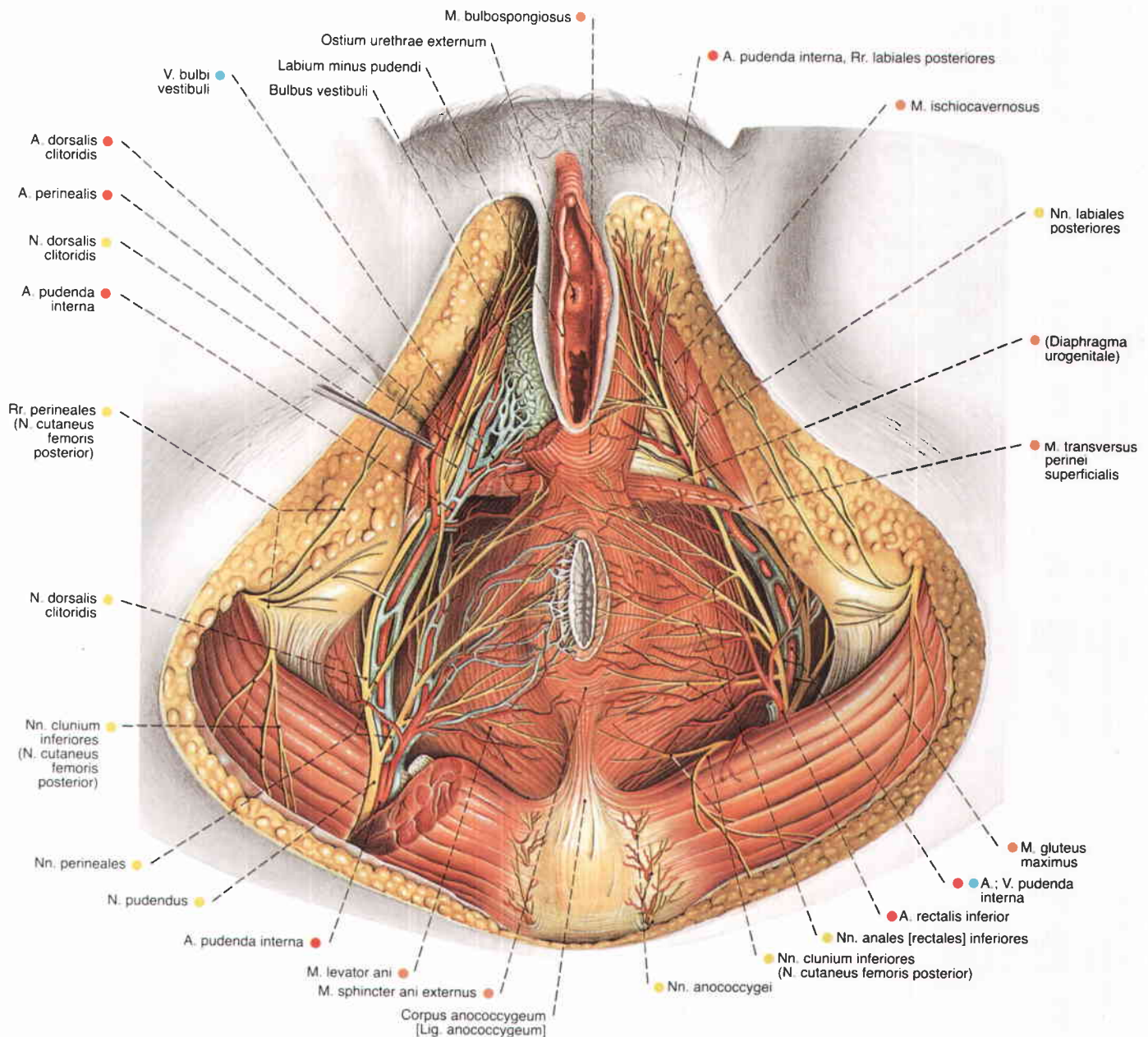
This view into the vestibule of the vagina is only possible when the labia majora and minora are held apart, for example by a speculum or by the fingers of the physician (not shown here).



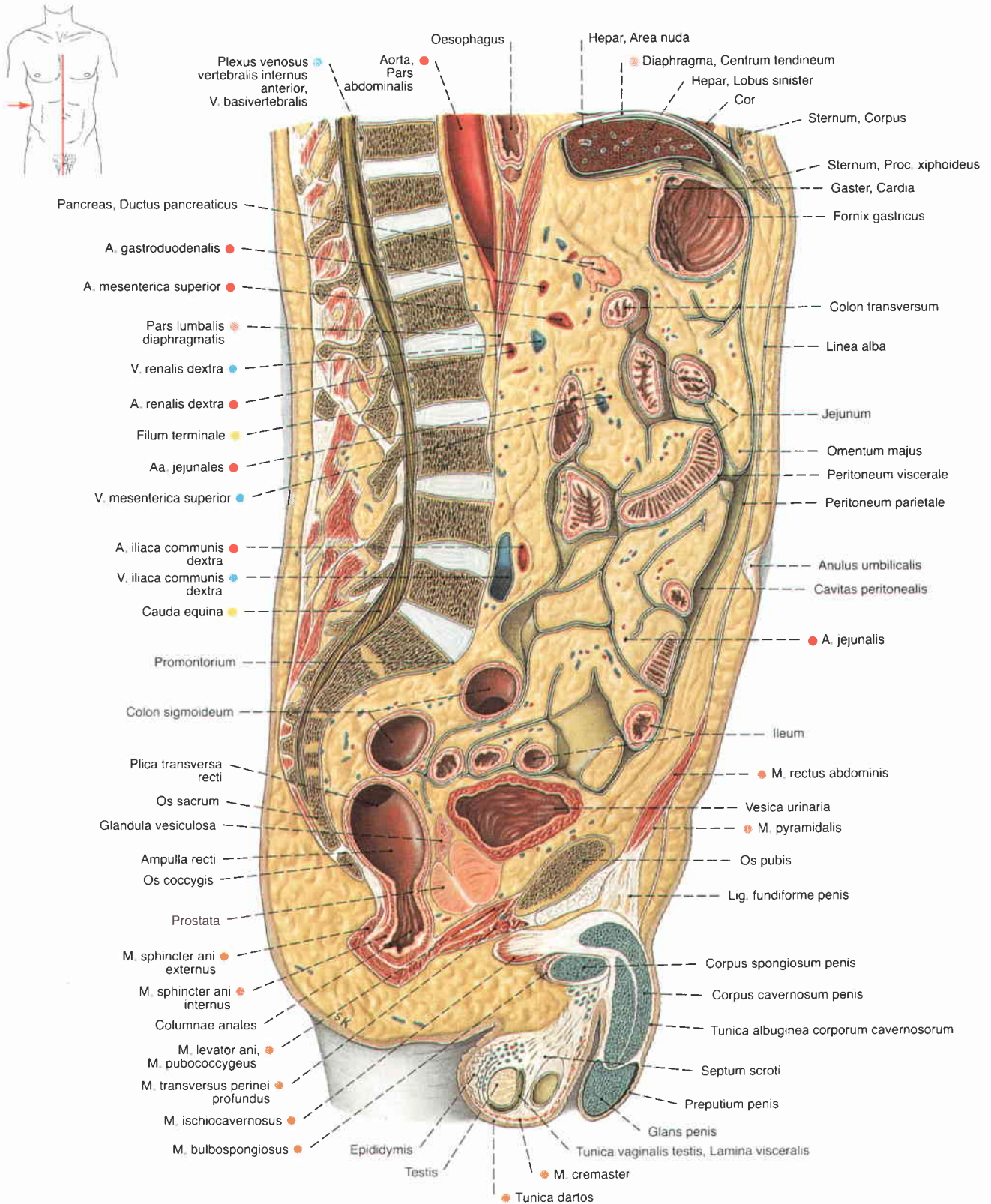
**Fig. 1130** External genital organs of a female, *Organa genitalia feminina externa*; inferior view.

Even with the legs spread apart the labia minora cover the entry of the vagina, as in this 26-year-old female.





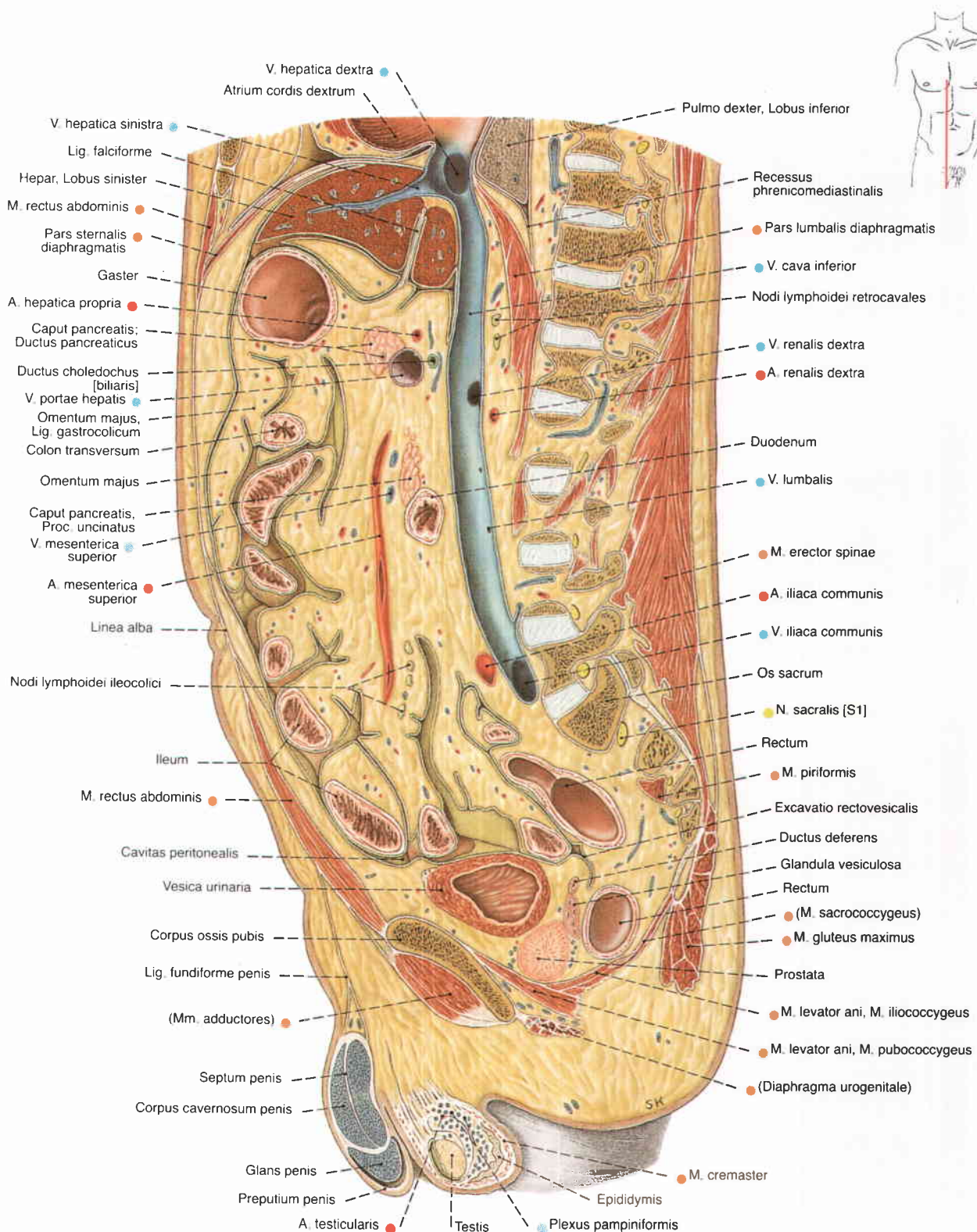
**Fig. 1131** Vessels and nerves of the perineal region, Regio perinealis, and of the external genital organs of a female, Organa genitalia feminina externa; the subcutaneous fat and that of the ischio-anal fossa have been removed to demonstrate the vessels and nerves; on the right the gluteus maximus and the transversus perinei profundus muscles have been sectioned to demonstrate the course of the vessels and nerves; the right bulbospongiosus muscle has been removed to show the erectile body of the vestibular bulb; inferior view.



**Fig. 1132** Abdomen, Abdomen, and pelvis, Pelvis, of a male; median section; lateral view.

The external genital organs and the anterior parts of the pelvis have been sectioned to the left of the median plane.

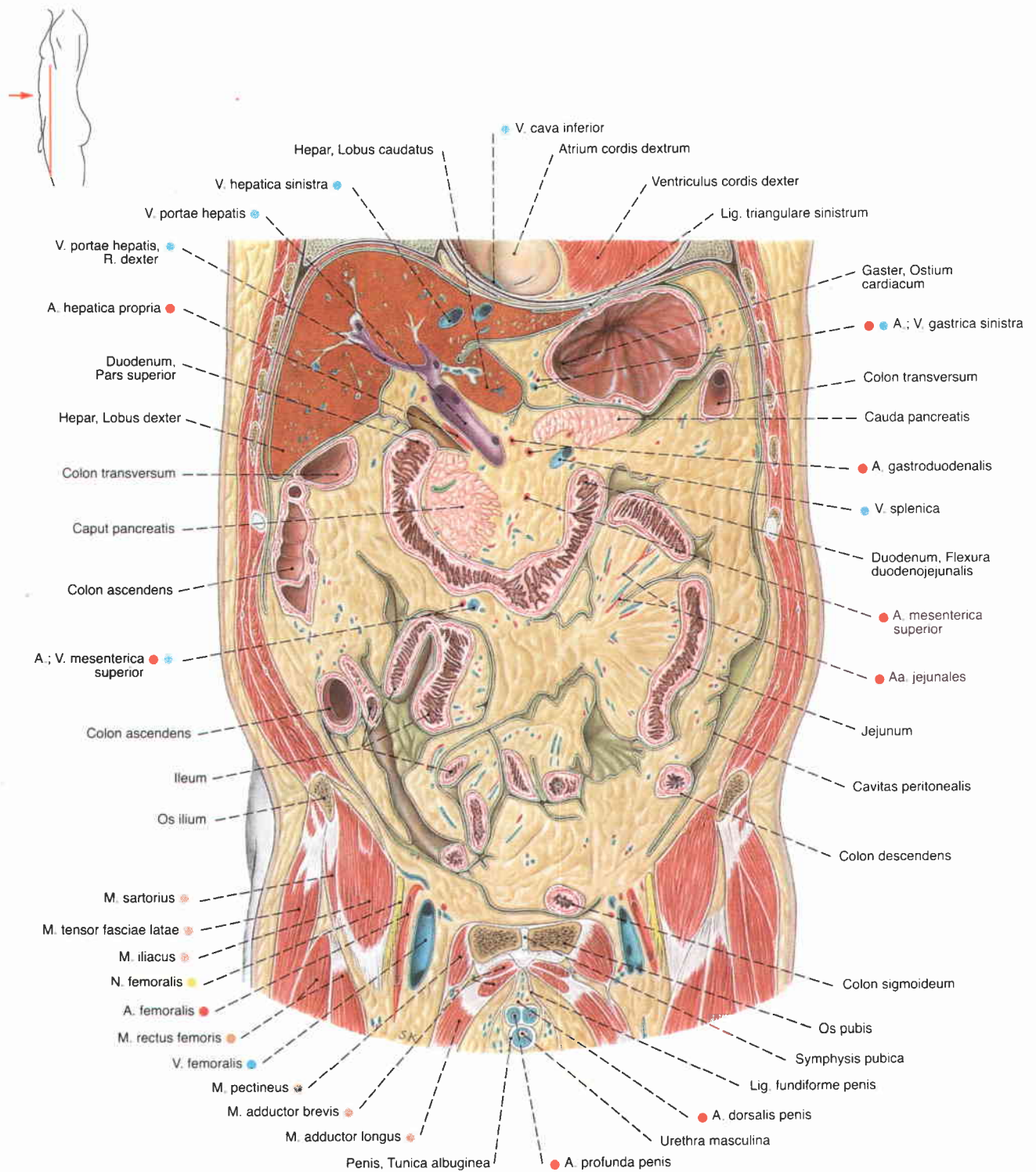




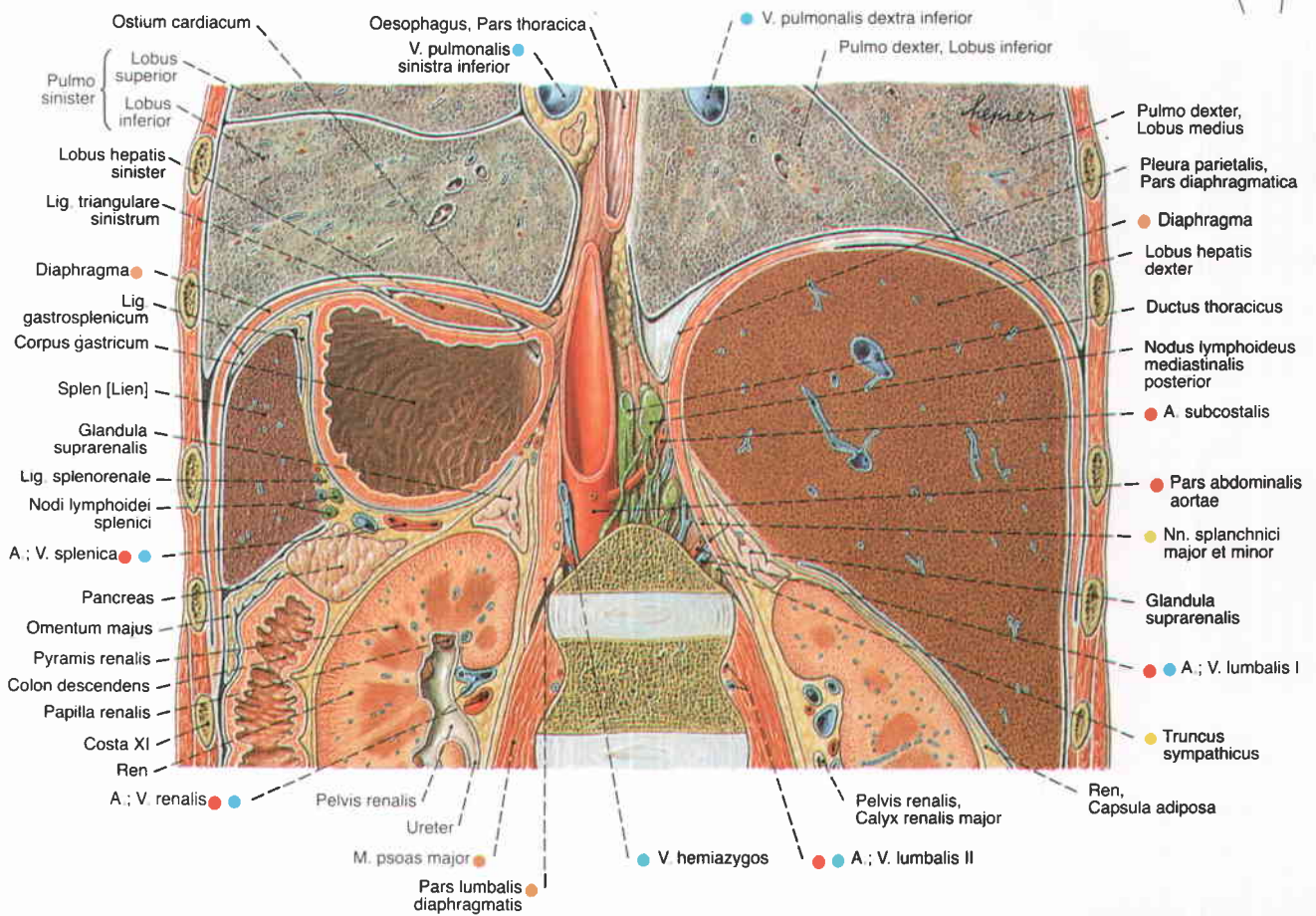
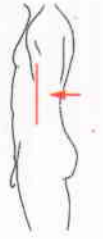
**Fig. 1133** Abdomen, Abdomen, and pelvis, Pelvis, of a male; sagittal section to the right of the median plane; medial view (r.).

Because of its lateral curvature (skoliosis) the lumbar spine has been sectioned more laterally than the thoracic spine. In contrast to the subcutaneous adipose tissue a lot of adipose tissue is deposited in the mesentery and the greater omentum.



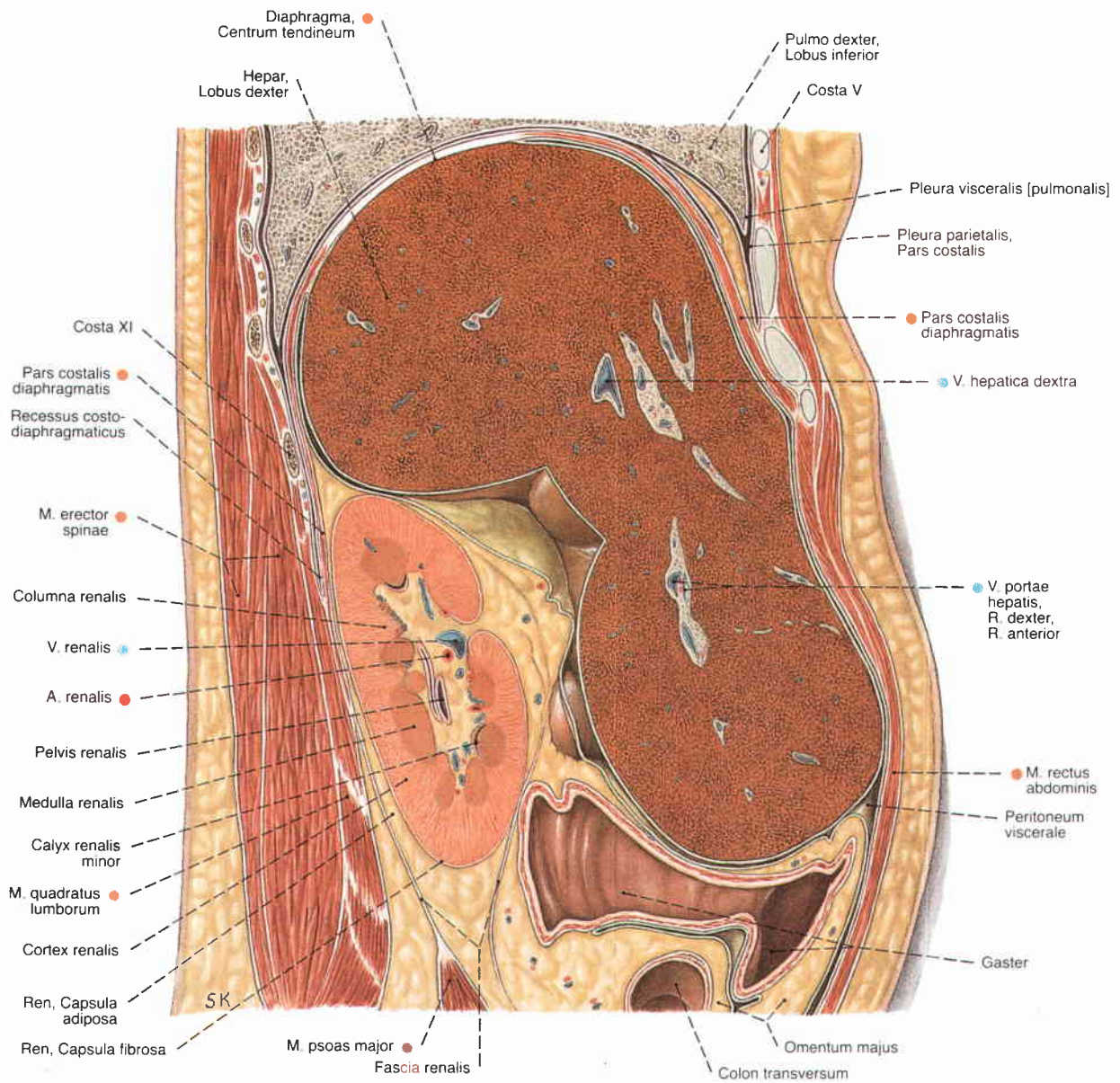
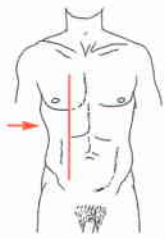


**Fig. 1134** Abdomen, Abdomen;  
frontal section through the most ventral part of the  
peritoneal cavity;  
ventral view.  
The names of the muscles, vessels and nerves are  
shown in Fig. 837.



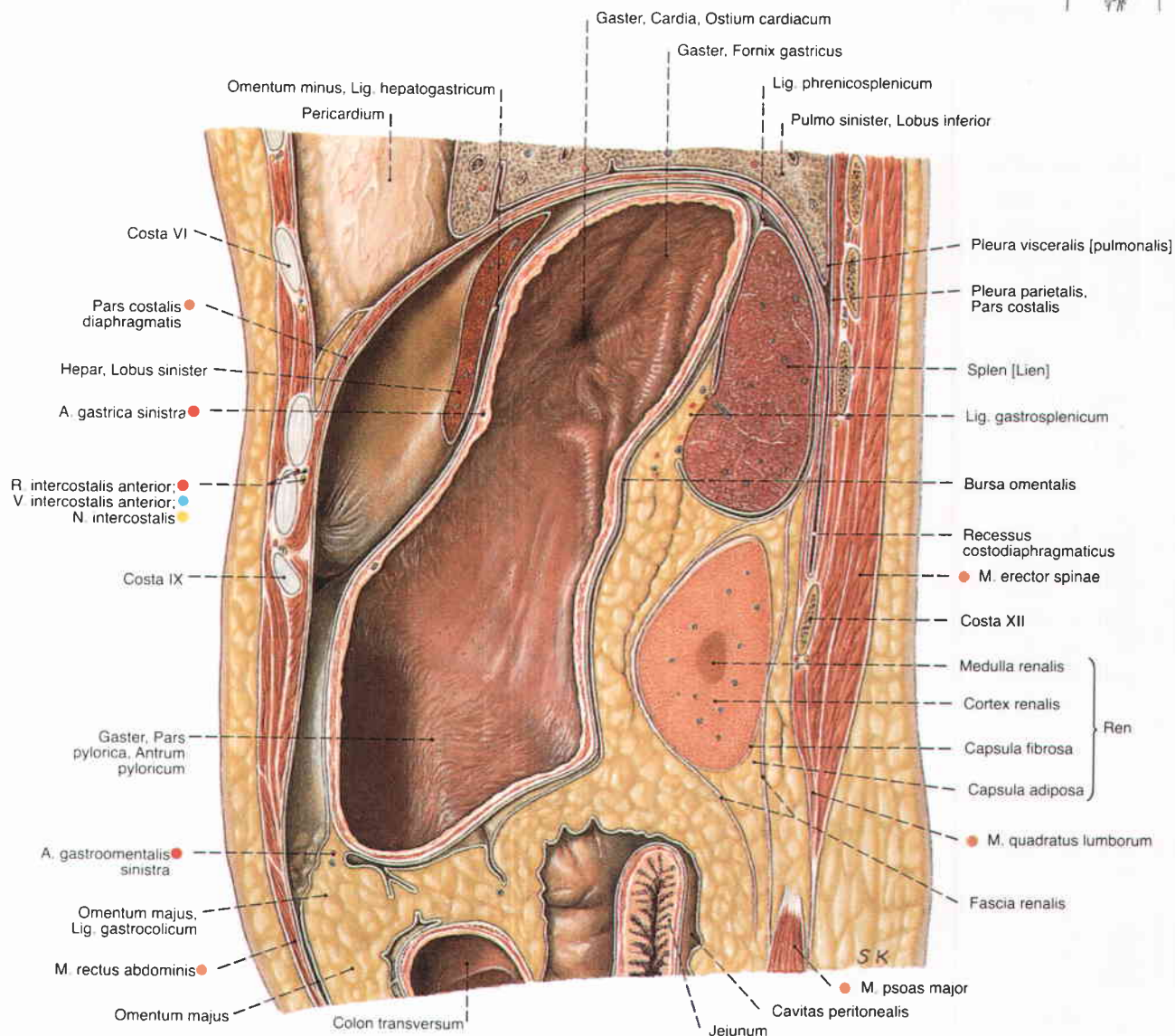
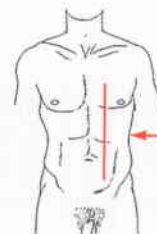
**Fig. 1135** Abdomen, Abdomen;  
frontal section showing the diaphragm, the  
viscera of the upper abdomen and the kidneys;  
dorsal view.  
Because of the lumbar lordosis the first and  
second lumbar vertebrae have been sectioned.



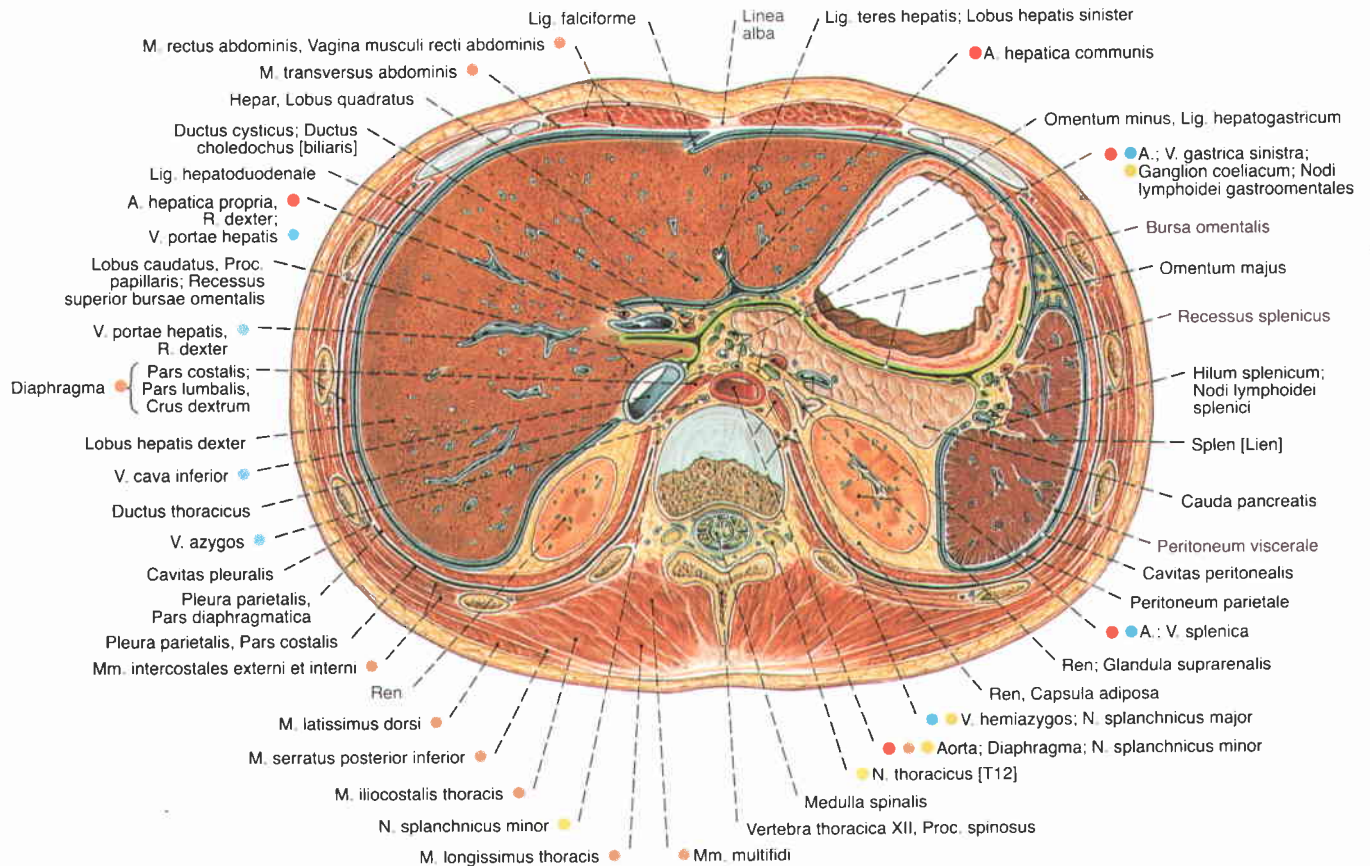


**Fig. 1136** Abdomen, Abdomen;  
sagittal section through the upper abdomen  
at the level of the right kidney;  
viewed from the right.



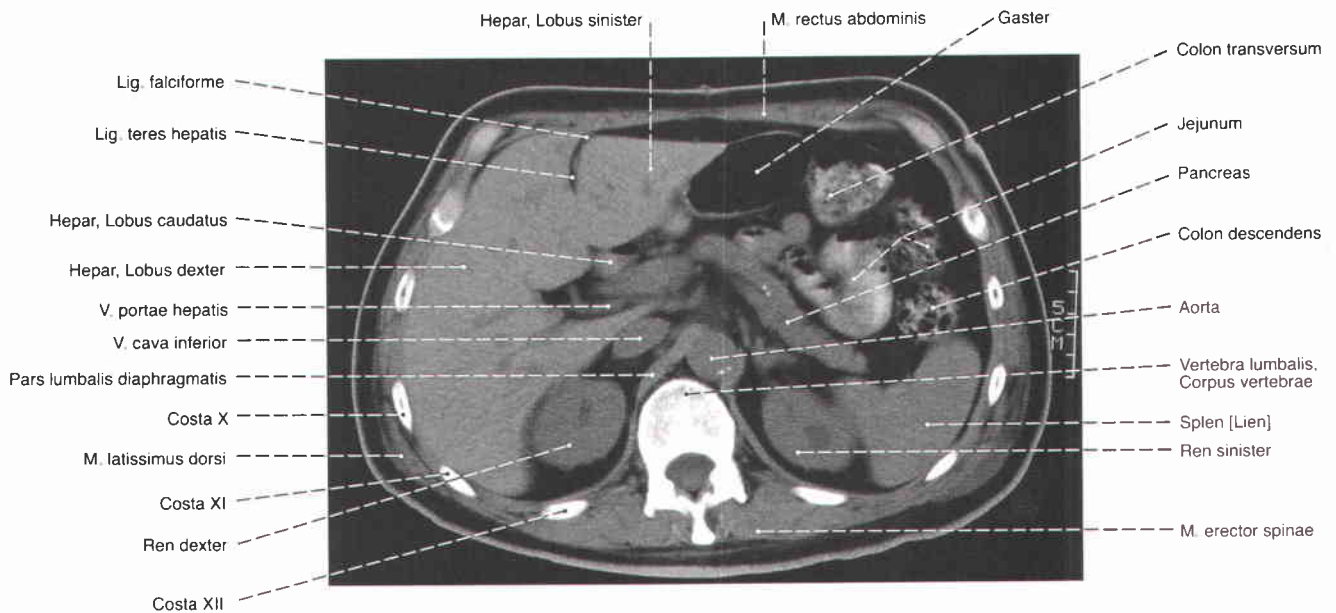


**Fig. 1137** Abdomen, Abdomen;  
sagittal section through the upper abdomen at the  
level of the spleen;  
viewed from the left.  
The thickened capsule of the liver is pathological.



**Fig. 1138** Abdomen, Abdomen; transverse section through the intervertebral disc between the twelfth thoracic vertebra and the first lumbar vertebra;

the peritoneum has been coloured blue, except for the omental bursa where it is green; inferior view.  
In this specimen there is little adipose tissue.



**Fig. 1139** Abdomen, Abdomen; cross-sectional image through the first lumbar vertebra obtained with computed tomography (CT); inferior view.  
The intestine has been partially filled with a contrast medium.



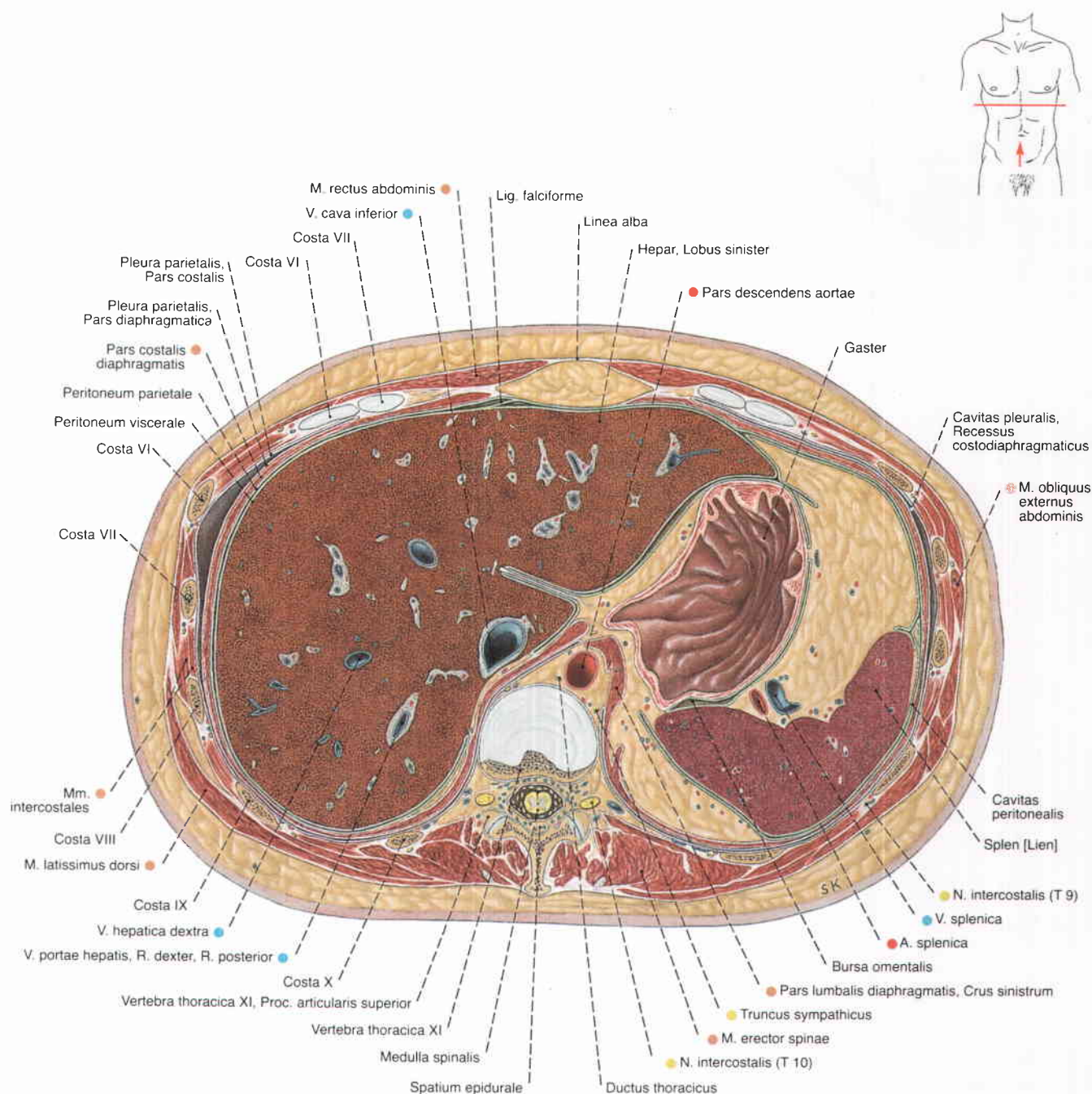
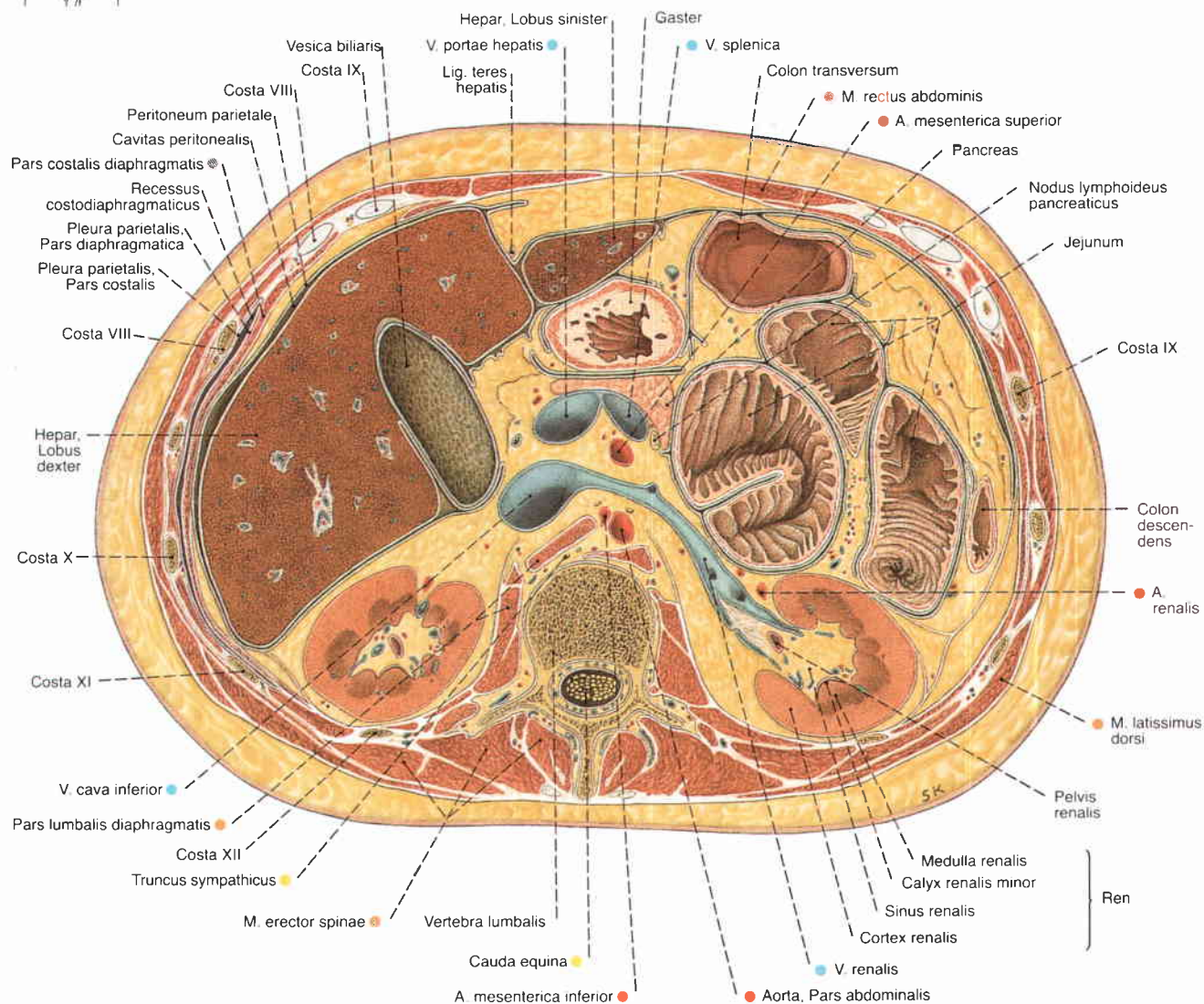
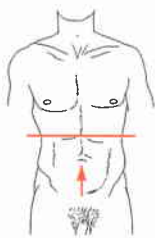


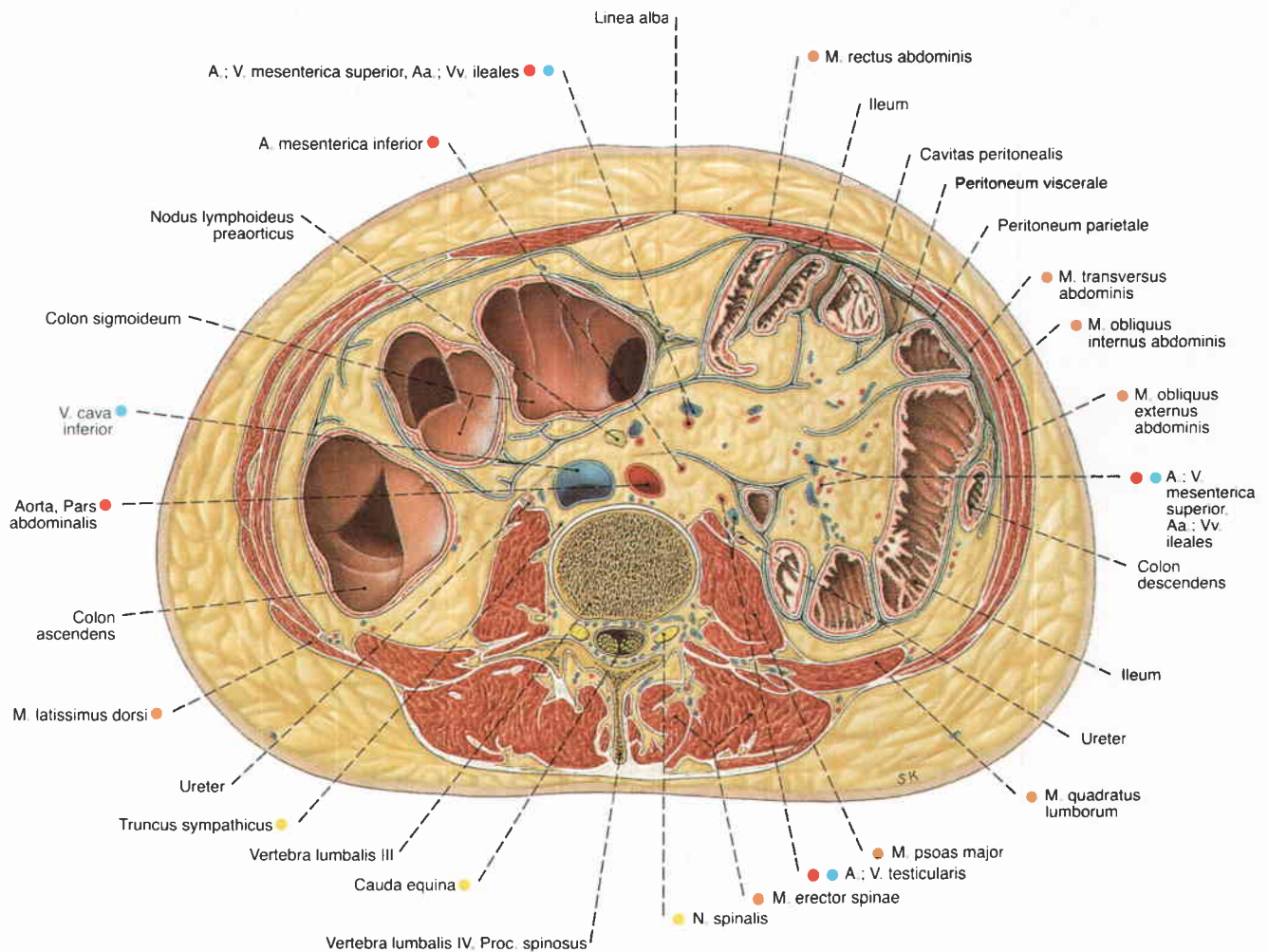
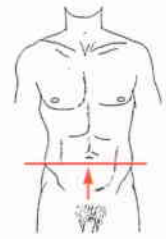
Fig. 1140 Abdomen, Abdomen;  
transverse section through the upper  
abdomen at the level of the eleventh  
thoracic vertebra;  
inferior view.





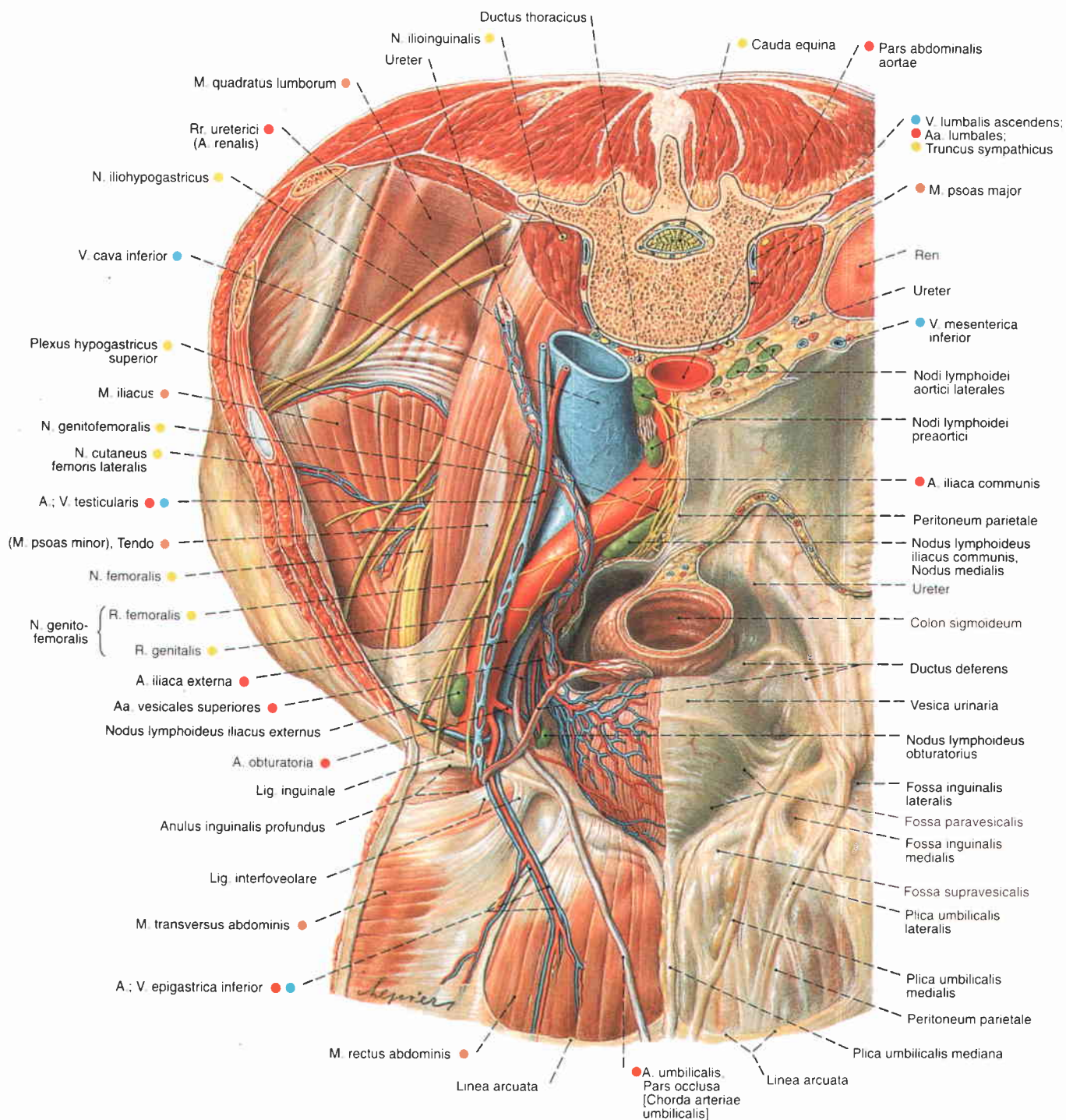
**Fig. 1141** Abdomen, Abdomen;  
transverse section through the upper abdomen at the  
level of the first lumbar vertebra;  
inferior view.

In this case the spinal cord is no longer present. Instead  
cauda equina can be seen. The stomach is contracted  
which makes the mucosa appear very thick.



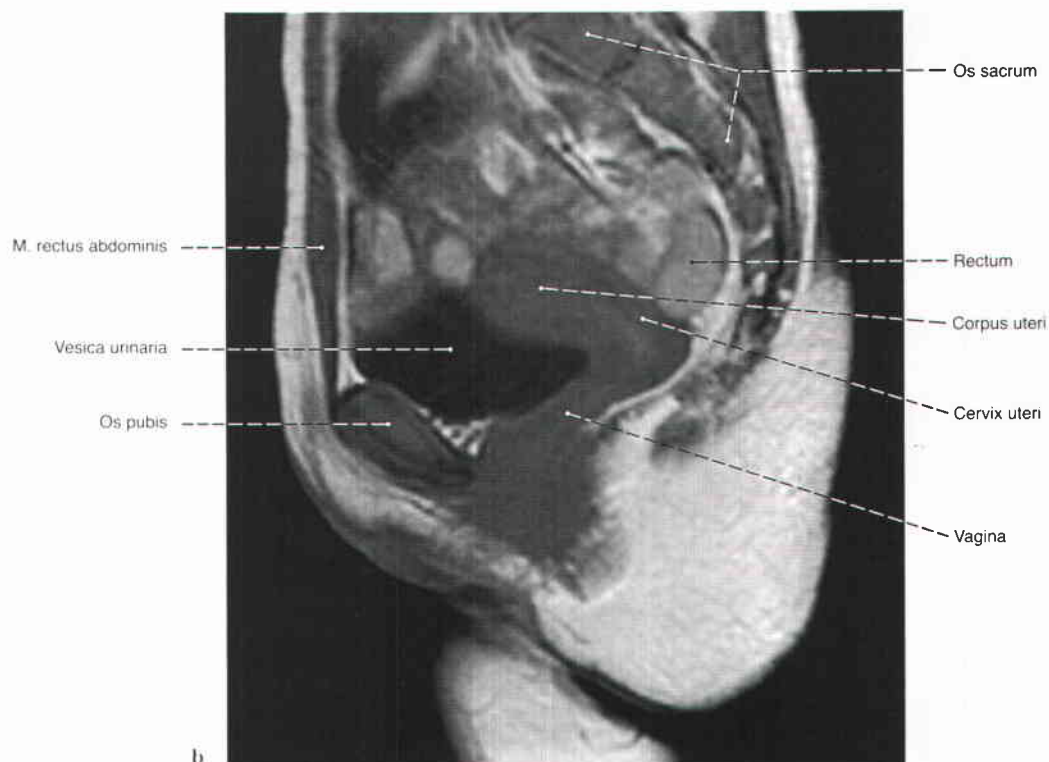
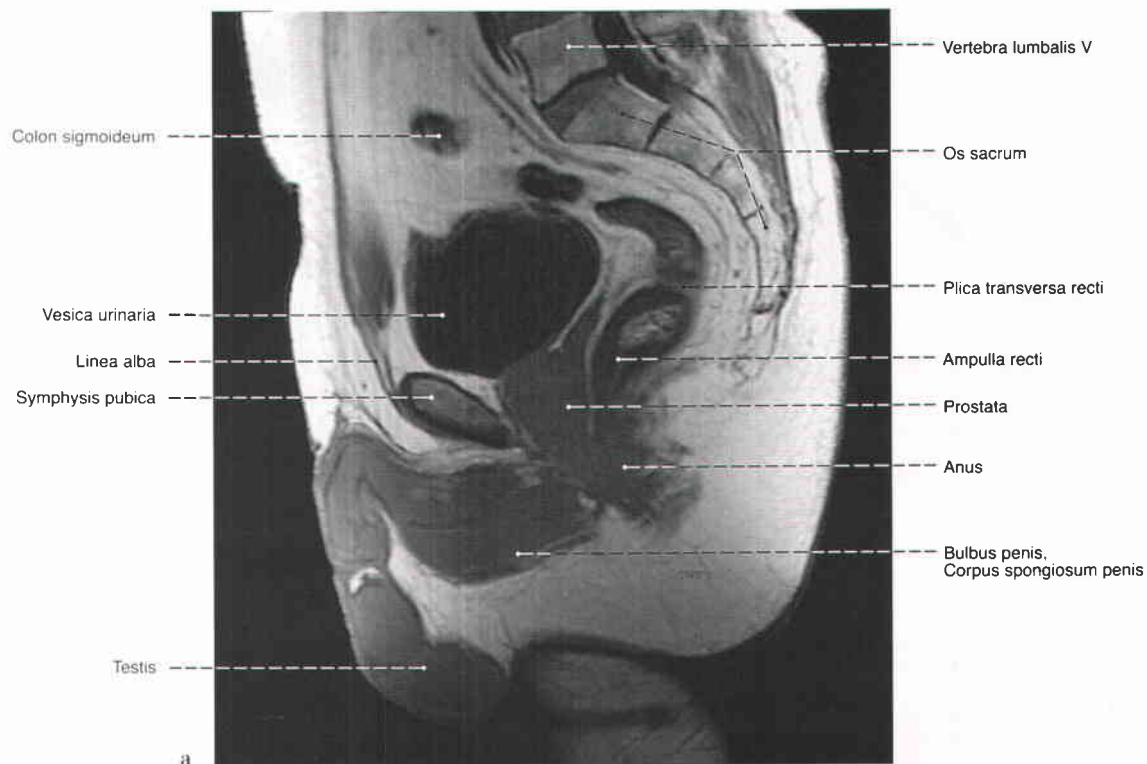
**Fig. 1142** Abdomen, Abdomen;  
transverse section through the lower abdomen at the  
level of the third lumbar vertebra;  
inferior view.  
In this case the sigmoid loop rises so far superiorly that  
the ascending and descending parts can be seen.



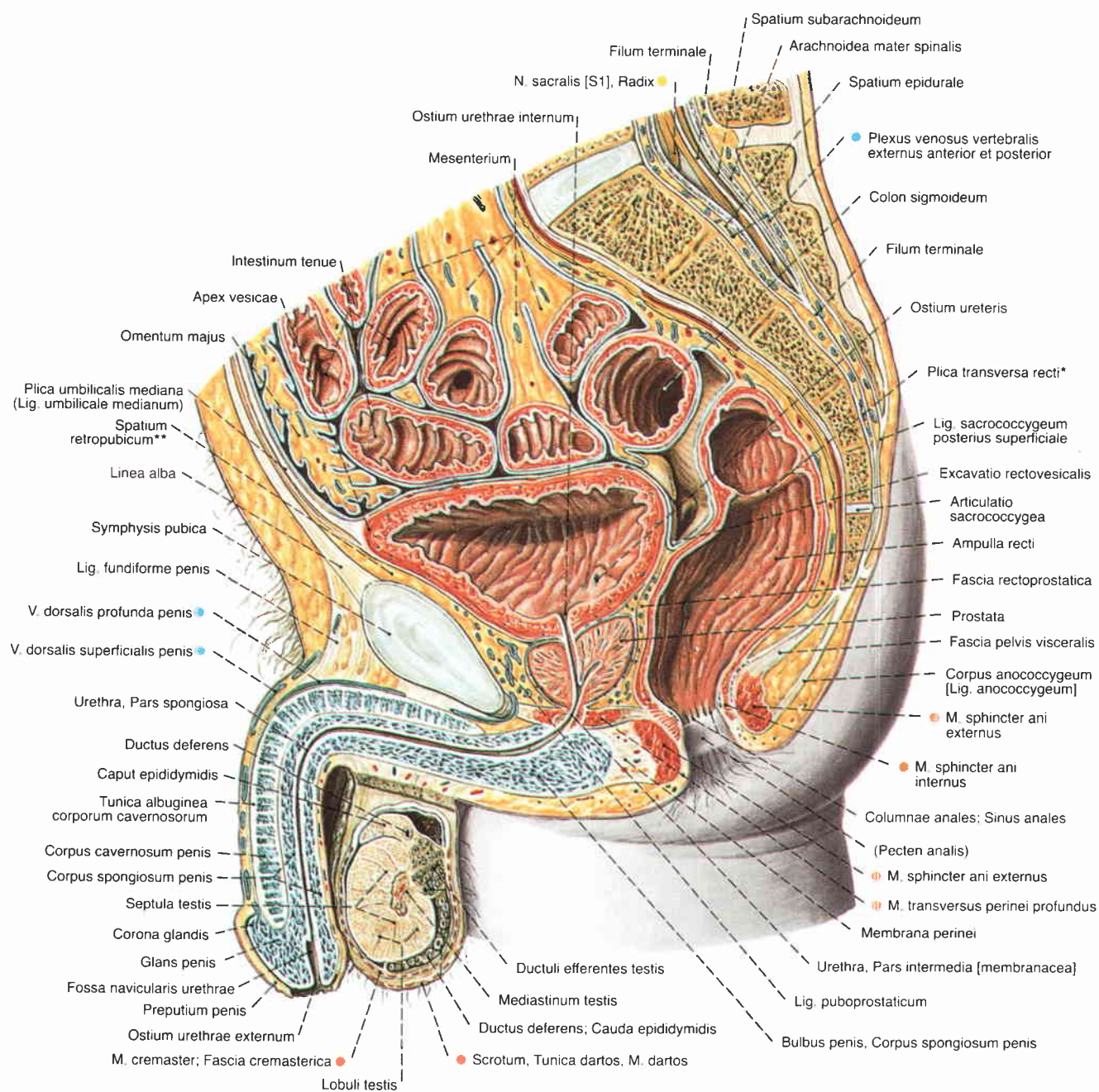


**Fig. 1143** Abdominal wall and pelvic viscera of a male; the posterior abdominal wall has been sectioned in the transverse plane; the anterior wall has been pulled ventrally; on the right the peritoneum has been removed to show the vessels and nerves; superior view.





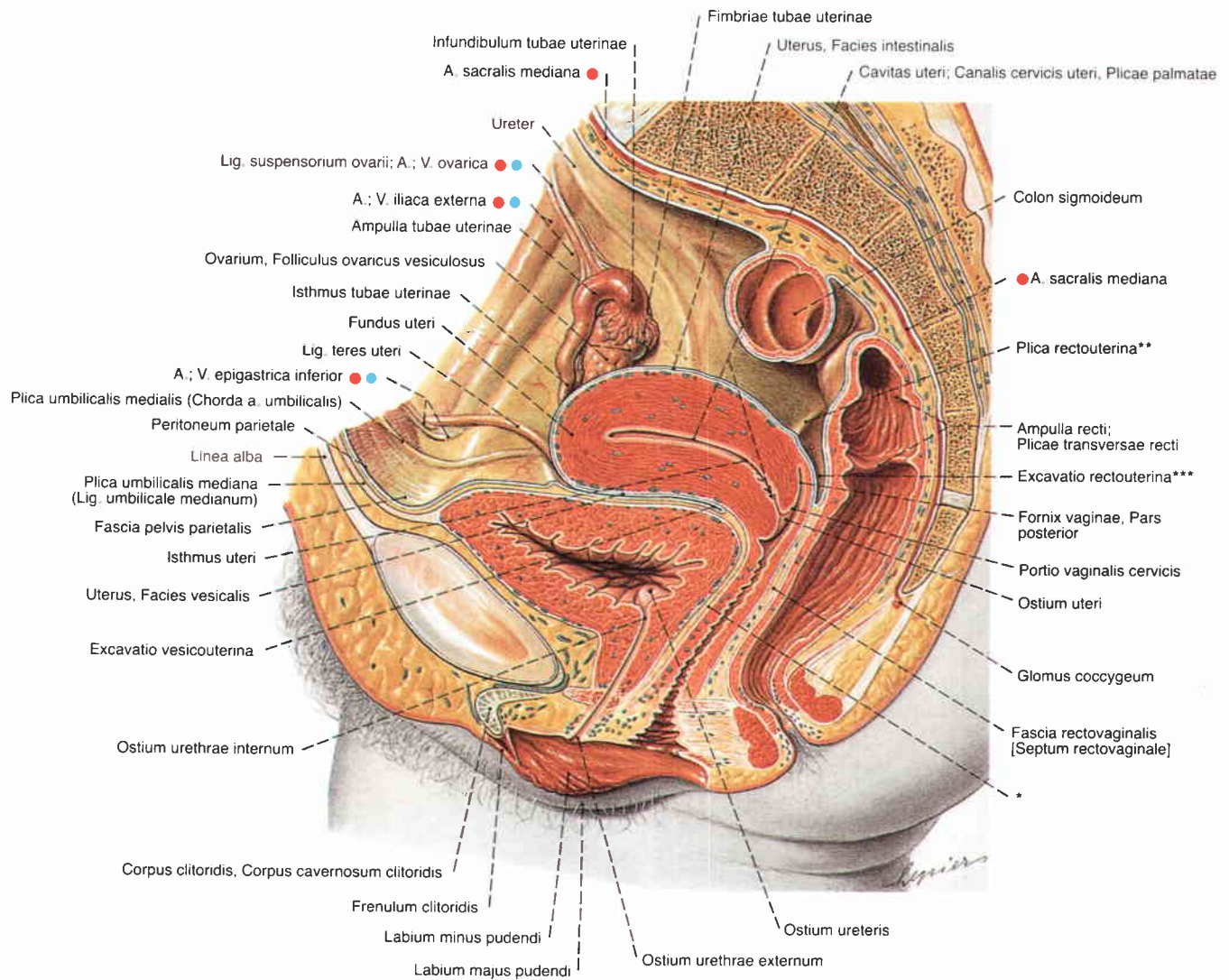
**Figs. 1144 a, b** Pelvis, Pelvis;  
sectional image in the paramedian plane obtained  
with magnetic resonance tomography (MRT);  
viewed from the left.  
**a** in a male  
**b** in an female  
Compare to Figs. 1145 and 1146.



**Fig. 1145** Pelvis, Pelvis, of a male;  
median section;  
lateral view (r.).

\* clinical: KOHLRAUSCH's fold

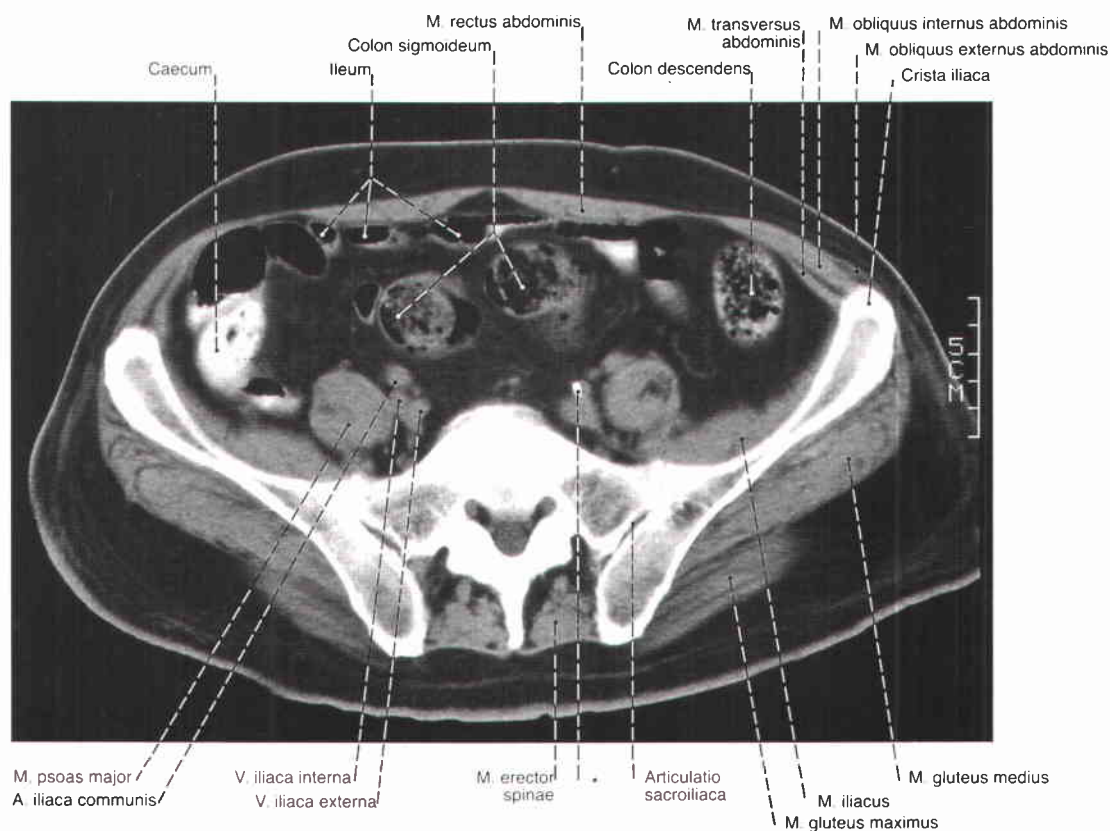
\*\* clinical: RETZIUS's space



**Fig. 1146** Pelvis, Pelvis, of a female; median section; the intestine has been removed, except for parts of the sigmoid colon and rectum; lateral view (r.).

\* clinical: vesico-vaginal septum  
 \*\* clinical: sacro-uterine ligament  
 \*\*\* clinical: Douglas's space

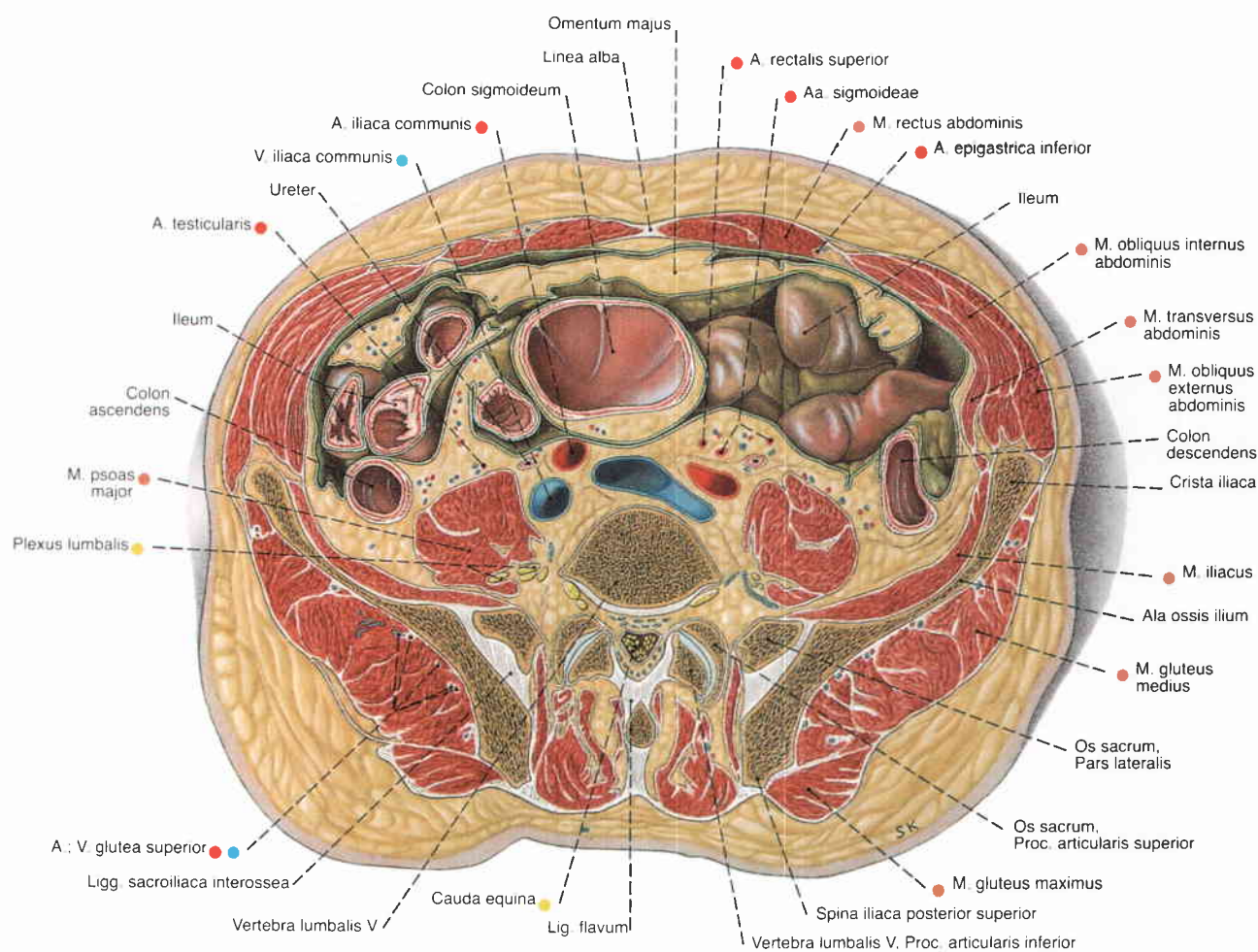




**Fig. 1147** Pelvis, Pelvis;  
cross-sectional image through the first sacral segment obtained  
with computed tomography (CT); a contrast medium has been  
introduced into the colon with the patient lying on his back;  
inferior view.

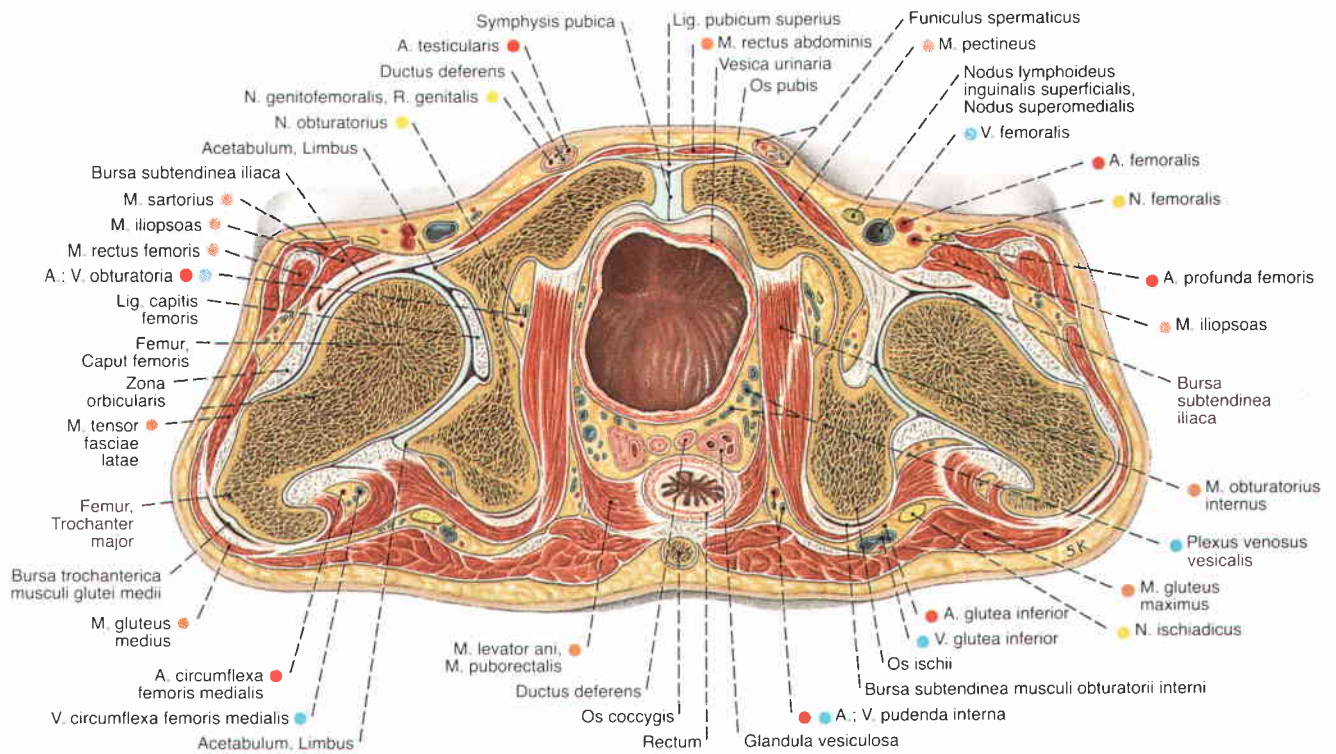
\* calcification in the wall of the common iliac artery

In the sigmoid and the descending colon the contrast medium has mixed with the contents of the intestine, whereas the caecum is almost completely filled with the contrast medium. The thickness of the subcutaneous fat in the gluteal region is quite marked in this patient. This is of importance during intramuscular injections, because many medicines should only be injected into the musculature, but not into the adipose tissue. Compare to Figs. 1342 and 1343.

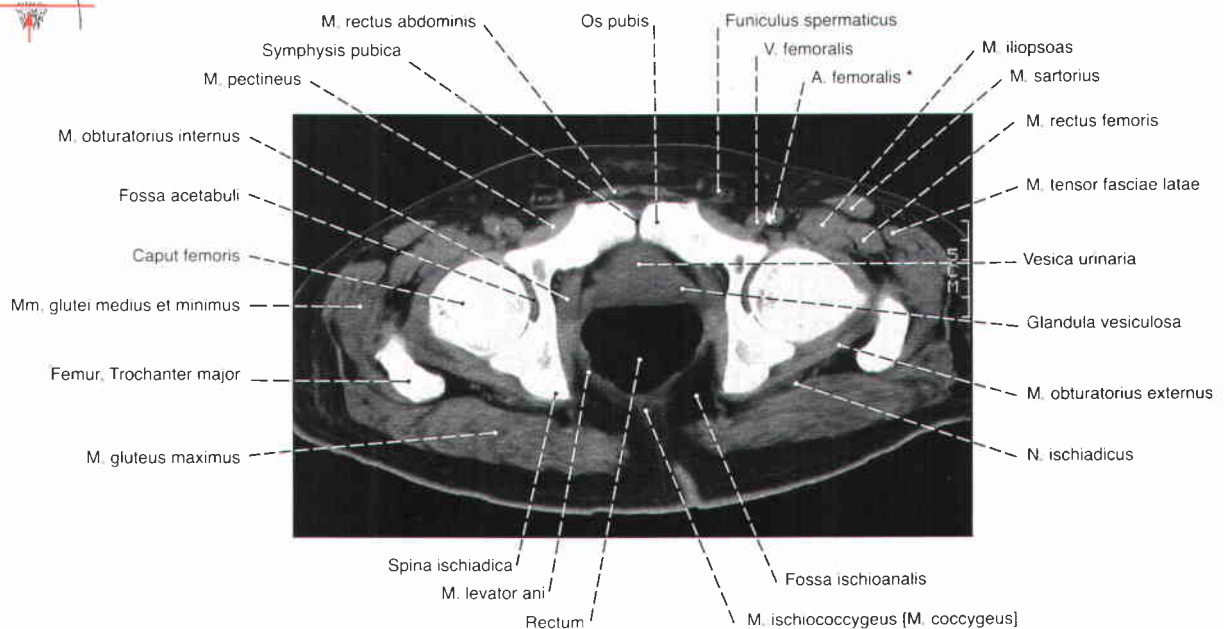


**Fig. 1148** Pelvis, Pelvis;  
transverse section through the fifth lumbar vertebra;  
inferior view.

This section was obtained from a different individual than the sections in Figs. 1140 to 1142. The sigmoid colon reaches far superiorly, the top of its loop has therefore been sectioned. The thickness of the subcutaneous fat in the gluteal region must be taken into account during intramuscular injections.



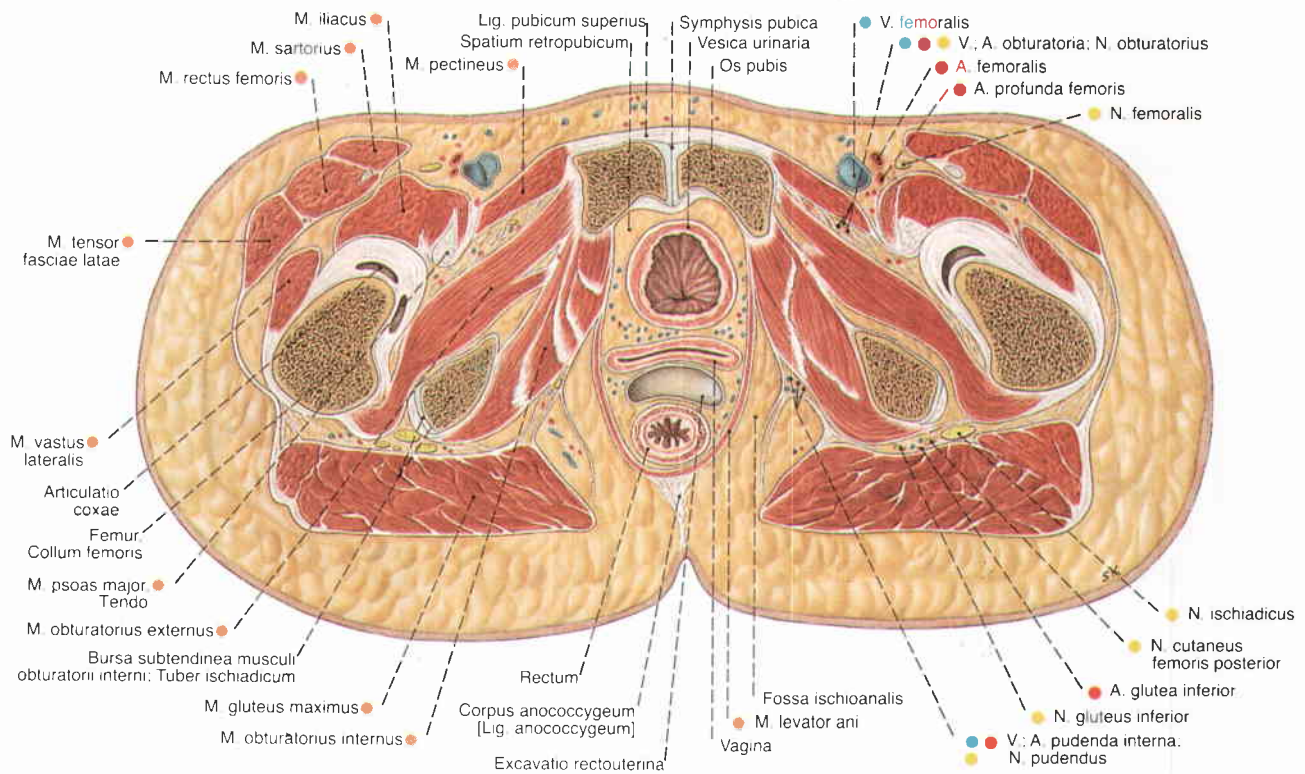
**Fig. 1149** Pelvis, Pelvis, of a male; transverse section through the lesser pelvis at the level of the symphysis; inferior view.  
Because of the slight asymmetry of this pelvis the hip joint has been sectioned at different levels on the left and on the right.



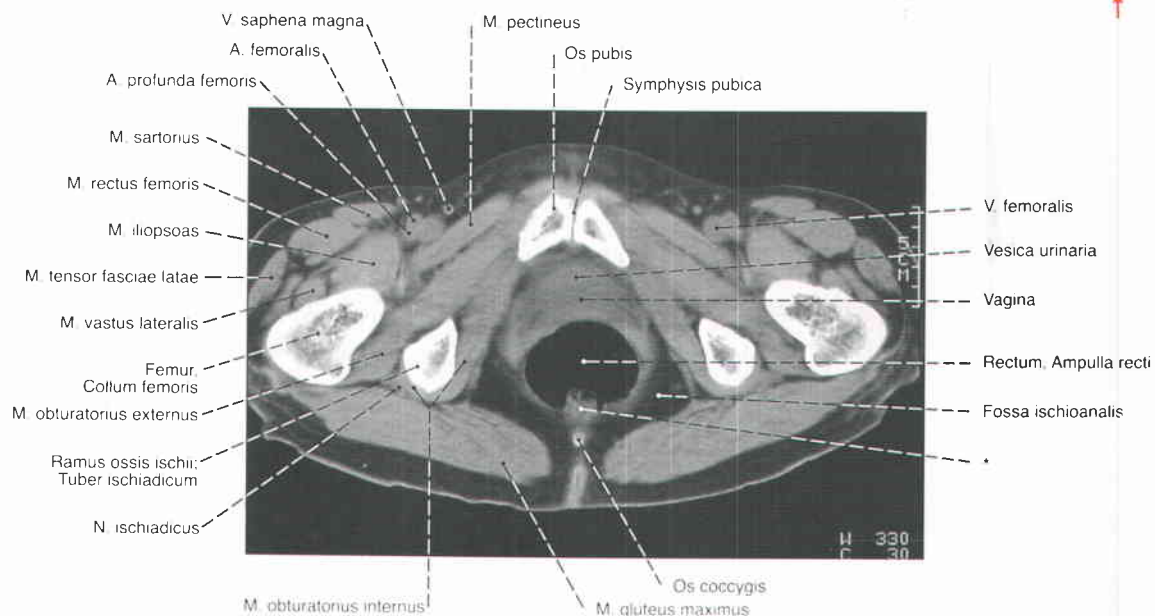
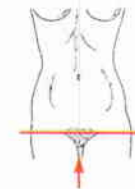
**Fig. 1150** Pelvis, Pelvis, of a male; cross-sectional image through the lesser pelvis obtained with computed tomography (CT); the patient is lying on his back; section similar to Fig. 1149; inferior view.

\* calcification in the medial part of the femoral artery



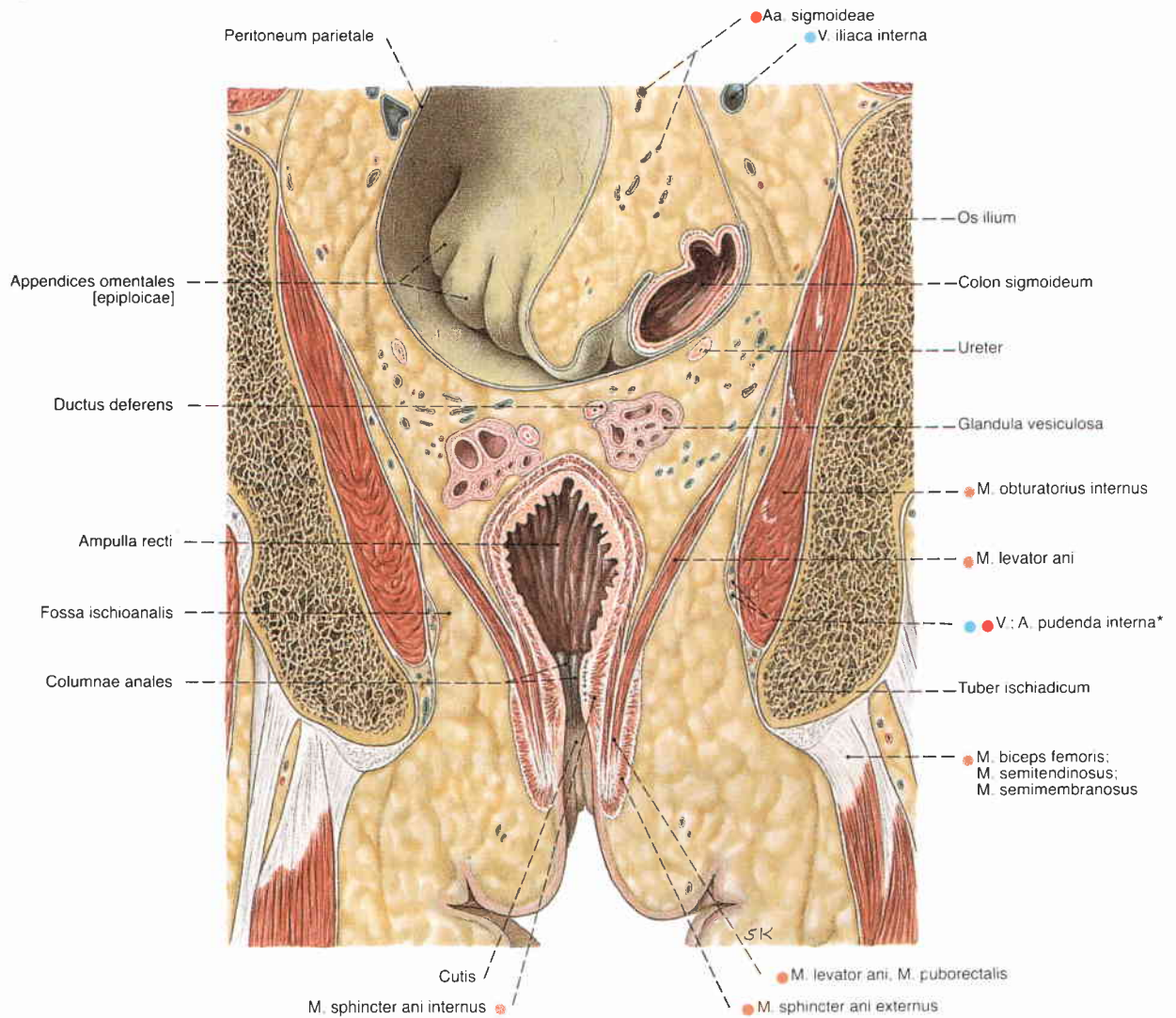
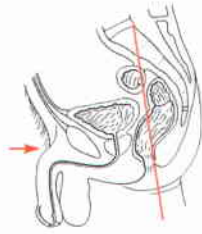


**Fig. 1151** Pelvis, Pelvis, of a female; transverse section through the lesser pelvis at the level of the symphysis; inferior view.



**Fig. 1152** Pelvis, Pelvis, of a female; cross-sectional image through the lesser pelvis obtained with computed tomography (CT); the patient is lying on her back; section similar to Fig. 1151; inferior view.

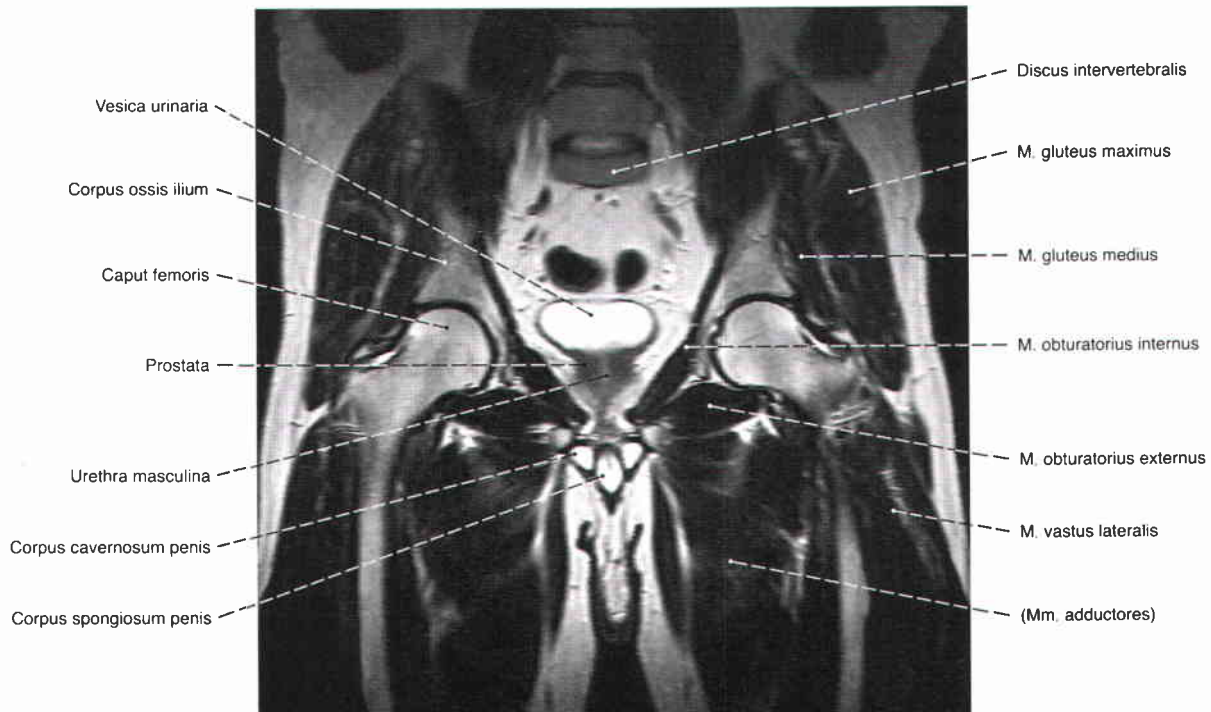
\* remaining contrast medium in the intestine



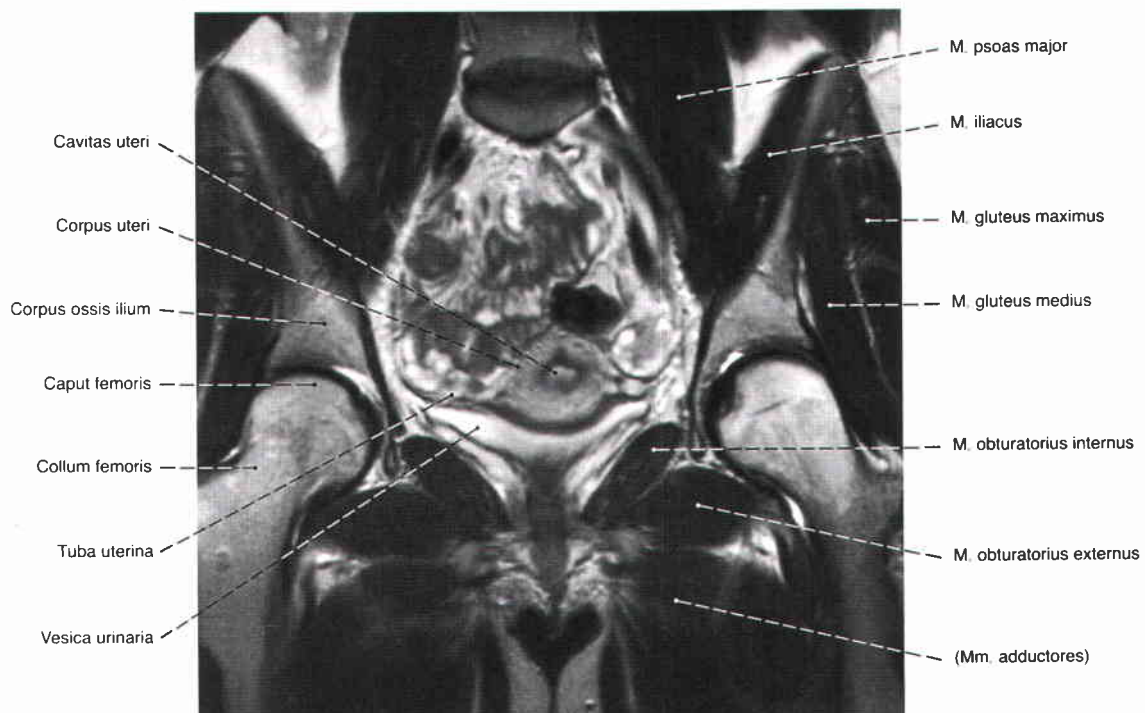
**Fig. 1153** Pelvis, Pelvis, of a male;  
frontal section through the lesser pelvis;  
ventral view.

\* clinical: ALCOCK'S canal





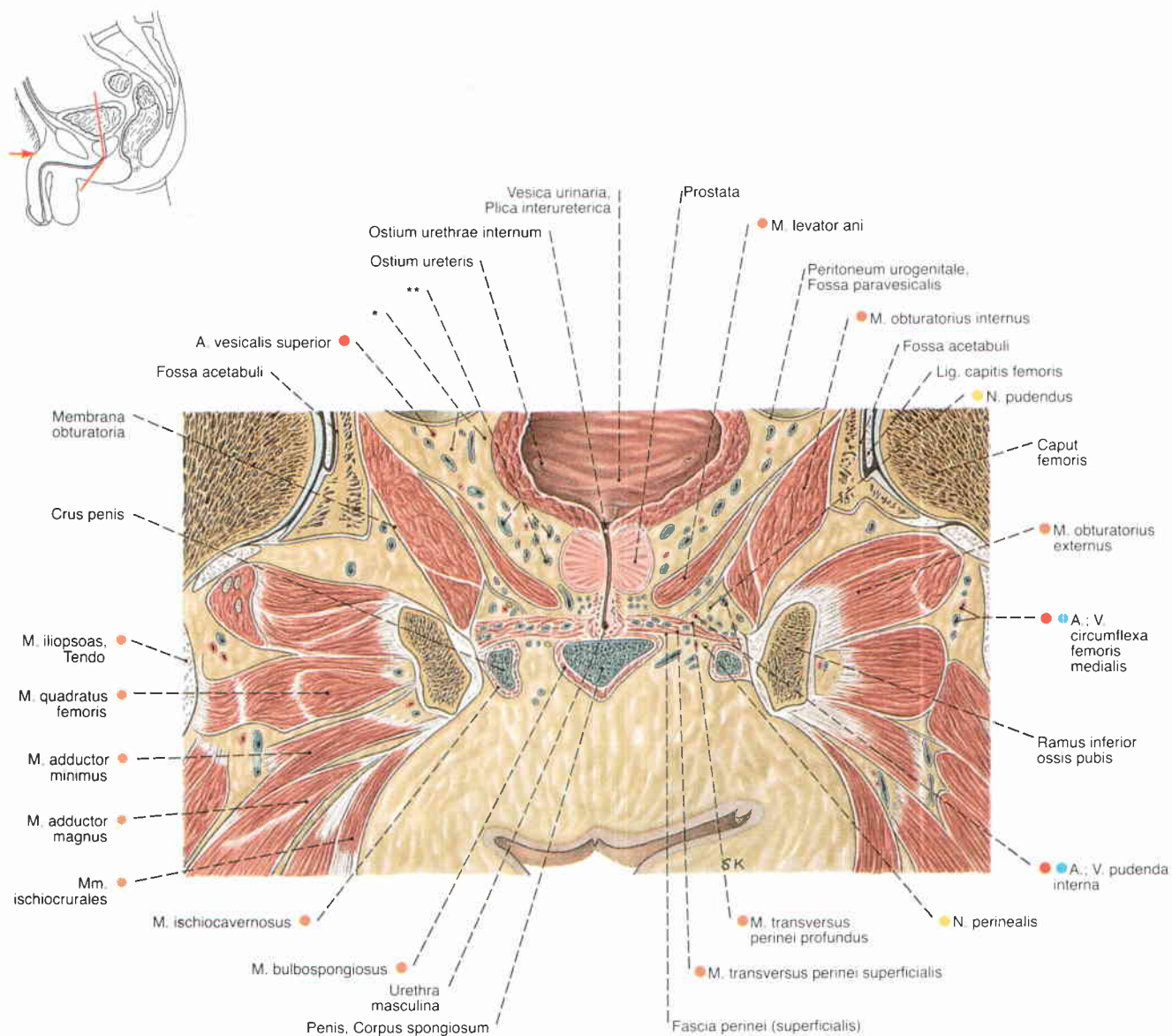
**Fig. 1154** Pelvis, Pelvis, of a male;  
sectional image in the frontal plane through both hip joints  
obtained with magnetic resonance tomography (MRT);  
ventral view.



**Fig. 1155** Pelvis, Pelvis, of a female;  
sectional image in the frontal plane through both hip joints,  
obtained with magnetic resonance tomography (MRT);  
ventral view.

When the bladder is empty, the uterus lies on its roof due to the antelexion.

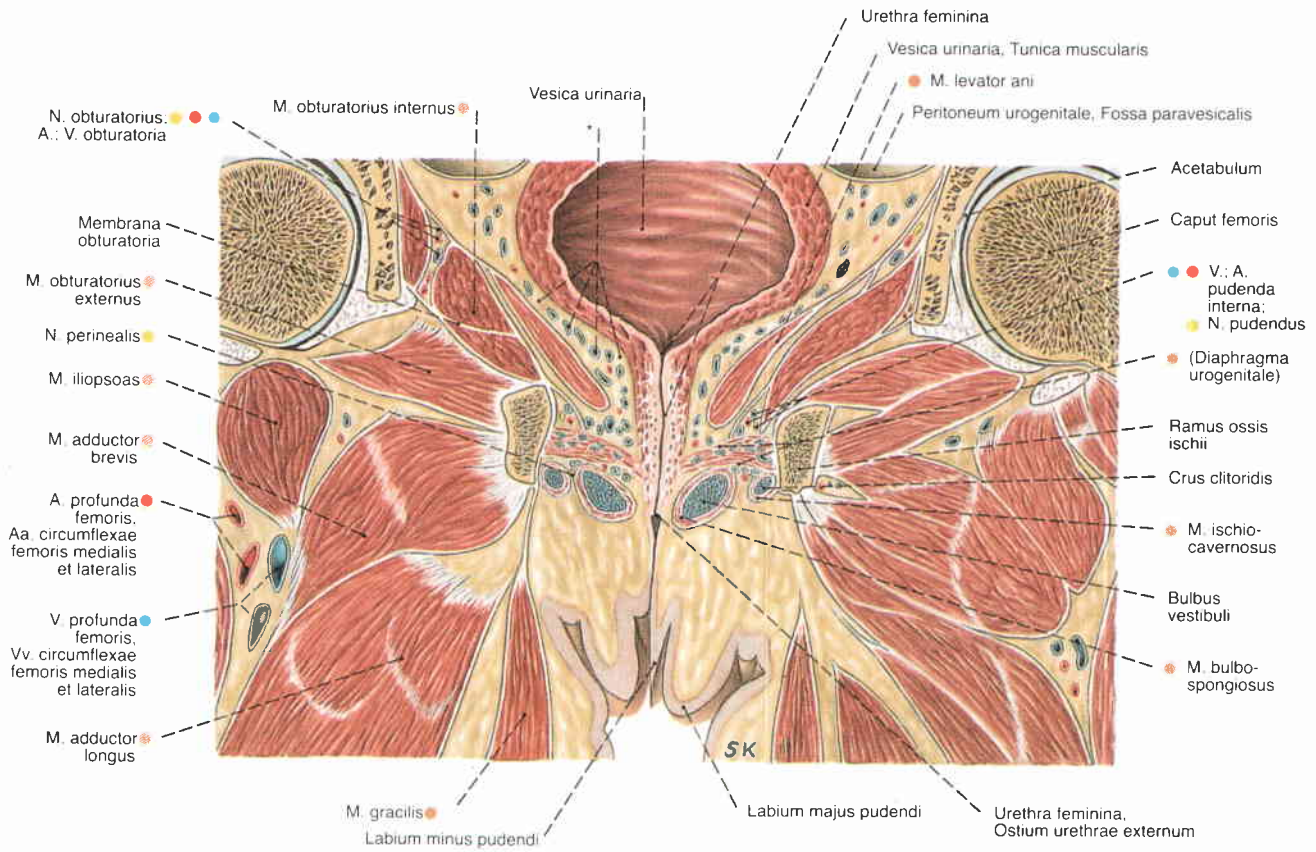
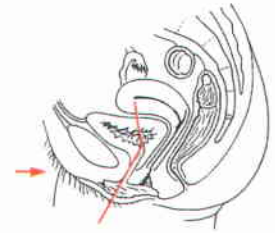




**Fig. 1156** Pelvis, Pelvis, of a male; angular section through the urinary bladder; ventral view.

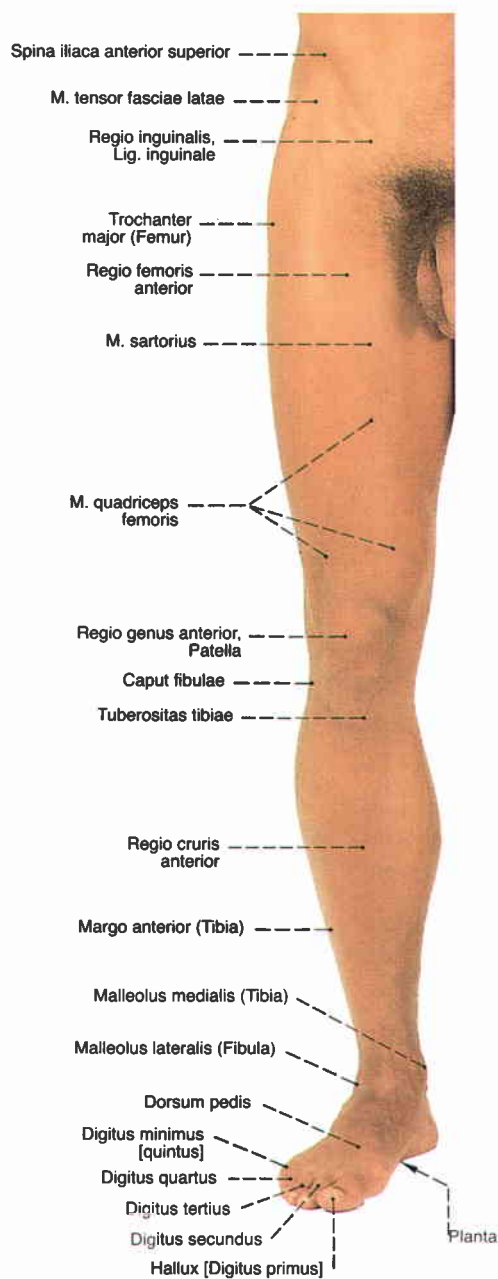
\* clinical: paracystium

\*\* clinical: venous plexus of the prostate

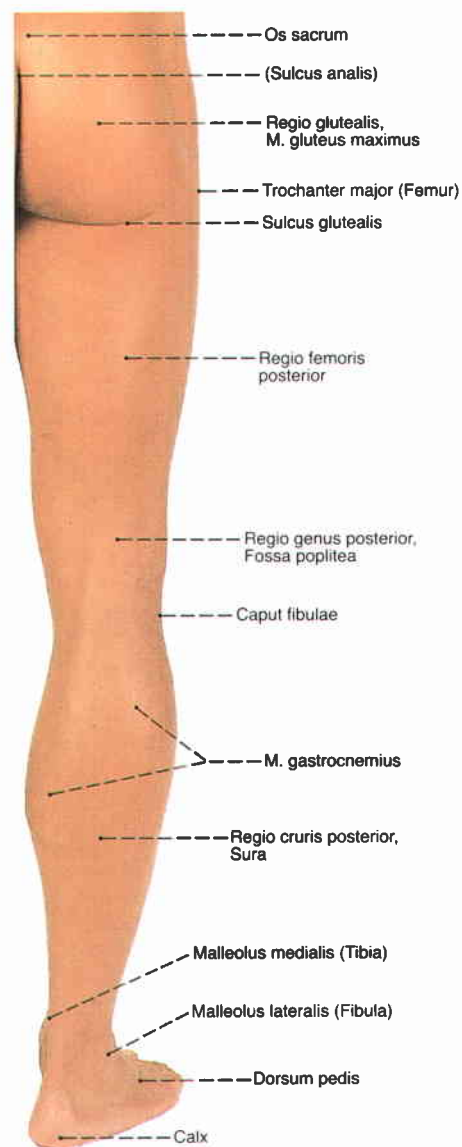


**Fig. 1157** Pelvis, Pelvis, of a female; angular section through the urinary bladder; ventral view.

\* paracystium with venous plexus

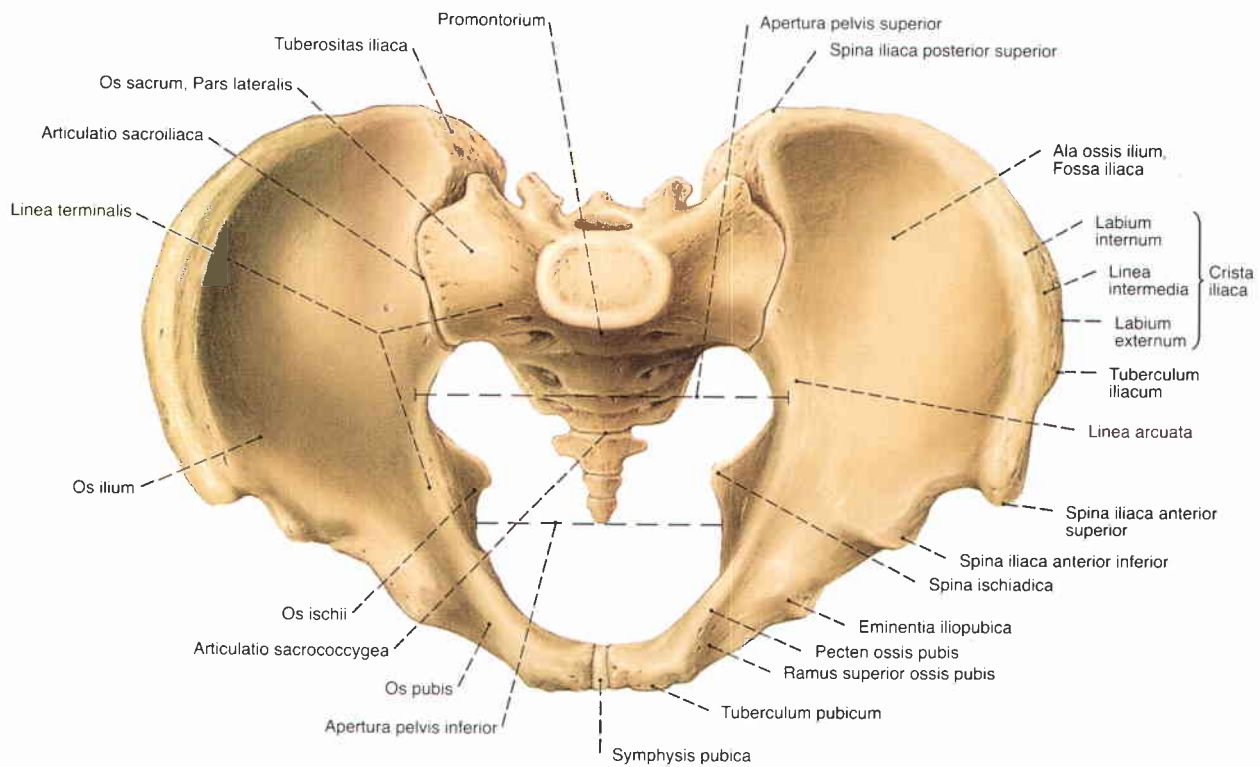


**Fig. 1158** Lower limb, Extremitas inferior; surface anatomy; ventral view (r.).



**Fig. 1159** Lower limb, Extremitas inferior; surface anatomy; dorsal view (r.).



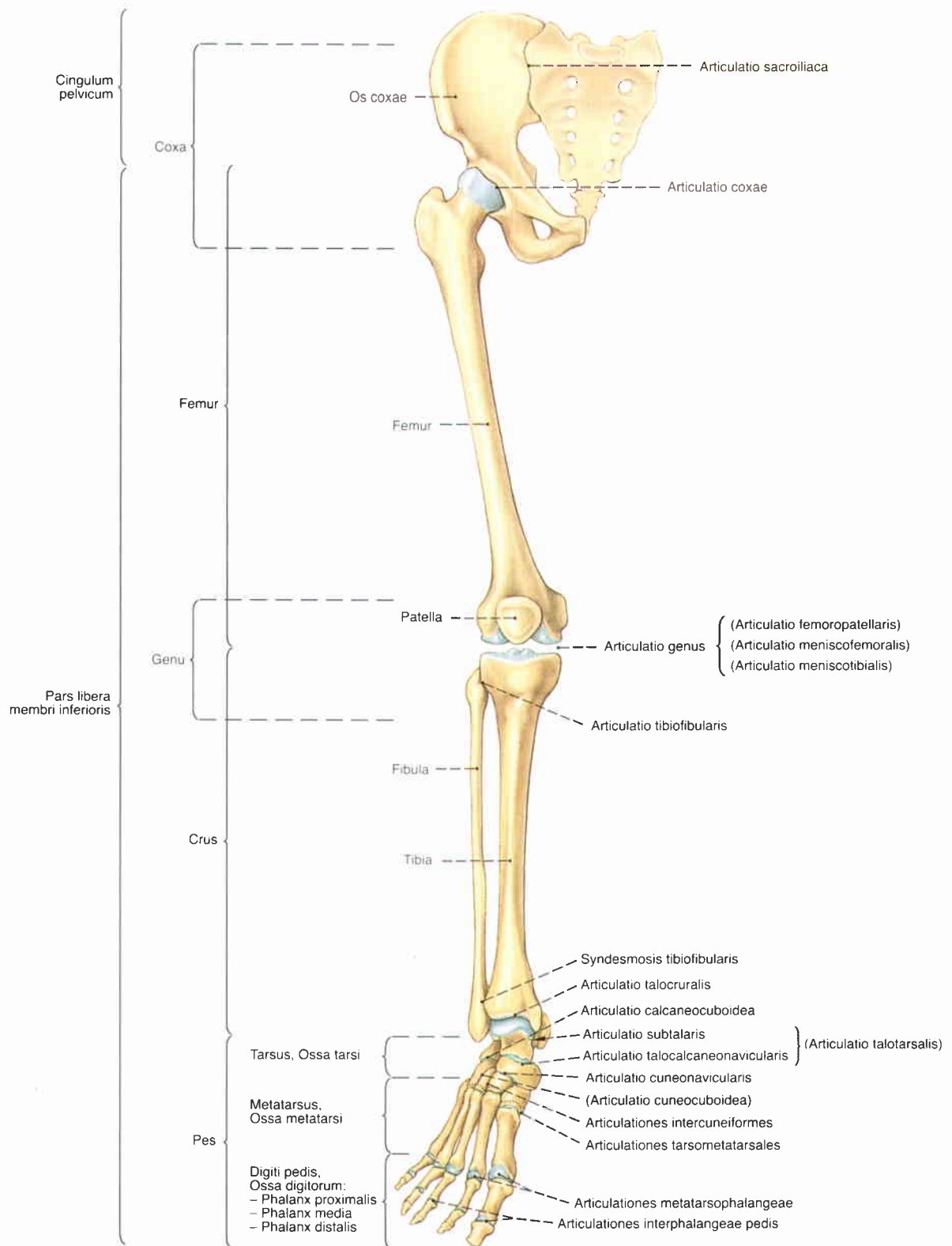


**Fig. 1160** Sacral bone, Os sacrum, and pelvic girdle, Cingulum pelvicum; ventrosuperior view (40%).

The space above the Linea terminalis is called the greater pelvis, Pelvis major, the space below it the lesser pelvis, Pelvis minor.

### Connections of the bones of the pelvic girdle, Juncturae cinguli pelvici

Name	Type	Possible movements
Pubic symphysis, Symphysis pubica	Cartilaginous synchondrosis with Discus interpubicus	
Sacroiliac joint, Articulatio sacroiliaca	Rigid joint, amphiarthrosis	
Ligg. sacroiliaca anteriora Ligg. sacroiliaca posteriora Ligg. sacroiliaca interossea Lig. sacrotuberale Lig. sacrospinale Lig. pubicum superius Lig. pubicum inferius	Syndesmoses, fibrous joints	Displacement and rotation of a few millimeters, associated with the deformity of the pelvis as a unit under various weight-bearing stresses

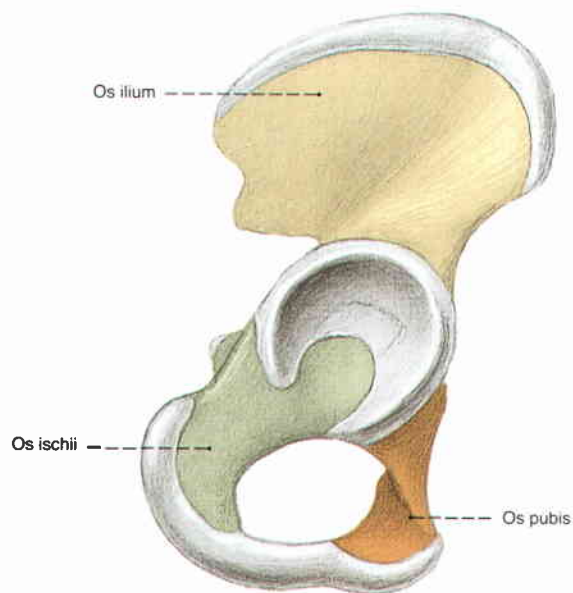


**Fig. 1161** Lower limb, Membrum inferius; demonstration of the skeleton and the articular regions; ventral view (r.).

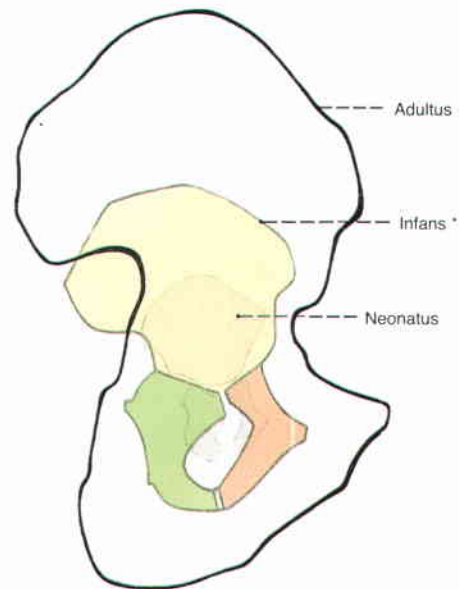
**Joints of the lower limb, Articulationes membri inferioris liberi (Fig. 1161)**

Joint	Type of Joint	Possible Movements
<b>Hip joint</b> Articulatio coxae	Ball-and-socket joint, Articulatio spherioidea	Flexion (anteversion), extension (retroversion), abduction, adduction, medial and lateral rotation, circumduction
<b>Knee joint</b> Articulatio genus	Pivot-hinge joint, compound: 2 condyloid and 1 sellar, Articulatio trochoidea/Ginglymus	Flexion, extension; medial and lateral rotation (only possible in flexed position)
<b>Proximal tibiofibular joint</b> Articulatio tibiofibularis (superior)	Rigid joint, Amphiarthrosis	Limited movement in transverse and vertical direction, limited rotation
<b>Distal tibiofibular joint</b> Articulatio tibiofibularis (inferior)	Fibrous, Articulatio fibrosa	Bones slightly separate in dorsal flexion of Articulatio talocruralis
<b>Ankle joint</b> Articulatio talocruralis	Hinge joint, Ginglymus	Plantar flexion Dorsal flexion
<b>Intertarsal joints</b> (Articulatio talotarsalis) a) Articulatio talocalcaneonavicularis (anterior part) b) Articulatio subtalaris (posterior part)	Spheroid joints, compound, multiaxial, synovial	Lift the medial border of the foot (supination) Lift the lateral border of the foot (pronation)
<b>Articulatio tarsi transversa</b> (CHOPART's joint line) a) Articulatio talonavicularis b) Articulatio calcaneocuboidea	Rigid joints, Amphiarthroses	Minimal gliding and rotation, hold the longitudinal arch of the foot (flatfoot)
<b>Tarsal joints</b> a) Articulatio cuneonavicularis b) Articulatio intercuneiformes c) Articulatio cuneocuboidea	Rigid joints, Amphiarthroses	Minimal gliding and rotation, assist in inversion and eversion, assist in gripping the ground while walking
<b>Tarsometatarsal joints</b> Articulationes tarsometatarsales (LISFRANC's joint line)	Rigid joints, Amphiarthroses	Minimal gliding, supination and pronation of the forepart of the foot
<b>Intermetatarsal joints</b> Articulationes intermetatarsales	Rigid joints, Amphiarthroses	Assist in rotating the forepart of the foot
<b>Metatarsophalangeal joints</b> Articulationes metatarsophalangeae	Limited ball-and-socket joints	Flexion and extension of the toes
<b>Interphalangeal joints</b> Articulationes interphalangeae pedis	Hinge joints, Ginglymi	



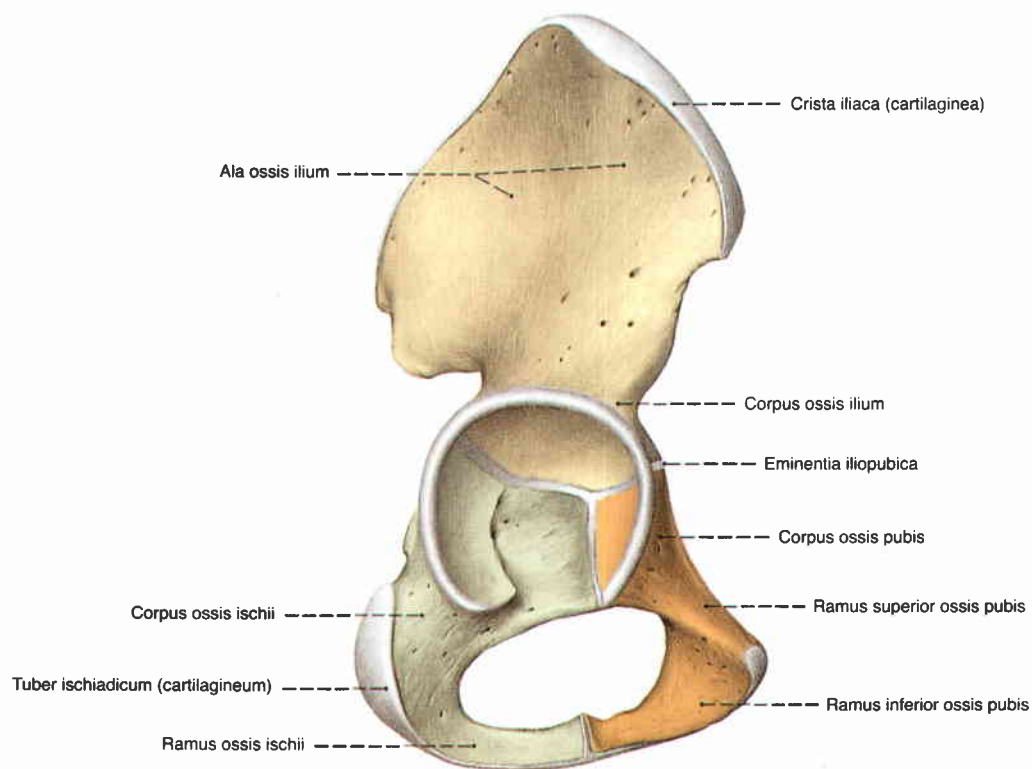


**Fig. 1162** Hip bone, Os coxae;  
extent of its three osseous parts in the neonate;  
lateral view (r., 110%).



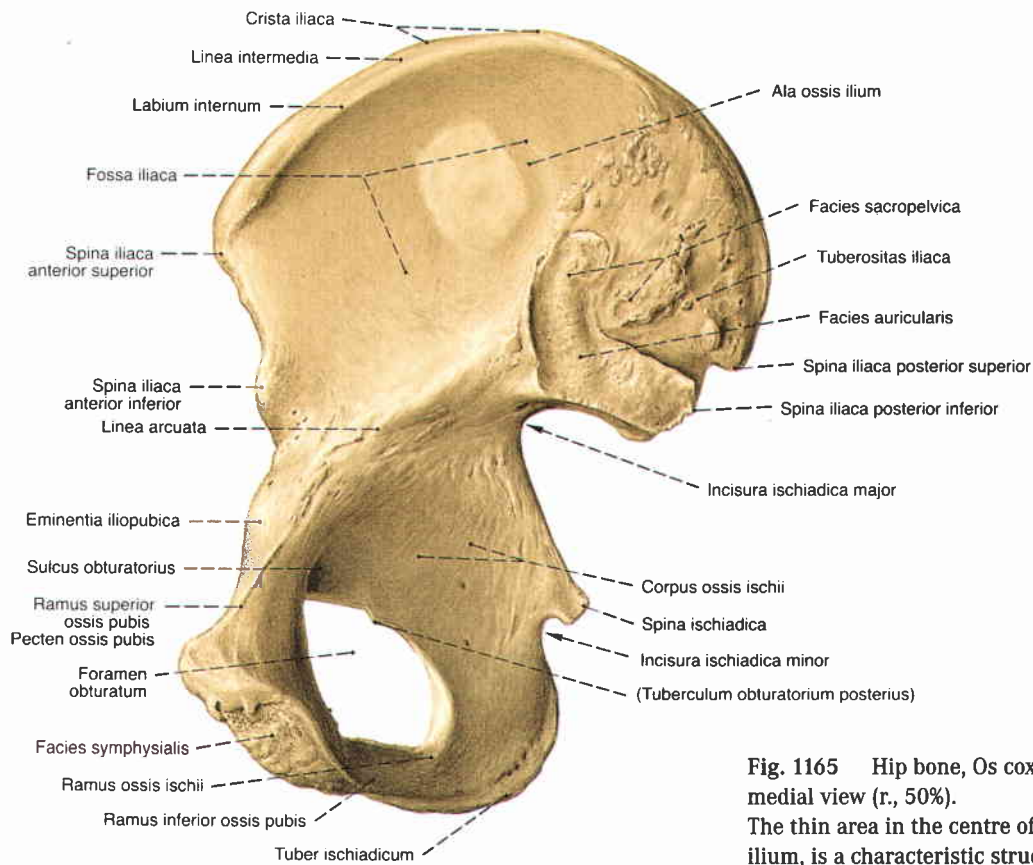
**Fig. 1163** Hip bone, Os coxae;  
extension of its three osseous parts at different ages;  
lateral view (r.).

\* here about 6 years of age



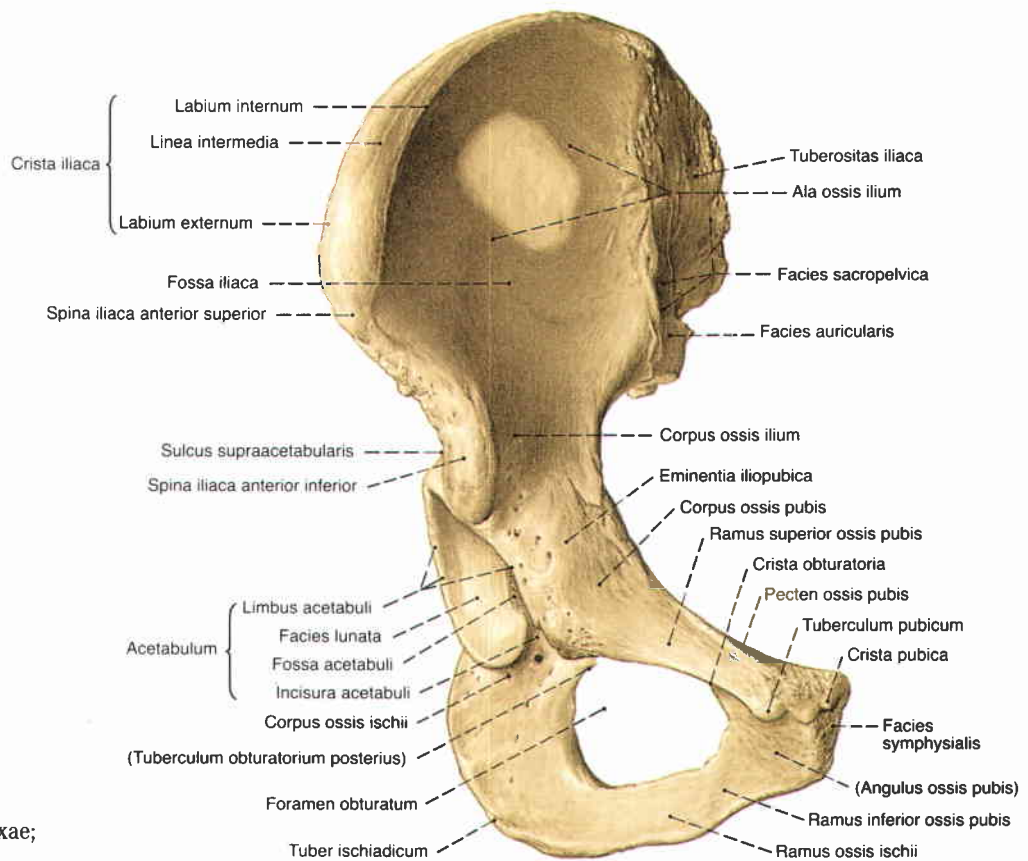
**Fig. 1164** Hip bone, Os coxae;  
stage of development in a 6-year-old child;  
lateral view (r., 90%).

The three parts of the hip bone join in the acetabulum to form a Y-shaped cartilaginous junction. They fuse between the age of 13 and 18.



**Fig. 1165** Hip bone, Os coxae;  
medial view (r., 50%).

The thin area in the centre of the ala of the ilium, Ala ossis ilium, is a characteristic structural feature of the pelvis.



**Fig. 1166** Hip bone, Os coxae;  
ventral view (r., 50%).

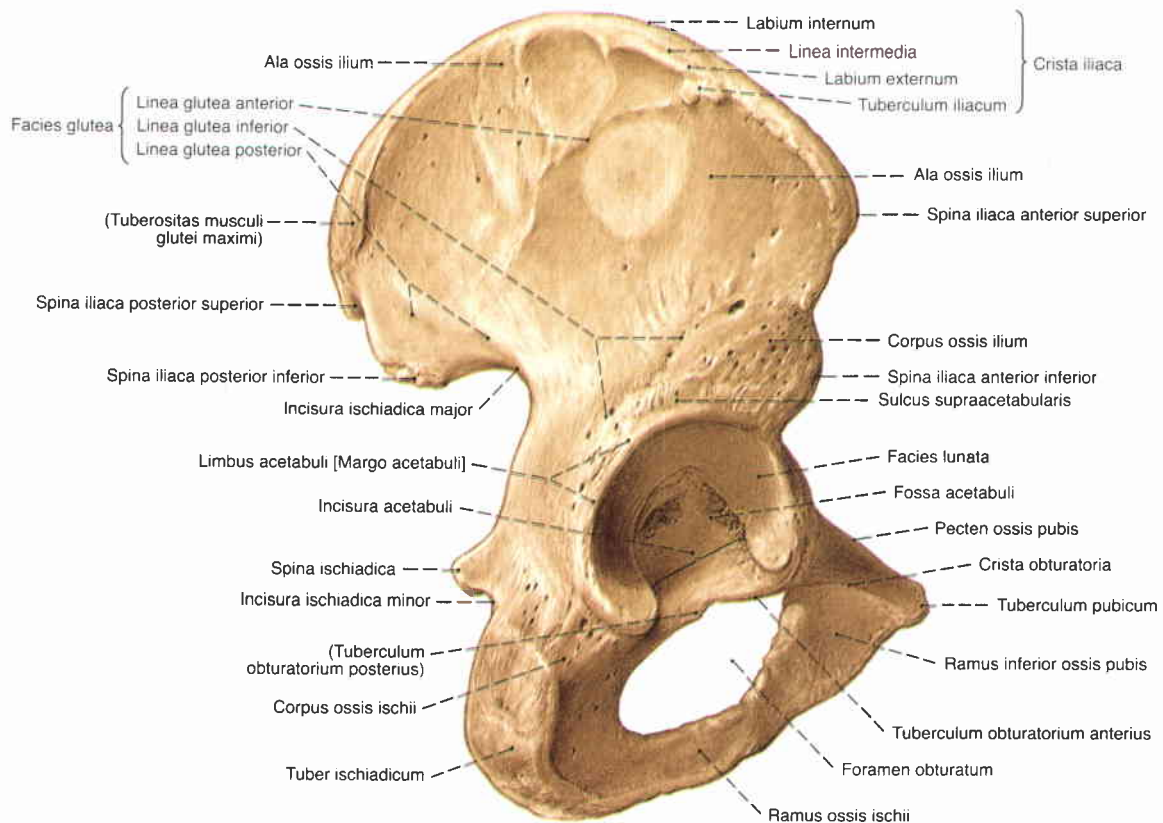


Fig. 1167 Hip bone, Os coxae; dorsolateral view (r., 50%).

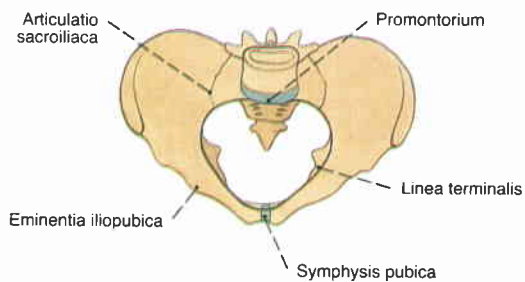


Fig. 1168 Pelvis, Pelvis; form of the pelvic inlet in the male; superior view.

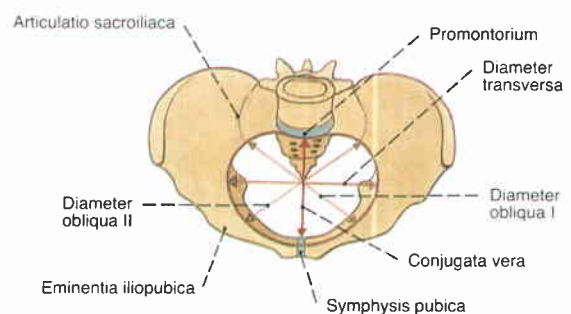


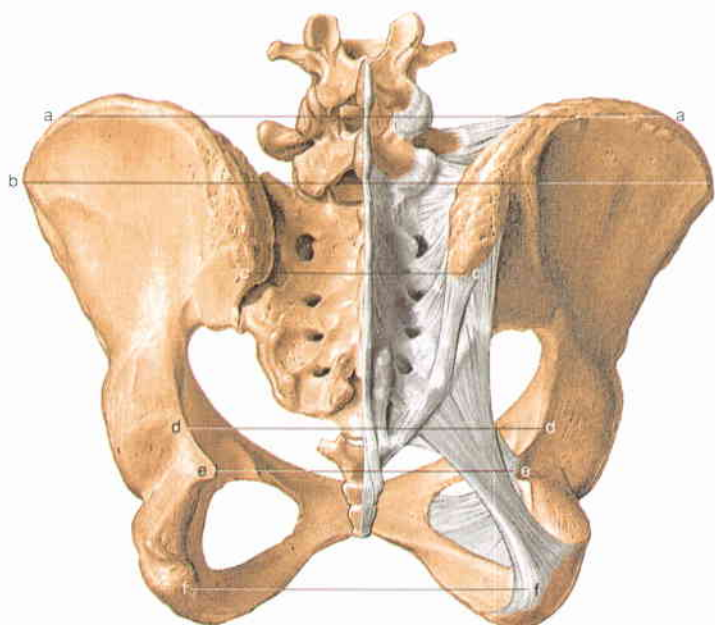
Fig. 1169 Pelvis, Pelvis; form and measurements of the pelvic inlet in the female; superior view.

## Differences between the male and female pelvis

In the male the inlet of the pelvis is clearly narrowed by the promontorium of the Os sacrum. The female pelvis has a more oval-shaped inlet. The rami of the Os pubis form a right angle in the male, Angulus subpubicus, but an arch in the female,

Arcus pubicus. The lateral parts of the pelvis are flatter and broader in the female. The maximum diameter of the Foramen obturatum is found in the transverse plane in the female, but in the vertical plane in the male.



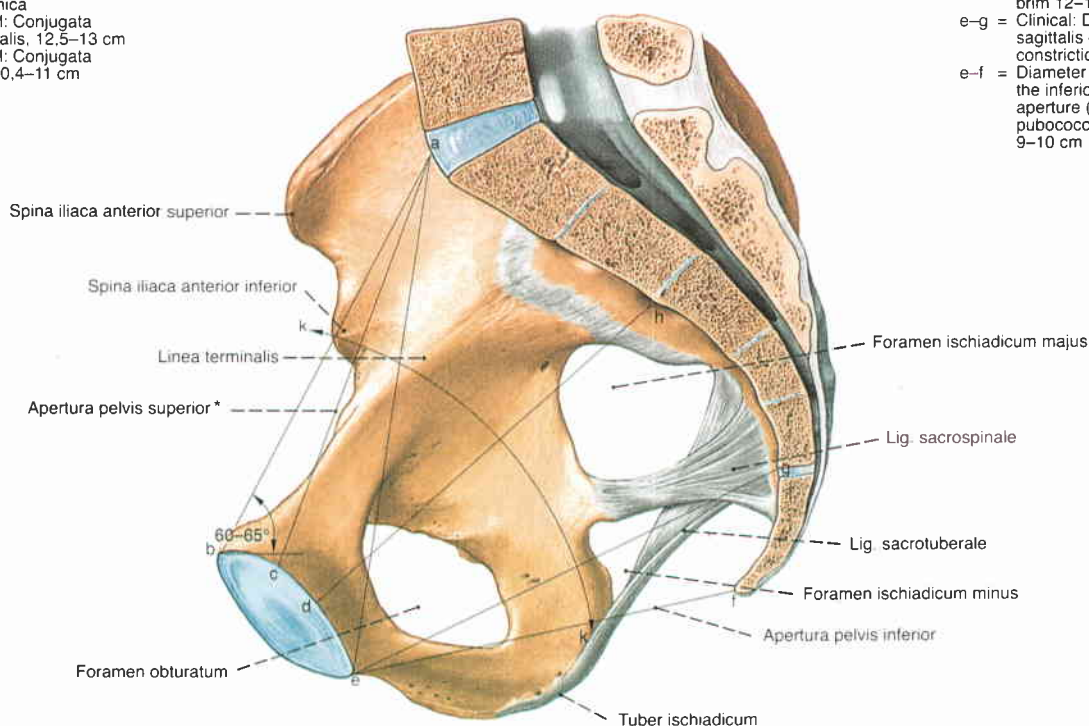


- a-a = Crestal distance,  
Distantia intercristalis  
29–29 cm\*
- b-b = Anterior spinal distance,  
Distantia interspinosa  
anterior 25–26 cm\*
- c-c = Posterior spinal distance,  
Distantia interspinosa  
posterior (width of the  
sacrum) 10 cm
- \* Due to perspective  
reasons the crestal  
distance appears shorter  
than the spinal distance

**Fig. 1170** Pelvis, Pelvis;  
various measurements of the pelvis in the female;  
dorsal view.

- d-d = Diameter transversa of  
the pelvic brim  
(= interacetabular line)  
12–12,5 cm
- e-e = Diameter transversa of  
the pelvic constriction  
(= interspinal line)  
10,5 cm
- f-f = Diameter transversa of  
the inferior pelvic aperture  
(= tuberal diameter)  
11–12 cm

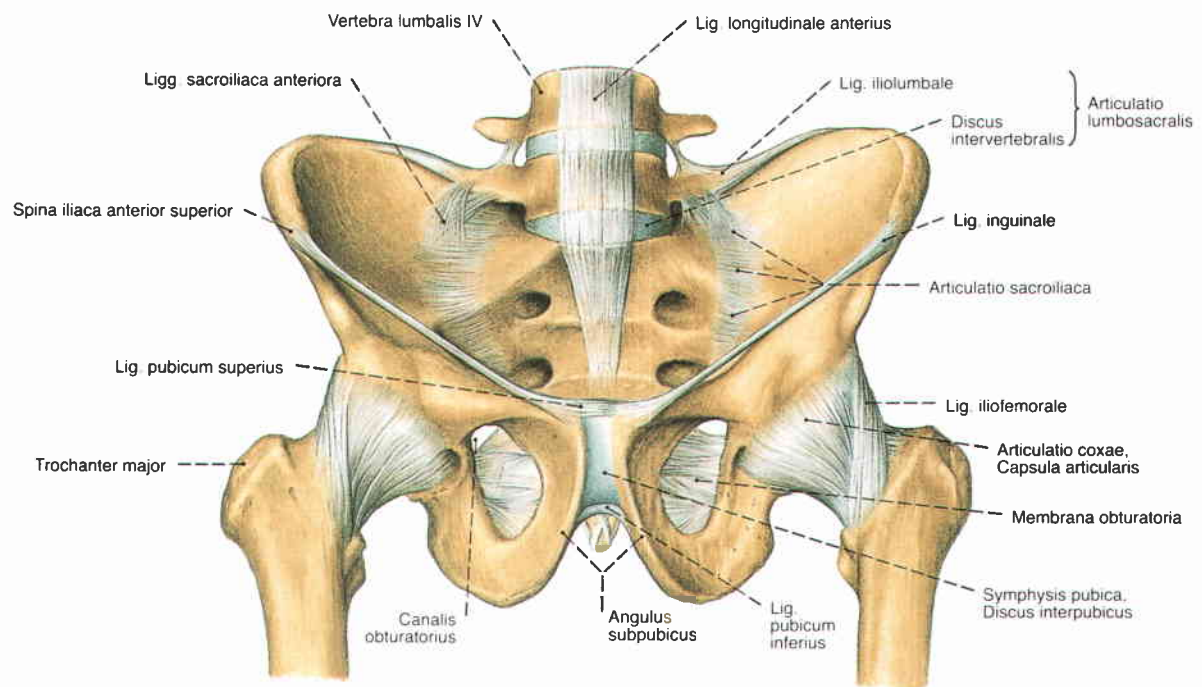
- k-k = Pelvic axis, Axis pelvis
- a-b = Clinical: Conjugata  
anatomica
- a-e = Clinical: Conjugata  
diagonalis, 12,5–13 cm
- a-c = Clinical: Conjugata  
vera, 10,4–11 cm



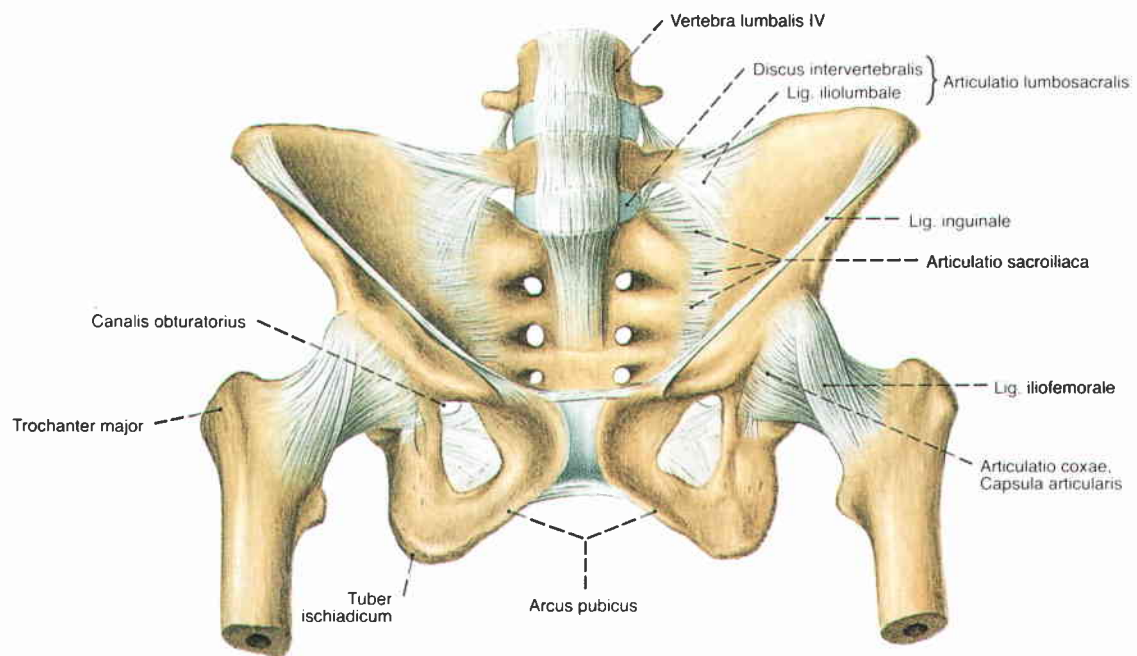
- h-d = Clinical: Diameter  
sagittalis of the pelvic  
brim 12–12,5 cm
- e-g = Clinical: Diameter  
sagittalis of the pelvic  
constriction 11–11,5 cm
- e-f = Diameter sagittalis of  
the inferior pelvic  
aperture (= Distantia  
pubococcygea)  
9–10 cm

**Fig. 1171** Pelvis, Pelvis;  
various measurements of the pelvis in the female; median section;  
medial view (r.).

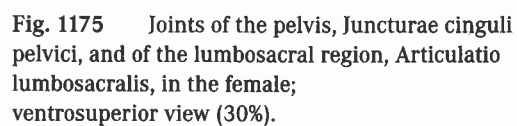
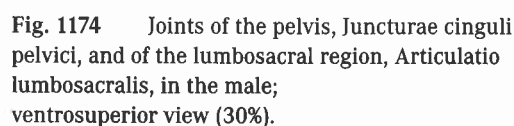
\* The Linea terminalis forms the upper margin of the pelvic inlet - also called pelvic brim (Apertura pelvis superior). Line a-c shows the plane of this inlet. The pelvic outlet (Apertura pelvis inferior) is bounded by the tip of the coccygis, the ischial tuberosities, the rami of the ischium and the inferior pubic rami.



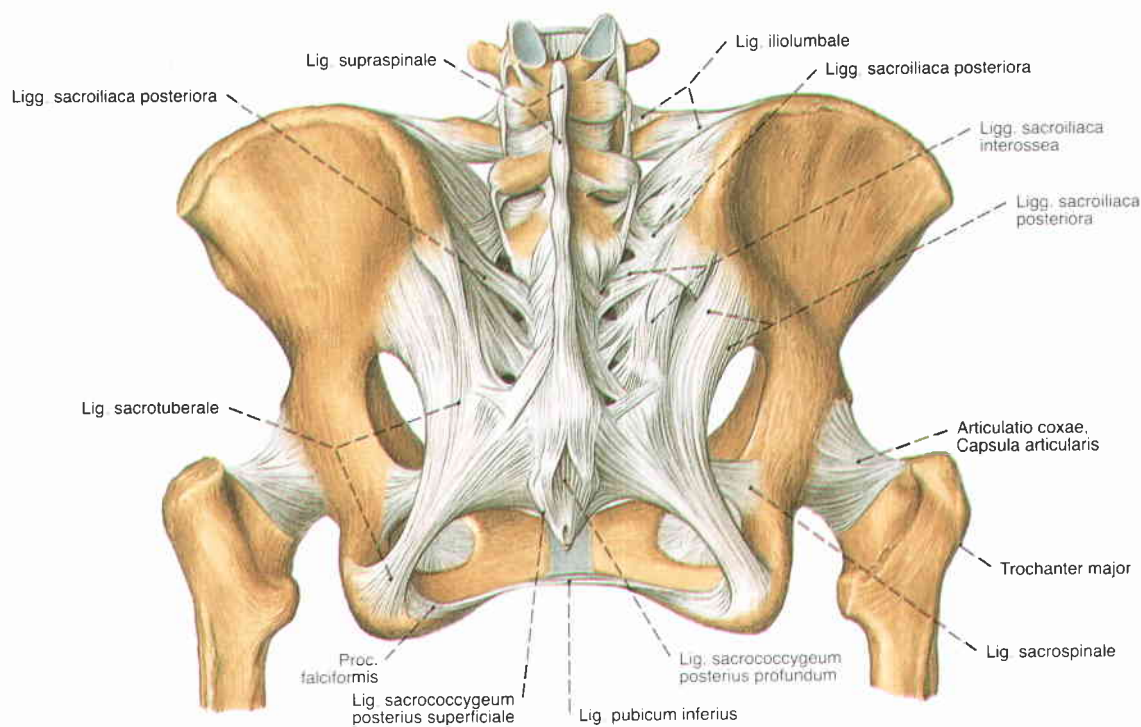
**Fig. 1172** Joints of the pelvis, *Juncturae cinguli pelvici*, and of the lumbosacral region, *Articulatio lumbosacralis*, in the male; ventroinferior view (30%).



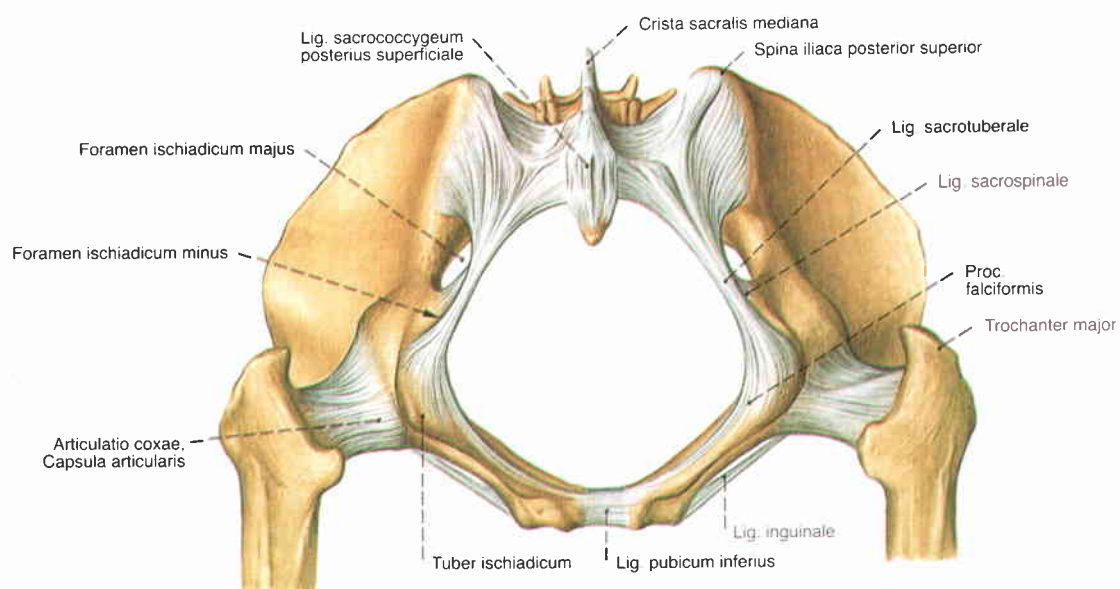
**Fig. 1173** Joints of the pelvis, *Juncturae cinguli pelvici*, and of the lumbosacral region, *Articulatio lumbosacralis*, in the female; ventroinferior view (30%).



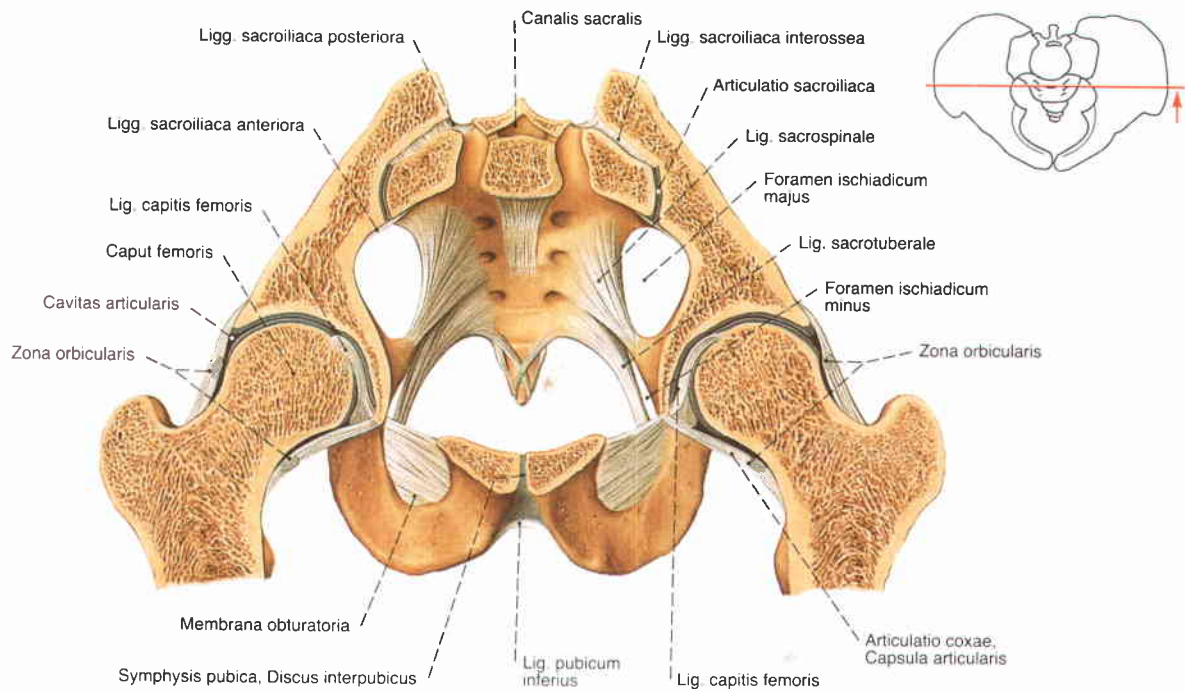




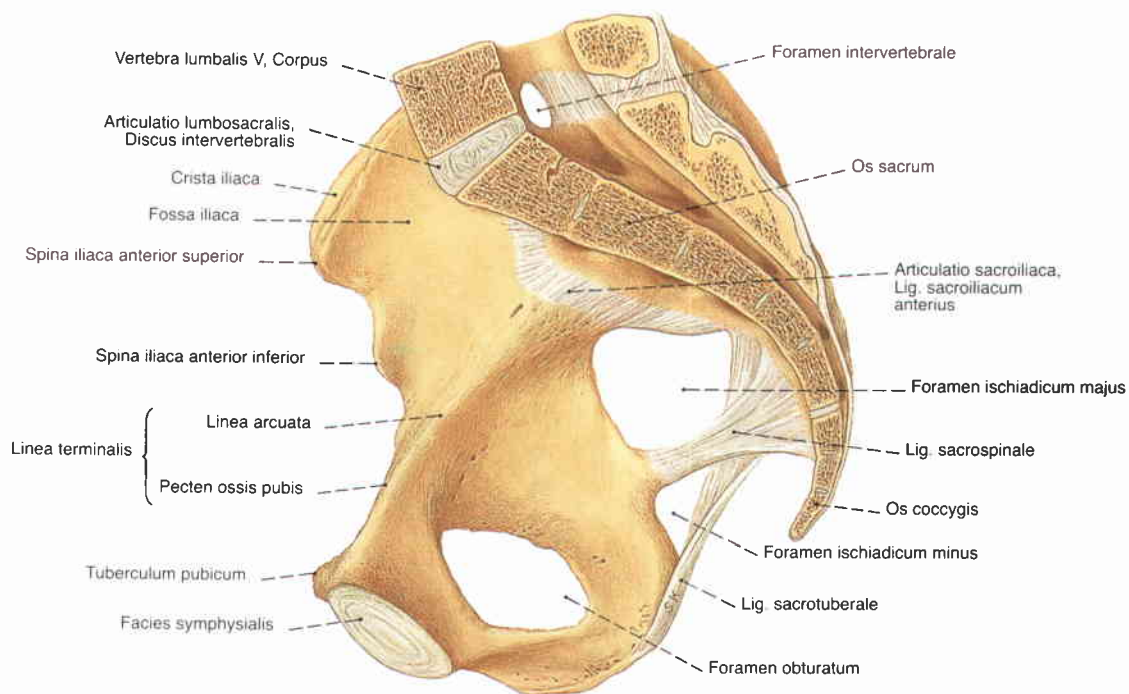
**Fig. 1176** Joints of the pelvis, *Juncturae cinguli pelvici*, and of the lumbosacral region, *Articulatio lumbosacralis*, in the female; posterior view (30%).



**Fig. 1177** Joints of the pelvis, *Juncturae cinguli pelvici*, in the female; inferior view (30%).

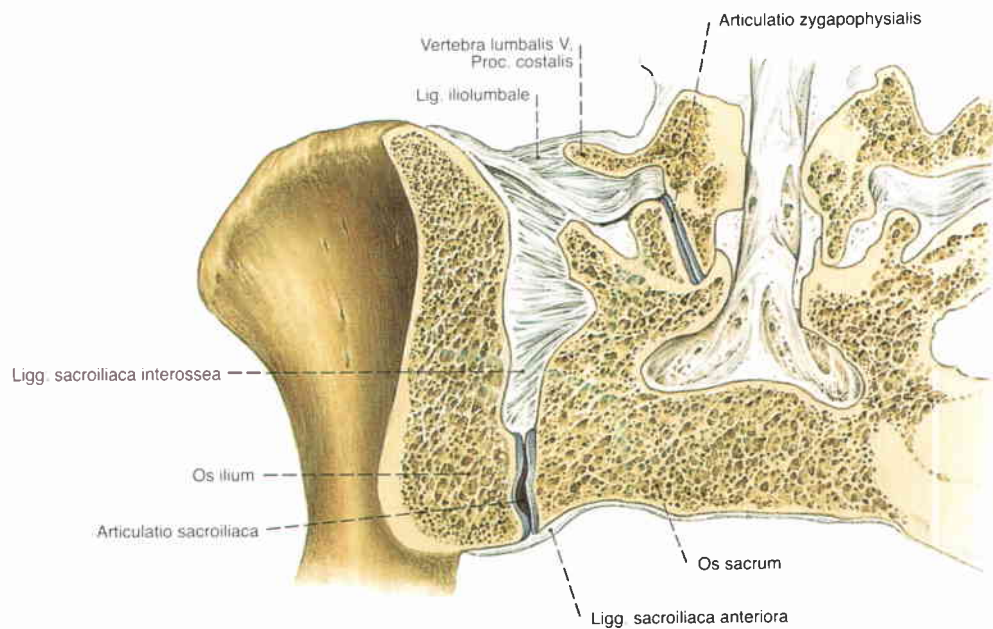


**Fig. 1178** Joints of the pelvis, Juncturae cinguli pelvici, in the female; frontal section through the centre of the acetabulum; ventral view (30%).

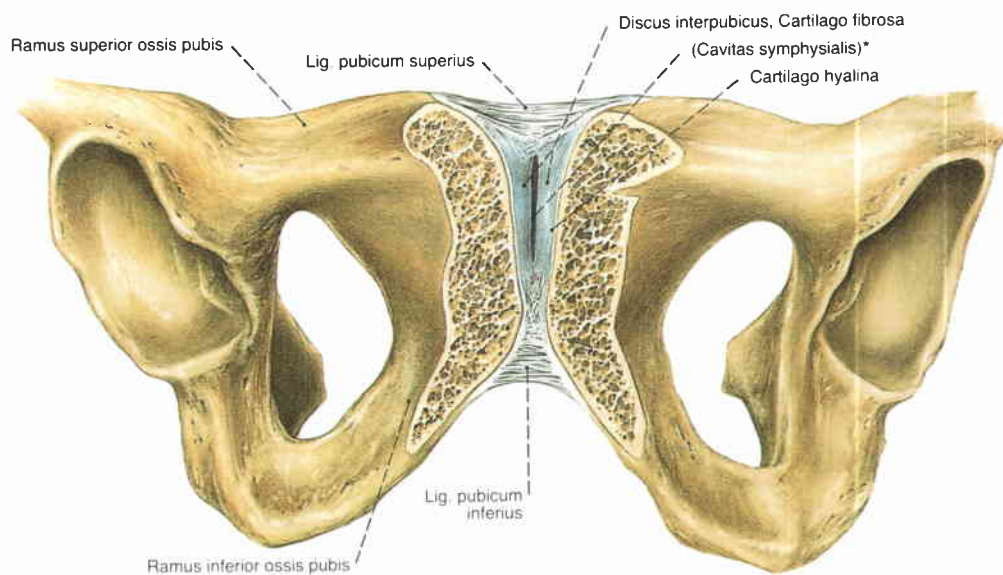
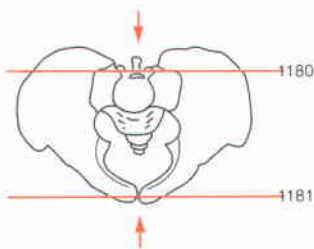


**Fig. 1179** Joints of the pelvis, Articulationes cinguli pelvici, and of the lumbosacral region, Articulatio lumbosacralis, in the female; median section; medial view (35%).

Usually the anterior margin of the lowest intervertebral disc is the most prominent point of the posterior boundary of the pelvic inlet. The most ventral point of the sacral bone, which is also visible on radiographs, is called the promontory.



**Fig. 1180** Sacroiliac joint, Articulatio sacroiliaca; frontal section; ventral view (L., 45%).

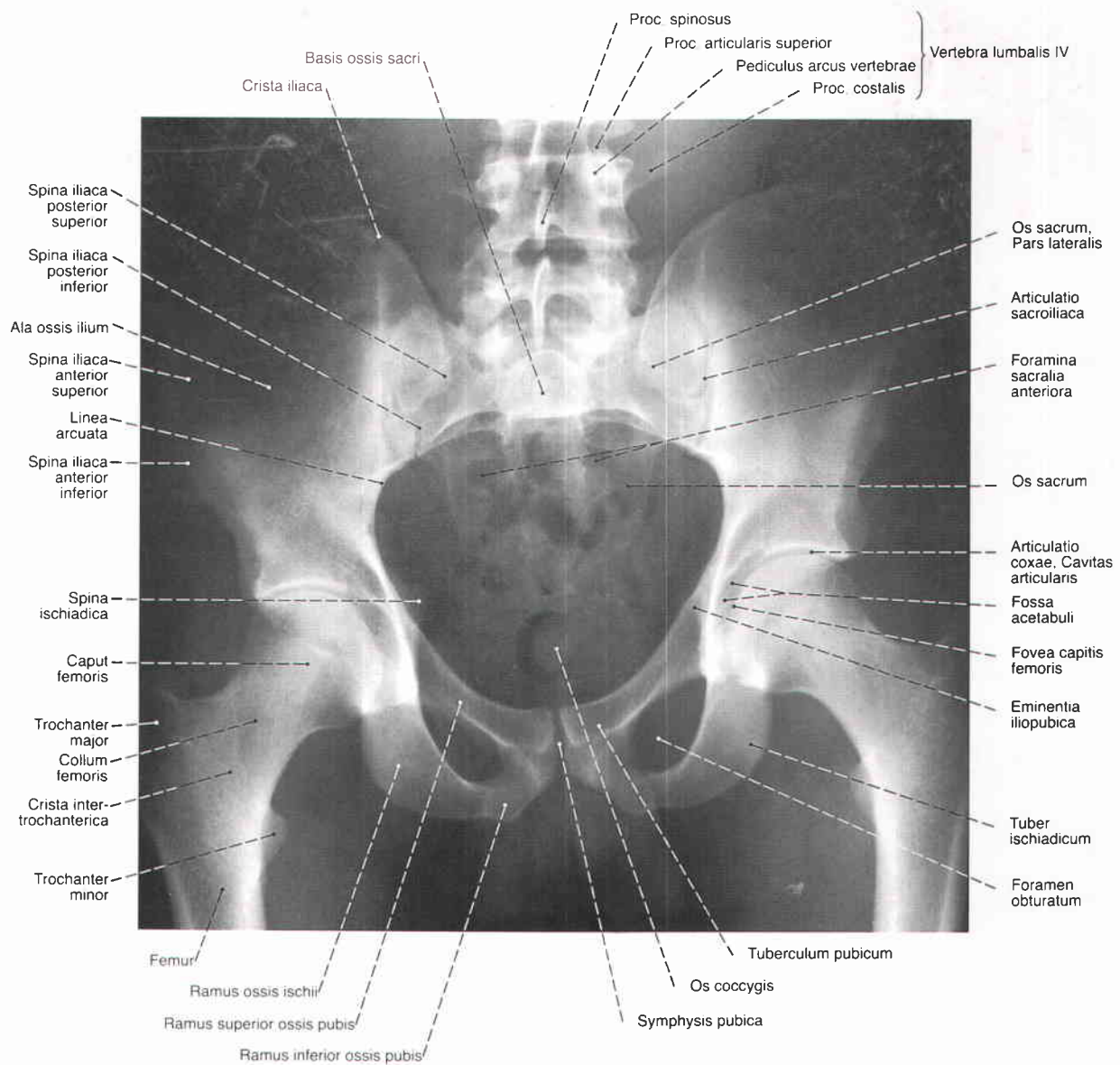


**Fig. 1181** Pubic symphysis, Symphysis pubica; oblique section along the longitudinal axis of the pubic symphysis, slightly inclined to the frontal plane; ventroinferior view (60%).

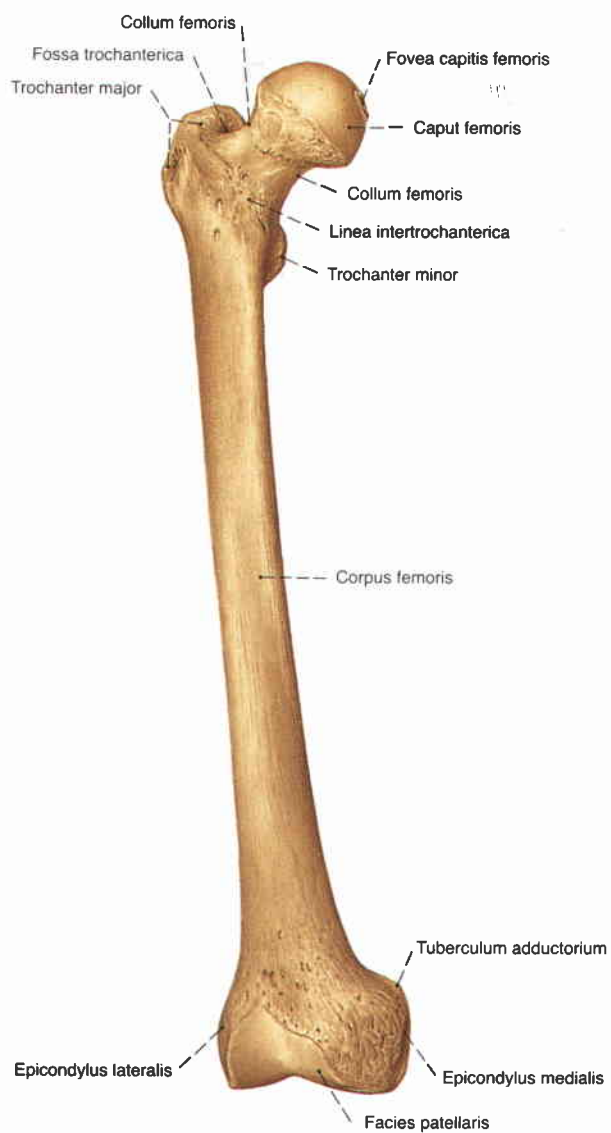
The interpubic disc consists of fibrous cartilage with exception of the surface adjacent to the symphyseal sides of both pubic bones which are hyaline cartilaginous.

\* From the 10th year of life this longitudinal flat cleft occurs.

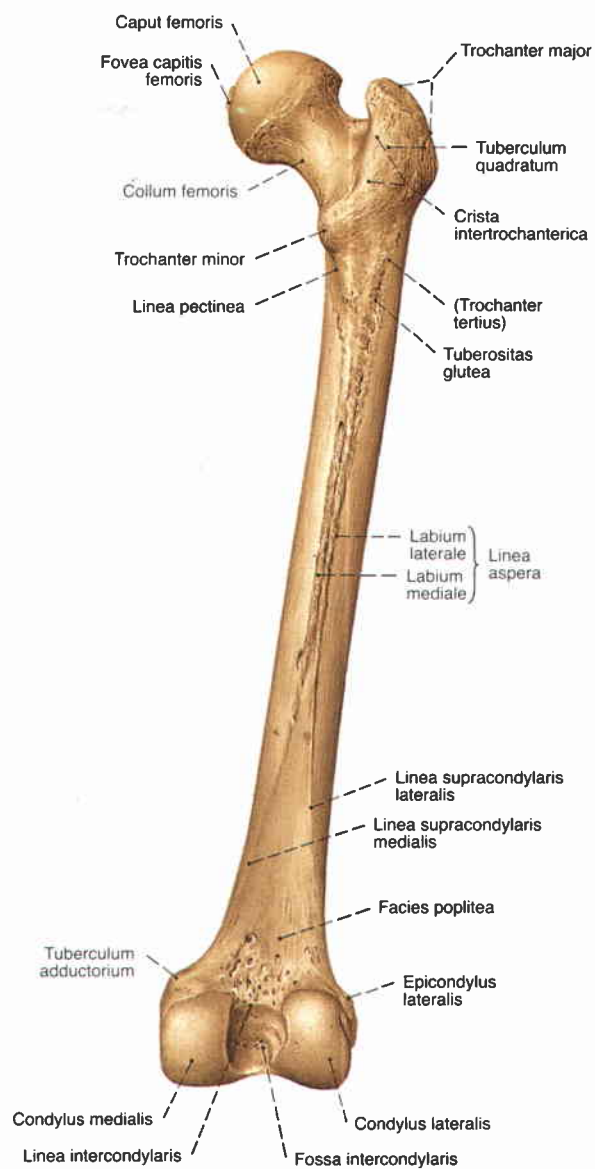




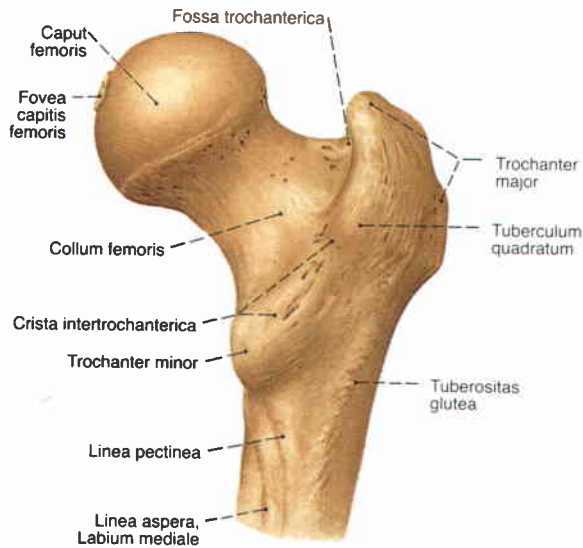
**Fig. 1182** Pelvis, Pelvis, of a male;  
AP-radiograph; the patient is standing upright;  
the central beam is focused on the third sacral segment.



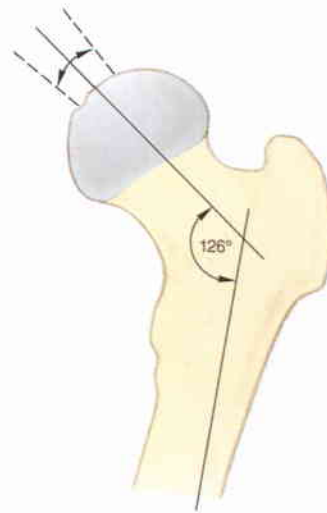
**Fig. 1183** Femur, Femur;  
ventral view (r., 30%).



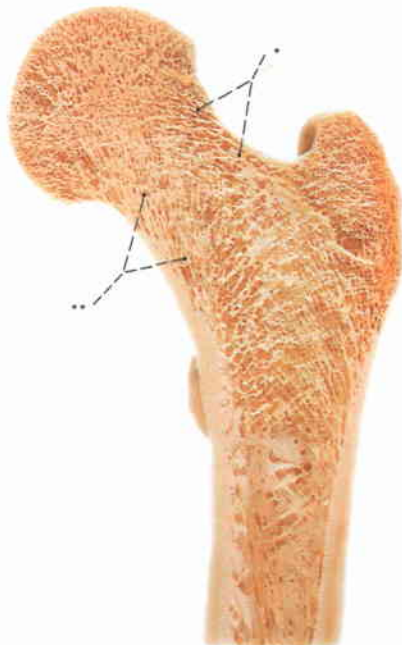
**Fig. 1184** Femur, Femur;  
dorsal view (r., 30%).



**Fig. 1185** Femur, Femur;  
proximal end;  
dorsal view (r., 60%).



**Fig. 1186** Femur, Femur;  
variation of the angle of the femoral neck;  
dorsal view (r.).  
This angle is also called the collodiaphyseal angle.  
It measures 150° in the neonate and about 126° in the adult.

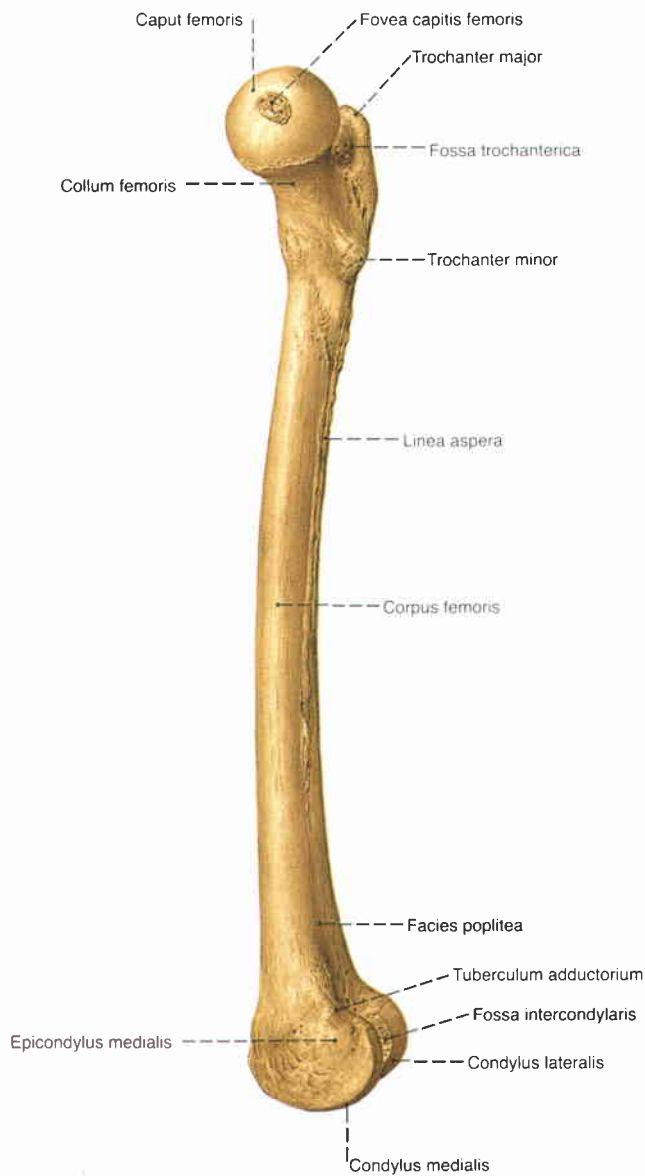


**Fig. 1187** Femur, Femur;  
structure of the trabecular bone in the Coxa valga (great  
collodiaphyseal angle); the bone has been sectioned in  
the plane of antetorsion of the femoral neck (60%).  
The lateral plates (\*) of trabecular bone ("tensile system")  
are hardly developed, the medial plates (\*\*) of trabecular  
bone ("compressive system") are well developed to transmit  
forces from the femoral head to the neck and shaft.

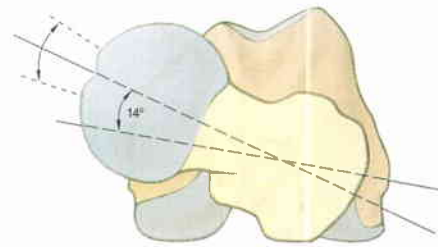


**Fig. 1188** Femur, Femur;  
structure of the trabecular bone in the Coxa vara (small  
collodiaphyseal angle); the bone has been sectioned in  
the plane of antetorsion of the femoral neck (60%).  
The lateral plates (\*) of trabecular bone ("tensile system") are  
well developed, the medial plates (\*\*) of trabecular bone  
("compressive system") are hardly developed. The cortical bone  
on the interior side of the femoral neck is particularly thick  
reflecting high bending stress.

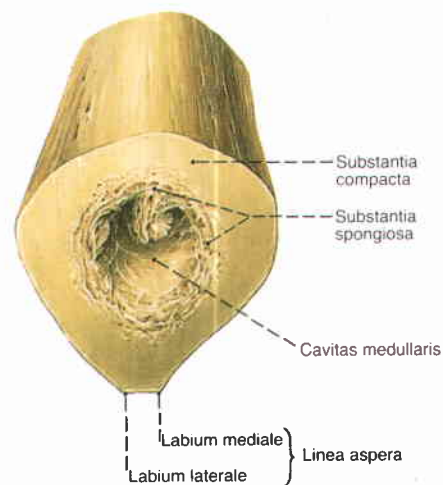




**Fig. 1189** Femur, Femur;  
medial view (r., 30%).



**Fig. 1190** Femur, Femur;  
variation of the angle of antetorsion; the proximal end  
of the femur has been projected over the distal end;  
proximal view (r., 70%).  
In infants the angle of antetorsion measures  
approximately 30°, in adults about 14°.

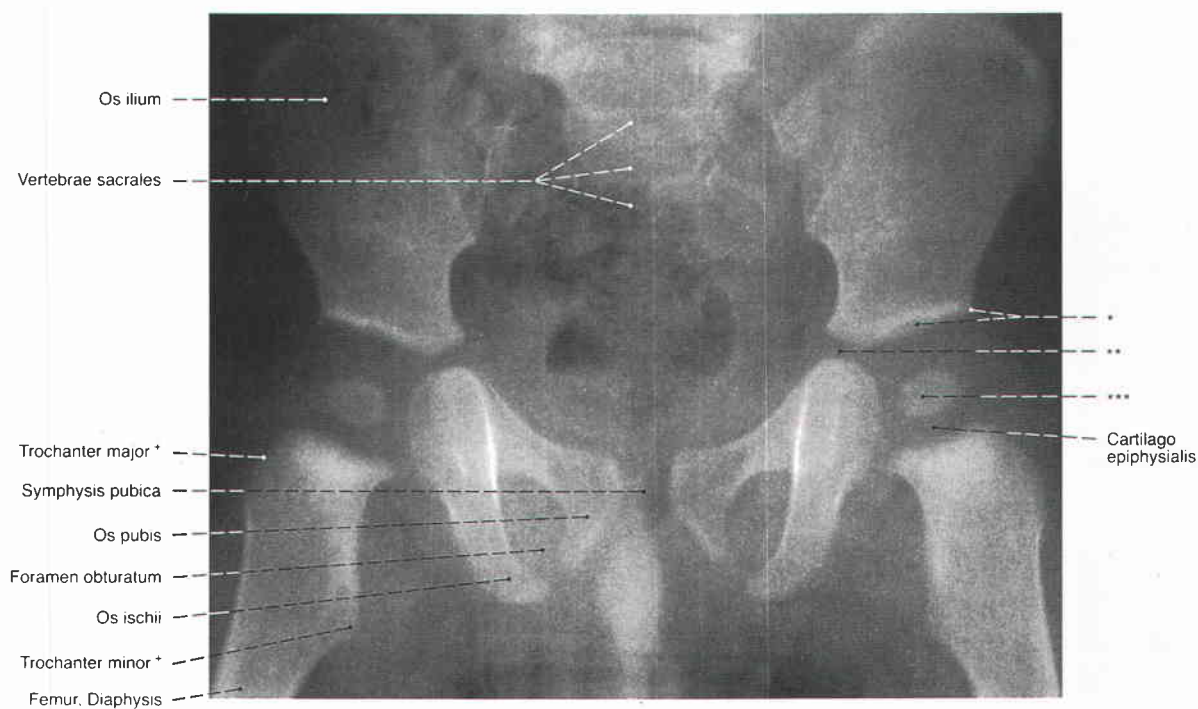


**Fig. 1191** Femur, Femur;  
cross section through the middle of the diaphysis;  
distal view (r.)



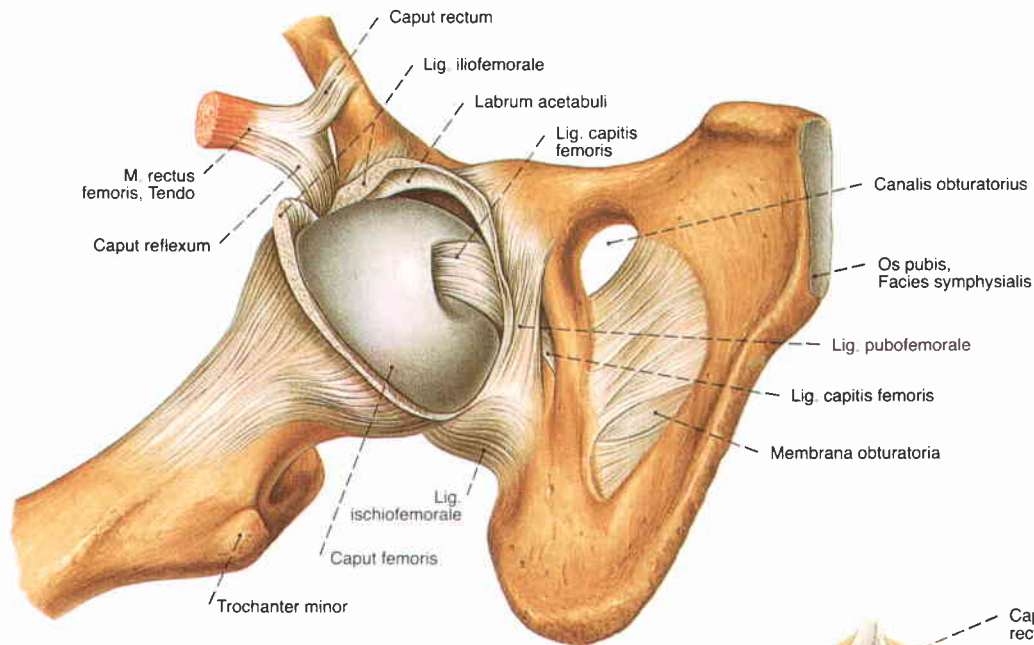
**Fig. 1192** Pelvis, Pelvis, and femur, Femur;  
AP-radiograph of a female fetus born prematurely in the eighth  
month of pregnancy.

- \* osseous roof of the acetabulum (acetabular roof)
- \*\* Y-shaped junction in the base of the acetabular fossa
- \*\*\* The ossification centre in the head of the femur appears between the third and fifth months of life.
- + At this age both greater trochanters are only seen as small protuberances of the bone of the diaphysis.

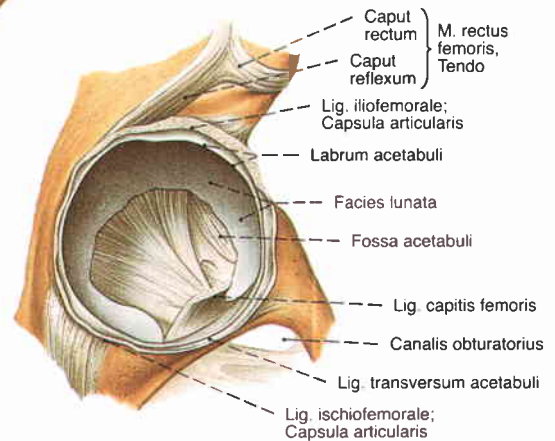


**Fig. 1193** Pelvis, Pelvis, and femur, Femur;  
AP-radiograph of a 12-month-old male.

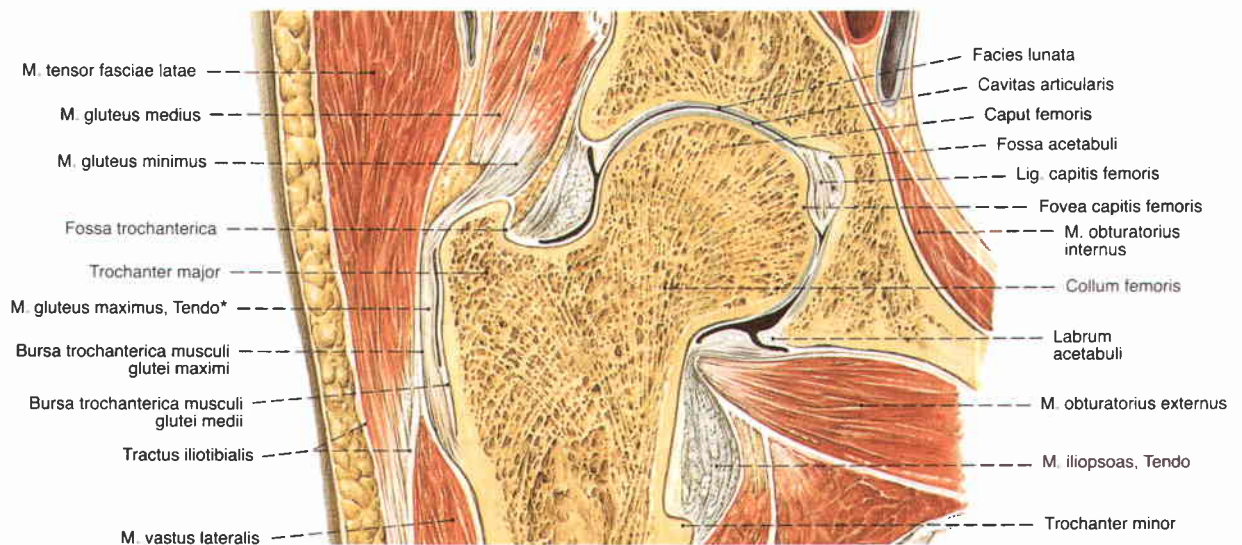
- \* osseous roof of the acetabulum (acetabular roof)
- \*\* Y-formed junction in the base of the acetabular fossa
- \*\*\* ossification centre of the epiphysis of the head of the femur
- + At this age both greater trochanters become apparent only as small protuberances of the bone of the diaphysis.



**Fig. 1194** Hip joint, Articulatio coxae; the joint capsule has been exposed and the head of the femur has been partially disarticulated; laterodistal view (r., 70%).



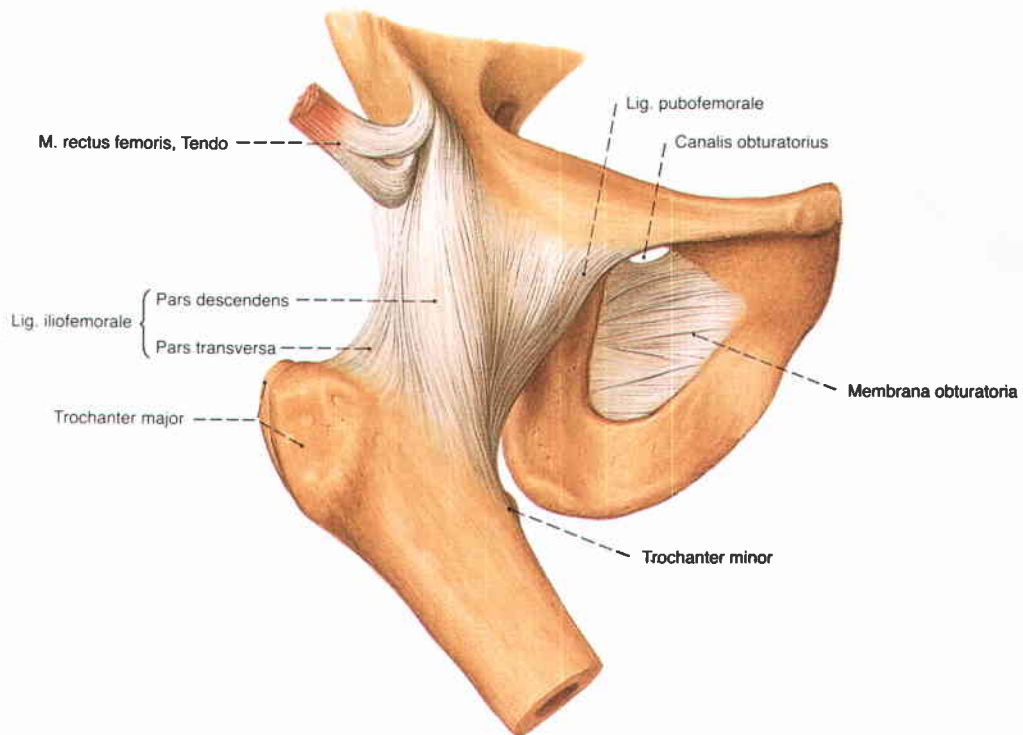
**Fig. 1195** Hip joint, Articulatio coxae; acetabular fossa of the hip joint; the joint capsule has been sectioned and the head of the femur has been exarticulated; laterodistal view (r., 50%).



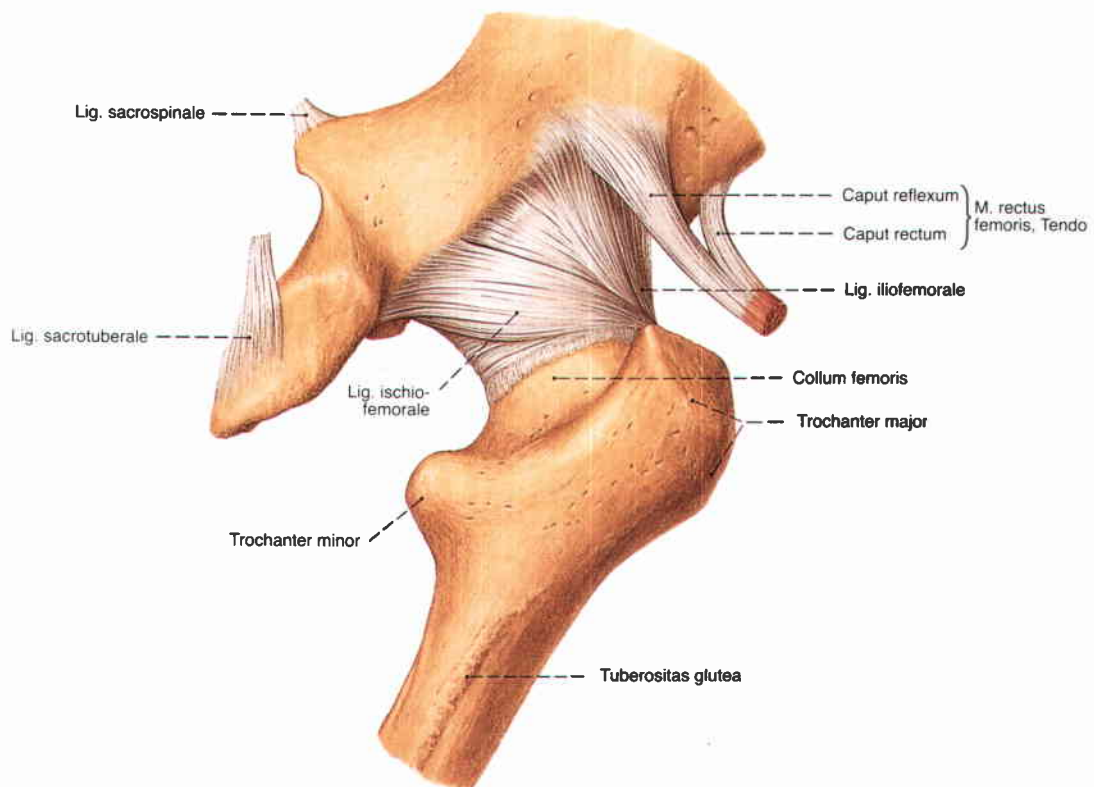
**Fig. 1196** Hip joint, Articulatio coxae; vertical section in a plane corresponding to the angle of antetorsion; ventral view (r., 65%).

\* radiating into the iliotibial tract, Tractus iliotibialis

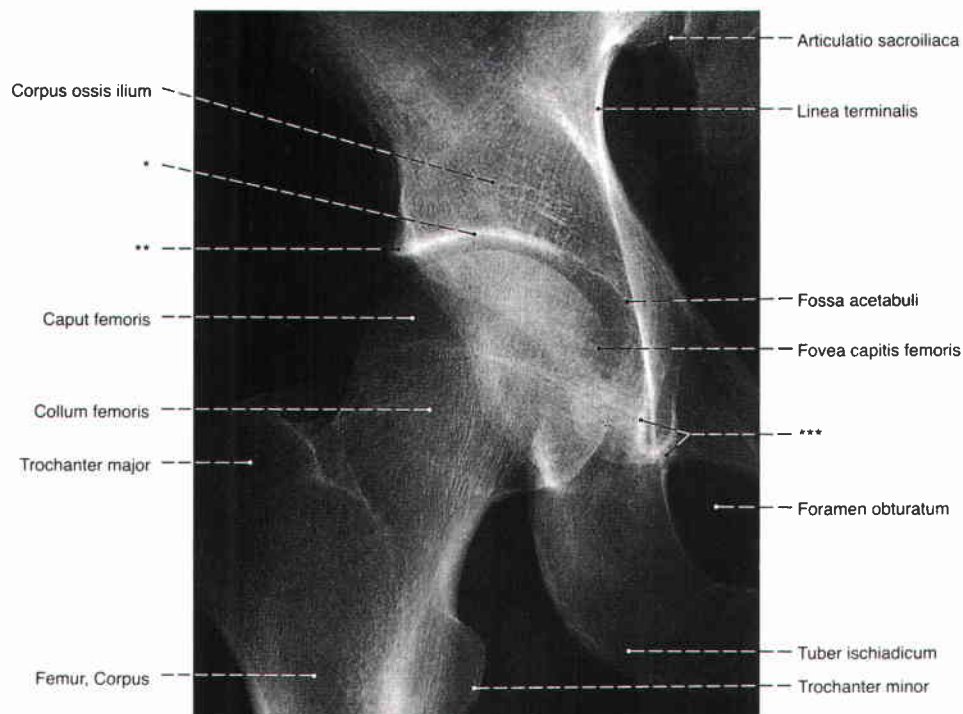




**Fig. 1197** Hip joint, *Articulatio coxae*;  
ventrodistal view (r., 50%).

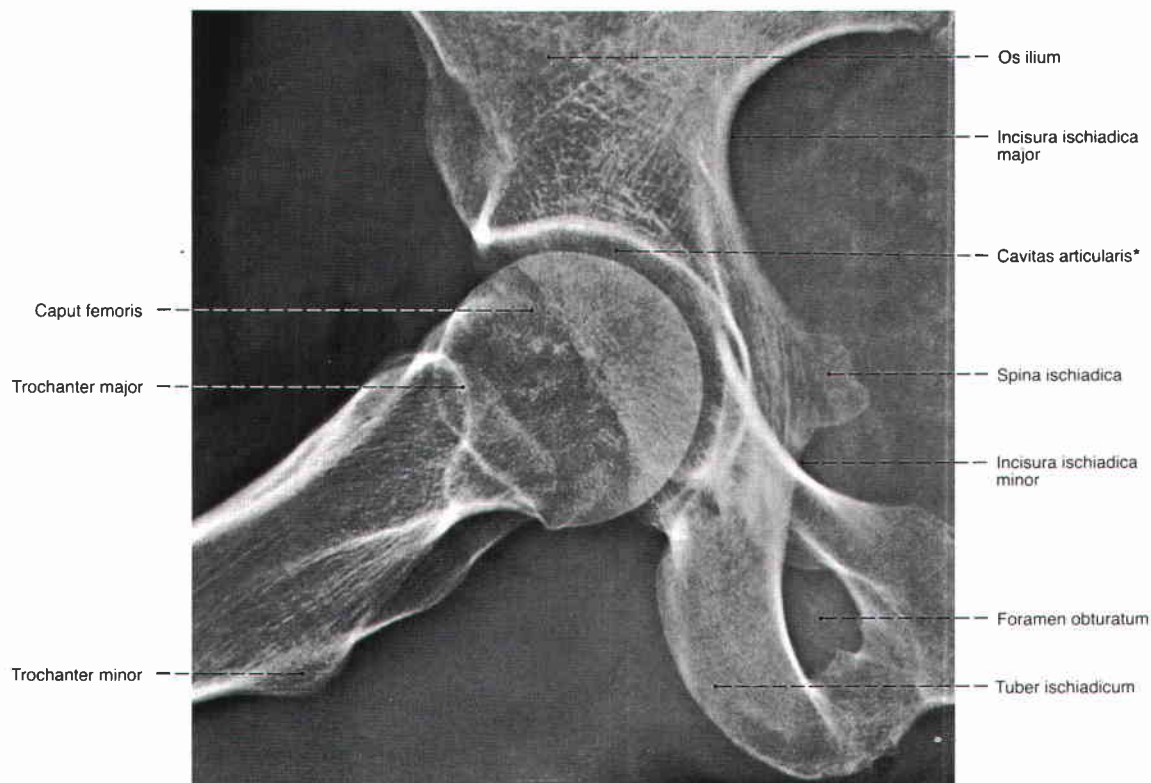


**Fig. 1198** Hip joint, *Articulatio coxae*;  
posterior view (r., 50%).



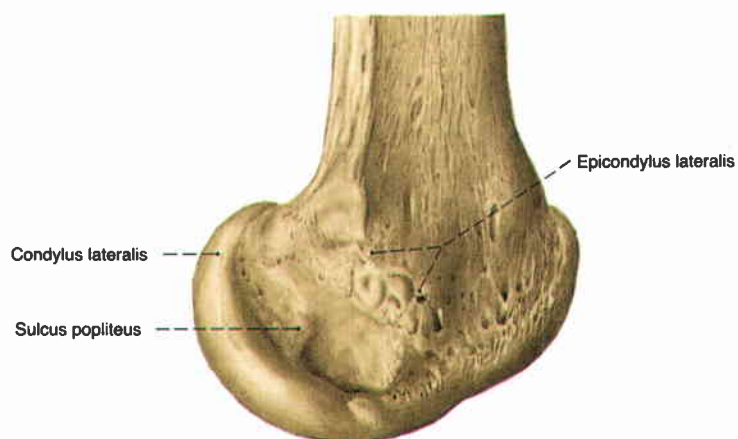
**Fig. 1199** Hip joint, Articulatio coxae;  
AP-radiograph in a standing position.

- \* clinical: acetabular roof, the tangential projection of the lunate surface
- \*\* clinical: most prominent lateral part of the acetabulum
- \*\*\* clinical: KÖHLER's tear-like figure, projection of the acetabular fossa

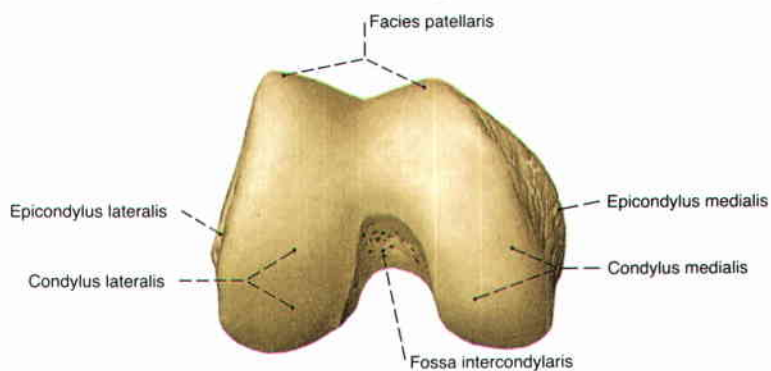


**Fig. 1200** Hip joint, Articulatio coxae;  
AP-radiograph; abduction and flexion of the thigh in a patient  
who is lying on his back (so-called LAUENSTEIN projection).

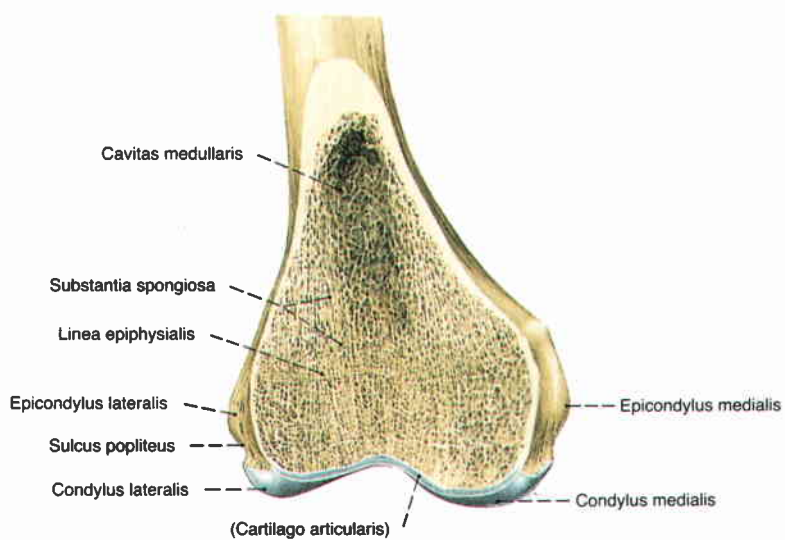
- \* radiological articular space. This space appears wide because the cartilage absorbs hardly any X-rays.



**Fig. 1201** Femur, Femur;  
distal end;  
lateral view (r., 80%).

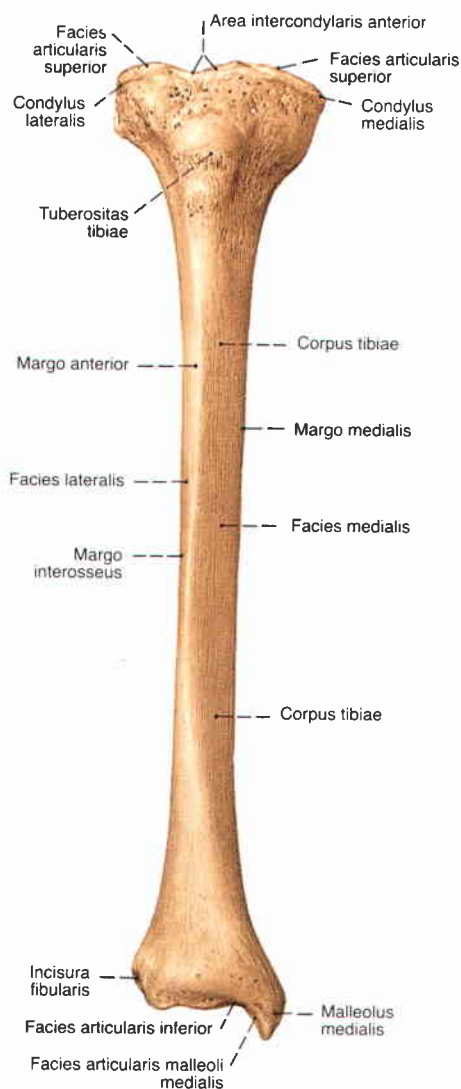


**Fig. 1202** Femur, Femur;  
distal end;  
distal view (r., 50%).

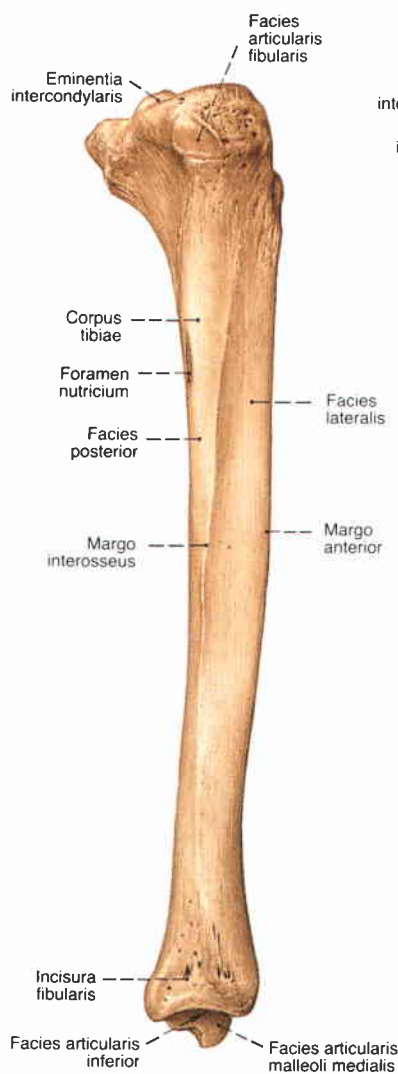


**Fig. 1203** Femur, Femur;  
frontal section through the distal end;  
ventral view (r., 50%).

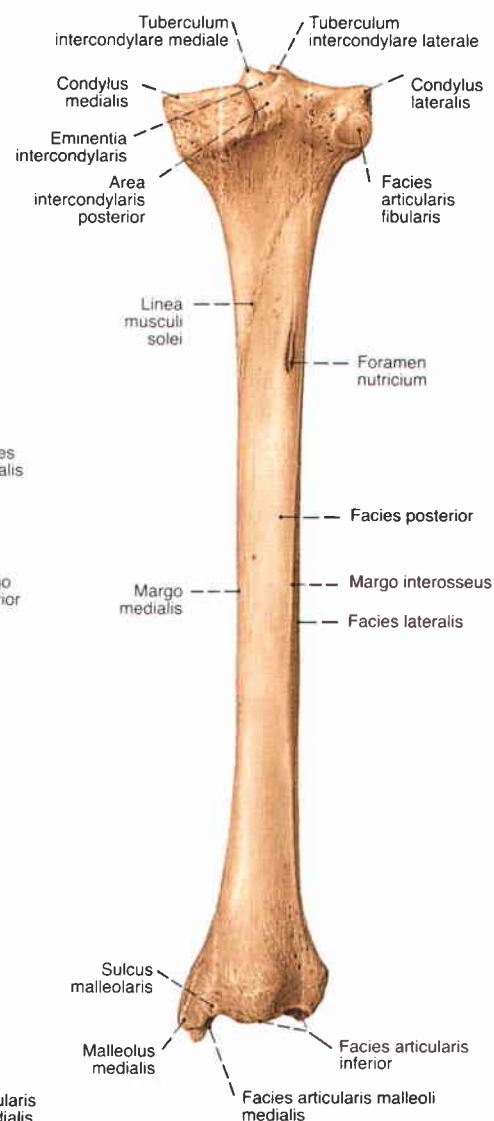




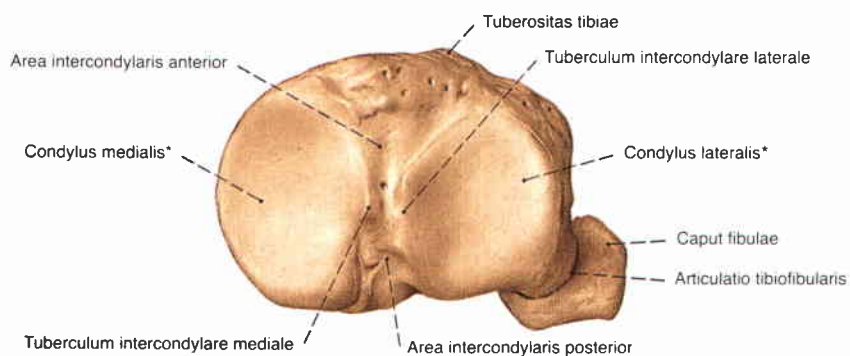
**Fig. 1204** Tibia, Tibia;  
ventral view (r., 35%).



**Fig. 1205** Tibia, Tibia;  
lateral view (r., 35%).

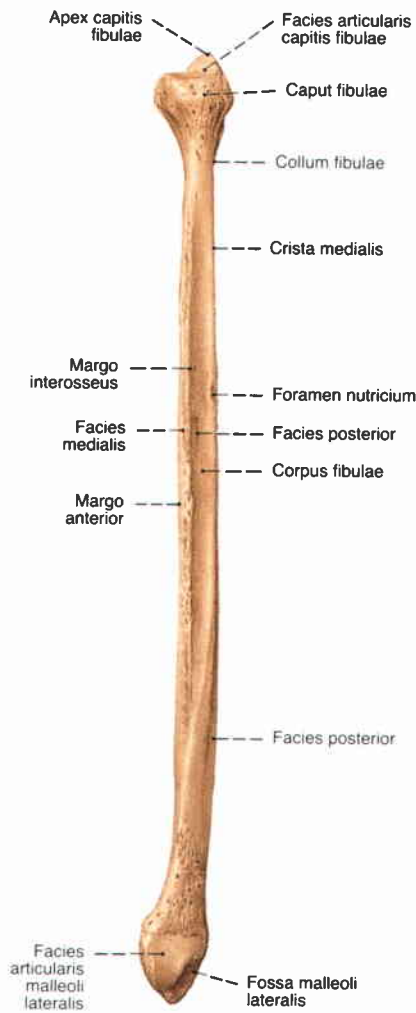


**Fig. 1206** Tibia, Tibia;  
dorsal view (r., 35%).

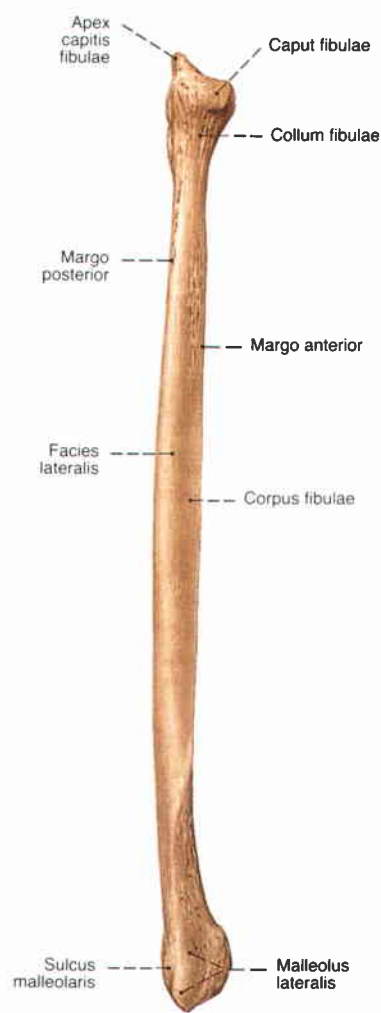


**Fig. 1207** Tibia, Tibia, and fibula, Fibula;  
proximal view (r., 70%).

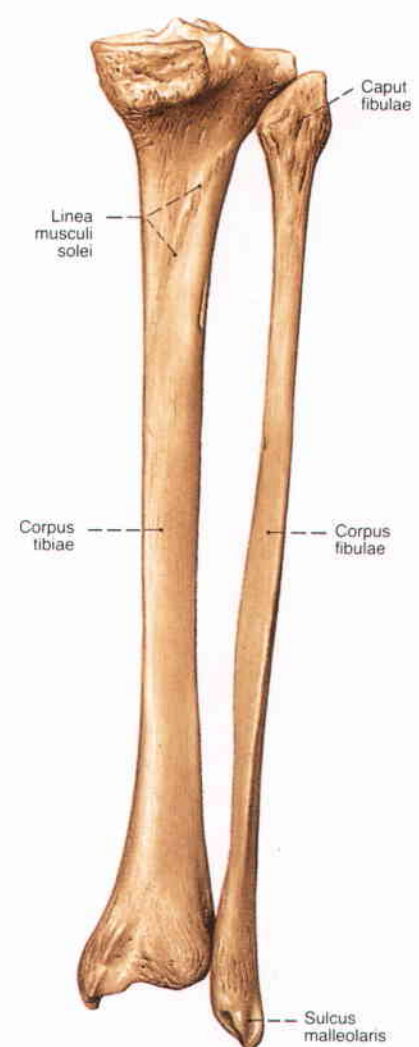
\* The articular surfaces of the condyles taken as a whole are called *Facies articularis superior*.



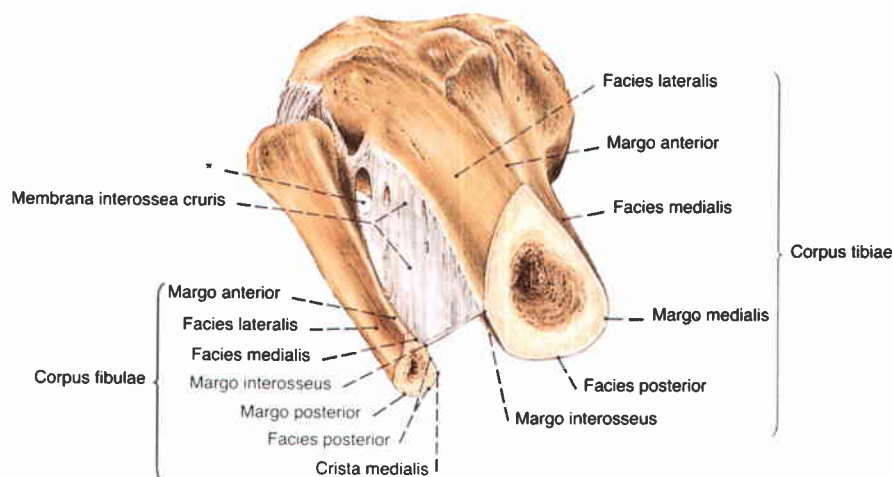
**Fig. 1208** Fibula, Fibula;  
medial view (r., 35%).



**Fig. 1209** Fibula, Fibula;  
lateral view (r., 35%).

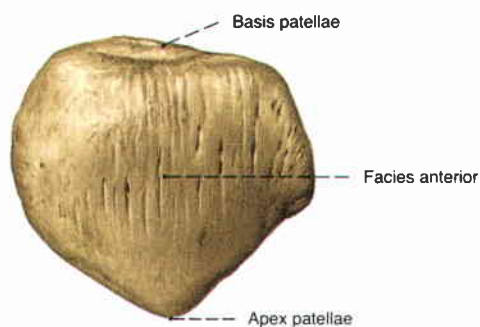


**Fig. 1210** Tibia, Tibia, and  
fibula, Fibula;  
dorsal view (r., 35%).

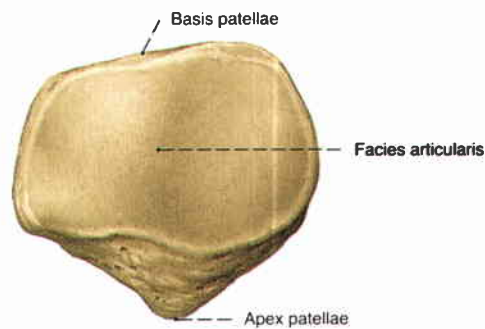


**Fig. 1211** Tibia, Tibia, and fibula, Fibula;  
cross section; with the interosseous membrane of the crus;  
distal view (r., 60%).

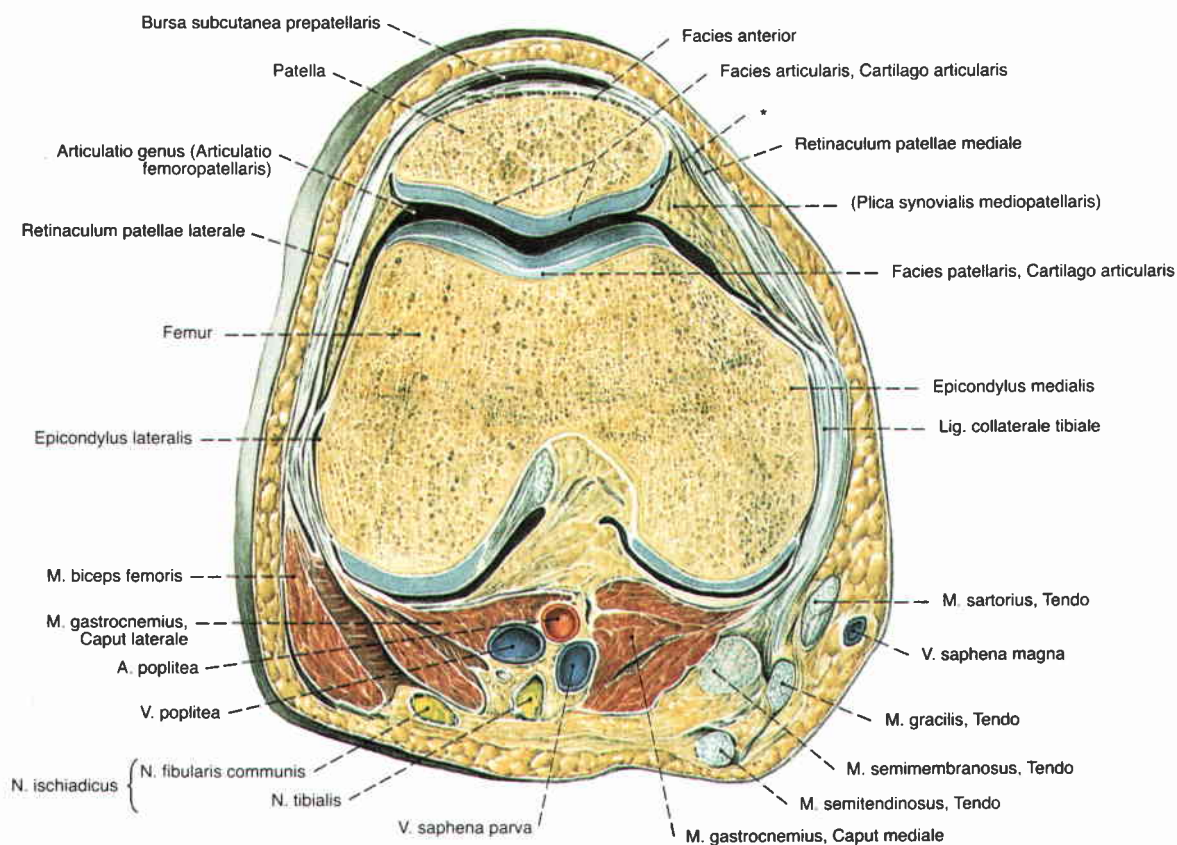
\* opening for the anterior tibial artery



**Fig. 1212** Patella, Patella;  
ventral view (r., 80%).



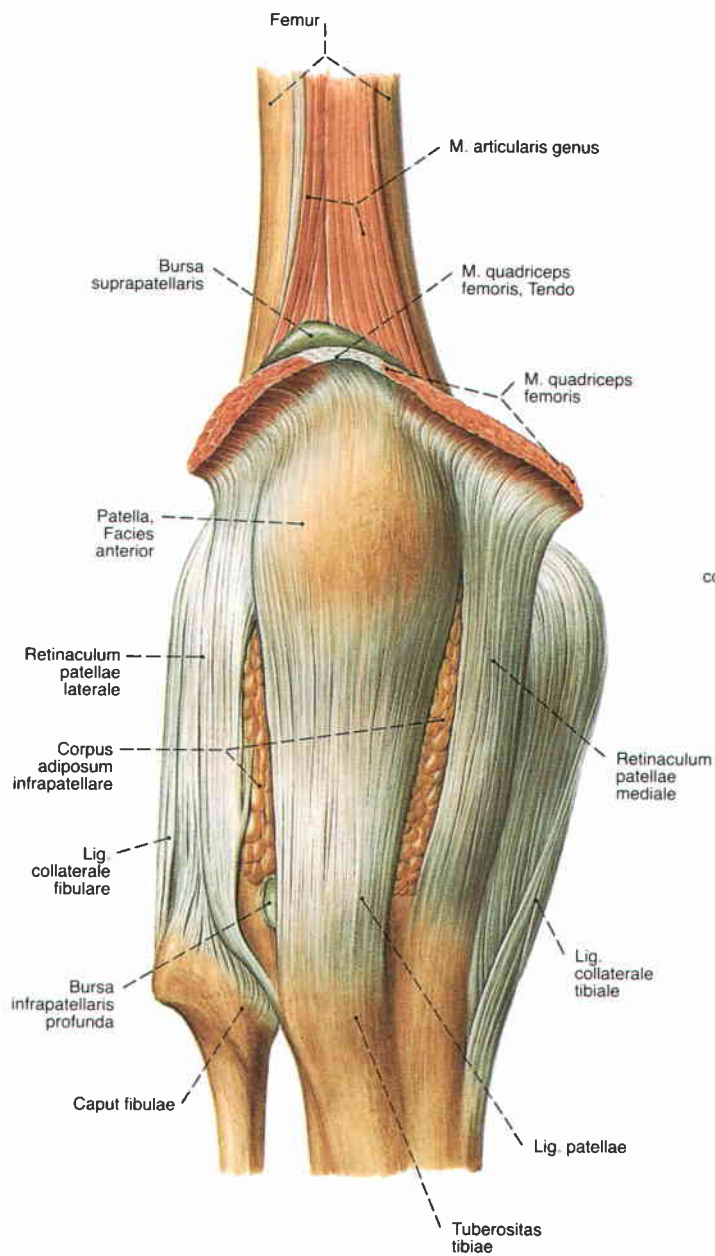
**Fig. 1213** Patella, Patella;  
dorsal view (r., 80%).



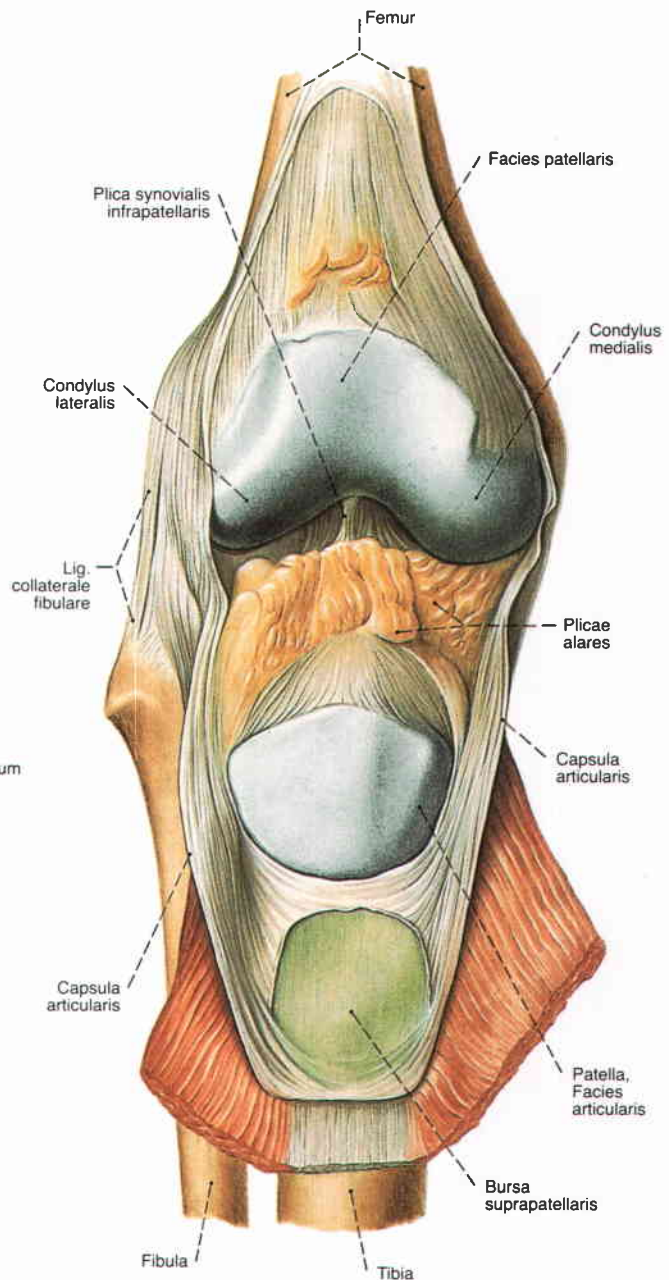
**Fig. 1214** Patella, Patella, and femur, Femur;  
cross section through the knee joint at the level of  
the middle of the femoropatellar joint; knee joint  
in extension;  
distal view (r., 70%).

\* medial border facet

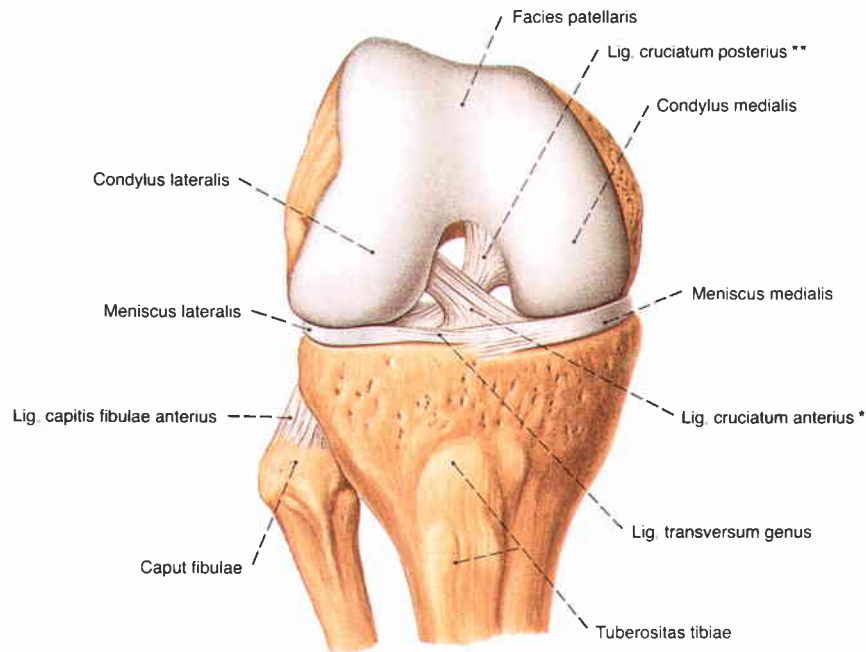




**Fig. 1215** Knee joint, *Articulatio genus*; the joint capsule is intact; ventral view (r., 65%).

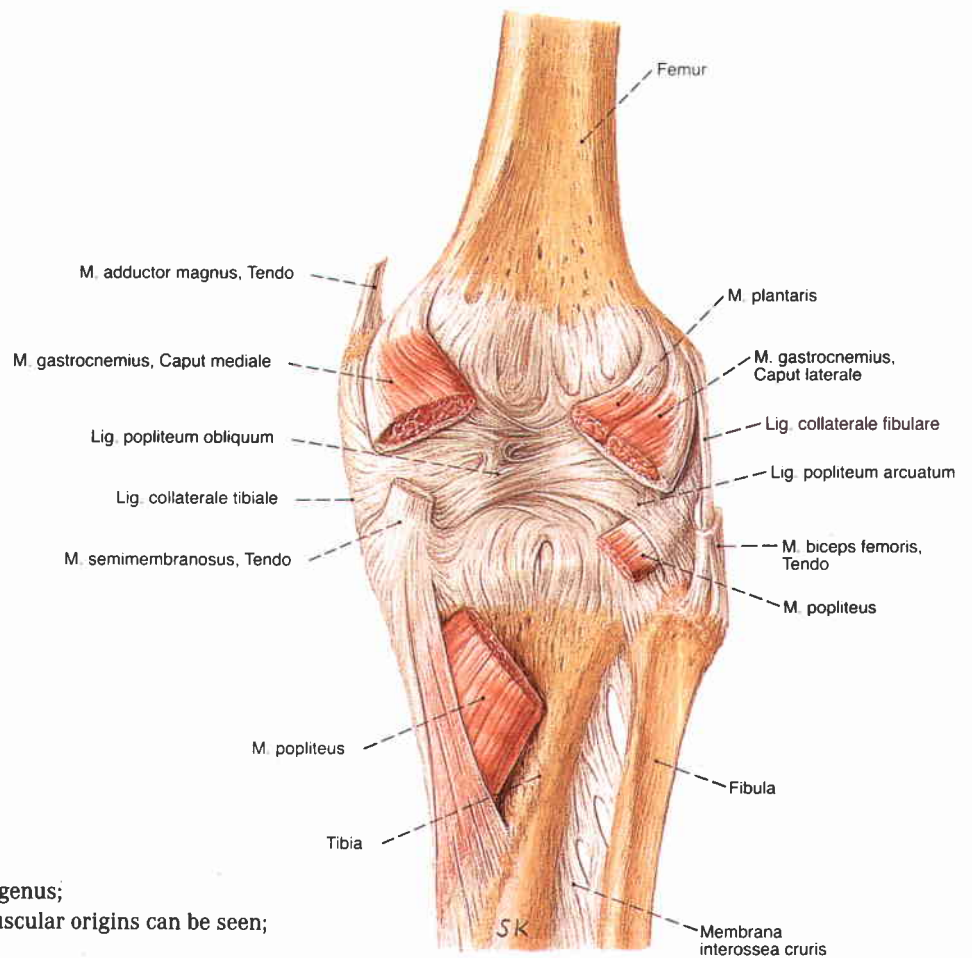


**Fig. 1216** Knee joint, *Articulatio genus*; the ventral part of the joint capsule has been retracted distally, the quadriceps muscle sectioned and the suprapatellar bursa exposed; ventral view (r., 65%).

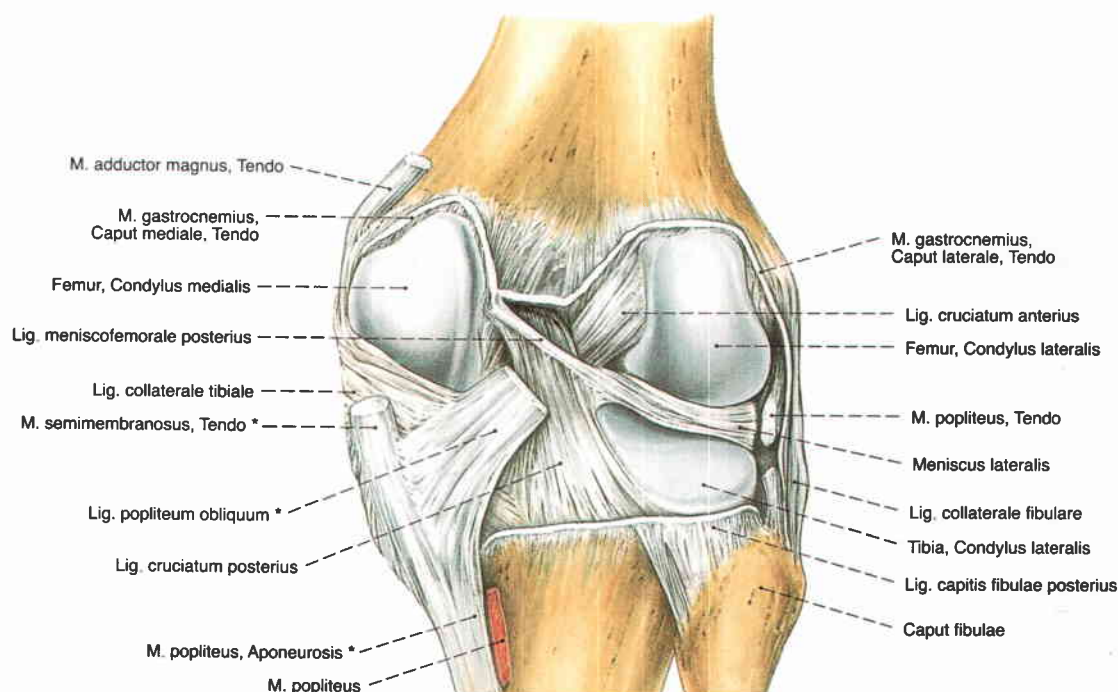


**Fig. 1217** Knee joint, *Articulatio genus*; 90° flexion; the joint capsule and the collateral ligaments have been removed; ventral view (r., 65%).

\* clinical: ACL (= anterior cruciate ligament)  
 \*\* clinical: PCL (= posterior cruciate ligament)

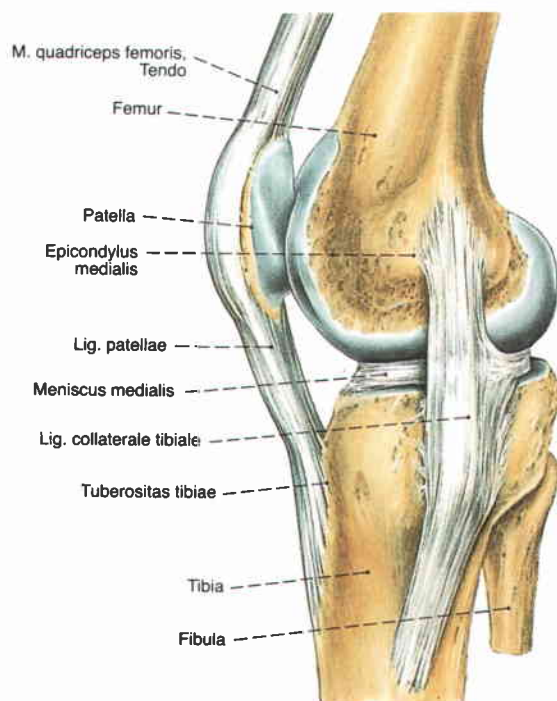


**Fig. 1218** Knee joint, *Articulatio genus*; the joint capsule is intact and the muscular origins can be seen; dorsal view (r., 65%).



**Fig. 1219** Knee joint, *Articulatio genus*;  
the cruciate ligaments and the menisci have been exposed;  
dorsal view (r., 65%).

\* In addition to the insertion below the medial condyle of the tibia, the tendon of the semimembranosus muscle radiates into the oblique popliteal ligament and into an aponeurosis which covers the area of the origin of the popliteus muscle.



**Fig. 1220** Knee joint, *Articulatio genus*;  
organisation of fibres of the tibial collateral ligament with the  
knee in an extended position;  
medial view (r., 60%).

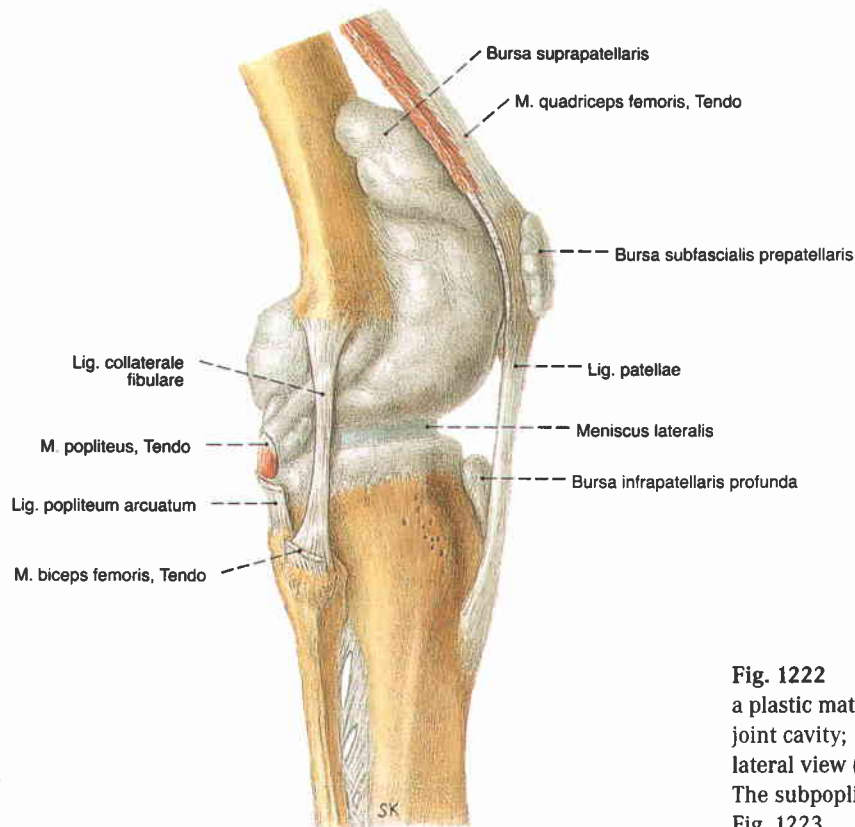
Only the posterior fibres of the tibial collateral ligament are fixed to the medial meniscus.



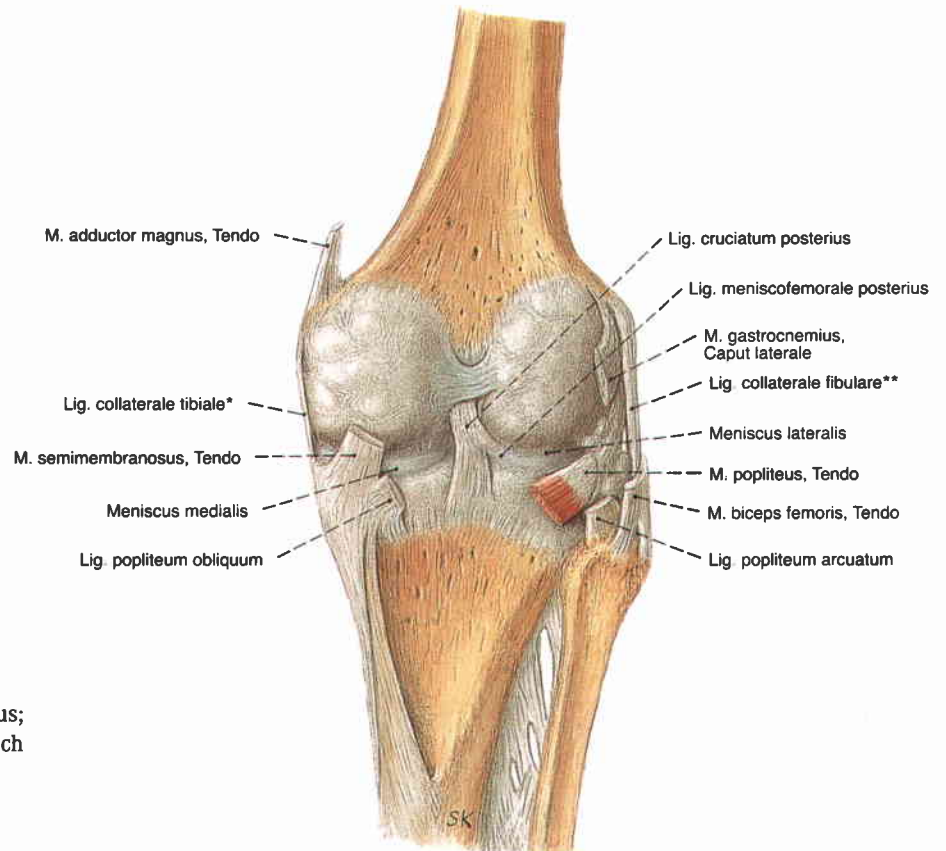
**Fig. 1221** Knee joint, *Articulatio genus*;  
organisation of fibres of the tibial collateral ligament with the  
knee in a flexed position;  
medial view (r., 60%).

During flexion the posterior and proximal fibres of the tibial collateral ligament become twisted, thereby stabilizing the medial meniscus.



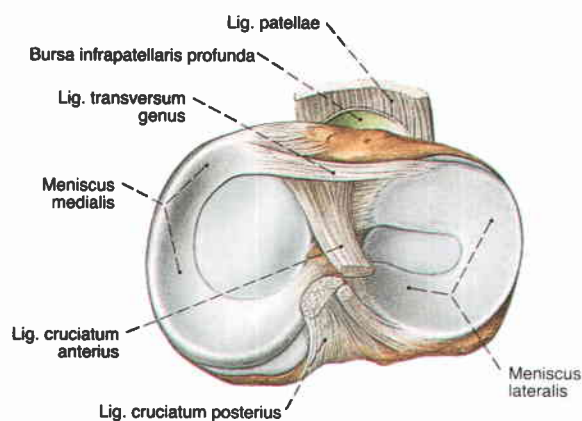


**Fig. 1222** Knee joint, Articulatio genus; a plastic material has been injected which completely fills the joint cavity; lateral view (r., 65%). The subpopliteal recessus is not shown here. Compare to Fig. 1223.

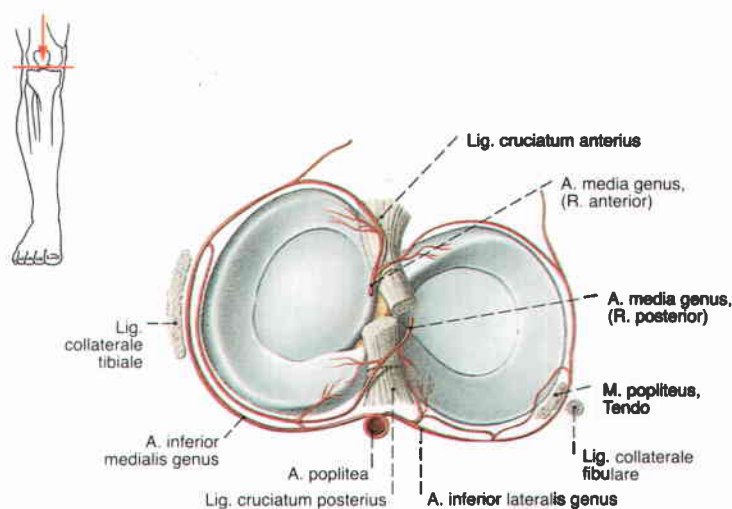


**Fig. 1223** Knee joint, Articulatio genus; a plastic material has been injected which completely fills the joint cavity; dorsal view (r., 65%).

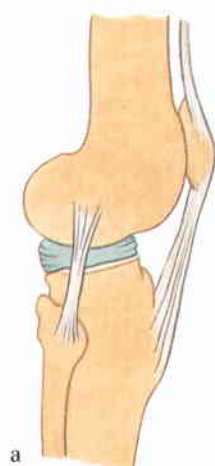
\* clinical: LCM (= Lig. collaterale mediale)  
 \*\* clinical: LCL (= Lig. collaterale laterale)



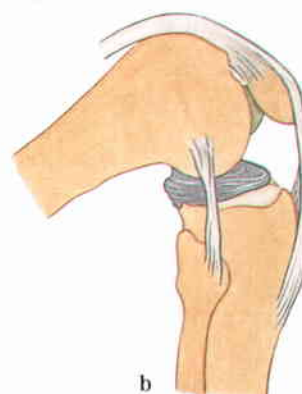
**Fig. 1224** Knee joint, Articulatio genus; the joint capsule, the cruciate and the collateral ligaments have been sectioned in the transverse plane to show the menisci; proximal view (r., 65%).



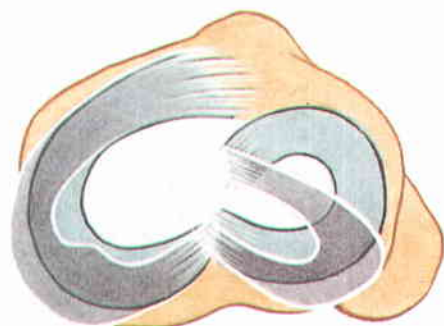
**Fig. 1225** Knee joint, Articulatio genus; arterial supply of the menisci; the joint capsule, the cruciate and the collateral ligaments have been sectioned in the transverse plane; proximal view (r., 65%).



**Figs. 1226 a, b** Knee joint, Articulatio genus; displacement of the menisci during flexion; lateral view (r.).



**a** extension  
**b** flexion

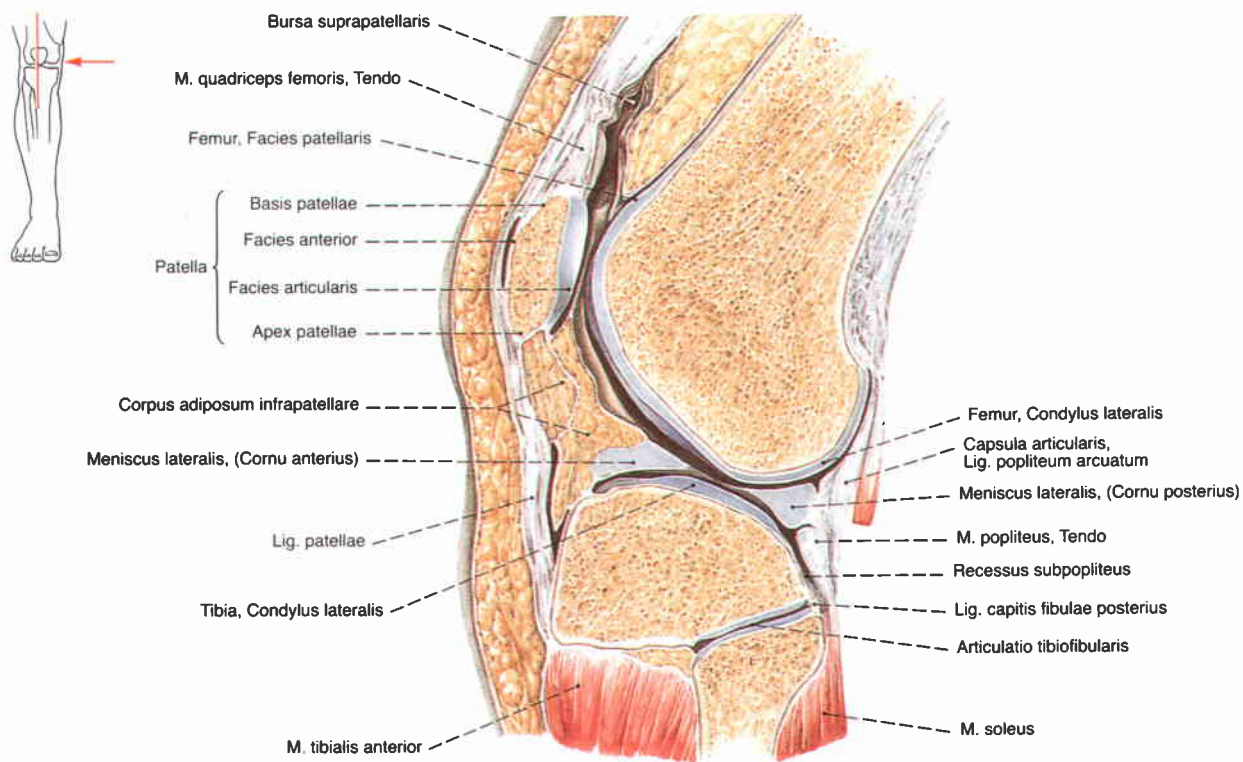


**Fig. 1227** Knee joint, Articulatio genus; displacement of the menisci during flexion; proximal view (r.). During flexion both menisci are forced posteriorly over the edge of the tibial condyles. There is less risk of damage to the lateral meniscus, which can be explained by its greater mobility.

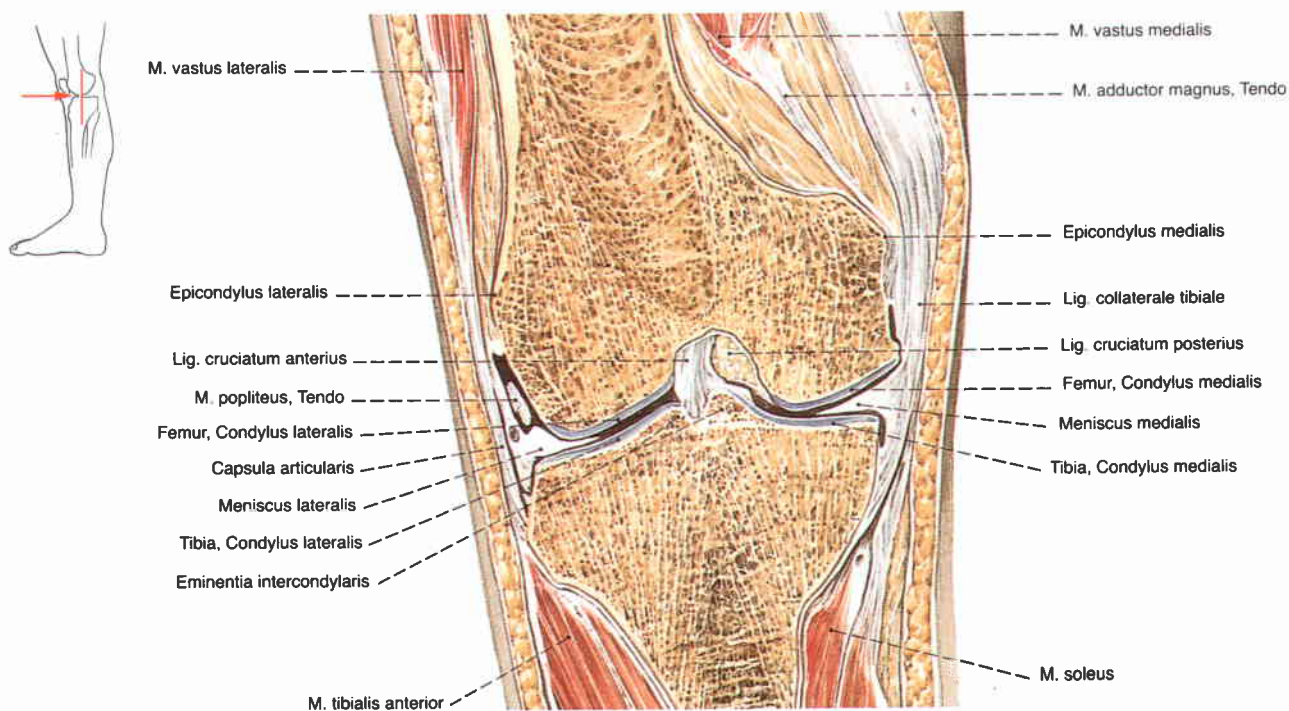
## Parts of the knee joint

The composite structure of the knee joint with three bones and the incomplete compartmentalisation by the menisci have led to a functionally based division into three parts: the

femoropatellar, the meniscomfemoral and the meniscotibial joints. The menisci are mobile parts of the joints which facilitate the transmission of pressure to the condyles of the tibia.

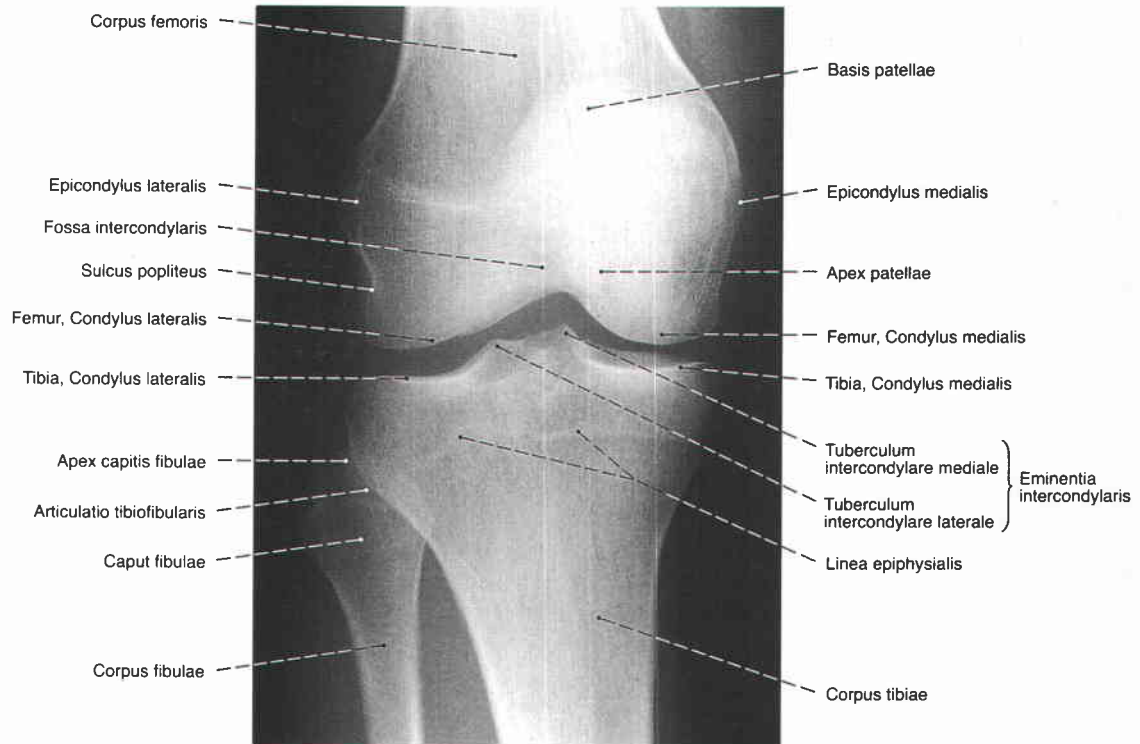


**Fig. 1228** Knee joint, Articulatio genus; sagittal section through the lateral part of the joint; lateral view (r., 65%).

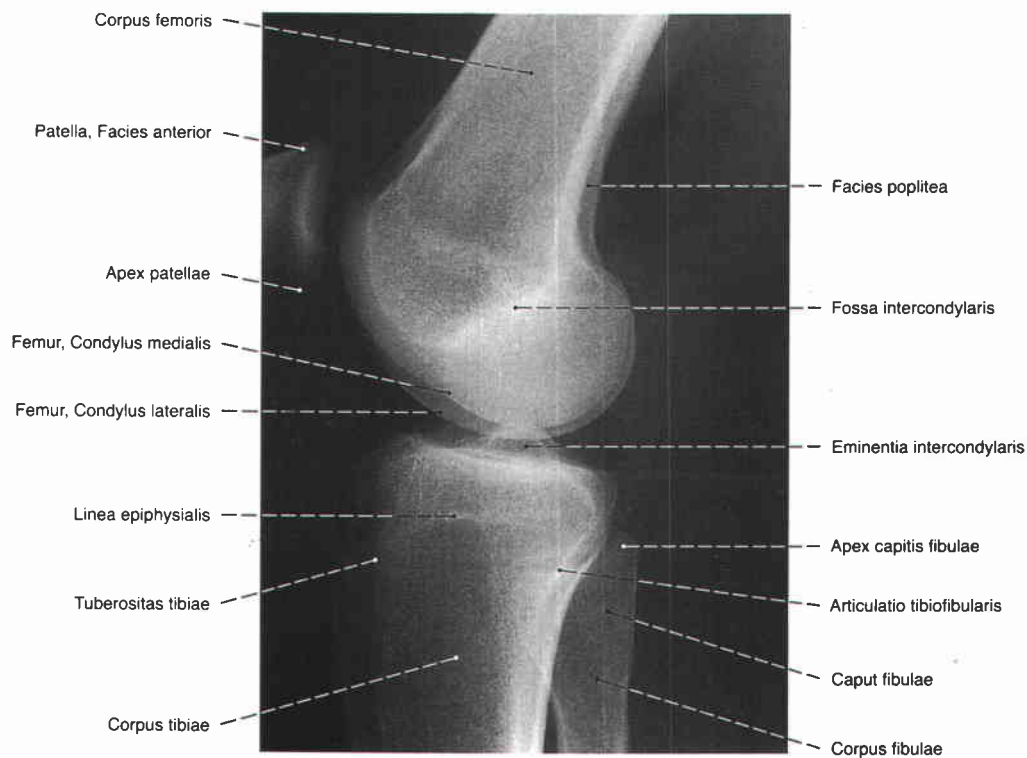


**Fig. 1229** Knee joint, Articulatio genus; frontal section through the middle of the joint; ventral view (r., 65%).

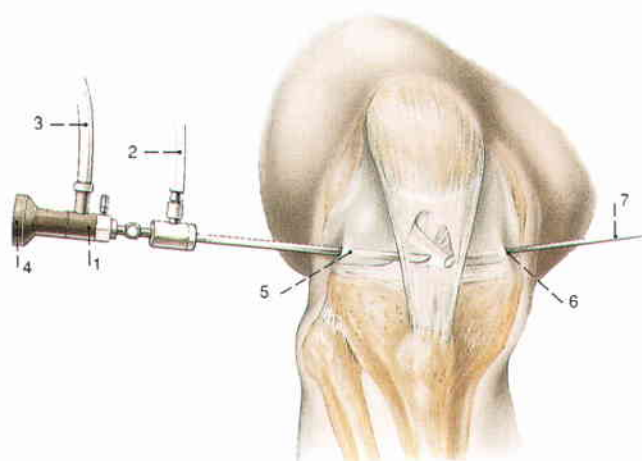




**Fig. 1230** Knee joint, Articulatio genus; AP-radiograph; the patient is lying and the central beam is focused on the middle of the knee.

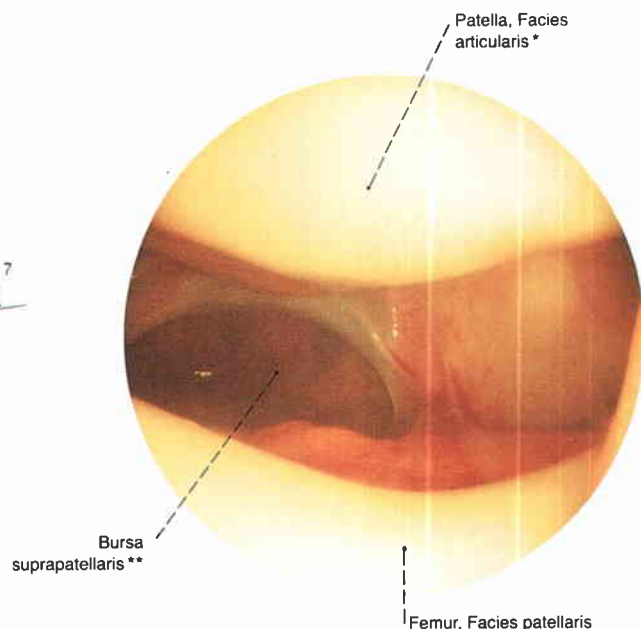


**Fig. 1231** Knee joint, Articulatio genus; lateral radiograph; the patient is lying and the central beam is focused on the middle of the knee.

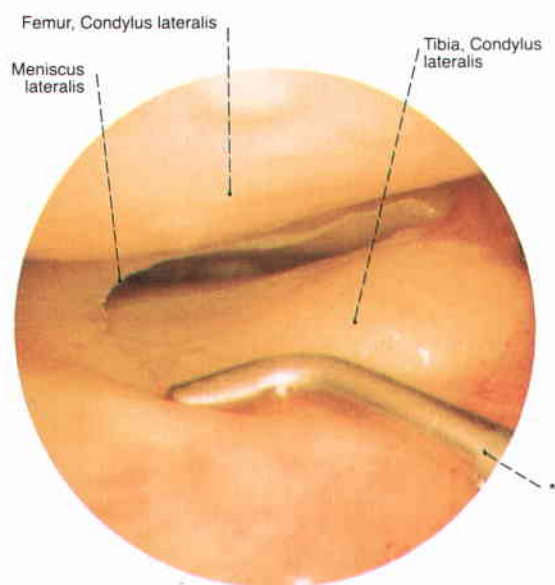


- 1 Arthroscope
- 2 Inlet or outlet for the rinsing solution
- 3 Cold light source
- 4 Ocular or connector to the video system
- 5 Anterolateral approach
- 6 Anteromedial approach
- 7 Additional instrument

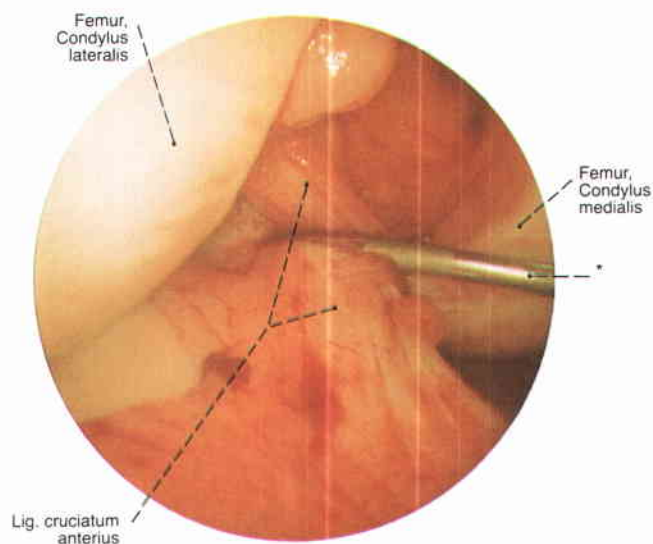
Fig. 1232 Arthroscopic approaches.



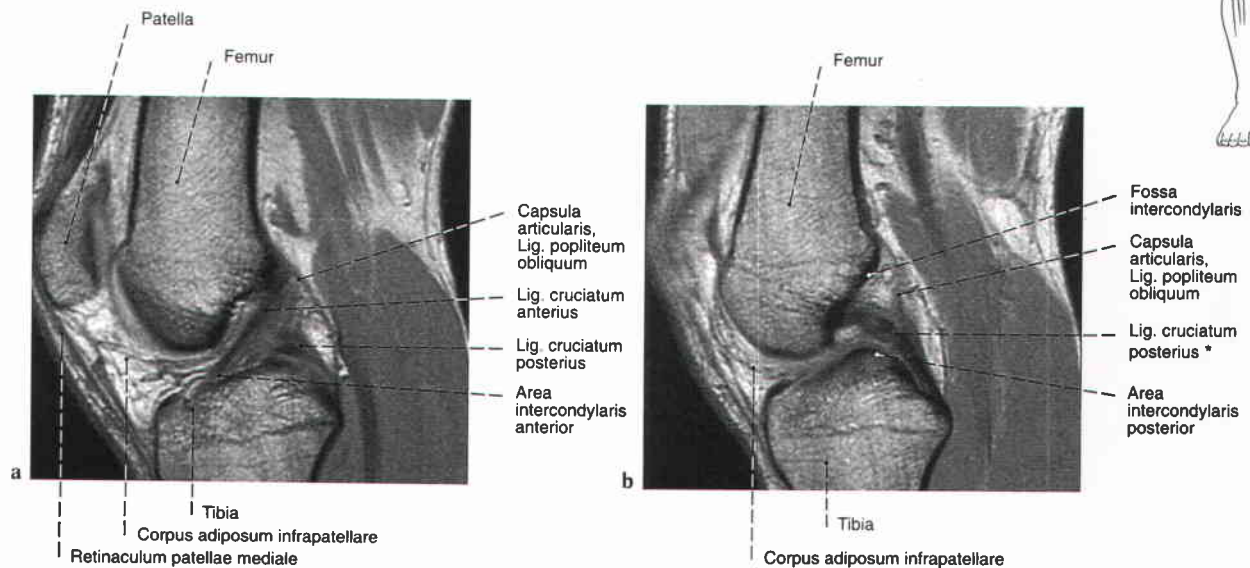
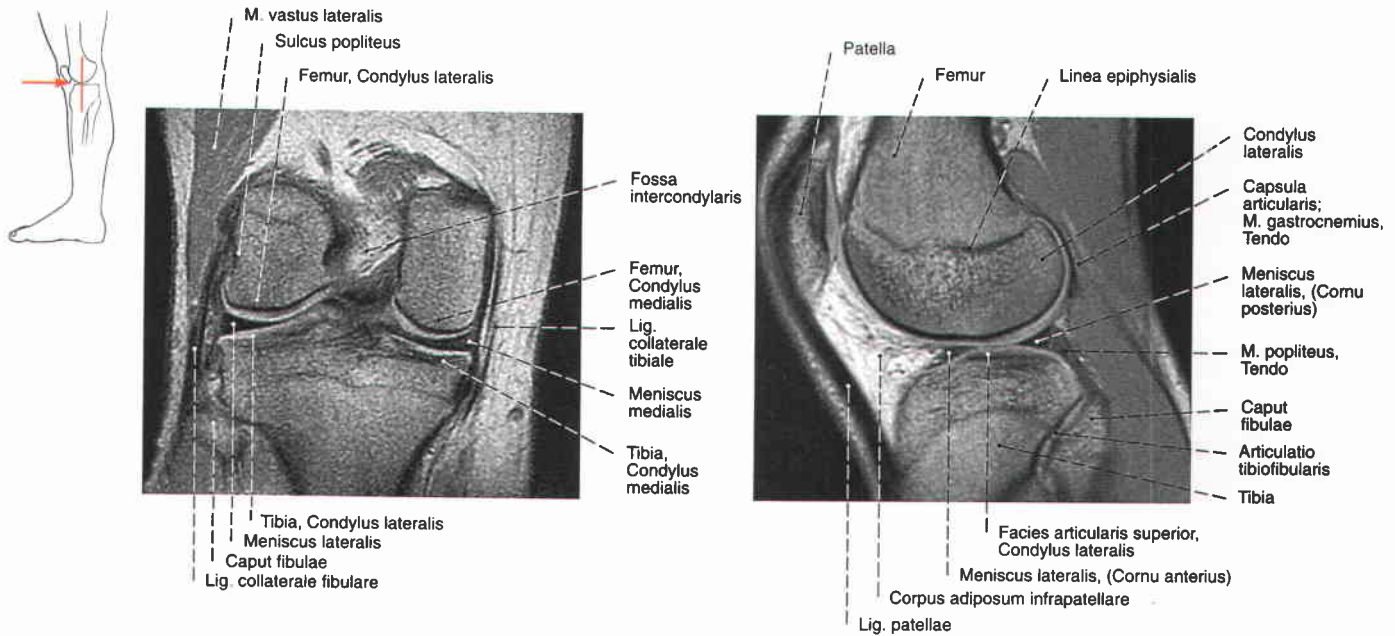
Figs. 1233 a-c Knee joint, Articulatio genus; arthroscopy;  
 a inferior view into the femoropatellar joint (r.).  
 \* ridge between the medial and lateral articular surfaces  
 \*\* clinical: suprapatellar recess



b Knee joint, Articulatio genus; arthroscopy; medial view of the free inner edge of the lateral meniscus (r.). The ventral part of the meniscus has been somewhat depressed by a probing hook (\*).

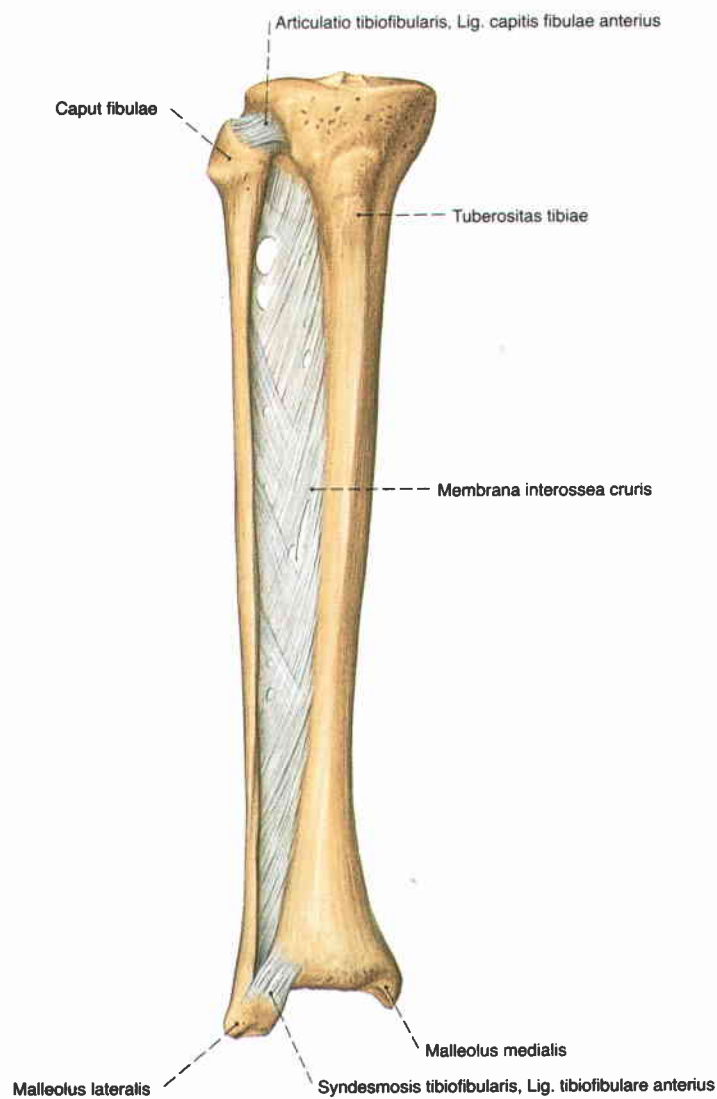


c Knee joint, Articulatio genus; arthroscopy; anterolateral view of the distal part of the anterior cruciate ligament (r.). The ligament is covered by a vascular synovial membrane, it has been slightly retracted medially by a probing hook (\*).

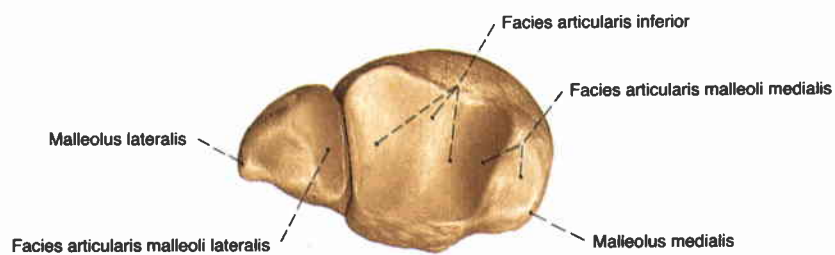


\* The inhomogeneous appearance is due to the oblique sectioning of the fibre bundles.





**Fig. 1237** Connecting fibres of the bones of the crus;  
ventral view (r., 30%).



**Fig. 1238** Tibia, Tibia, and fibula, Fibula;  
distal view (r., 55%).

Fig. 1239 Bones of the foot, Ossa pedis;  
proximal view (r., 50%).

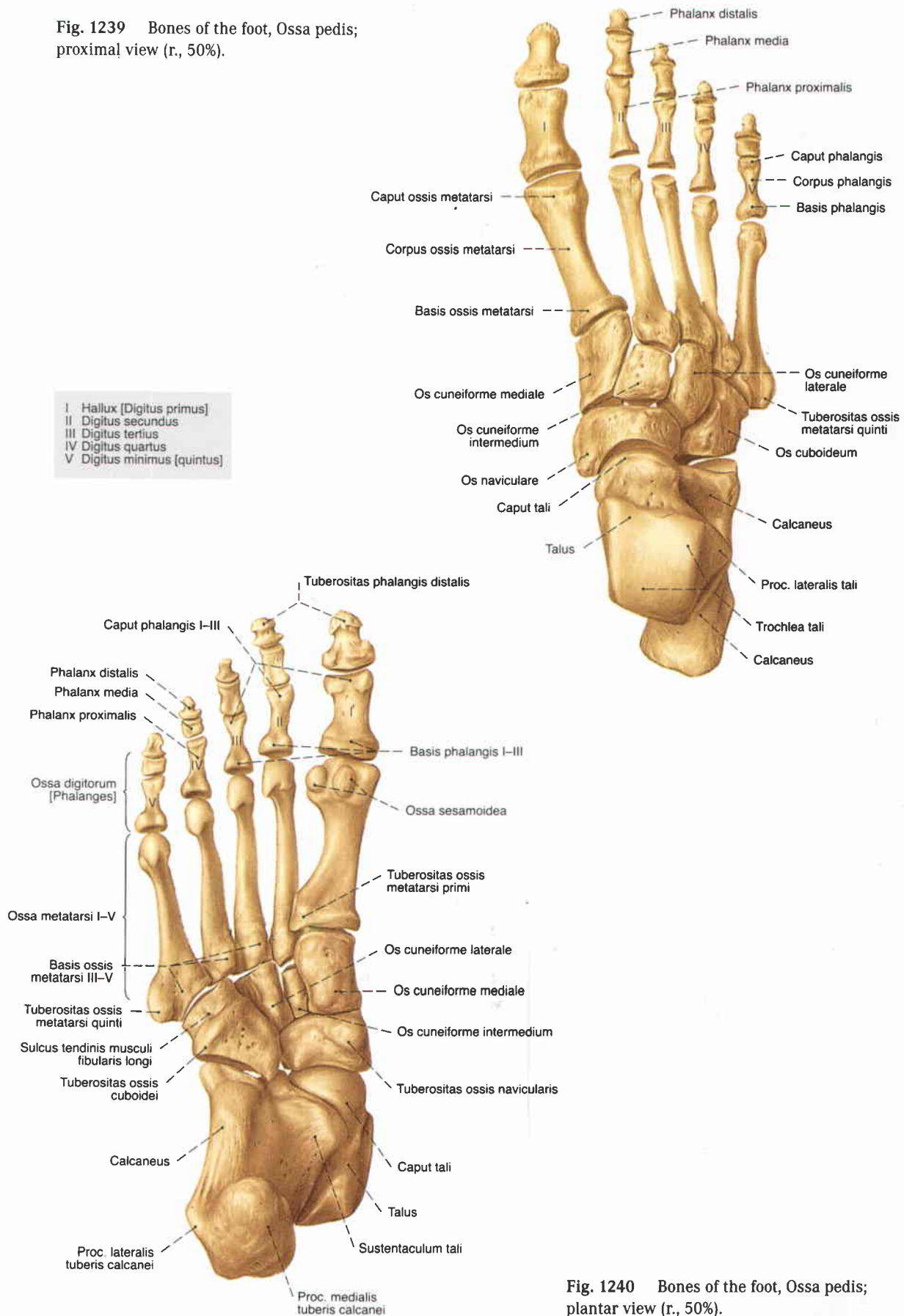
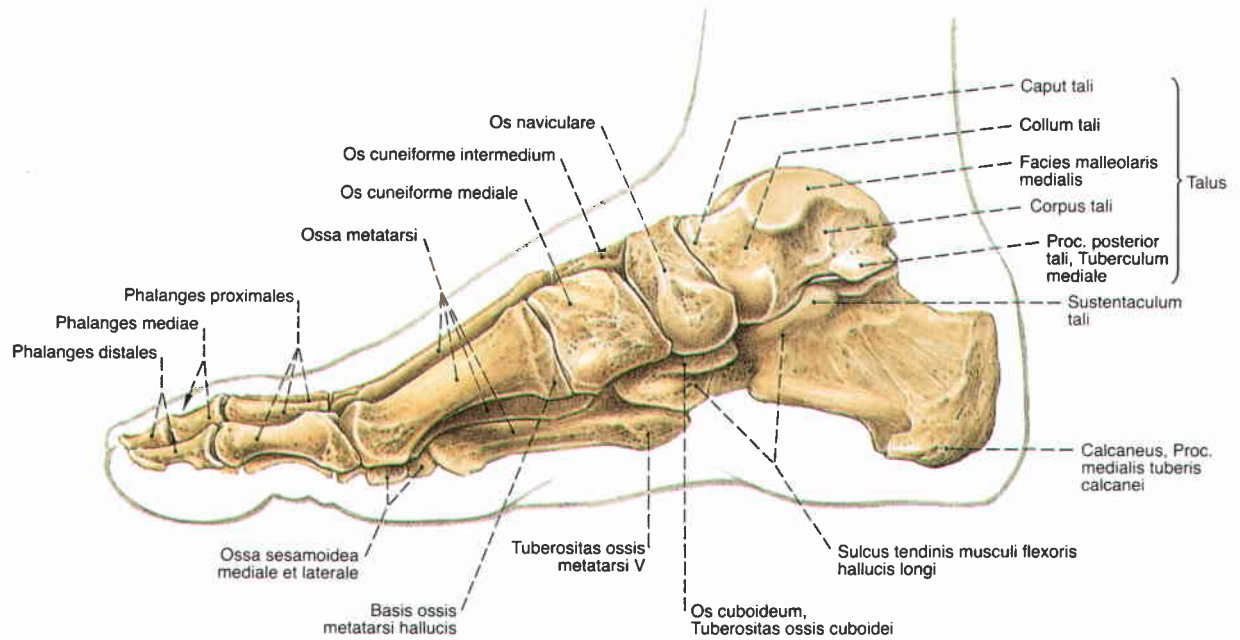
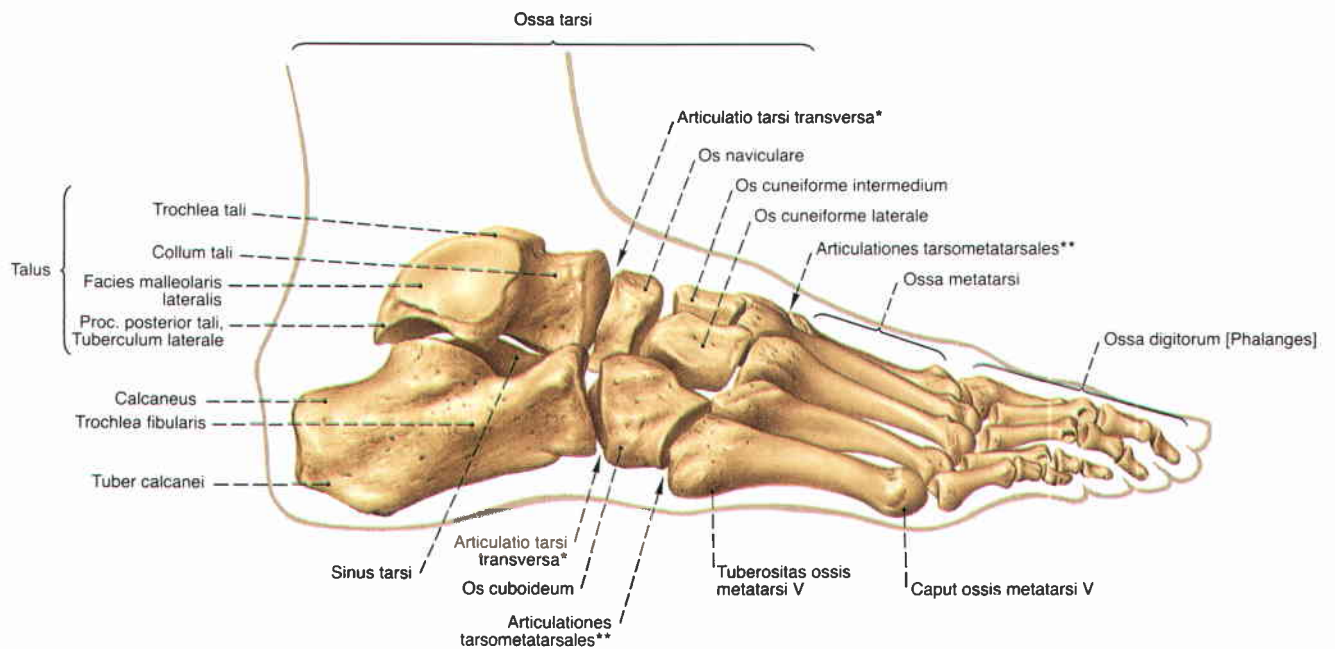


Fig. 1240 Bones of the foot, Ossa pedis;  
plantar view (r., 50%).



**Fig. 1241** Bones of the foot, *Ossa pedis*; medial view (r., 45%).



**Fig. 1242** Bones of the foot, *Ossa pedis*; lateral view (r., 45%).

\* also CHOPART's joint line

\*\* also LISFRANC's joint line



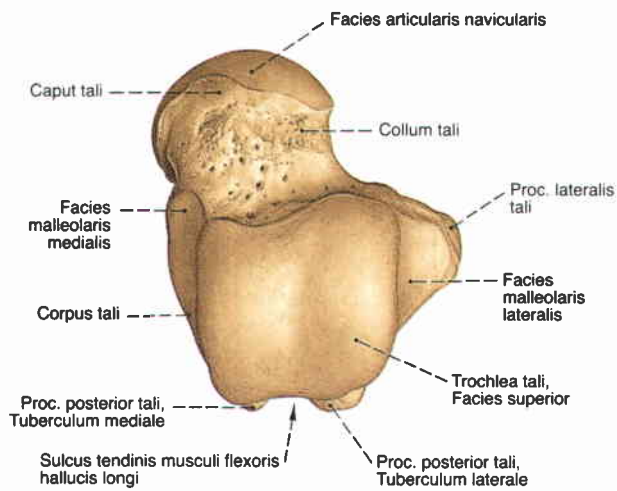


Fig. 1243 Talus, Talus;  
proximal view (r., 85%).

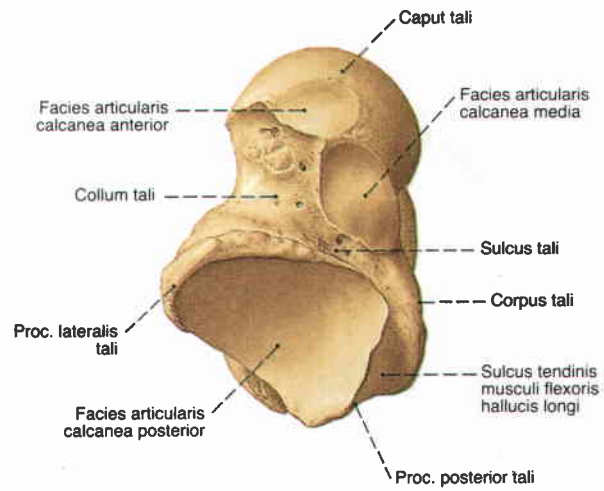


Fig. 1244 Talus, Talus;  
plantar view (r., 85%).

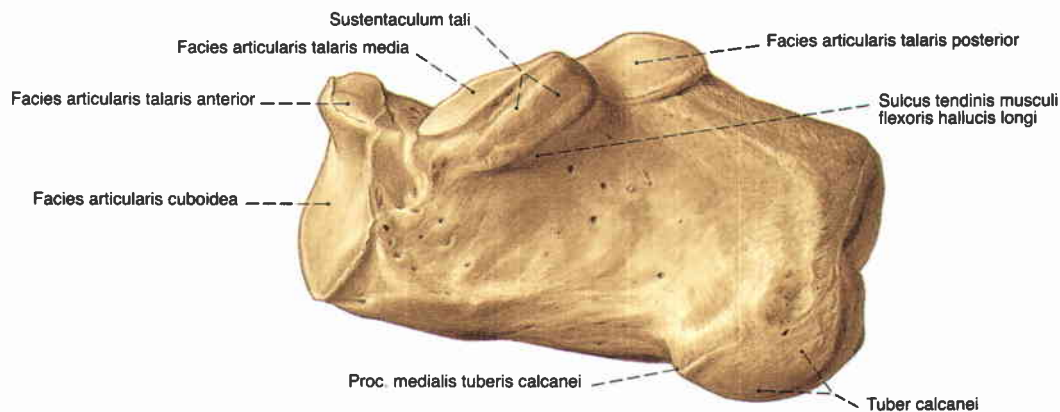


Fig. 1245 Calcaneus, Calcaneus;  
medial view (r., 90%).

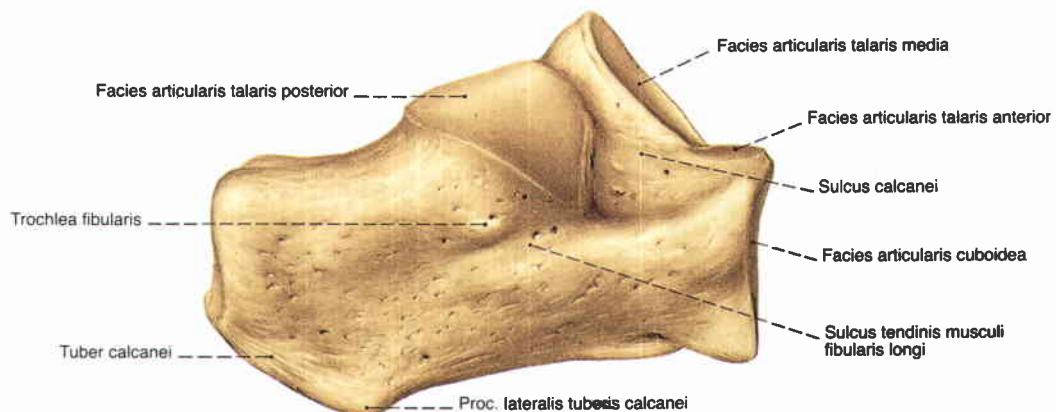
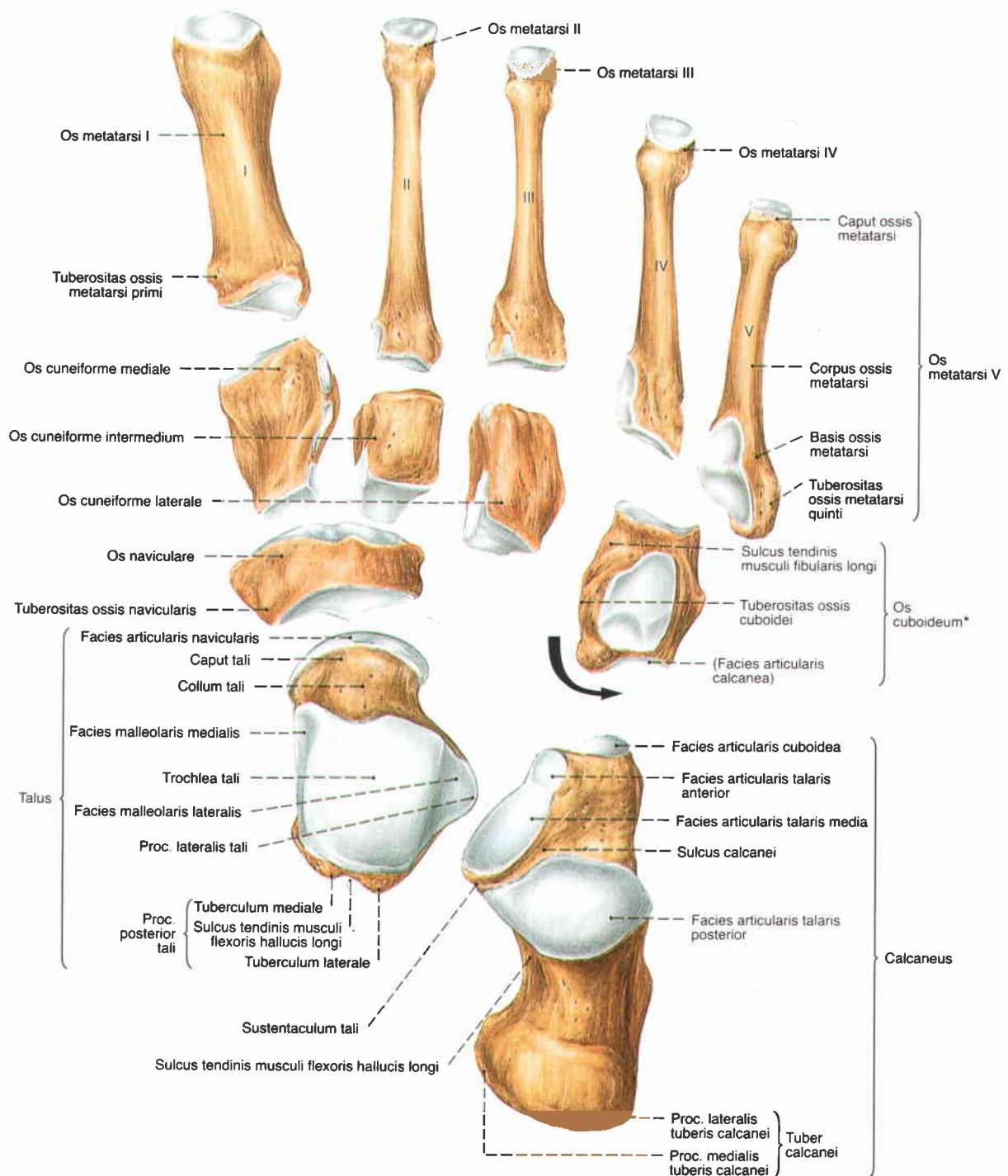
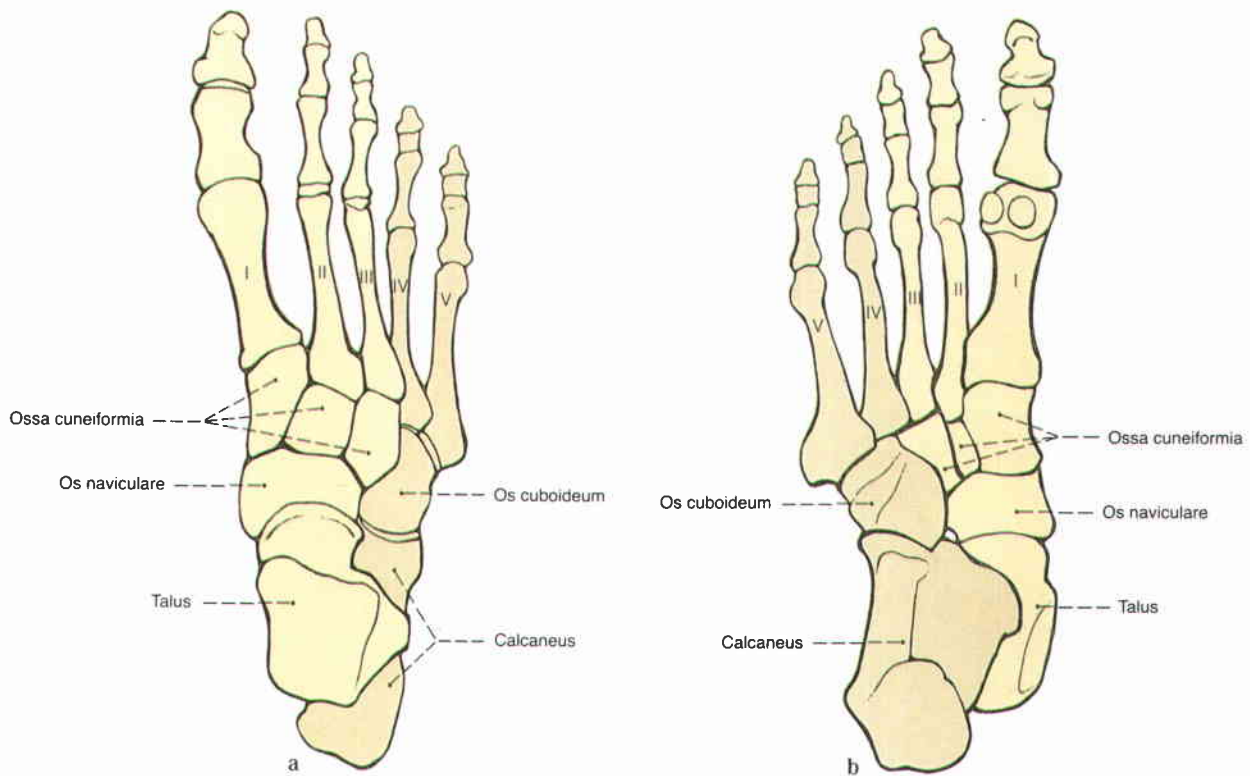


Fig. 1246 Calcaneus, Calcaneus;  
lateral view (r., 90%).



**Fig. 1247** Tarsal bones, Ossa tarsi, and metatarsal bones, Ossa metatarsi; the distance between the bones has been enlarged; proximal view (r., 80%).

\* The cuboid bone is shown from medial.



Figs. 1248 a, b The bones of the foot, Ossa pedis; structural diagram.

a proximal view (r.)  
b plantar view (r.)

The heads of all metatarsal bones lie in the plantar plane. The cuneiform bones, the navicular bone and the talus rest upon the lateral parts of the skeleton, especially in the posterior part of the foot. The talus is therefore situated above the calcaneus and the longitudinal vault is formed on the medial aspect of the foot. The wedge-shaped cross section of the cuneiform bones and the bases of the metatarsal bones contributes to the formation of the transverse vault.

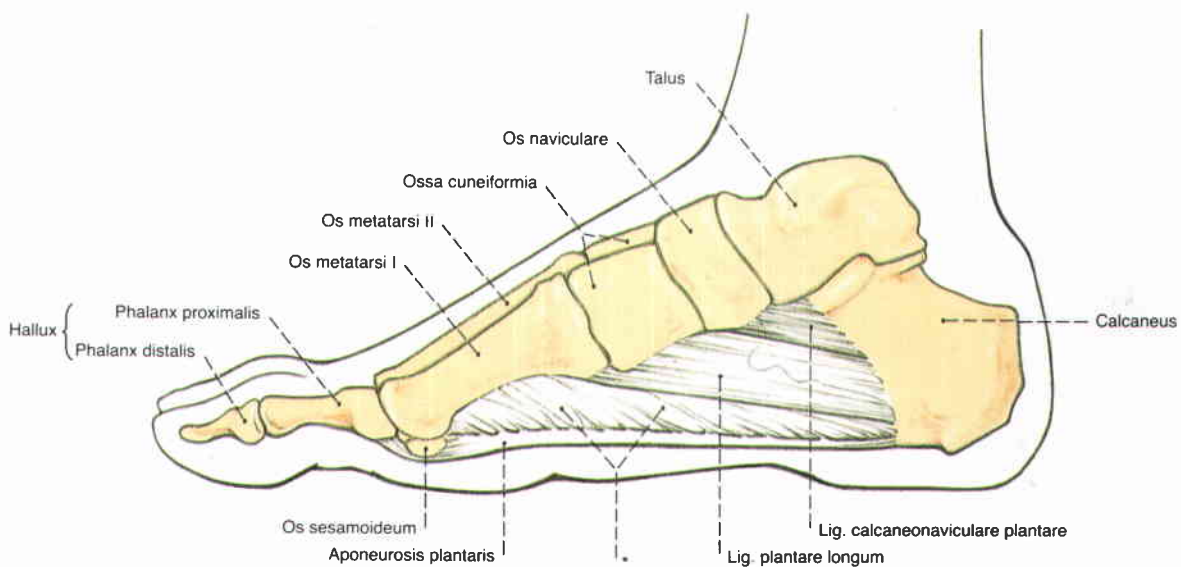
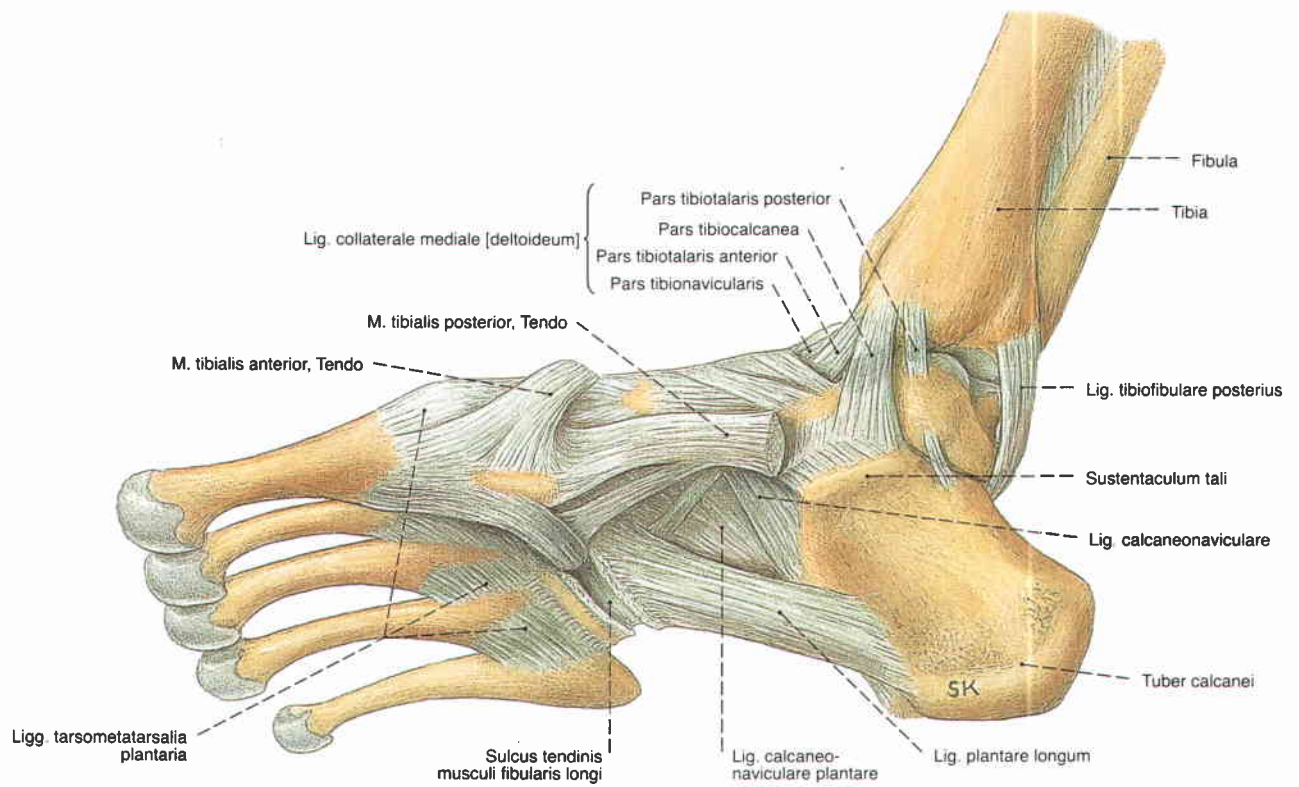


Fig. 1249 Bracing of the longitudinal vault of the foot; medial view (r.).

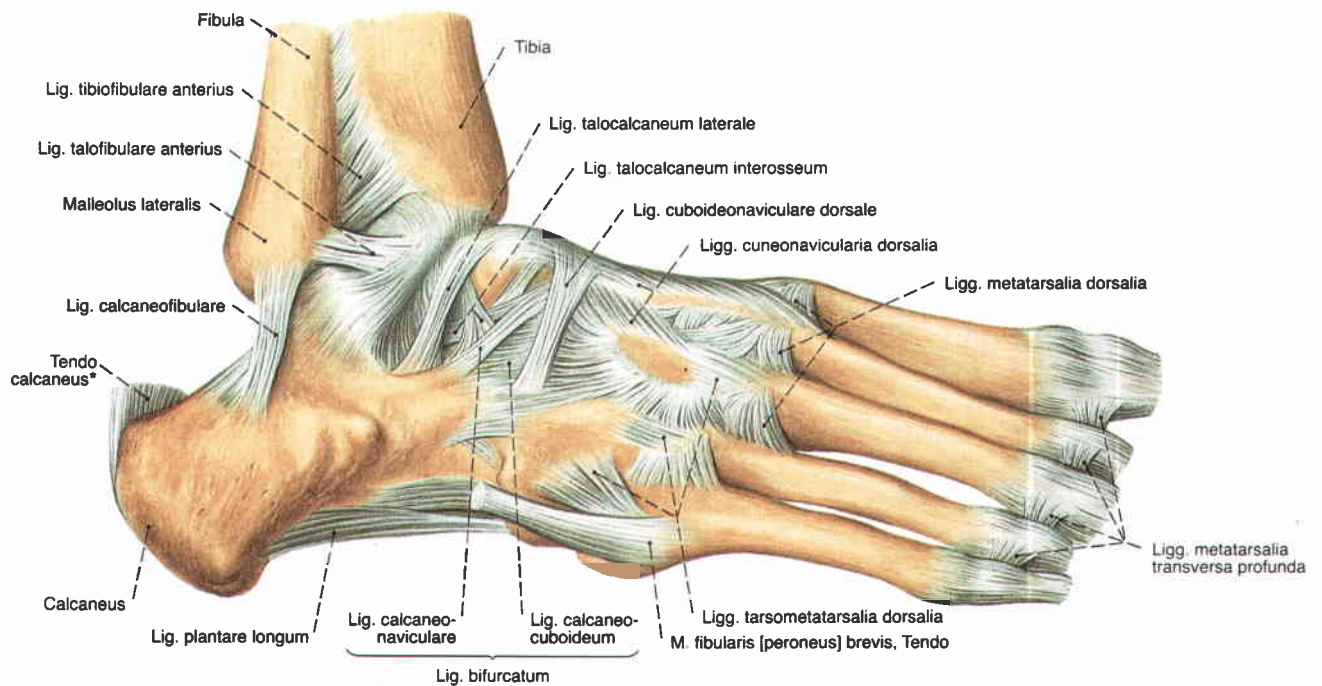
\* medial intermuscular septum

The ligamentous structures which are shown in this figure are orientated in the longitudinal axis of the foot and passively brace the longitudinal vault. They are mainly supported by the short muscles of the foot.



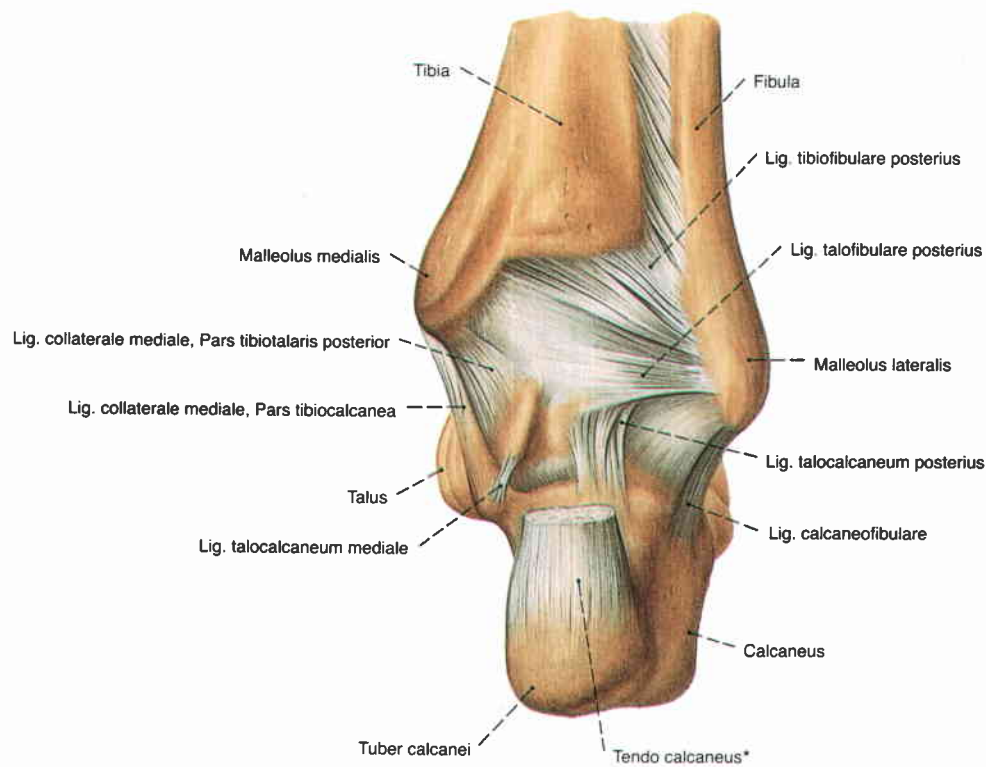


**Fig. 1250** Joints of the foot, *Articulationes pedis*; ligaments and tendons of the foot and ankle (talocrural) joint; medial view (r., 70%).



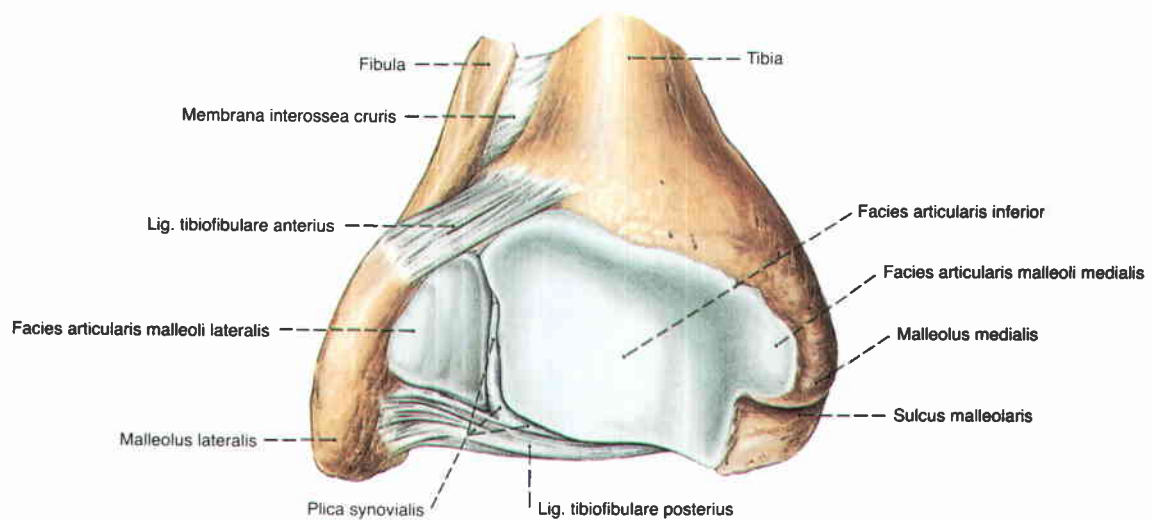
**Fig. 1251** Joints of the foot, *Articulationes pedis*; ligaments and tendons of the tarsus and the metatarsus; lateral view (r., 70%).

\* also Achilles tendon

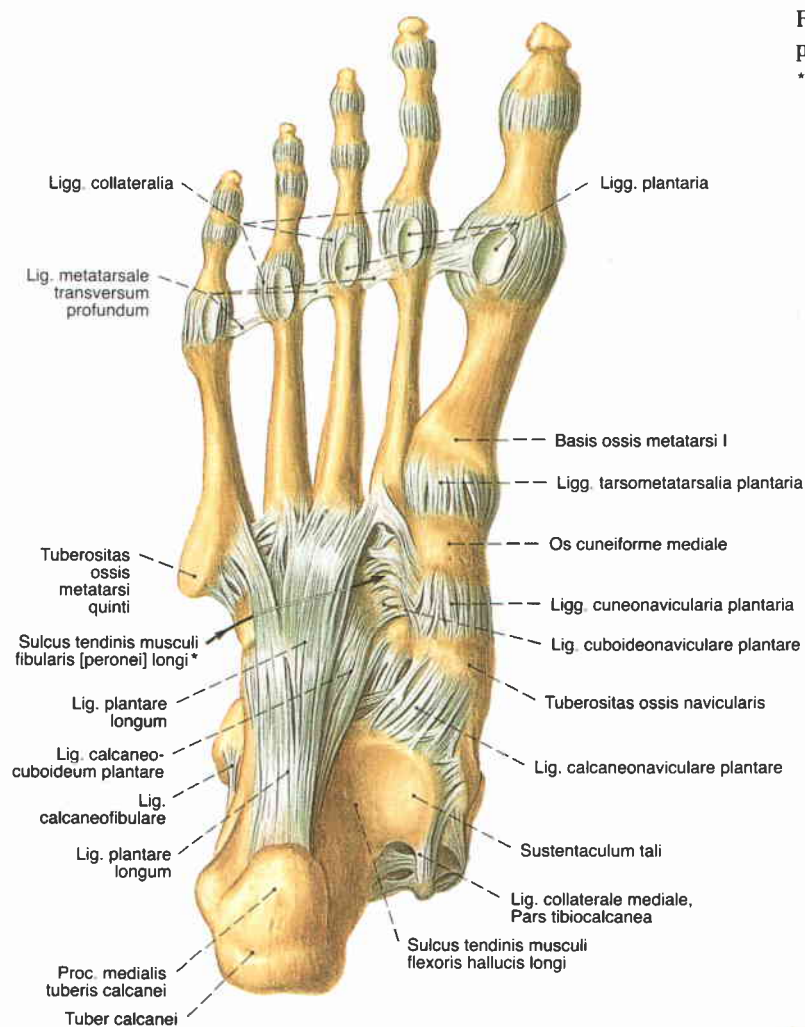


**Fig. 1252** Joints of the foot, *Articulationes pedis*; ligaments and tendons of the tarsus; dorsal view (r., 70%).

\* also Achilles tendon

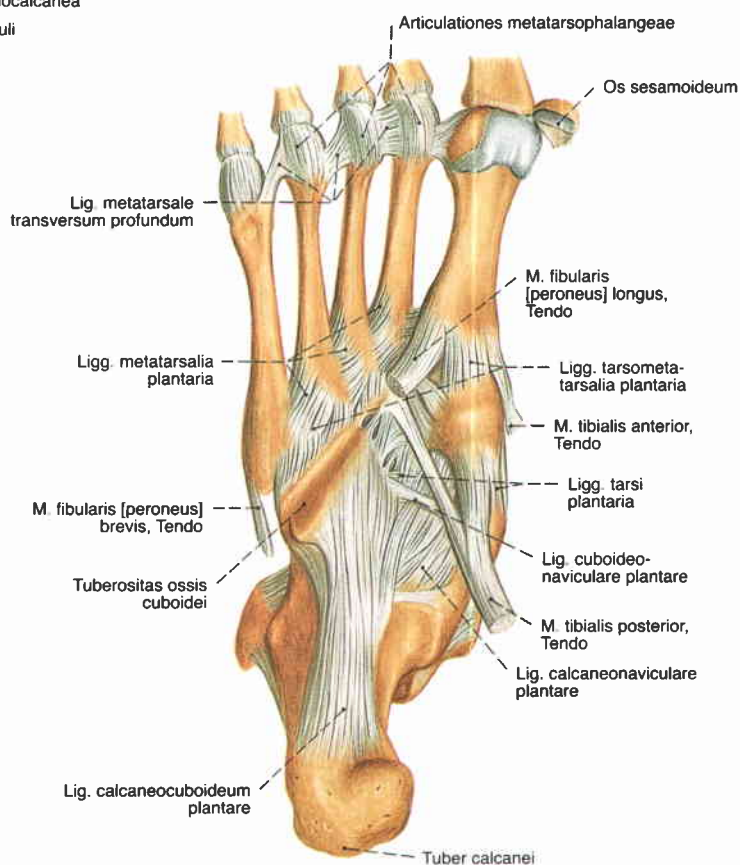


**Fig. 1253** Ankle joint, *Articulatio talocruralis*; proximal elements; distal view (r., 120%).



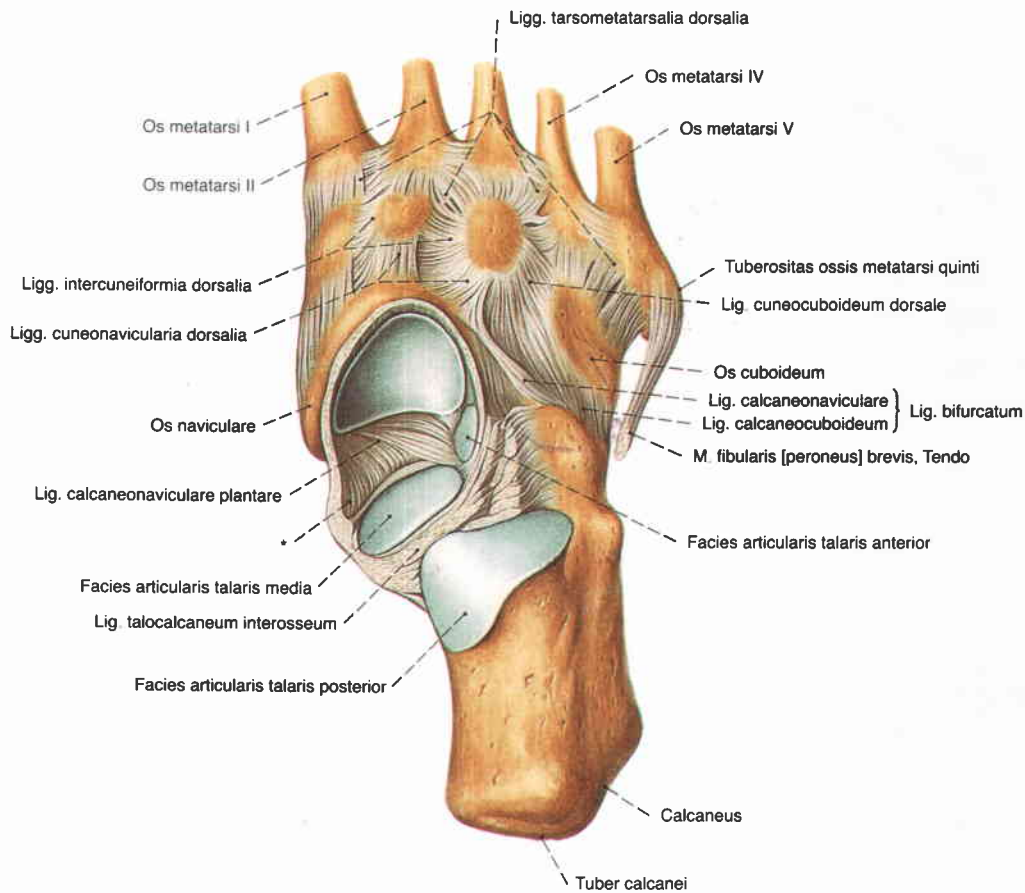
**Fig. 1254** Joints of the foot, *Articulationes pedis*; plantar view (r., 55%).

\* The long plantar ligament encloses the groove of a canal for the tendon of *M. fibularis* [peroneus] longus.



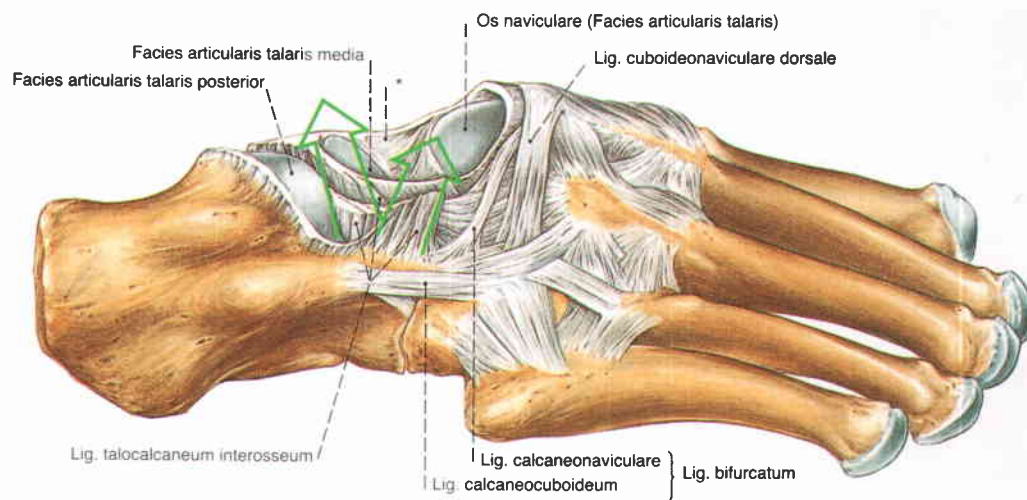
**Fig. 1255** Joints of the foot, *Articulationes pedis*; ligaments and tendons of the tarsus and the metatarsus; plantar view (r., 55%).





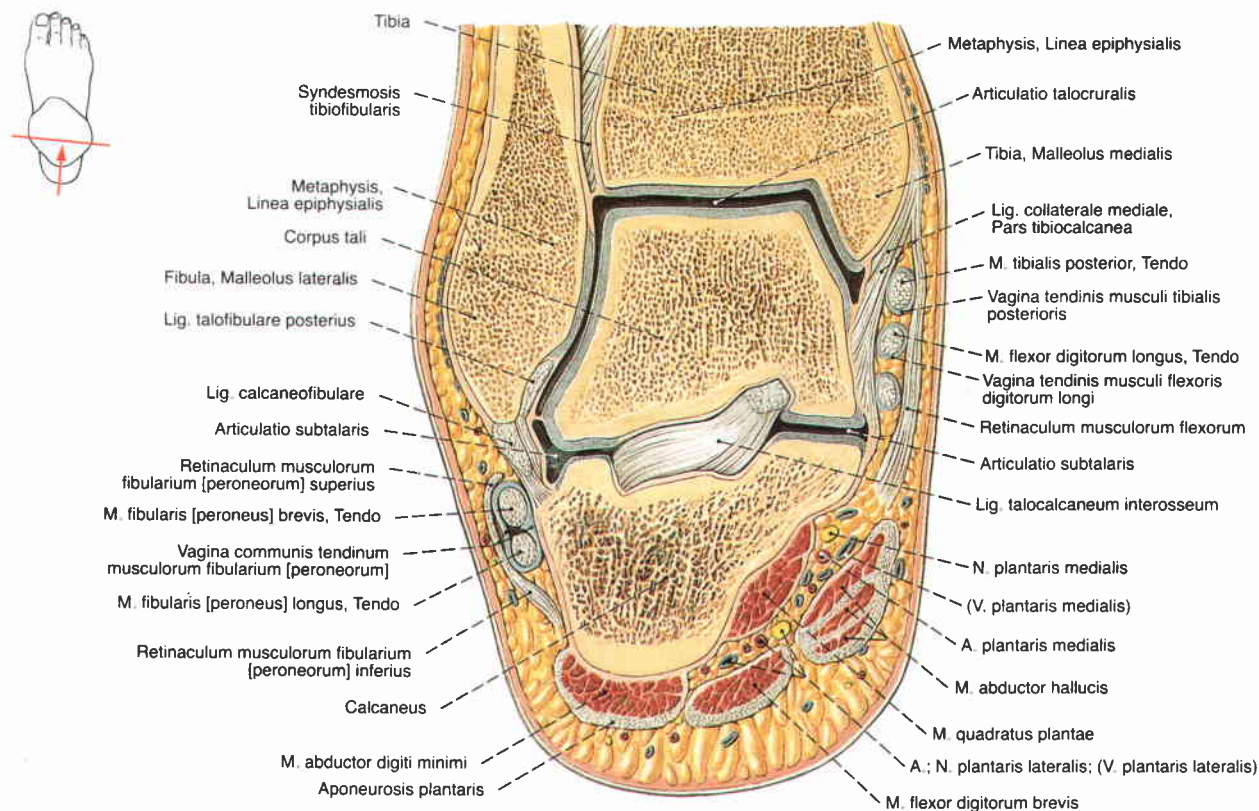
**Fig. 1256** Joints of the foot, *Articulationes pedis*; the talocalcaneonavicular joint has been exarticulated; proximal view (r., 70%).

\* see Fig. 1257

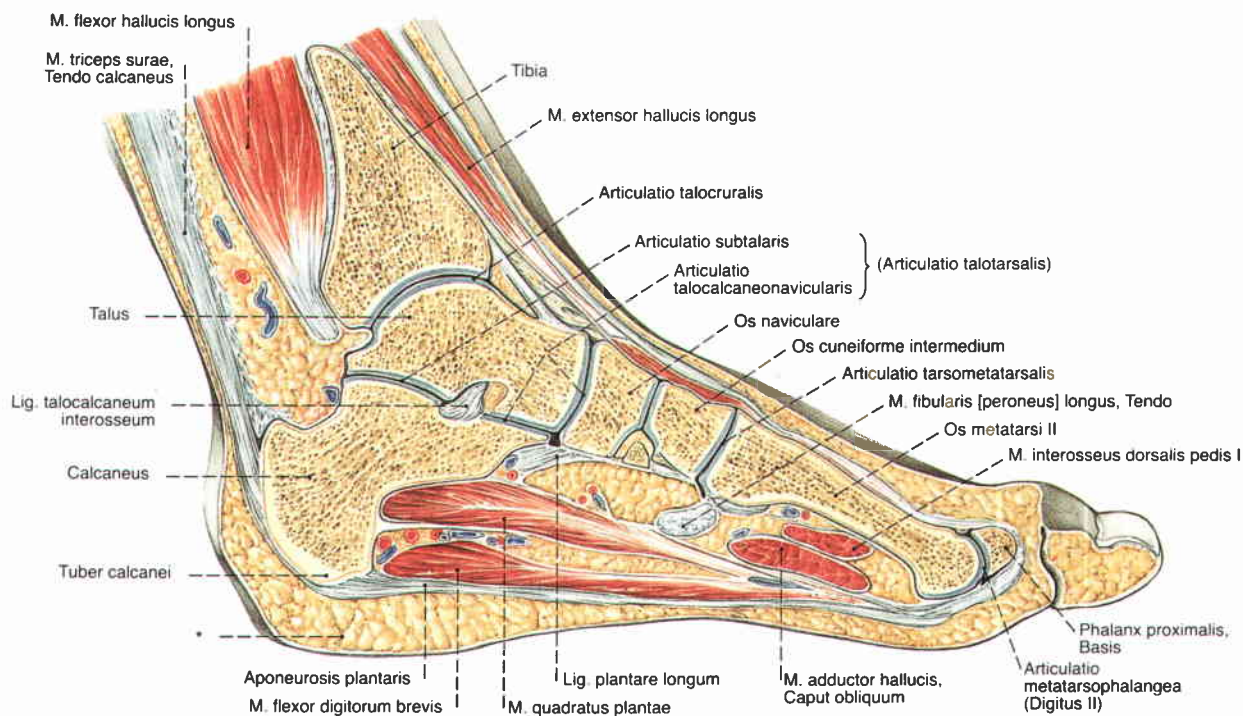


**Fig. 1257** The right talocalcaneonavicular joint, *Articulatio talocalcaneonavicularis*; the talus and the lateral ligaments have been removed; lateral view (r., 70%). The two arrows indicate the corkscrew twist of the interosseous talocalcaneal ligament.

\* tight fibrous tissue sheet between the plantar calcaneonavicular ligament and the tibionavicular part of the deltoid ligament. This structure encloses the medially directed head of the talus. If it weakens, flattening of the longitudinal vault occurs (flat foot).



**Fig. 1258** Ankle and intertarsal joints, Articulationes talocruralis et talocalcaneonavicularis; frontal section through the malleoli; distal view (r., 90%).



**Fig. 1259** Ankle and intertarsal joints, Articulationes talocruralis et talocalcaneonavicularis;

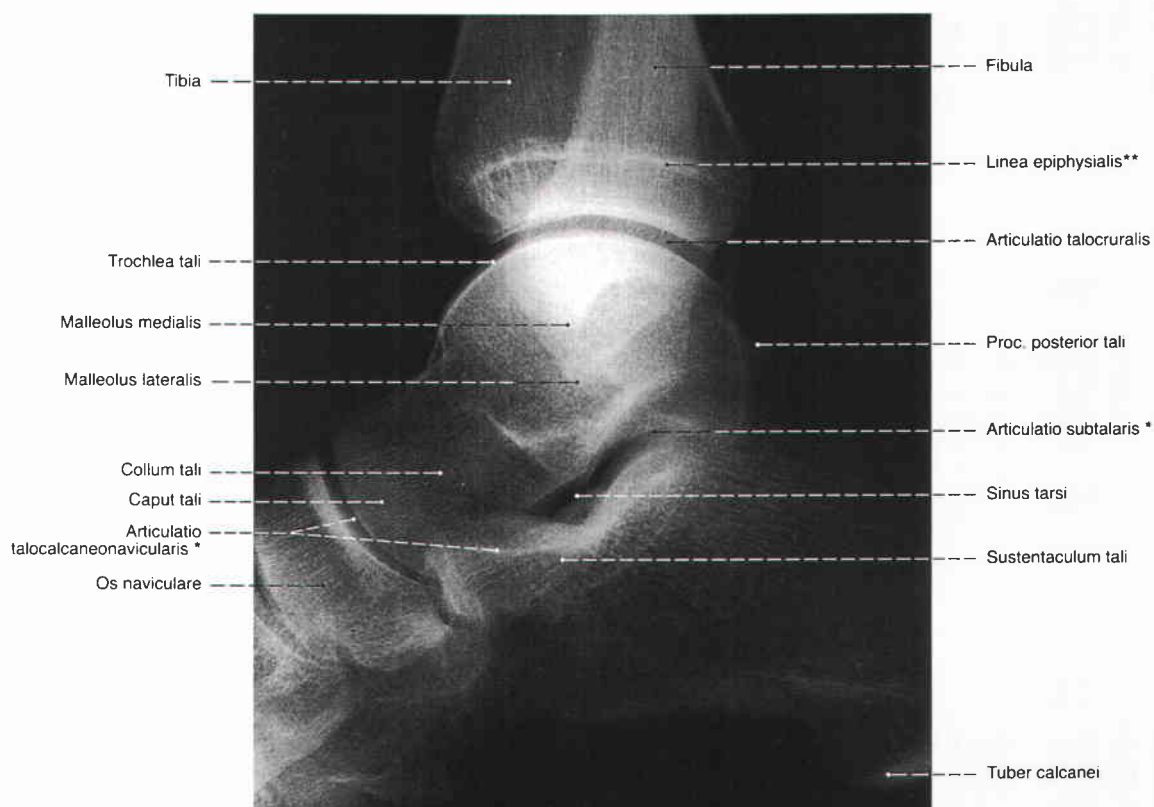
sagittal section through the middle of the trochlea of the talus; lateral view (r., 50%).

\* fat pad of the heel



**Fig. 1260** Ankle and intertarsal joints, Articulationes talocruralis et talocalcaneonavicularis; AP-radiograph; the patient is lying; the central beam has been tangentially focused on the trochlea of the talus.

\* The posterior margin of the fibular notch is clinically termed *Malleolus tertius*.

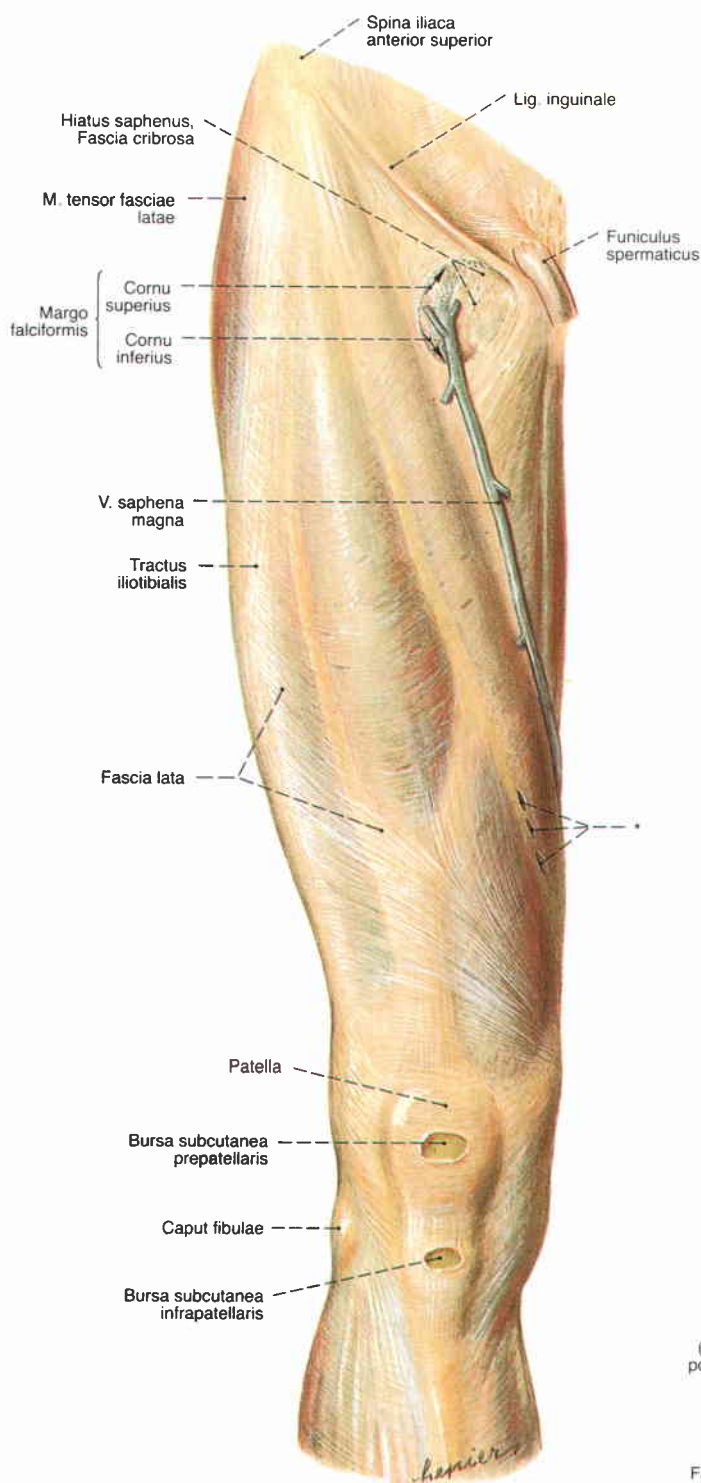


**Fig. 1261** Ankle and intertarsal joints, Articulationes talocruralis et talocalcaneonavicularis; lateral radiograph; the patient is lying; the central beam has been focused on the top of the trochlea of the talus.

\* The joint spaces are not orthogradely aligned with the film because of their screw-like form.

\*\* overlapping of the epiphyseal lines of the tibia and the fibula

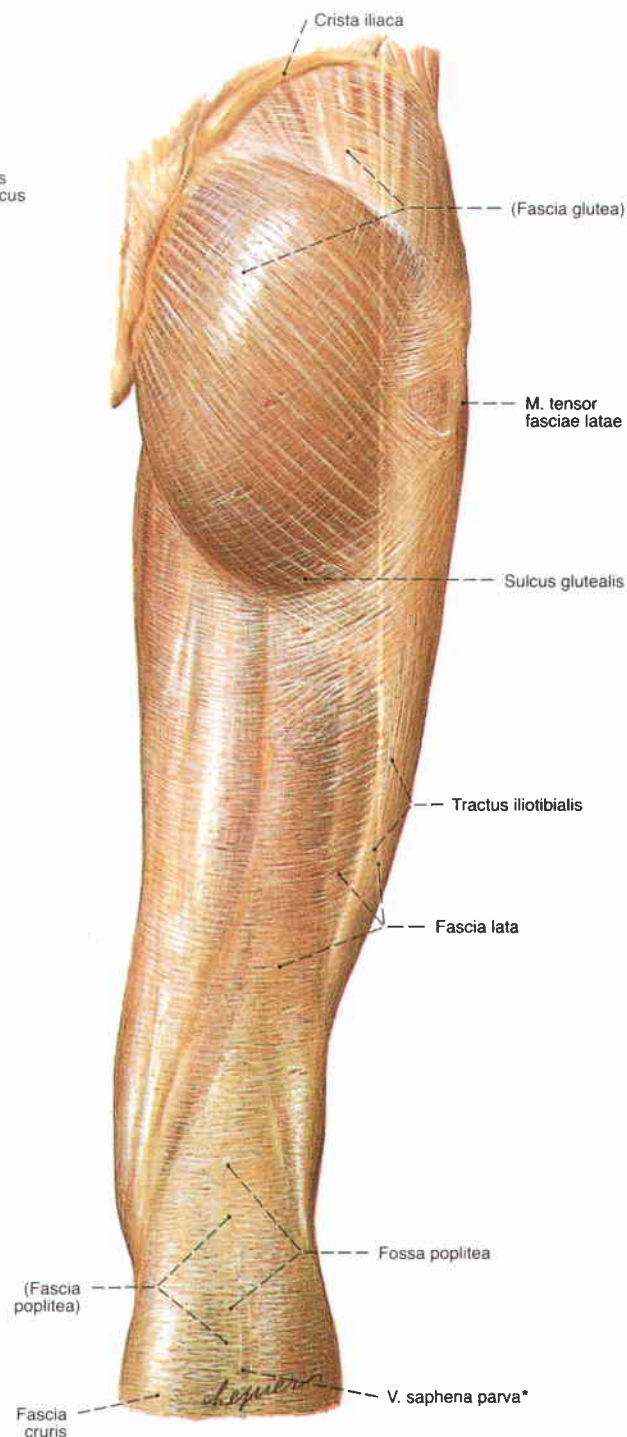




**Fig. 1262** Fascia of the thigh, Fascia lata; ventral view (r.).

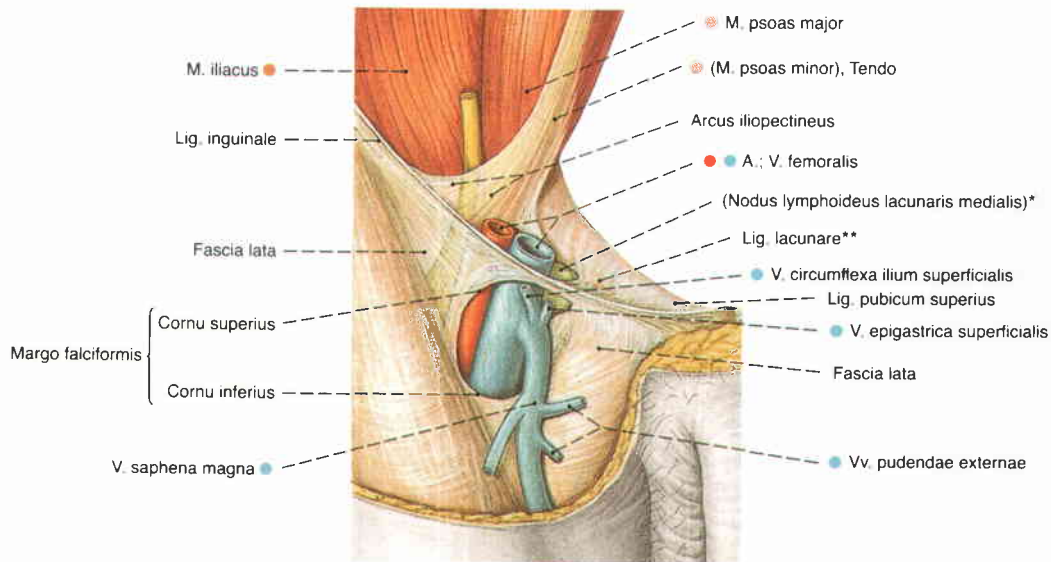
The transitional area between the aponeurosis of the obliquus externus abdominis muscle and the fascia lata is called the inguinal ligament, Lig. inguinale. It inserts laterally to the anterior superior iliac spine and medially to the pubic tubercle.

\* gaps for the perforating veins (Dodd's veins)



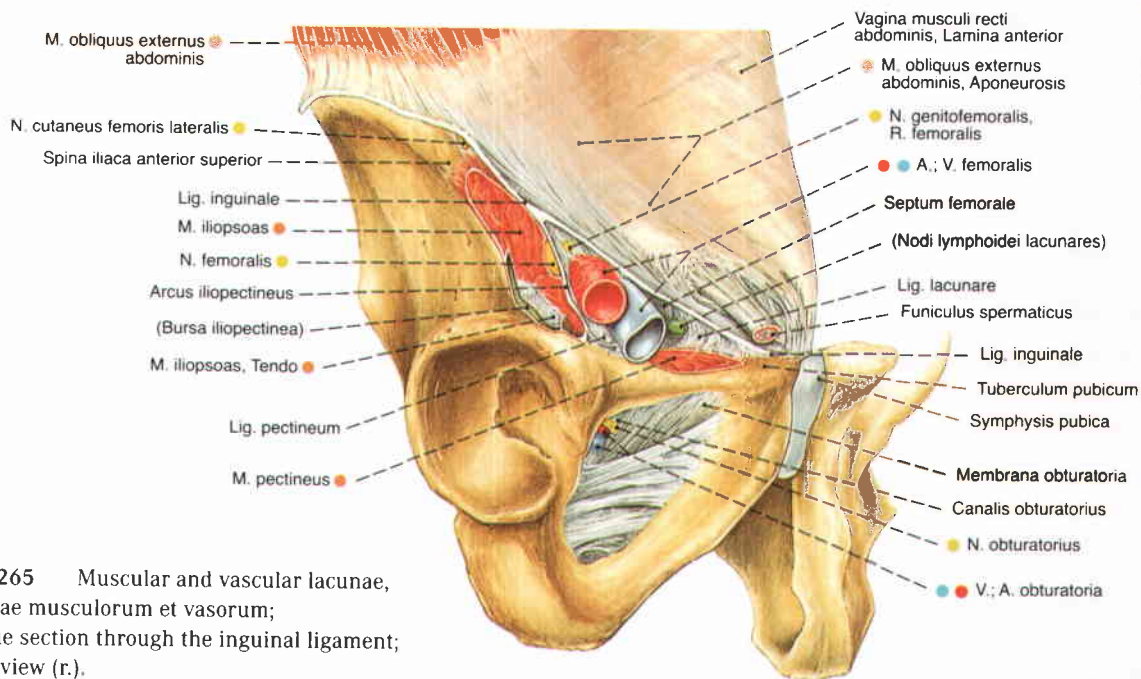
**Fig. 1263** Fascia of the thigh, Fascia lata; dorsal view (r.).

\* subfascial and intrafascial course of the saphena parva vein



**Fig. 1264** Saphenous hiatus, Hiatus saphenus, and vascular lacuna, Lacuna vasorum; the anterior abdominal wall, the abdominal viscera, the iliac fascia and the femoral septum (CLOQUET) have been removed; ventral view (r.).

\* also ROSENMÜLLER's lymph node  
\*\* also GIMBERNAT's ligament



**Fig. 1265** Muscular and vascular lacunae, Lacunae musculorum et vasorum; oblique section through the inguinal ligament; distal view (r.).

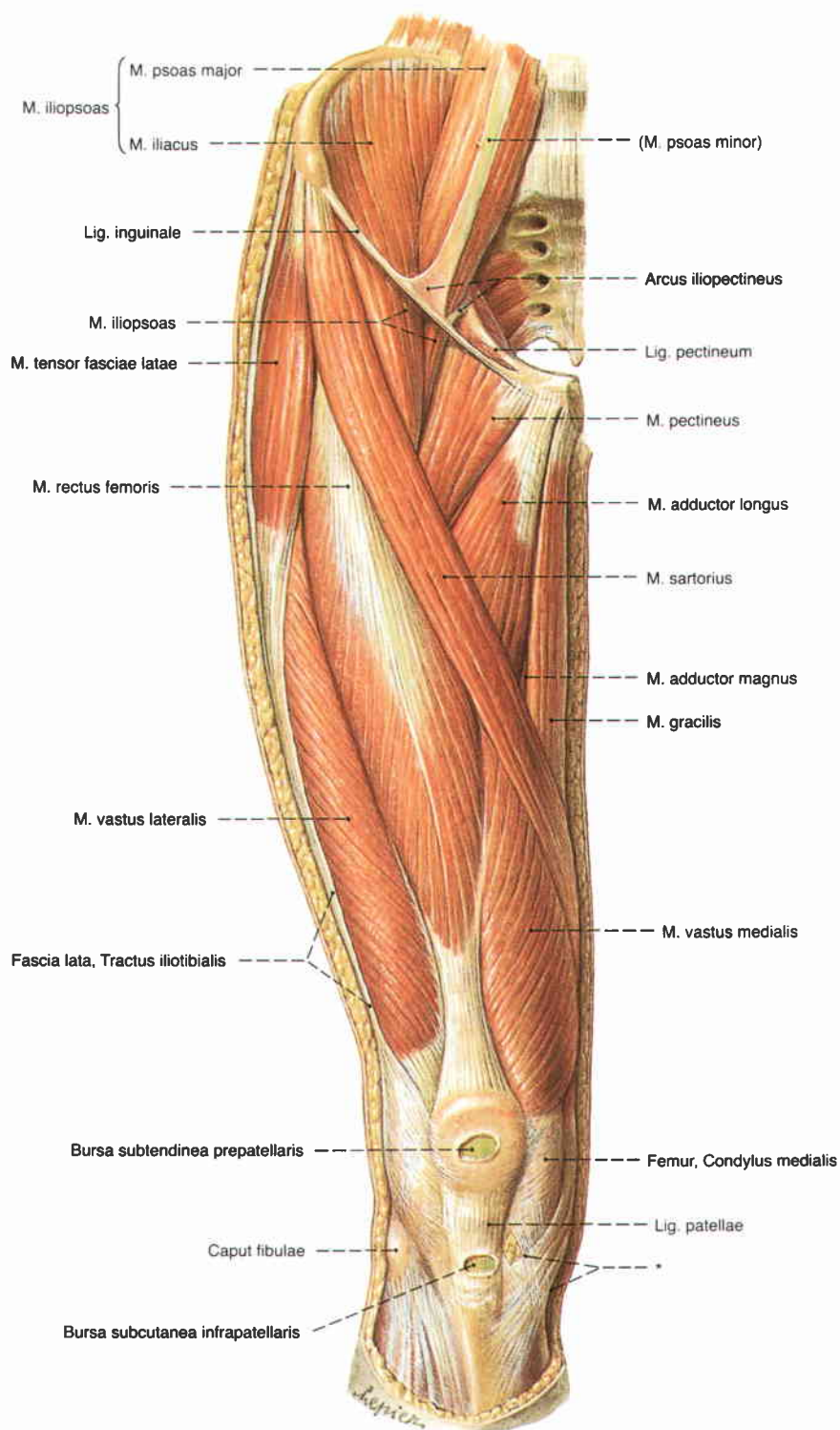
### Lacunae below the inguinal ligament

The arcus iliopectineus divides the space below the inguinal ligament into a lateral and a medial lacuna, the lacuna musculorum and the lacuna vasorum, respectively.

The M. iliopsoas, the N. cutaneus femoris lateralis and the N. femoralis pass through the lacuna musculorum to the thigh. The A. and V. femoralis, the R. femoralis of the N. genitofemoralis, the nodi lymphoidei lacunares (lateralis, medialis and intermedius) as well as lymphatic vessels are found in the lacuna

vasorum. The space bordered by the V. femoralis on the lateral side, the Lig. lacunare (medial), the Lig. inguinale (ventral) and the Lig. pectineum (dorsal) is filled with loose connective tissue, the Septum femorale (CLOQUET), and is called the Anulus femoralis or Canalis femoralis.

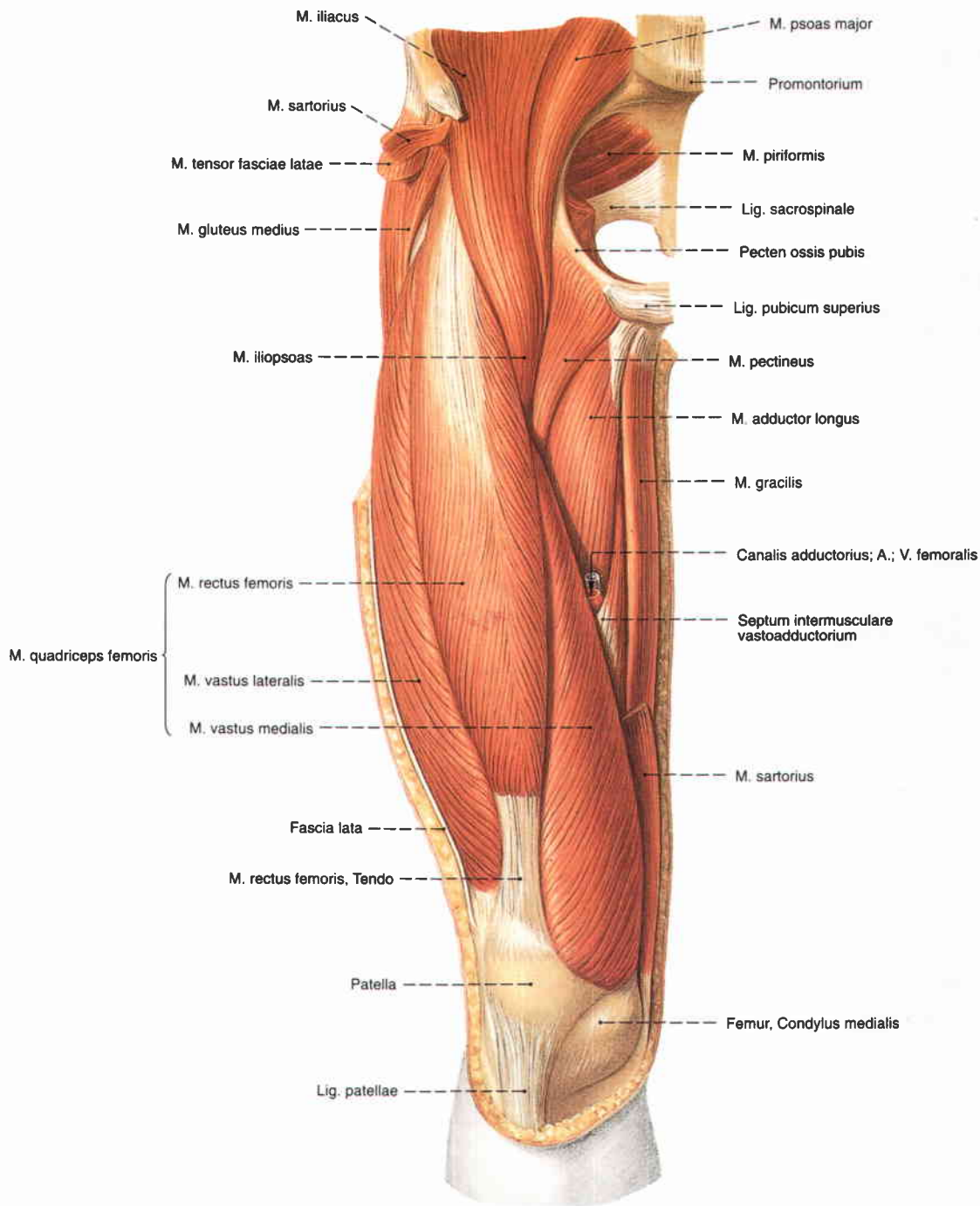
Femoral hernias can develop in this region, with the Anulus femoralis becoming the internal opening and the Hiatus saphenus the external opening of the hernia.



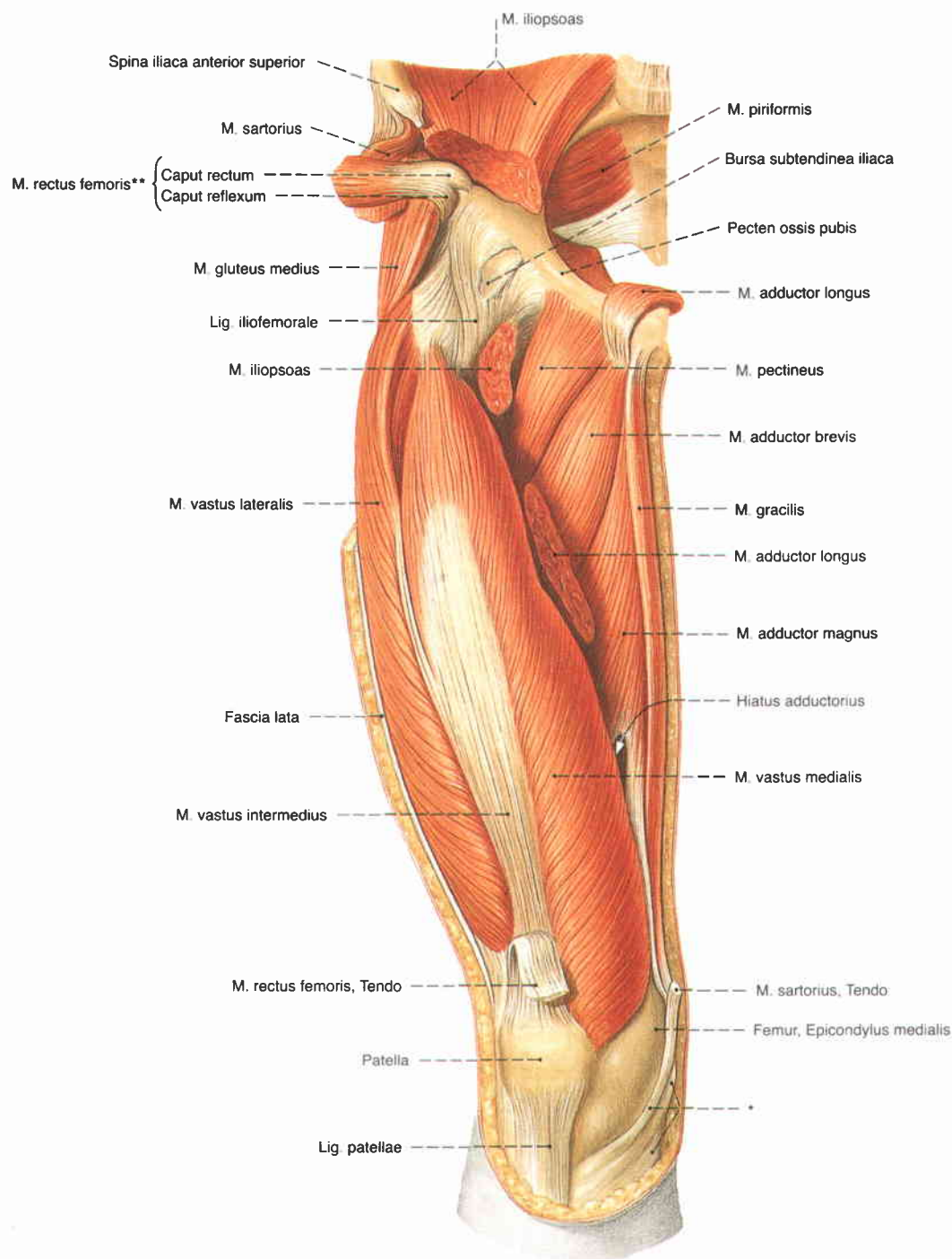
**Fig. 1266** Muscles of the thigh and hip; the Fascia lata has been removed, except for the iliotibial tract; ventral view (r.).

\* common insertion of the sartorius, gracilis and semitendinosus muscles below the medial tibial condyle (formerly called Pes anserinus superficialis)





**Fig. 1267** Muscles of the thigh and hip; the Fascia lata, the tensor fasciae latae muscle and the sartorius muscle have been removed; ventral view (r.).

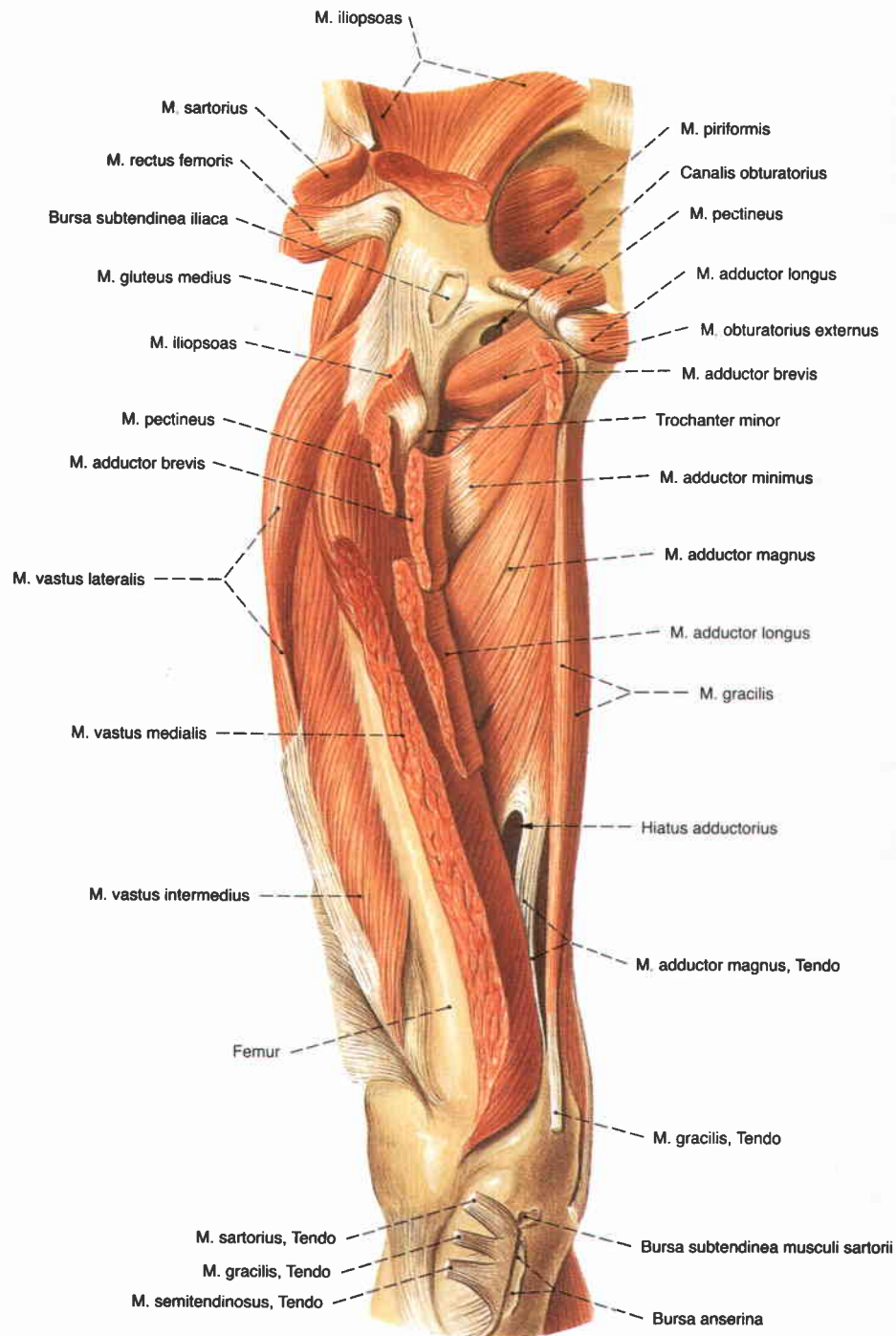


**Fig. 1268** Muscles of the thigh and hip; deep layer; the sartorius, the rectus femoris and the adductor longus muscles have been completely removed; the M. iliopsoas has been partially removed at the level of the joint; the ventral and lateral walls of the adductor canal, Septum intermusculare vastoadductorium, have been removed so that the opening into

the popliteal fossa, Hiatus adductorius, is visible; ventral view (r.).

\* common insertion of the sartorius, gracilis and semitendinosus muscles below the medial tibial condyle

\*\* The origin of M. rectus femoris has been moved aside.



**Fig. 1269** Muscles of the thigh and hip; most of the superficial muscles and some of the deeper muscles have been removed; the ventral and lateral walls of the adductor canal have been removed; ventral view (r.).



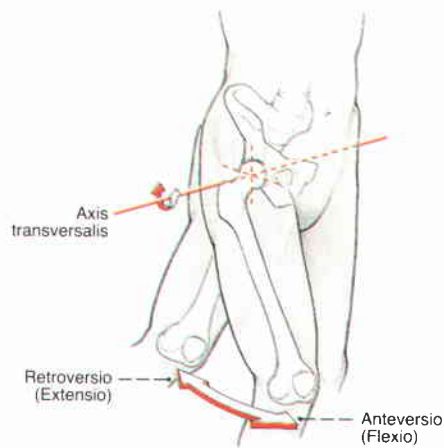


Fig. 1270 Hip joint; movement in the sagittal plane.

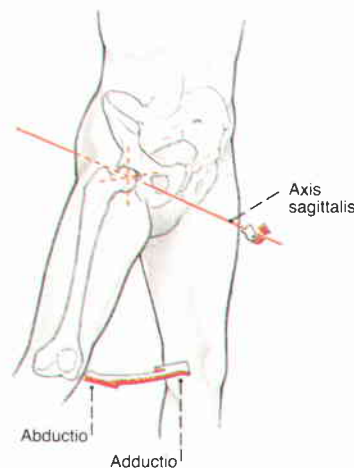


Fig. 1271 Hip joint; movement in the frontal plane.

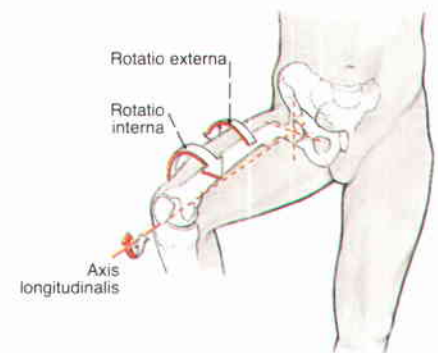


Fig. 1272 Hip joint; movement in the transverse plane.

### Ventral muscles of the hip (Figs. 1266–1268, 1285)

To this group belongs the *M. iliopsoas*, that consists of *M. iliacus* and *M. psoas major*. This is the only muscle that draws frontally over the hip only. All other muscles also draw over the knee and are therefore part of the thigh.

Muscle Innervation	Origin	Insertion	Function
1. <b>M. iliacus</b> <i>Rr. musculares from the Plexus lumbalis</i>	Fossa iliaca, Spina iliaca anterior inferior of Os coxae, anterior capsule of the Articulatio coxae	Trochanter minor and adjacent region of the Labium mediale of the Linea aspera	
2. <b>M. psoas major</b> <i>Rr. musculares from the Plexus lumbalis</i>	<b>Superficial layer:</b> body of the 12th thoracic to 4th lumbar vertebrae (lateral surface), Disci intervertebrales <b>Deep layer:</b> Procc. costales of the 1st to 4th lumbar vertebrae	Trochanter minor	<b>Lumbar vertebral column:</b> Lateral flexion, extension (hyperlordosis)  <b>Hip joint:</b> Flexion and medial rotation (when the <i>Mm. glutei</i> contract simultaneously also lateral rotation)
3. <b>M. psoas minor</b> <i>Rr. musculares from the Plexus lumbalis (variable)</i>	Body of the 12th thoracic vertebra and the 1st lumbar vertebra (lateral surface)	Fascia of <i>M. iliopsoas</i> , Arcus iliopectineus (often a long, flat tendon)	

### Ventral muscles of the thigh (Figs. 1266, 1267, 1285)

From proximal lateral, oblique over the thigh *M. sartorius* draws medial distal. The most lateral ventral muscle of the thigh is *M. tensor fasciae latae*, that ends in the Tractus iliotibialis. The major ventral muscle is *M. quadriceps femoris*.

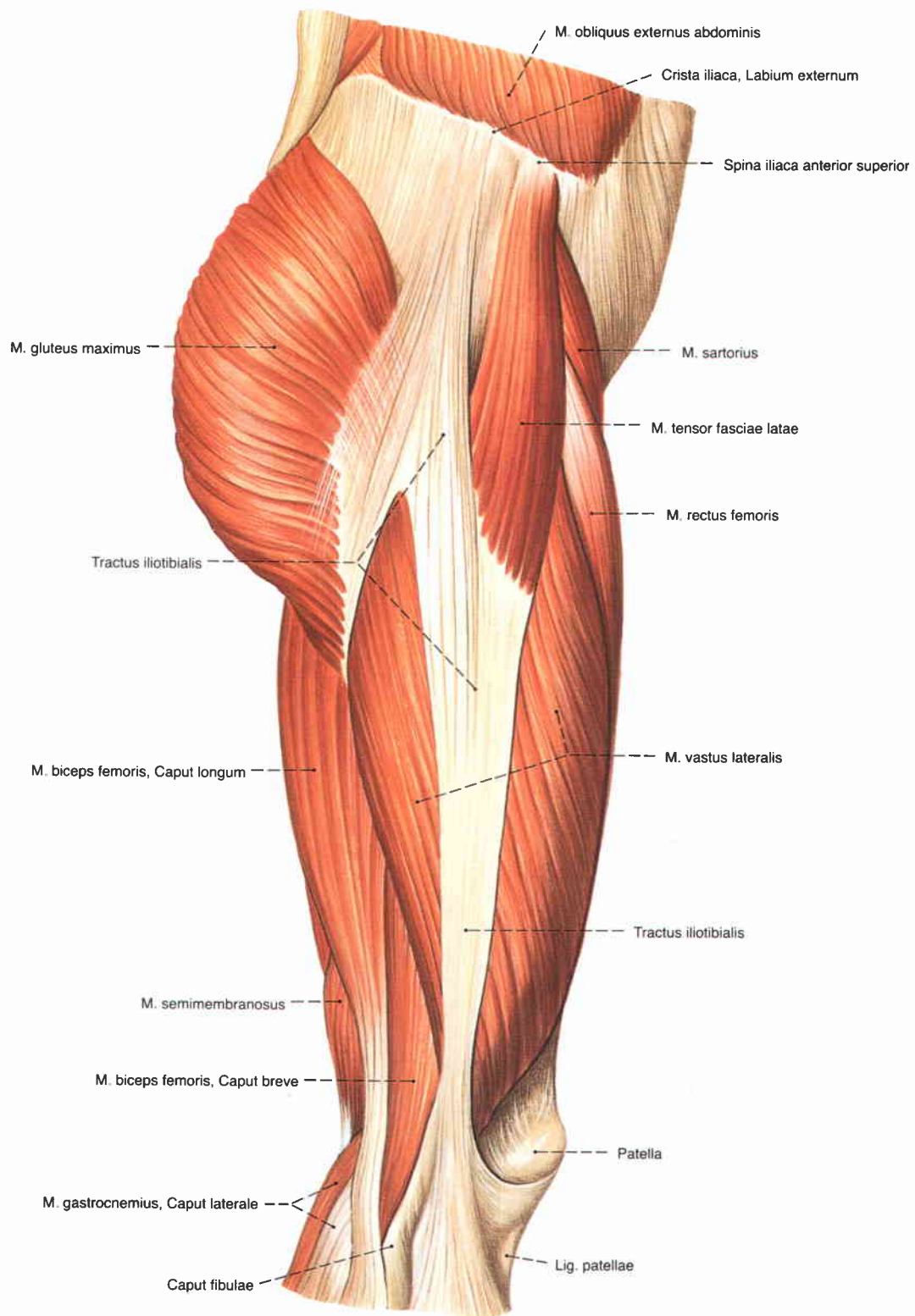
Muscle Innervation	Origin	Insertion	Function
1. <b>M. quadriceps femoris</b> <i>N. femoralis (Plexus lumbalis)</i> <i>M. rectus femoris:</i> operates two joints; <i>Mm. vasti medialis, lateralis and intermedius:</i> operate one joint	<b>M. rectus femoris, Caput rectum:</b> Spina iliaca anterior inferior  <b>M. rectus femoris, Caput reflexum:</b> cranial margin of the acetabulum  <b>M. vastus medialis:</b> Labium mediale of Linea aspera (lower two thirds)	Common tendon of the most powerful muscle of the human body, attaches to the base and lateral margins of the patella and blends with the Lig. patellae and the Retinacula patellae to insert on the Tuberositas tibiae	<b>Hip joint:</b> <i>M. rectus femoris</i> assists in flexion of the Articulatio coxae  <b>Knee joint:</b> Extension

	<b>M. vastus lateralis:</b> Trochanter major (distal circumference). Labium laterale of Linea aspera <b>M. vastus intermedius:</b> Anterior surface of the femur (upper two thirds) <b>M. articularis genus:</b> Anterior surface of the femur (distal quarter)		
2. <b>M. sartorius</b> <i>N. femoralis</i> ( <i>Plexus lumbalis</i> )	Spina iliaca anterior superior	Medial surface of the Tuberositas tibiae	<b>Hip joint:</b> Flexes, laterally rotates and abducts the thigh <b>Knee joint:</b> Flexes and rotates medially when the knee is flexed
3. <b>M. tensor fasciae latae</b> <i>N. gluteus superior</i> ( <i>Plexus lumbalis</i> )	Spina iliaca anterior superior	Lateral end of tibia (above Tractus iliotibialis, below Condylus lateralis)	<b>Hip joint:</b> Flexes, medially rotates and abducts the thigh <b>Knee joint:</b> Stabilizes the knee when extended

### Medial femoral muscles of the thigh (Figs. 1266, 1268, 1269, 1285, 1286)

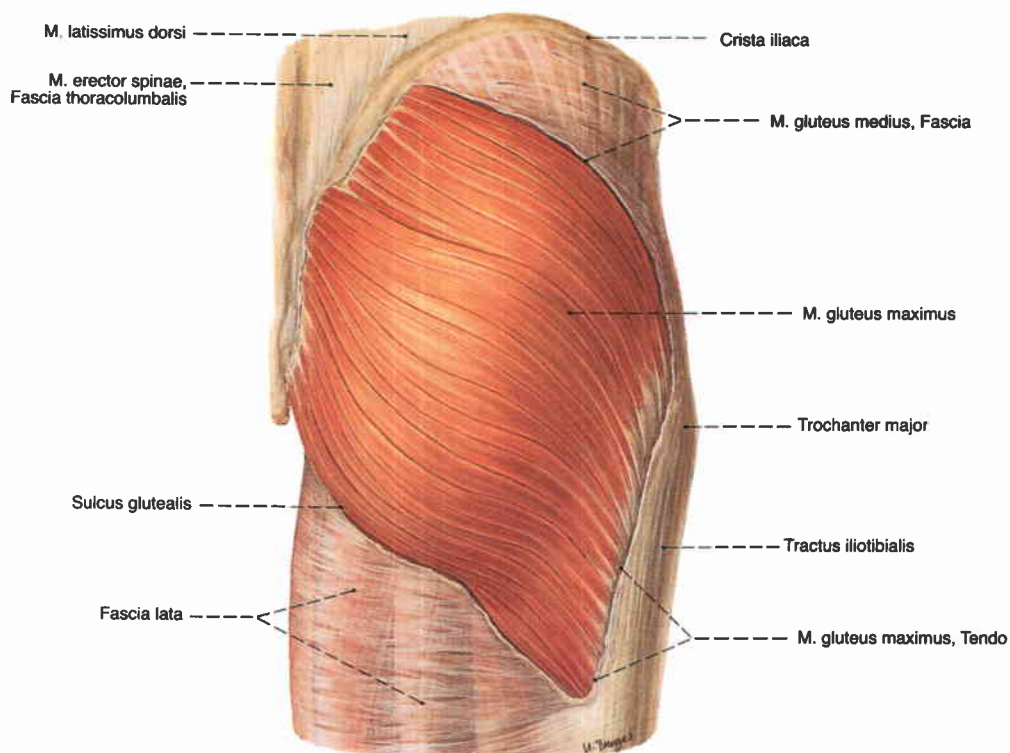
The group of medial femoral muscles of the thigh is, according to its main function adductors. In the ventral view, M. gracilis is the most medial, from proximal to distal one finds: M. pectineus, M. adductor brevis, M. adductor longus and M. adductor magnus. M. obturatorius externus is hidden behind M. pectineus.

Muscle Innervation	Origin	Insertion	Function
1. <b>M. gracilis</b> <i>N. obturatorius</i> ( <i>Plexus lumbalis</i> )	Ramus inferior ossis pubis (medial border, along the symphysis)	Proximal end of the tibia (medial of the Tuberositas tibiae)	<b>Hip joint:</b> Adduction, flexion, lateral rotation <b>Knee joint:</b> Flexion, medial rotation
2. <b>M. pectineus</b> <i>N. femoralis</i> and <i>N. obturatorius</i> ( <i>Plexus lumbalis</i> )	Pecten ossis pubis	Linea pectinea of the femur	<b>Hip joint:</b> Adduction, flexion, lateral rotation
3. <b>M. adductor brevis</b> <i>N. obturatorius</i> ( <i>Plexus lumbalis</i> )	Ramus inferior ossis pubis (closer to the Foramen obturatum than the M. adductor longus)	Proximal third of the Linea aspera, Labium mediale	<b>Hip joint:</b> Adduction, flexion, lateral rotation
4. <b>M. adductor longus</b> <i>N. obturatorius</i> ( <i>Plexus lumbalis</i> )	Os pubis (below Crista pubica to the symphysis)	Middle third of the Linea aspera, Labium mediale	<b>Hip joint:</b> Adduction, flexion, lateral rotation (most anterior fibres: medial rotation)
5. <b>M. adductor magnus</b> <i>N. obturatorius</i> ( <i>Plexus lumbalis</i> ) and <i>N. ischiadicus</i> ( <i>tibial part-Plexus sacralis</i> ) M. adductor minimus is a proximal part of M. adductor magnus	Ramus inferior ossis pubis, Ramus and Tuber ossis ischii (medial border)	Labium mediale of Linea aspera (proximal two thirds), Tuberositas, Tuberculum adductorium (Hiatus adductorius between the two insertions)	<b>Hip joint:</b> Adduction, lateral rotation, flexion (anterior part), extension (posterior part)
6. <b>M. obturatorius externus</b> <i>N. obturatorius</i> ( <i>Plexus lumbalis</i> )	Circumference of Foramen obturatum (lateral surface), Membrana obturatoria	Tendinous at the Fossa trochanterica of the femur	<b>Hip joint:</b> Rotates the thigh laterally, adduction, flexion of the Articulatio coxae

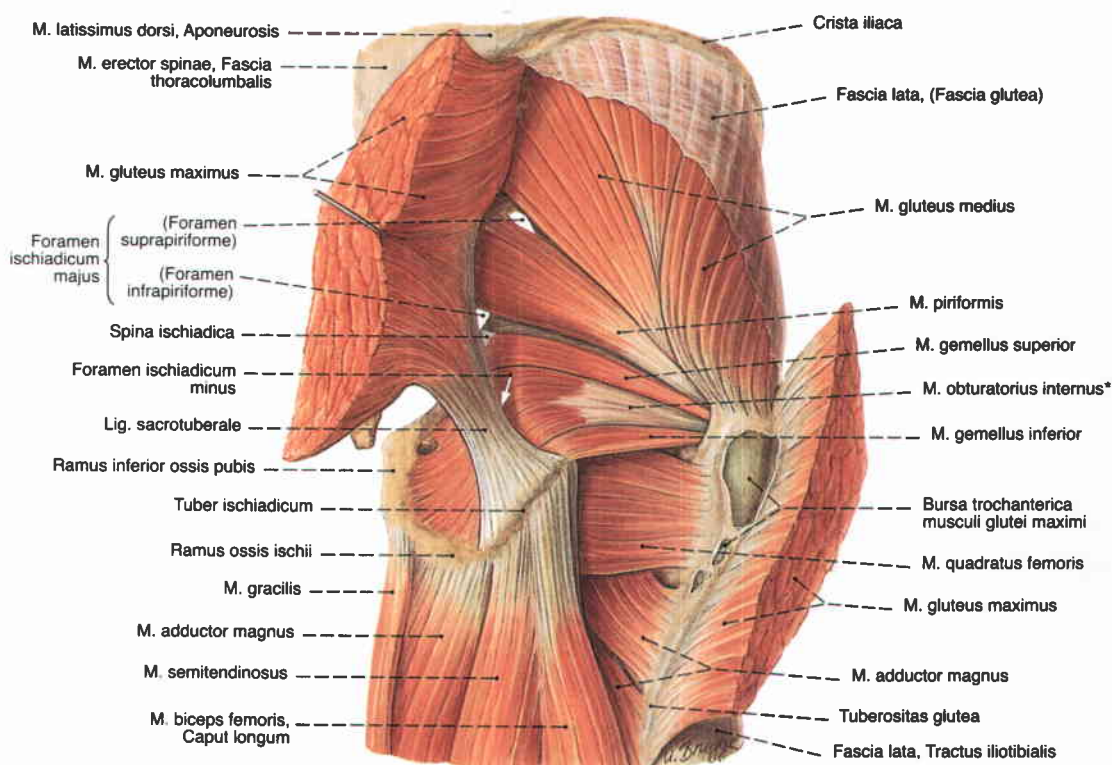


**Fig. 1273** Muscles of the thigh and hip; the Fascia lata has been removed, except for the iliotibial tract; lateral view (r.).



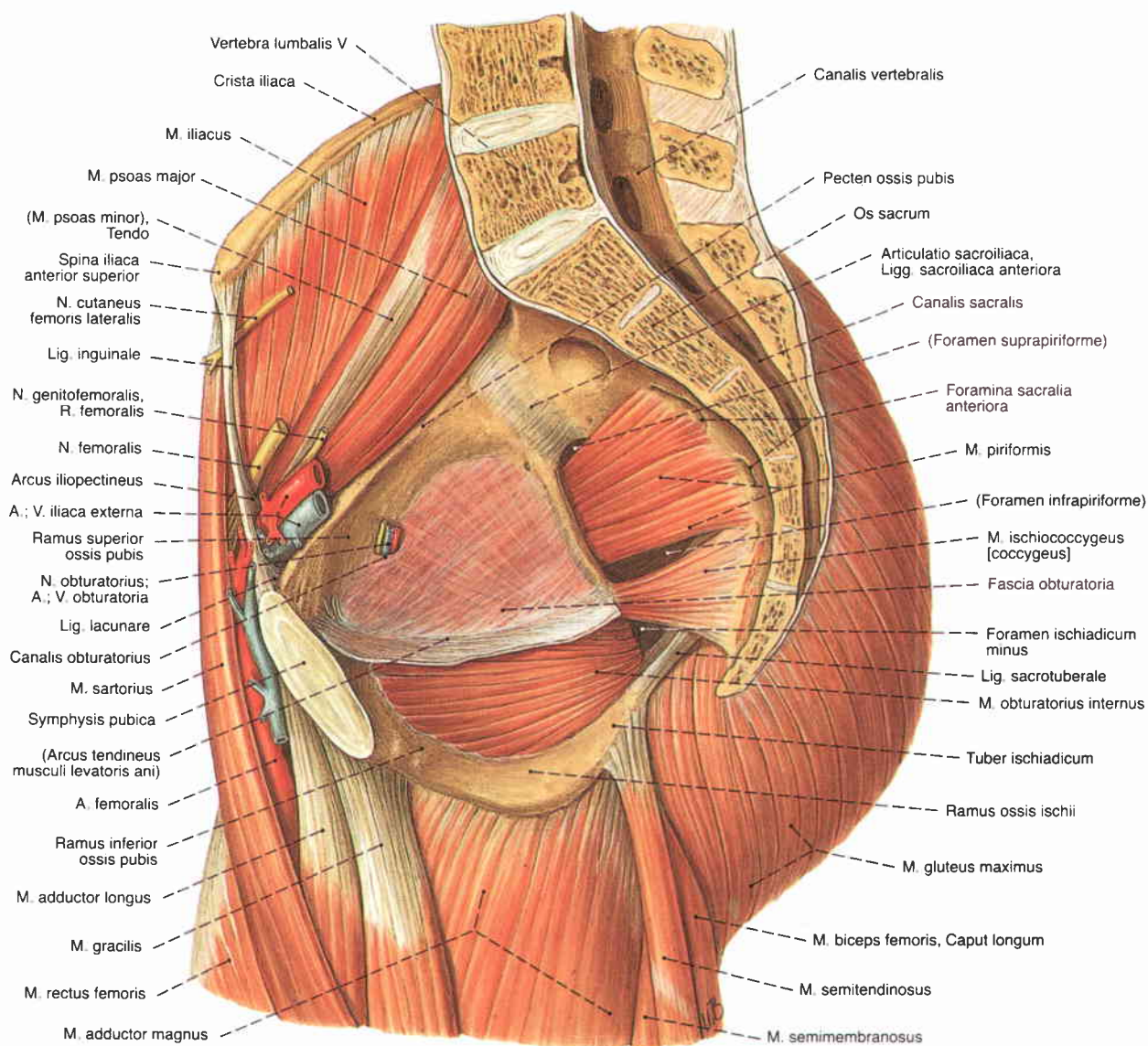


**Fig. 1274** Muscles of the thigh and hip; superficial hip muscles; the fascia of the gluteus maximus muscle has been removed; dorsal view (r.).



**Fig. 1275** Muscles of the thigh and hip; superficial hip muscles; the gluteus maximus muscle has been sectioned; dorsal view (r.).

\* The part of the internal obturator muscle from where it turns around the lesser sciatic notch and its insertion in the trochanteric fossa is frequently tendinous.



**Fig. 1276** Muscles of the thigh and hip; the hip musculature, the pelvis and the lumbar spine have been sectioned in the median plane; medial view (r.).

The Foramen ischiadicum [sciaticum] majus is bordered by the Incisura ischiadica major of the Os ischii, the lower margin of the sacro-iliac joint, the lateral margin of the Os sacrum and the Lig. sacrospinale. It is divided into the Foramen suprapiriforme and the Foramen infrapiriforme by the M. piriformis extending to the femur.

The smaller Foramen ischiadicum [sciaticum] minus is bordered by the Incisura ischiadica of the Os ischii and the Lig. sacrospinale and sacrotuberale.

The Canalis obturatorius is a gap in the Membrana obturatoria near to the Sulcus obturatorius (compare to Figs. 1171 and 1175).



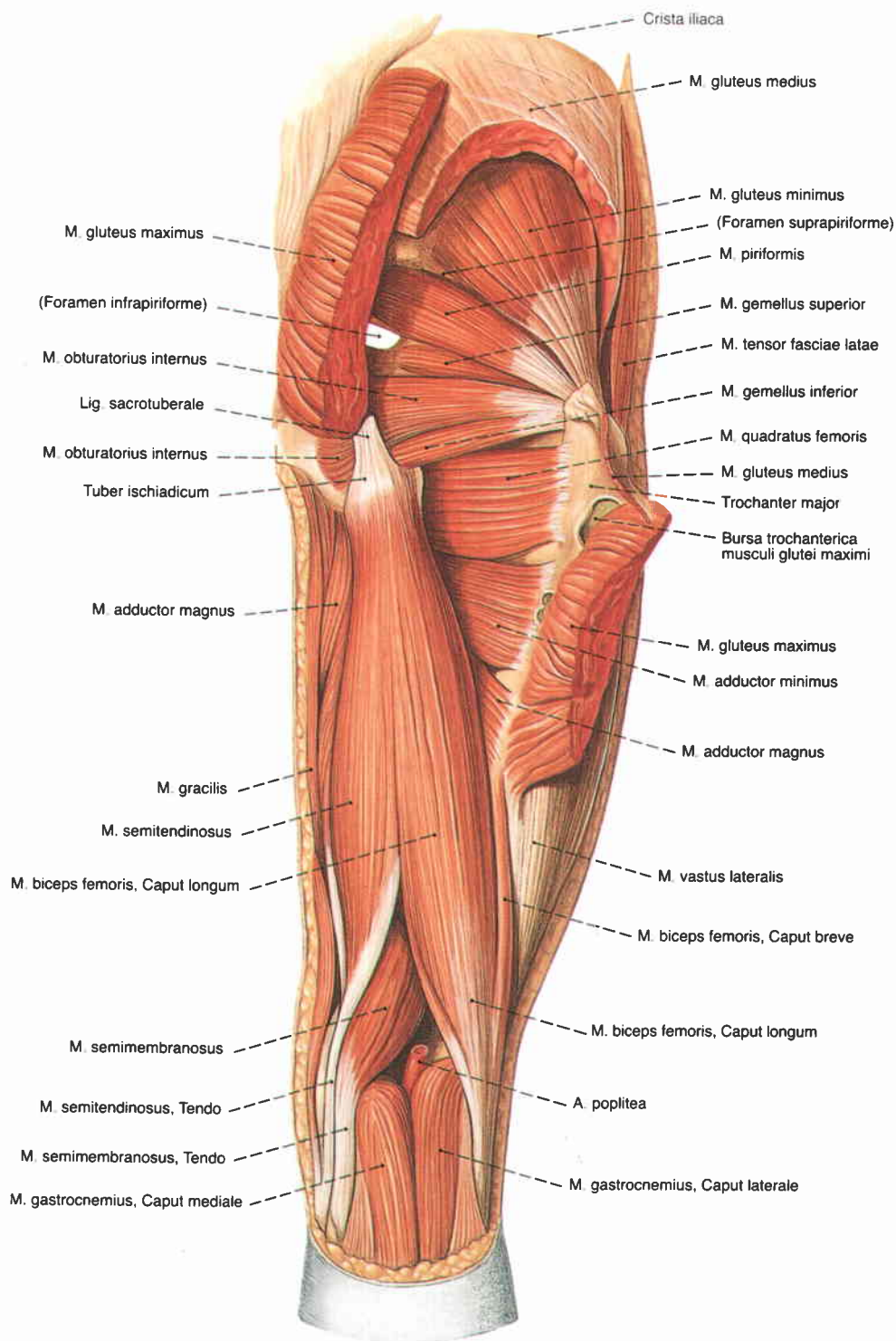
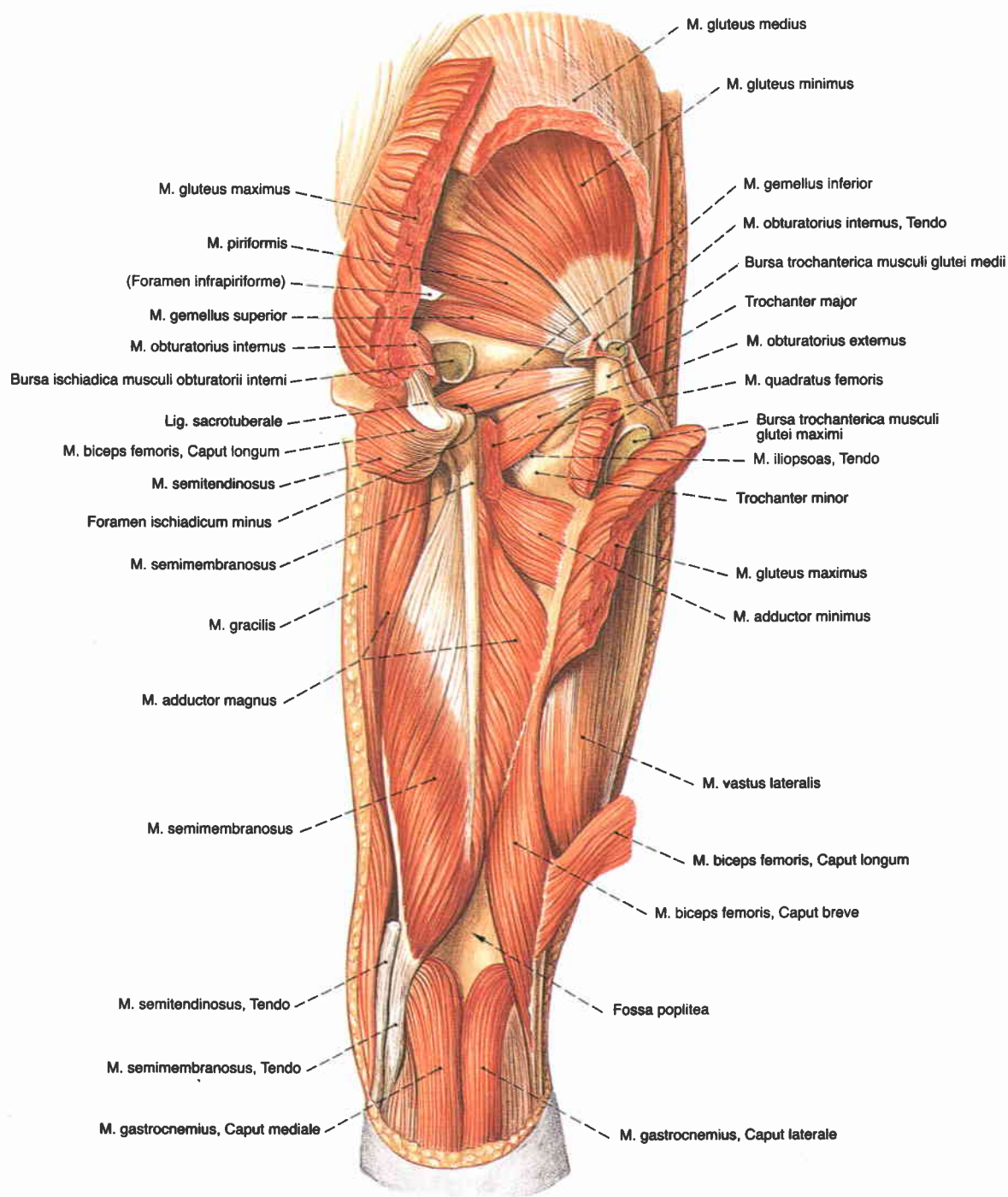


Fig. 1277 Muscles of the thigh and hip;  
the gluteus maximus and medius muscles have been  
partially removed;  
dorsal view (r.).





**Fig. 1278** Muscles of the thigh and hip; deep layer; most of the superficial gluteal and ischiocrural muscles have been removed; dorsal view (r.).

## Dorsal muscles of the hip (Figs. 1274, 1275, 1277, 1285, 1286)

M. gluteus maximus is responsible for the surface anatomy of the Regio glutealis. It covers nearly completely all the other muscles in the group. Cranially and ventrally a small portion of M. gluteus medius can be seen, which in turn covers M. gluteus minimus. Caudally and deeper follow M. piriformis, M. gemellus superior, M. obturatorius internus, M. **gemellus inferior** and M. **quadratus femoris**.

Muscle Innervation	Origin	Insertion	Function
1. <b>M. gluteus maximus</b> <i>N. gluteus inferior</i> ( <i>Plexus sacralis</i> )	Facies glutea of Ala ossis ilium (dorsal of Linea glutea posterior), Facies posterior of Os sacrum, Fascia thoracolumbalis, Lig. sacrotuberale	<b>Upper fibres:</b> Tibia, below Condylus lateralis (above Tractus iliotibialis). Between Trochanter major and Tractus iliotibialis is the Bursa trochanterica musculi glutei maximi. <b>Lower fibres:</b> Tuberositas glutea, Septum intermusculare femoris laterale	<b>Hip joint:</b> Upper fibres: tension, lateral rotation, abduction Lower fibres: extension, lateral rotation, adduction <b>Knee joint:</b> (via Tractus iliotibialis) extension
2. <b>M. gluteus medius</b> <i>N. gluteus superior</i> ( <i>Plexus sacralis</i> )	Facies glutea of Ala ossis ilium (between Lineae gluteae anterior and posterior)	Trochanter major (oblique ridge on the lateral surface)	<b>Hip joint:</b> Ventral part: abduction, flexion, medial rotation Dorsal part: abduction, extension, lateral rotation
3. <b>M. gluteus minimus</b> <i>N. gluteus superior</i> ( <i>Plexus sacralis</i> )	Facies glutea of Ala ossis ilium (between Lineae gluteae anterior and inferior)	Trochanter major (oblique ridge on the lateral surface)	<b>Hip joint:</b> Ventral part: abduction, flexion, medial rotation Dorsal part: abduction, extension, lateral rotation
4. <b>M. piriformis</b> <i>N. ischiadicus and/or N. musculi piriformis</i> ( <i>Plexus sacralis</i> )	Facies pelvica of Os sacrum (lateral and between 3rd and 4th Foramina sacralia pelvica), Incisura ischiadica major (close to Os sacrum)	Trochanter major (medial surface, superior border)	<b>Hip joint:</b> Lateral rotation, extension, adduction
5. <b>M. obturatorius internus</b> <i>N. musculi obturatorii interni and Rr. musculares</i> ( <i>Plexus sacralis</i> )	Inner surface of Foramen obturatum	Fossa trochanterica	
6. <b>M. gemellus superior</b> <i>N. musculi obturatorii interni and Rr. musculares</i> ( <i>Plexus sacralis</i> )	Spina ischiadica	Fossa trochanterica	
7. <b>M. gemellus inferior</b> <i>N. musculi obturatorii interni and Rr. musculares</i> ( <i>Plexus sacralis</i> )	Tuber ischiadicum	Fossa trochanterica	<b>Hip joint:</b> Lateral rotation, extension, adduction
8. <b>M. quadratus femoris</b> <i>N. musculi quadrati femoris</i> ( <i>Plexus sacralis</i> )	Lateral border of Tuber ischiadicum	Crista intertrochanterica	

## Dorsal muscles of the thigh (Figs. 1277, 1286)

To the dorsal muscles of the thigh belong: M. biceps femoris, M. semitendinosus, and M. semimembranosus (order from surface to bone)

Muscle Innervation	Origin	Insertion	Function
<b>1. M. biceps femoris</b> Caput longum: <i>N. ischiadicus, tibial part (Plexus sacralis)</i> Caput breve: <i>N. ischiadicus, fibular part (Plexus sacralis)</i> Caput longum: operates 2 joints Caput breve: operates 1 joint	<b>Caput longum:</b> Tuber ischiadicum (common tendon with M. semitendinosus)  <b>Caput breve:</b> Labium laterale of Linea aspera (medial third)	Caput fibulae (around Lig. collaterale fibulare), radiates into Fascia cruris	<b>Hip joint:</b> extension, adduction, lateral rotation  <b>Knee joint:</b> flexion, lateral rotation
<b>2. M. semitendinosus</b> <i>N. ischiadicus, tibial part (Plexus sacralis)</i>	Tuber ischiadicum (common tendon with Caput longum musculi bicipitis femoris)	Tuberositas tibiae (medial surface)	<b>Hip joint:</b> extension, adduction, medial rotation  <b>Knee joint:</b> flexion, medial rotation
<b>3. M. semimembranosus</b> <i>N. ischiadicus, tibial part (Plexus sacralis)</i>	Tuber ischiadicum	Proximal end of tibia (below Condylus medialis), posterior capsule of the knee joint, Lig. popliteum obliquum, fascia of M. popliteus. The three insertions of M. semimembranosus were earlier referred to as Pes anserinus profundus.	<b>Hip joint:</b> extension, adduction, medial rotation  <b>Knee joint:</b> flexion, medial rotation

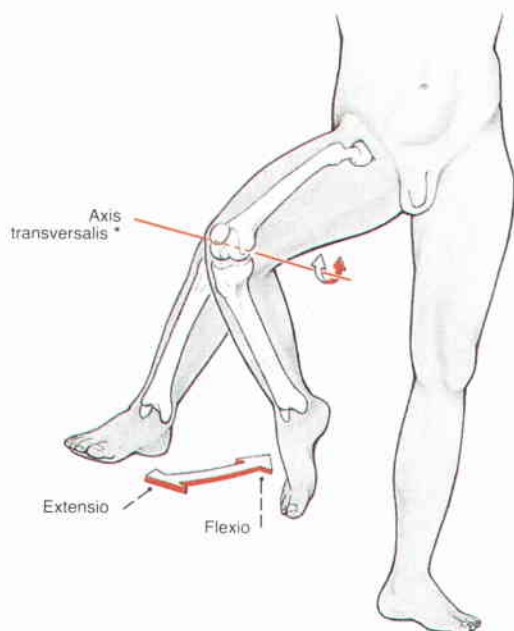


Fig. 1279 Knee joint; movement in the sagittal plane.

\* This axis in particular changes its position during the course of the movement corresponding to the different curvatures of the femoral condyles.

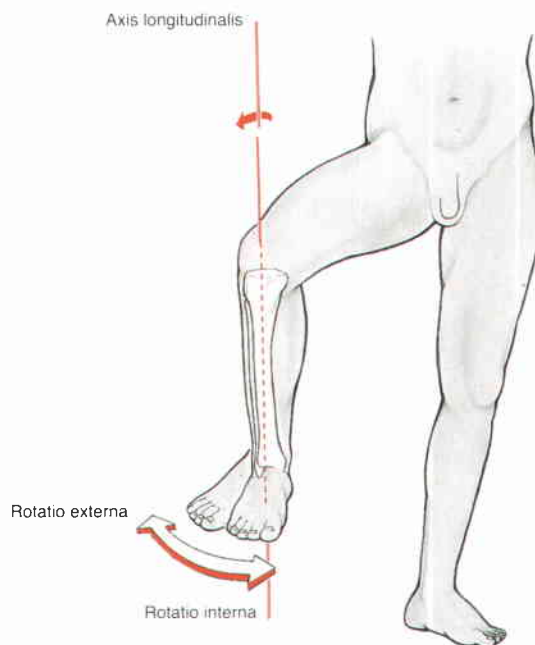
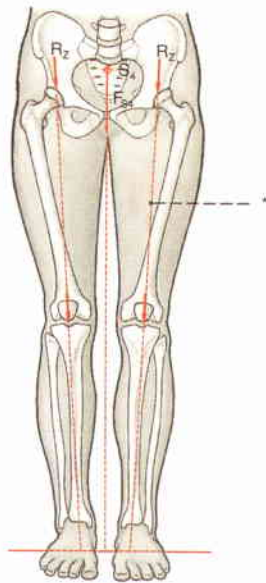


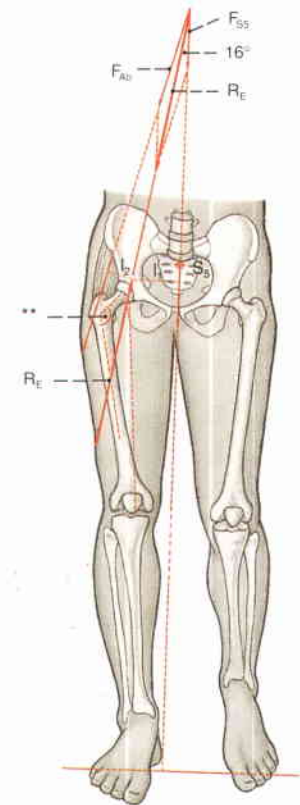
Fig. 1280 Knee joint; movement in the transverse plane.





**Fig. 1281** Forces on the hip joint, when standing on both legs.

- $S_4$  gravity of 4/6 of the body weight  
 $F_{S4}$  force of the part of the body weight on the hip joint  
 $R_Z$  resulting forces that have an effect on the hip joints when standing on both legs  
 $S_5$  gravity of 5/6 of the body weight  
 $F_{S5}$  force of the part of the body weight on the hip joint when standing on one leg  
 $R_E$  resulting forces that have an effect on the hip joints  
 $F_{Ab}$  forces of the abducting muscles  
 $l_1$  lever arm of  $F_{S5}$   
 $l_2$  lever arm of  $F_{Ab}$   
 $*$  carrying line  
 $**$  angle of femoral neck (approx. 125°)

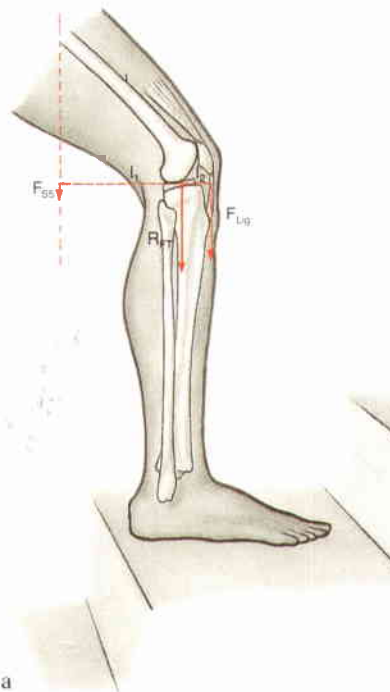


**Fig. 1282** Unilateral force on the hip joint in the standing phase when walking.



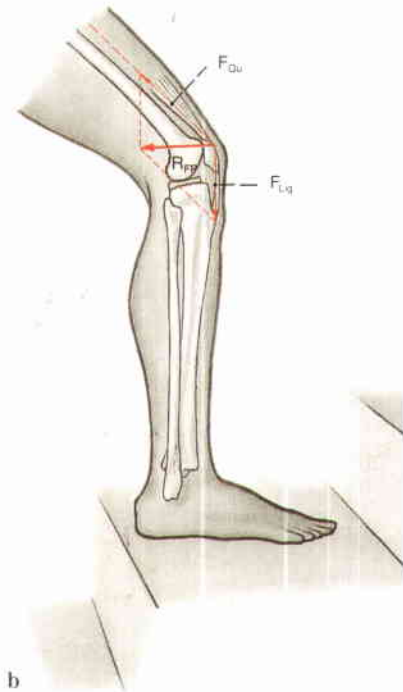
- $F_l$  part of the force that effects the lateral compartment  
 $F_m$  part of the force that effects the medial compartment  
 $F_{S5}$  force on the knee joint caused by about 5/6 of the body weight

**Fig. 1283** Forces on the knee joint; frontal plane.



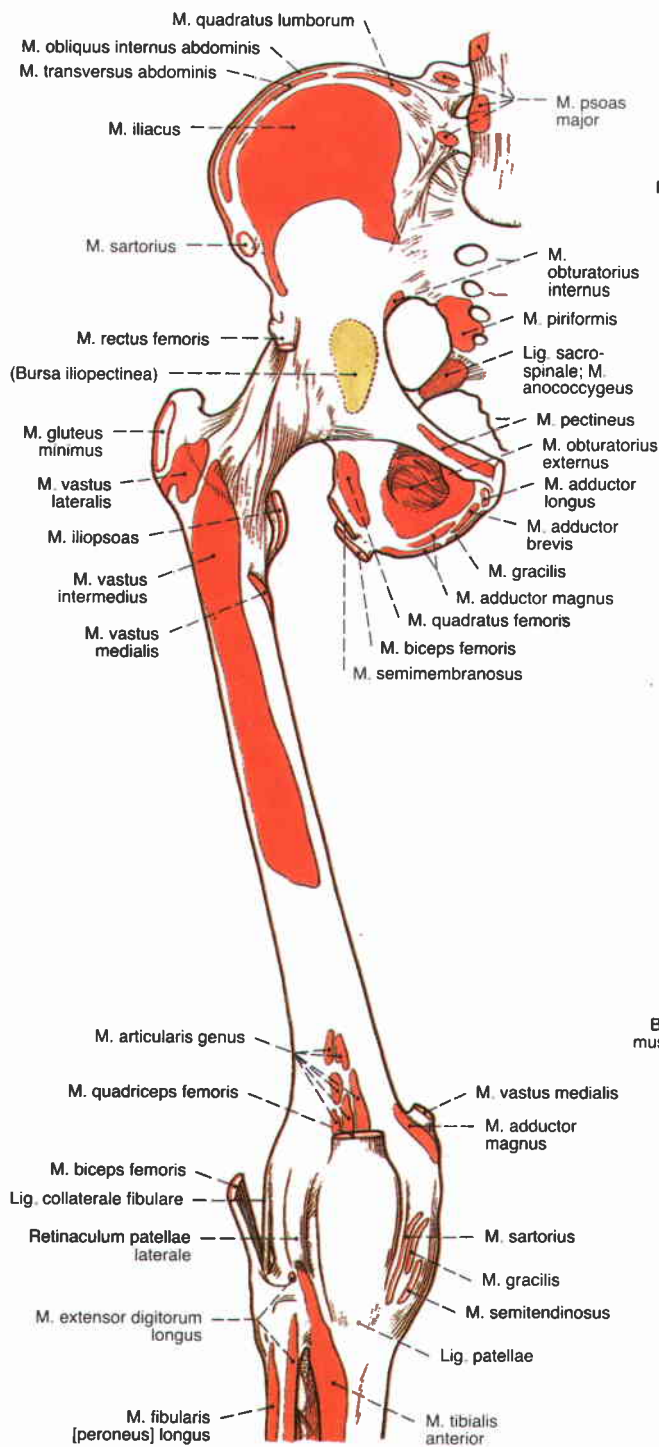
- $F_{Qu}$  force of M. quadriceps femoris  
 $F_{Lig}$  force of Lig. patellae  
 $R_{PT}$  resulting forces in the femoropatellar joint  
 $R_{FT}$  resulting forces in the femorotibial joint

**Figs. 1284 a, b** Forces on the knee joint; sagittal plane.  
**a** femorotibial joint

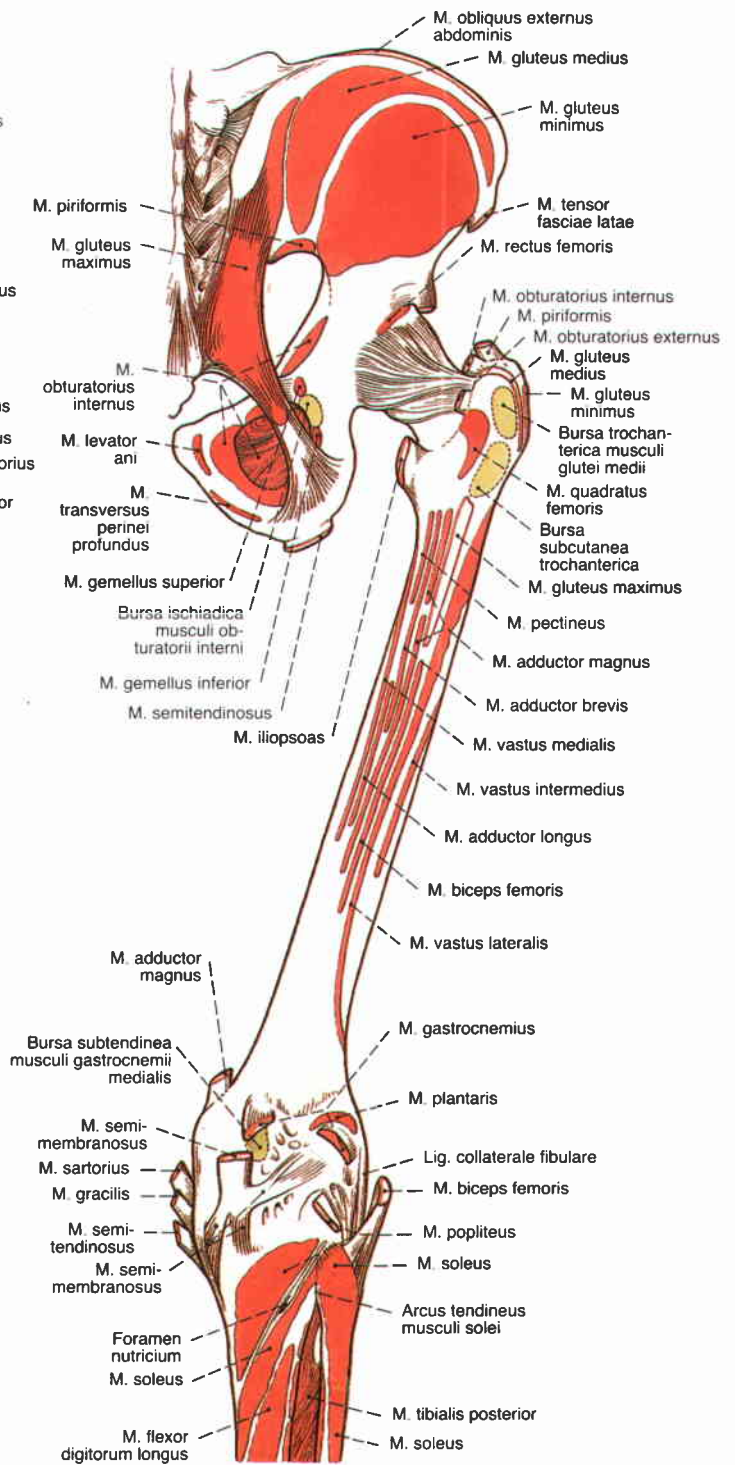


- $l_1$  lever arm caused by about 5/6 of the body weight on the knee joint in this position  
 $l_2$  lever arm of the Lig. patellae  
 $*$  body's impulse

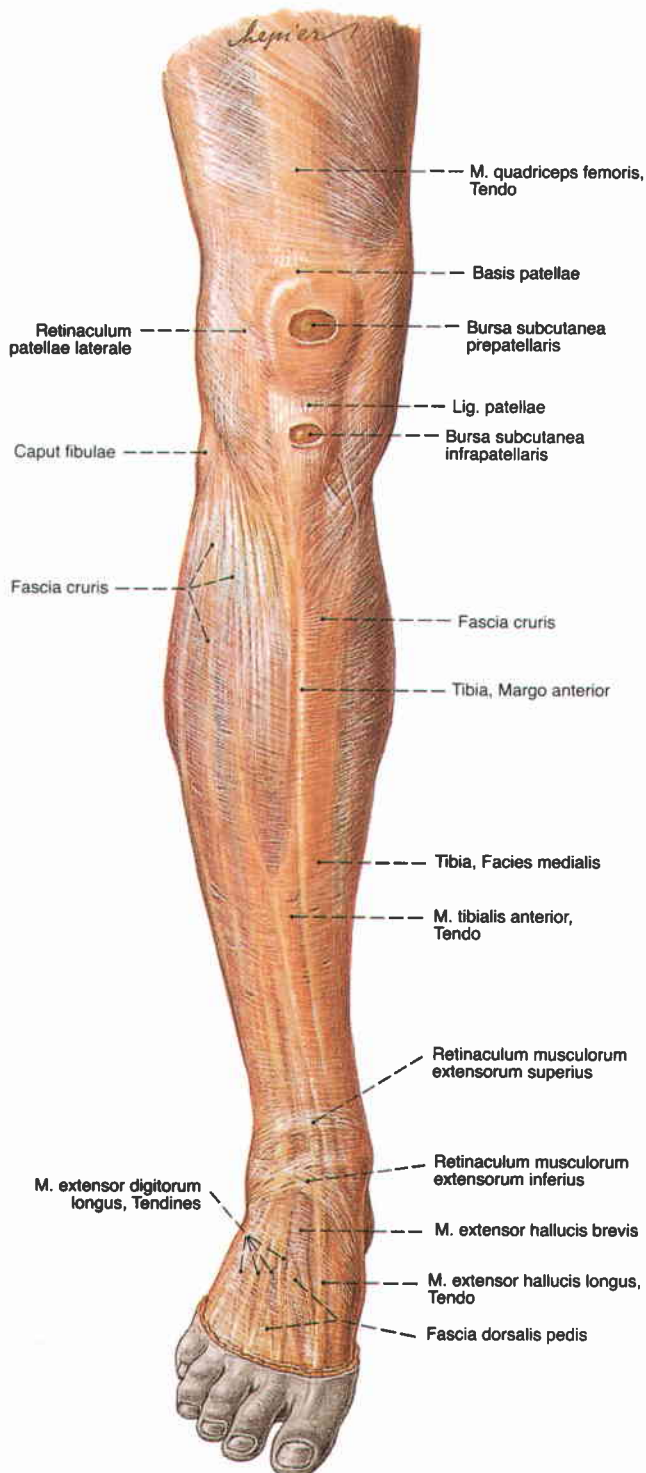
**b** femoropatellar joint



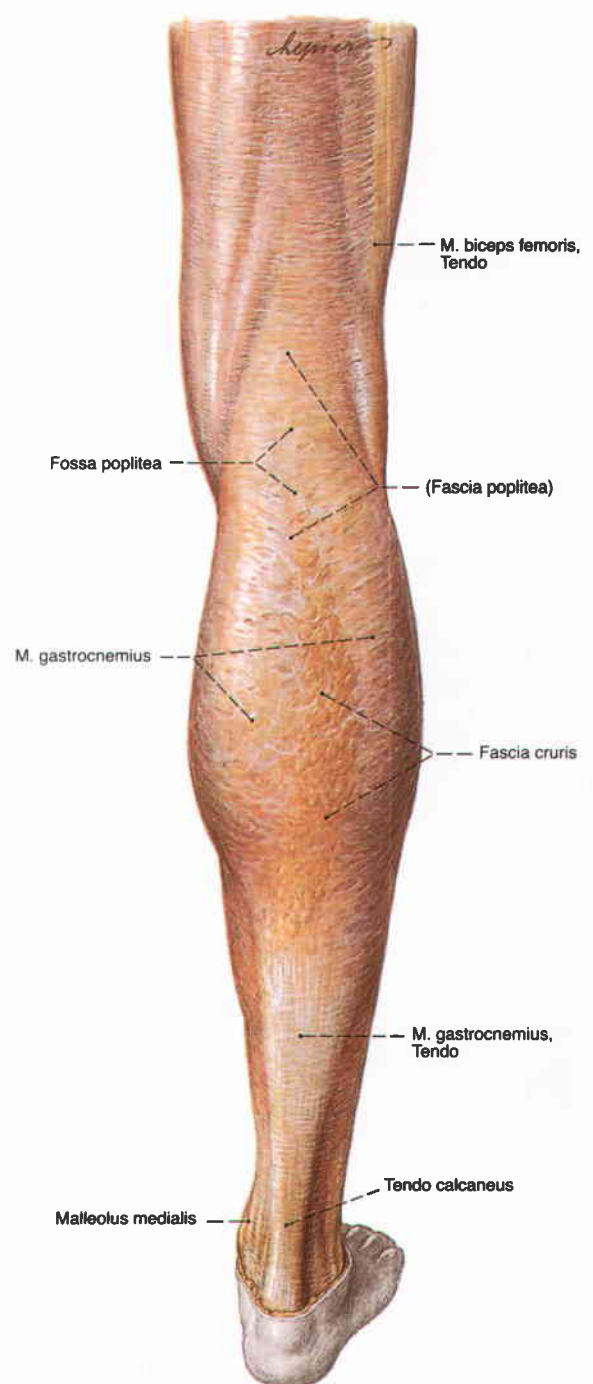
**Fig. 1285** Muscular origins and insertions on the lower lumbar spine, the pelvic bones, the femur and the proximal ends of the crural bones; ventral view (r.).



**Fig. 1286** Muscular origins and insertions on the pelvic bones, the femur and the proximal ends of the crural bones; dorsal view (r.).



**Fig. 1287** Fasciae of the knee and crus; ventral view (r.).



**Fig. 1288** Fasciae of the knee and crus; dorsal view (r.).



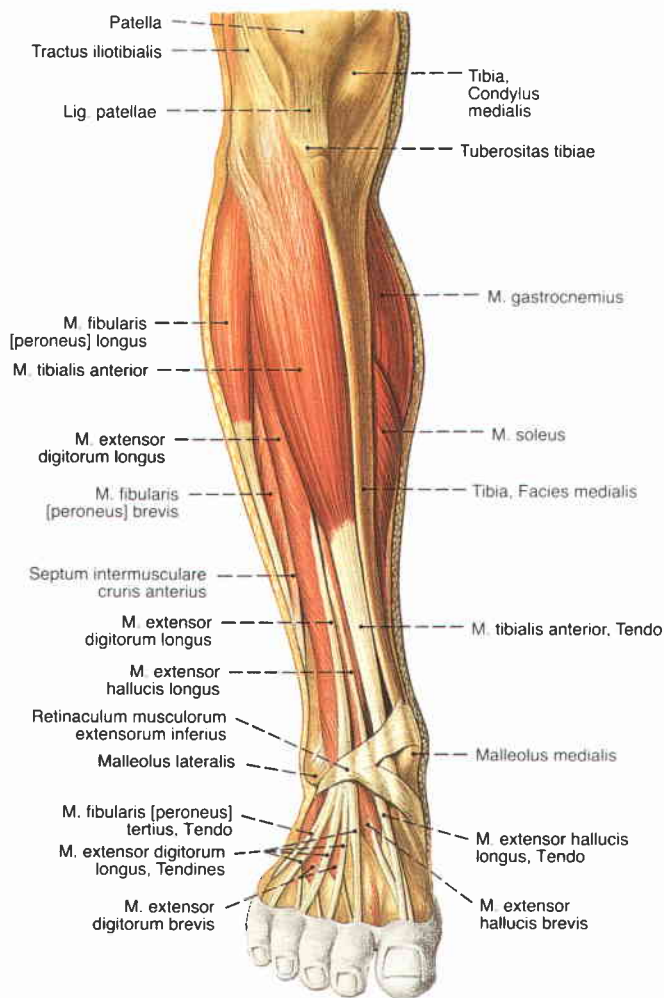


Fig. 1289 Muscles of the crus and foot; the fasciae have been removed; ventral view (r.).

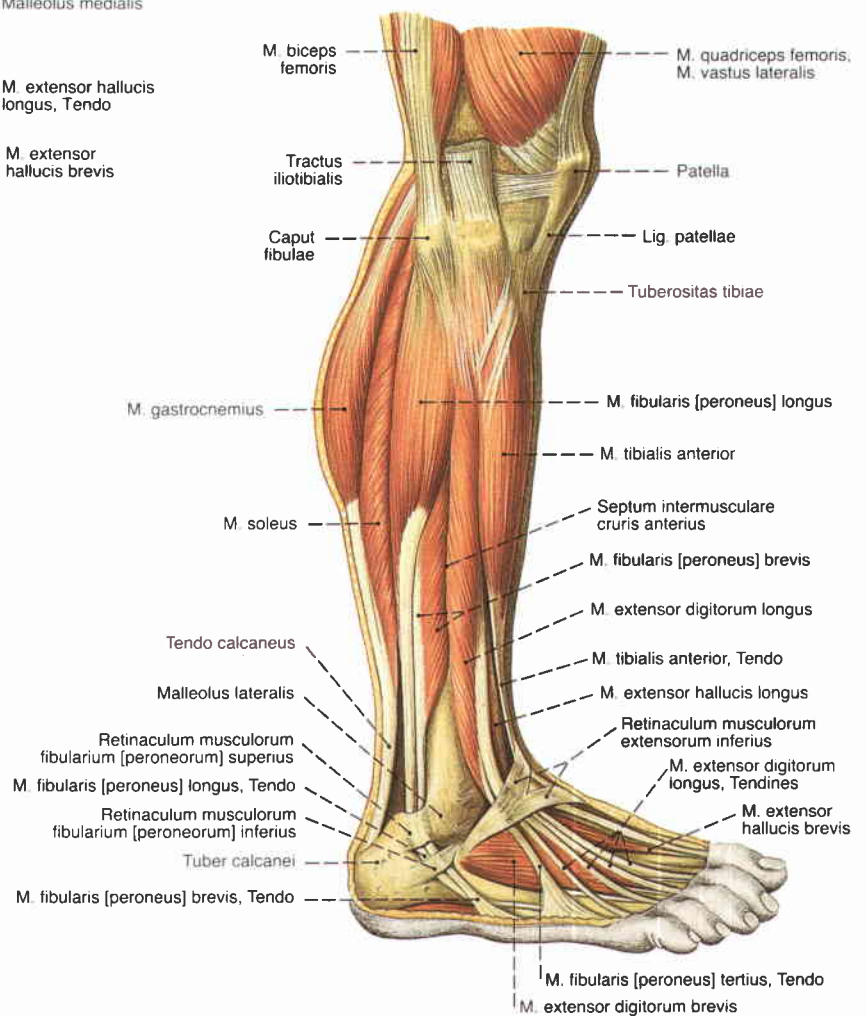


Fig. 1290 Muscles of the crus and foot; the fasciae have been removed; lateral view (r.).

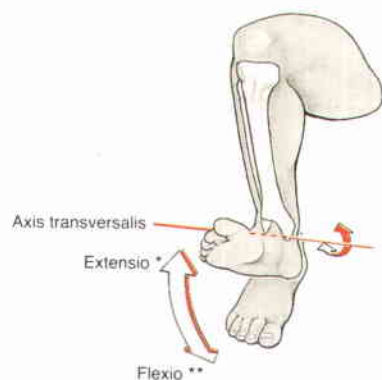


Fig. 1291 Ankle joint or talocrural joint; movement in the sagittal plane. Flexion and extension take place almost exclusively in the ankle joint. For clarity the Flexio\*\* may also be called “plantar flexion” and the Extensio\* “dorsiflexion”.

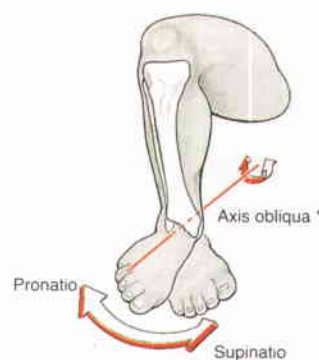


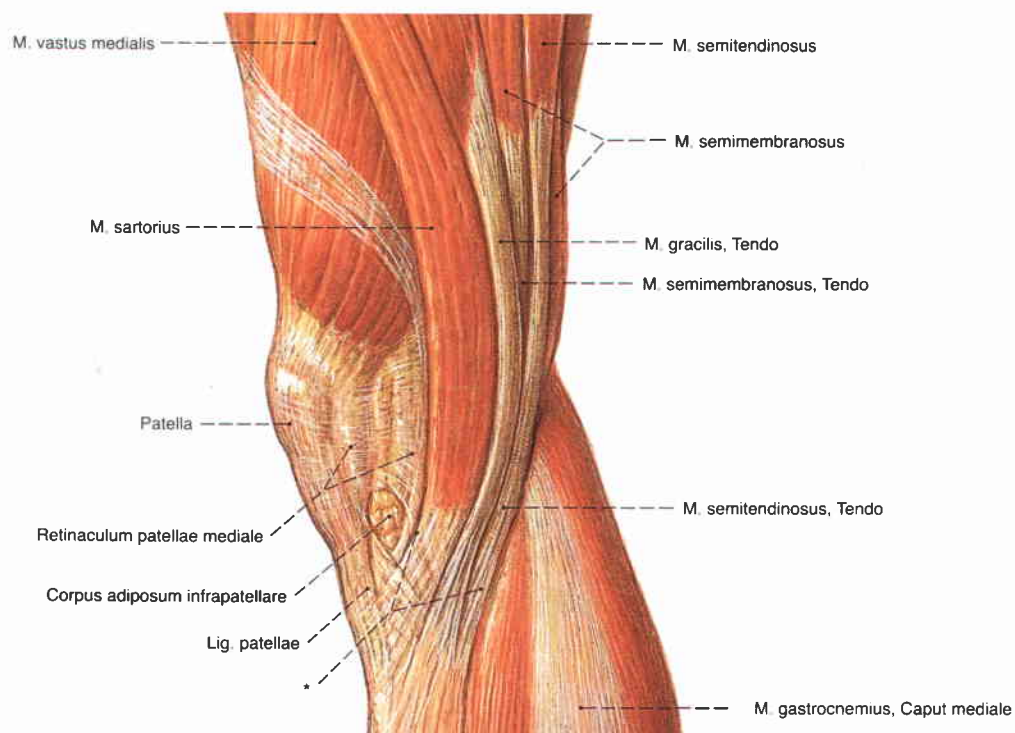
Fig. 1292 Intertarsal joints; turning movements of the foot. In extreme plantar flexion, pronation in the intertarsal joints may also be called lateral abduction, supination may be called medial abduction.

\* This axis running from the internal aspect of the talar neck posteroinferiorly to the lateral process of the Tuber calcanei has been exaggerated here in its oblique course (see Fig. 1310).

### Ventral muscles of the lower leg (Figs. 1289, 1300, 1308, 1310)

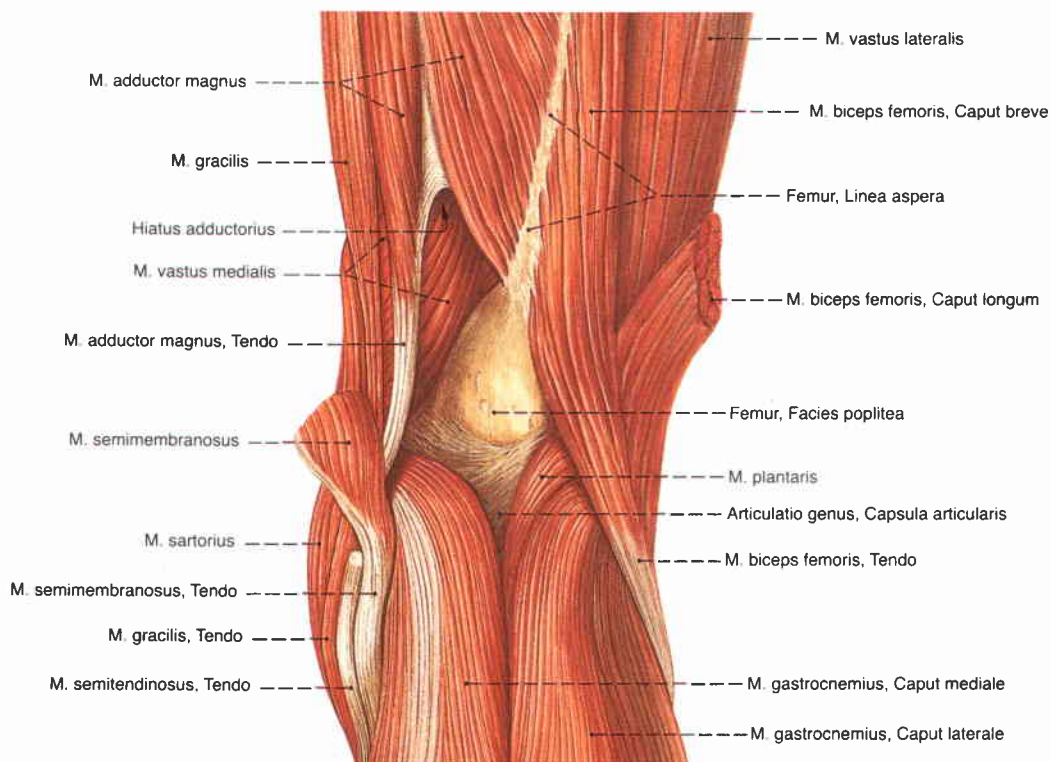
M. tibialis anterior, being the most superficial and medial, bulges the Fascia cruris forward. The next deeper muscle is M. extensor digitorum longus, from whose lateral border M. fibularis tertius often arises. The deepest is M. extensor hallucis longus.

Muscle Innervation	Origin	Insertion	Function
1. <b>M. tibialis anterior</b> <i>N. fibularis profundus</i> ( <i>N. ischiadicus</i> )	Proximal part of the tibia (below the Condylus lateralis), Facies lateralis of the tibia (upper 2/3), Membrana interossea, Fascia cruris	Base of 1st metatarsal bone (medial border), Os cuneiforme mediale (plantar surface)	<b>Ankle joint:</b> dorsiflexion <b>Intertarsal joints:</b> supinates the foot
2. <b>M. extensor hallucis longus</b> <i>N. fibularis profundus</i> ( <i>N. ischiadicus</i> )	Facies medialis of the fibula (distal 2/3), Membrana interossea, Fascia cruris	Base of the distal phalanx of the great toe, base of phalanx	<b>Ankle joint:</b> dorsiflexion <b>Intertarsal joints:</b> supinates the foot <b>Great toe joints:</b> extends the toe
3. <b>M. extensor digitorum longus</b> <i>N. fibularis profundus</i> ( <i>N. ischiadicus</i> )	Proximal part of the tibia (below Condylus lateralis), Margo anterior of fibula, Membrana interossea cruris, Septum intermusculare cruris anterius, Fascia cruris	Dorsal aponeuroses of the 4 lateral toes	<b>Ankle joint:</b> dorsiflexion <b>Intertarsal joints:</b> pronate the foot
4. <b>M. fibularis [peroneus] tertius</b> <i>N. fibularis superficialis</i> ( <i>ischiadicus</i> ) (variable)	Part of M. extensor digitorum longus	Basis of Os metatarsi V	<b>Toe joints:</b> extend the toes



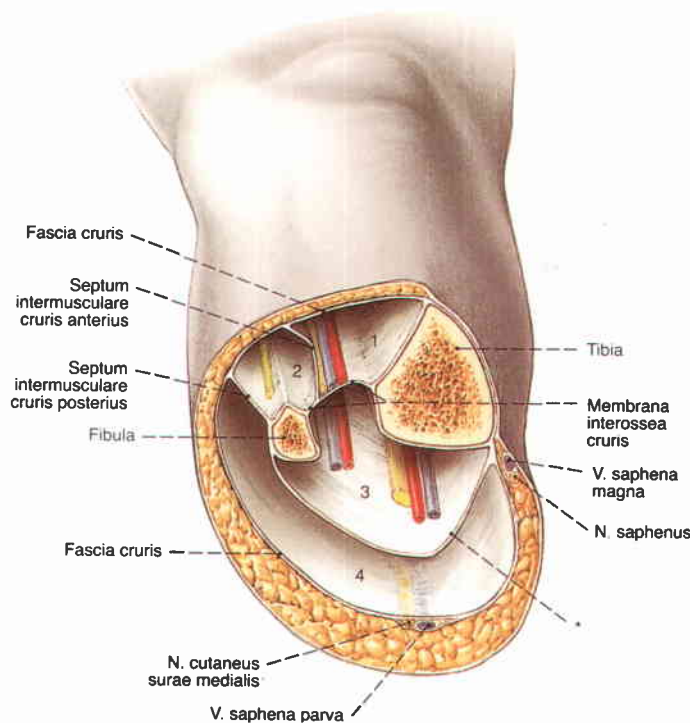
**Fig. 1293** Muscles in the area of the knee joint; the fasciae have been removed; medial view (r.).

\* common insertion below the medial condyle of the tibia (formerly called Pes anserinus superficialis)



**Fig. 1294** Muscles in the area of the knee joint; the fasciae and the ischiocrural muscles have been removed; dorsal view (r.).





**1 Compartmentum cruris anterior**  
 A. and V. tibialis anterior  
 N. fibularis profundus  
 M. tibialis anterior  
 M. extensor digitorum longus  
 M. extensor hallucis longus  
 M. fibularis [peroneus] tertius

**3 Compartmentum cruris posterius, Pars profunda**  
 A. and V. tibialis posterior  
 A. and V. fibularis  
 N. tibialis  
 M. flexor digitorum longus  
 M. tibialis posterior  
 M. flexor hallucis longus

**2 Compartmentum cruris laterale**  
 N. fibularis superficialis  
 M. fibularis [peroneus] longus  
 M. fibularis [peroneus] brevis

**4 Compartmentum cruris posterius, Pars superficialis**  
 M. triceps surae  
 M. plantaris

**Fig. 1295** Osteofibrous tubes of the crus; cross section above the middle of the crus; distal view (r.).

Clinically these osteofibrous tubes together with their contents are called compartments.

\* deep part of the crural fascia

The very compact Fascia cruris, the fibrous Septa intermuscularia cruris, the Membrana interossea cruris and the bones of the lower leg form osteofibrous tubes, also called compartments. There is an anterior, a lateral, a superficial posterior and a profound posterior compartment.

In addition to reducing bending stress in the bones, these

compartments cause an increase in pressure during muscular contraction. As long as the valves of the profound veins are intact, the reflux of the blood is essentially supported.

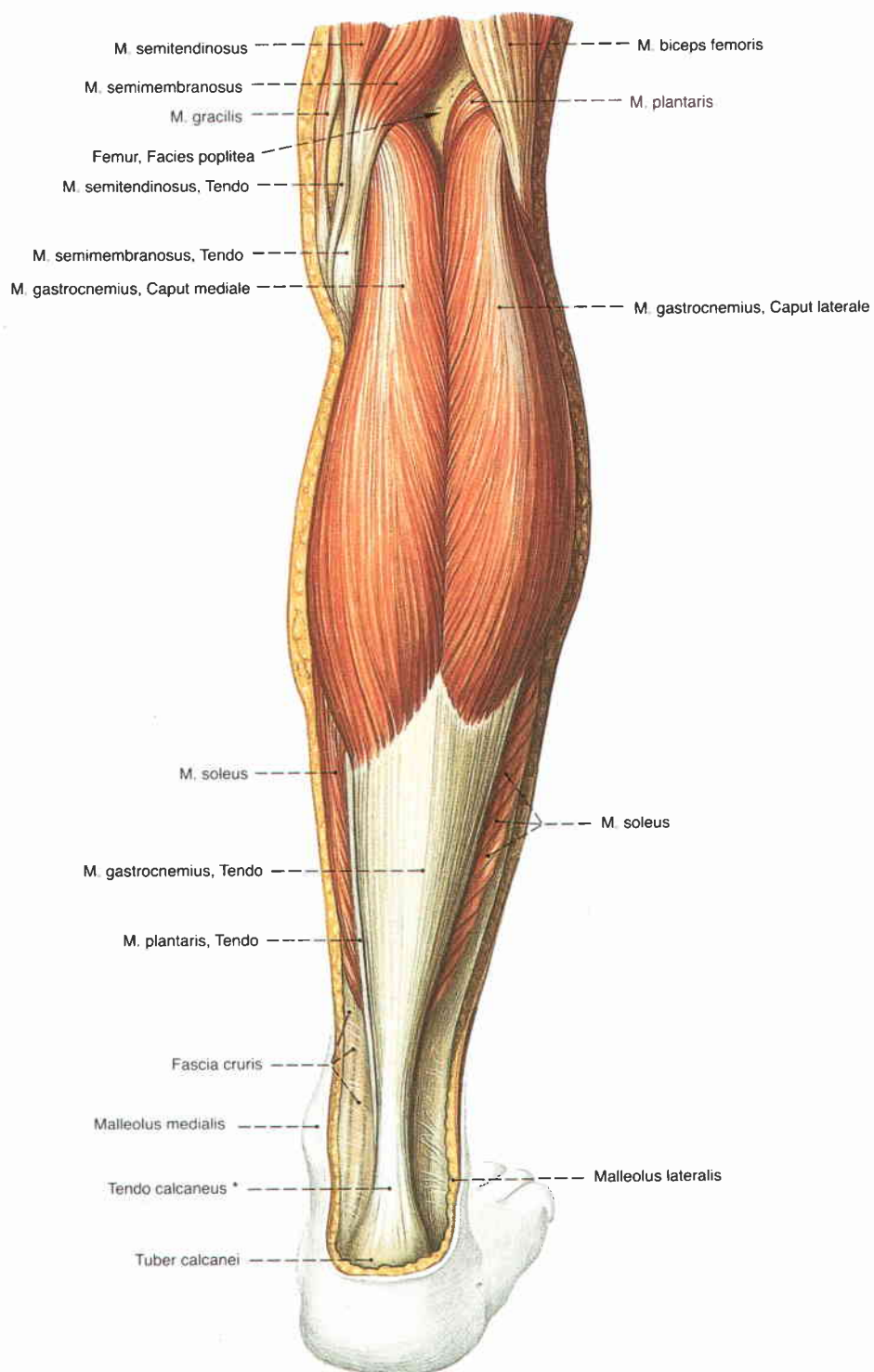
However, if this function is disturbed, e.g. due to a haematoma or contusion, the nerves and vessels in the compartment may be compressed, resulting in the so-called compartment syndrome.

## Lateral muscles of the lower leg (Fig. 1290)

The lateral superficial muscle is M. fibularis longus, below it, is M. fibularis brevis.

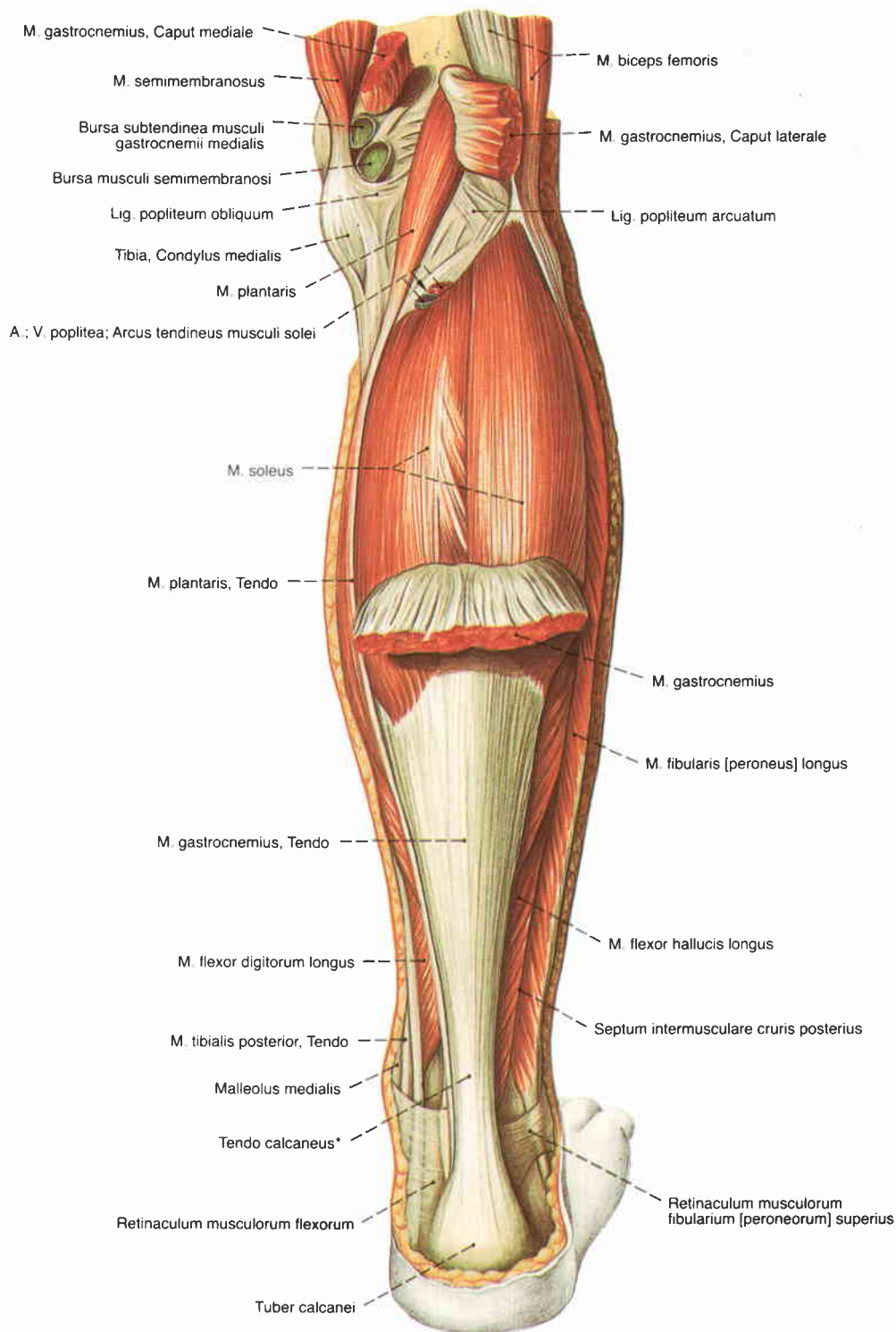
Muscle Innervation	Origin	Insertion	Function *
1. M. fibularis [peroneus] longus N. fibularis superficialis (N. ischiadicus)	Caput fibulae, Facies lateralis and Margo posterior of the fibula (proximal 2/3), Septa intermuscularia cruris anterior and posterior, Fascia cruris	Tuberositas ossis metatarsi I (II), Os cuneiforme intermedium (plantar surface)	Ankle joint: Plantar flexion Intertarsal joints: Pronation
2. M. fibularis [peroneus] brevis N. fibularis superficialis (N. ischiadicus)	Facies lateralis and Margo posterior of the fibula (distal half), Septa intermuscularia cruris anterior and posterior	Tuberositas ossis metatarsi V, tendon slips to little toe	Ankle joint: Plantar flexion Intertarsal joints: Pronation

\* Regarding the foot, plantar flexion is also called flexion, dorsal flexion is called extension



**Fig. 1296** Muscles of the crus; the crural fascia has been removed; dorsal view (r.).

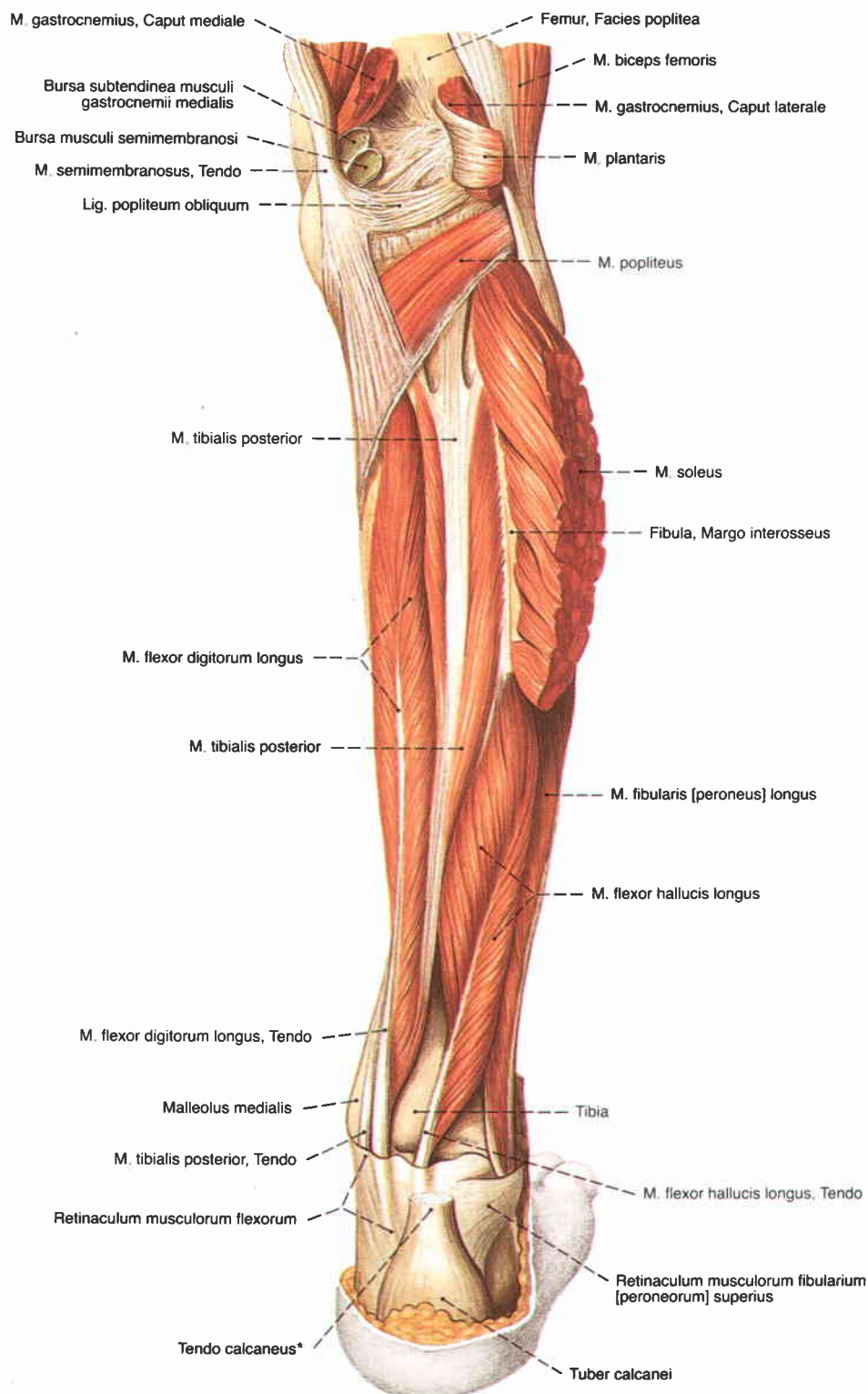
\* also: Achilles tendon



**Fig. 1297** Muscles of the crus; the gastrocnemius muscle has been partially removed; dorsal view (r.).

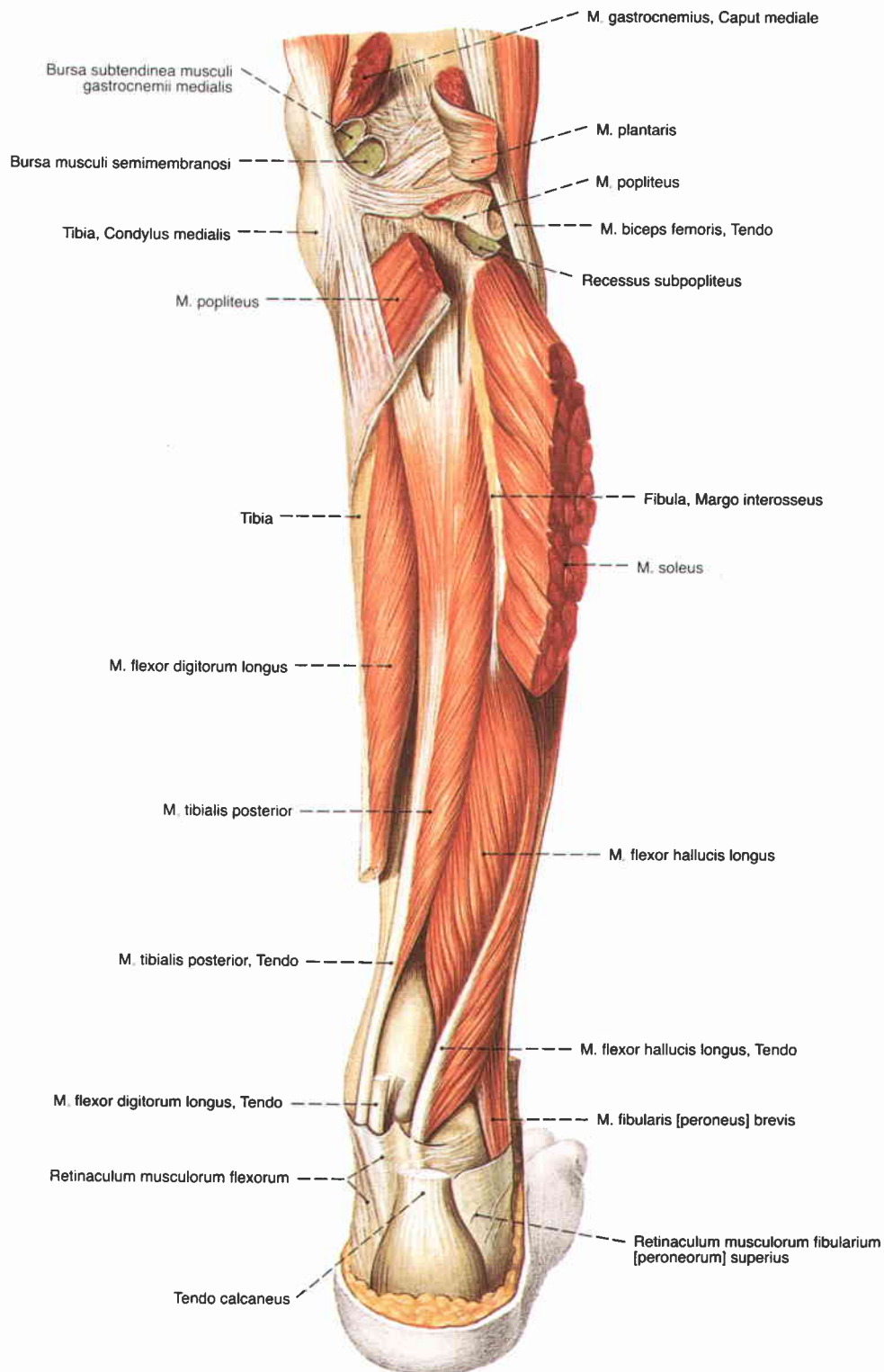
\* also: Achilles tendon





**Fig. 1298** Muscles of the crus;  
most of the superficial muscles have been removed;  
dorsal view (r.).

\* also: Achilles tendon



**Fig. 1299** Muscles of the crus; most of the superficial muscles have been removed; the popliteal muscle has been sectioned; the tendon of the flexor digitorum longus muscle has been removed where it crosses the tendon of M. tibialis posterior (so-called crural chiasma); dorsal view (r.).

### Dorsal muscles of the lower leg, superficial group (Figs. 1296, 1297, 1301)

The surface anatomy of the calf is formed by the two heads of *M. gastrocnemius*. It lies upon *M. soleus*. Together they form *M. triceps surae*. The small *M. plantaris* can be seen as the 4th muscle of this group.

Muscle Innervation	Origin	Insertion	Function*
<b>M. triceps surae</b> <i>N. tibialis (N. ischiadicus)</i>	<b>M. gastrocnemius, Caput mediale:</b> Facies poplitea of the femur (proximal of Condylus medialis) <b>M. gastrocnemius, Caput laterale:</b> Facies poplitea of the femur (proximal of Condylus lateralis) <b>M. soleus:</b> Caput fibulae, Facies posterior and Margo posterior of the fibula (proximal third), Facies posterior of the tibia (at and under Linea musculi solei), Arcus tendineus musculi solei <b>M. plantaris:</b> Facies poplitea femoris (proximal of Condylus lateralis)	Tuber calcanei, above Tendo calcaneus (Achilles tendon)	<b>Knee joint:</b> ( <i>M. gastrocnemius</i> and <i>M. plantaris</i> only) Flexion <b>Ankle joint:</b> Plantar flexion <b>Intertarsal joints:</b> Supination

\* Regarding the foot, plantar flexion is also called flexion, dorsal flexion is called extension

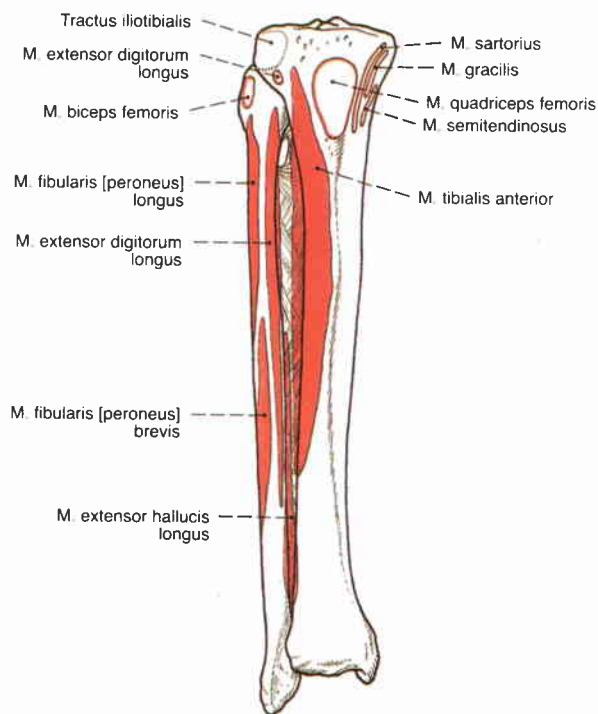
### Dorsal muscles of the lower leg, deep group (Figs. 1298, 1301, 1313, 1314, 1318)

The most proximal muscle, *M. popliteus*, courses obliquely lateral to the knee joint. Of all the muscles running into the feet, *M. tibialis posterior* is the most superficial. Below it are, medially, *M. flexor digitorum longus* and laterally, *M. flexor hallucis longus*.

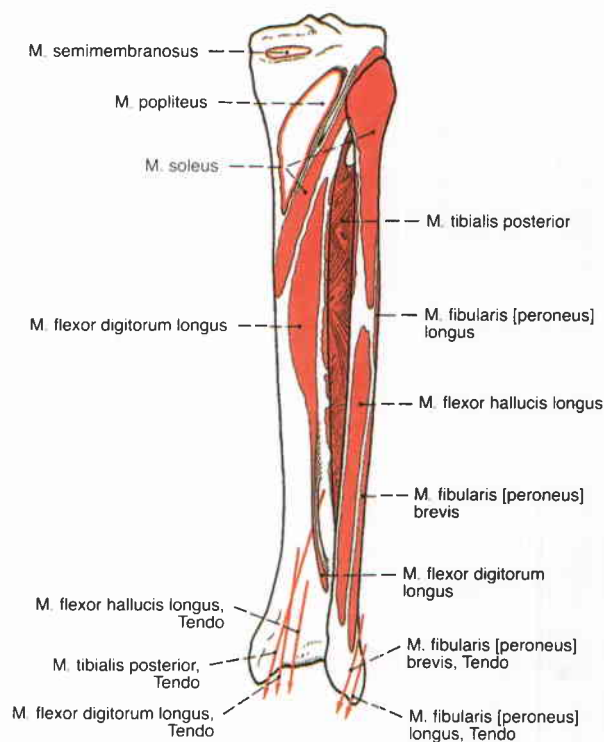
Muscle Innervation	Origin	Insertion	Function*
<b>1. M. popliteus</b> <i>N. tibialis (N. ischiadicus)</i>	Epicondylus lateralis of the femur	Facies posterior of the tibia, above Linea musculi solei	<b>Knee joint:</b> Medial rotation, flexion
<b>2. M. tibialis posterior</b> <i>N. tibialis (N. ischiadicus)</i>	Membrana interossea, Fascies posterior of tibia and fibula (proximal half adjacent to Membrana interossea)	Tuberositas ossis navicularis, Ossa cuneiformia I–III (plantar surface), bases of Ossa metatarsi II–IV	<b>Ankle joint:</b> Plantar flexion <b>Intertarsal joints:</b> Supination
<b>3. M. flexor digitorum longus</b> <i>N. tibialis (N. ischiadicus)</i>	Facies posterior of tibia (distal of Linea musculi solei), tendinous arch between fibula and tibia (proximal of Chiasma crurale)	Phalanges distales of the 2nd to 5th toes	<b>Ankle joint:</b> Plantar flexion <b>Intertarsal joints:</b> Supination <b>Toe joints:</b> Flexion
<b>4. M. flexor hallucis longus</b> <i>N. tibialis (N. ischiadicus)</i>	Facies posterior of tibia (distal 2/3), Membrana interossea, Septum intermusculare cruris posterius	Phalanx distalis of great toe	<b>Ankle joint:</b> Plantar flexion <b>Intertarsal joints:</b> Supination <b>Great toe joints:</b> Flexion

\* Regarding the foot, plantar flexion is also called flexion, dorsal flexion is called extension

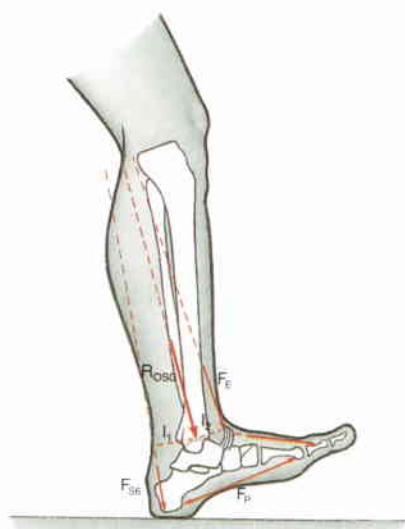




**Fig. 1300** Muscular origins and insertions on the crural bones; ventral view (r.).

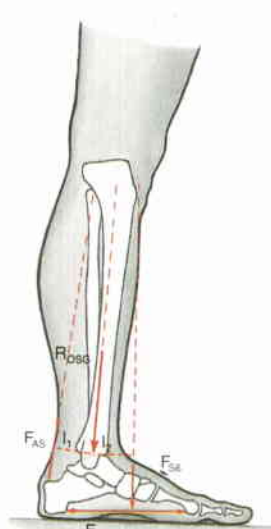


**Fig. 1301** Muscular origins and insertions on the crural bones; dorsal view (r.).



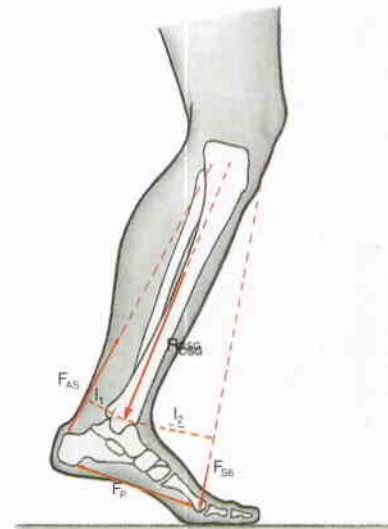
$F_{S6}$  Force of the body weight (6/6)  
 $R_{OS6}$  Resulting force in the superior ankle joint

**Fig. 1302** Forces on the foot when the heel touches the ground.



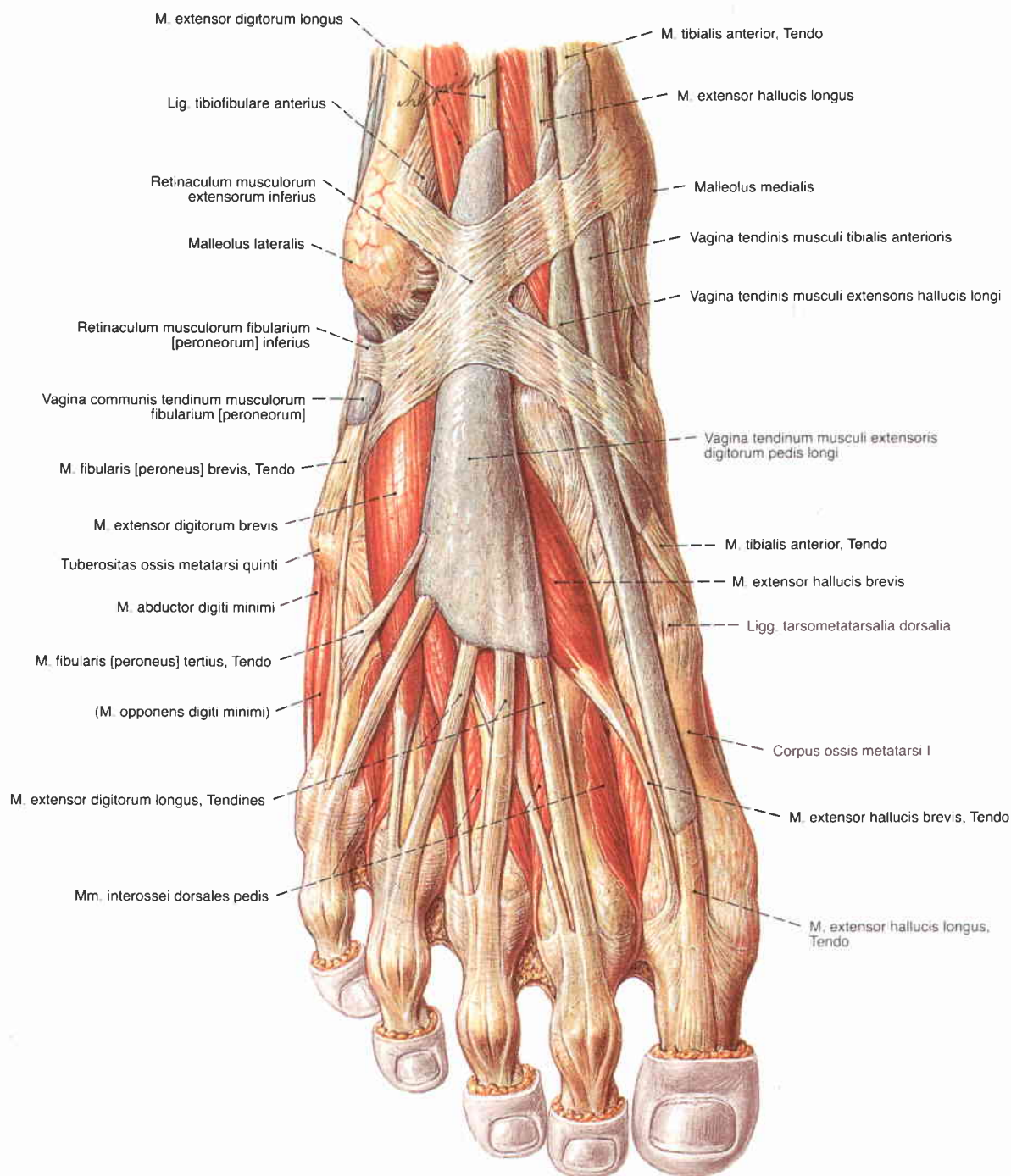
$F_{AS}$  Force of the Archilles tendon  
 $F_E$  Force of the extensor muscles  
 $F_P$  Stress on the plantar aponeurosis

**Fig. 1303** Forces on the foot when there is a static stress.



$I_1$  lever arm  
 $I_2$  lever arm

**Fig. 1304** Forces on the foot when pushing from the ball of the toe.



**Fig. 1305** Synovial sheaths of the tendons, *Vaginae tendinum*, of the foot; dorsal view (r.).

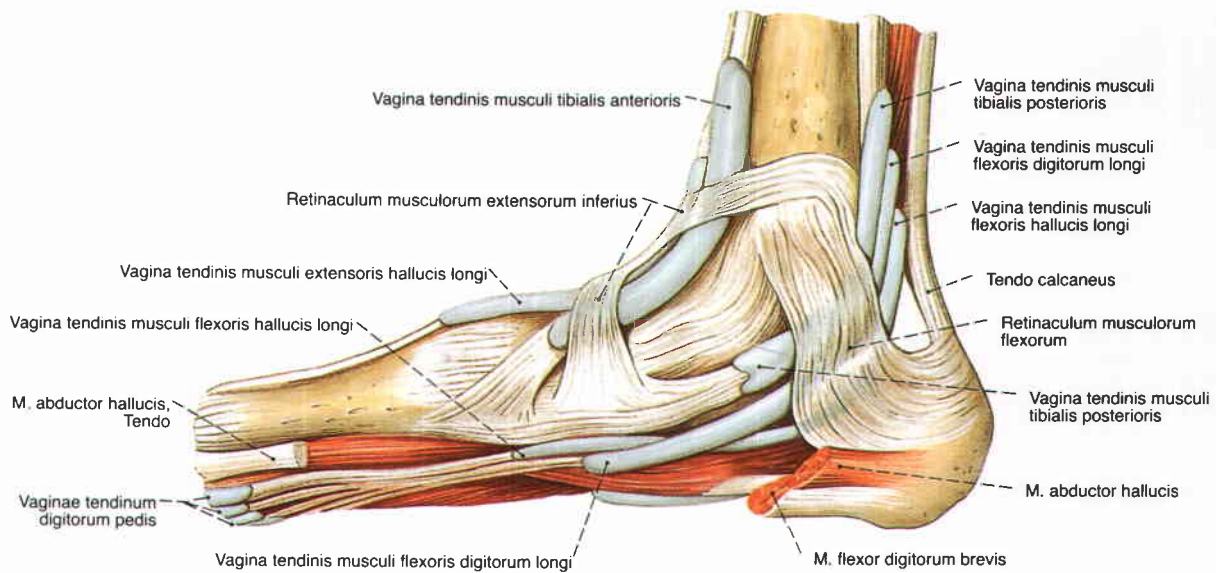


Fig. 1306 Synovial sheaths of the tendons, Vaginae tendinum, of the foot; medial view (r.).

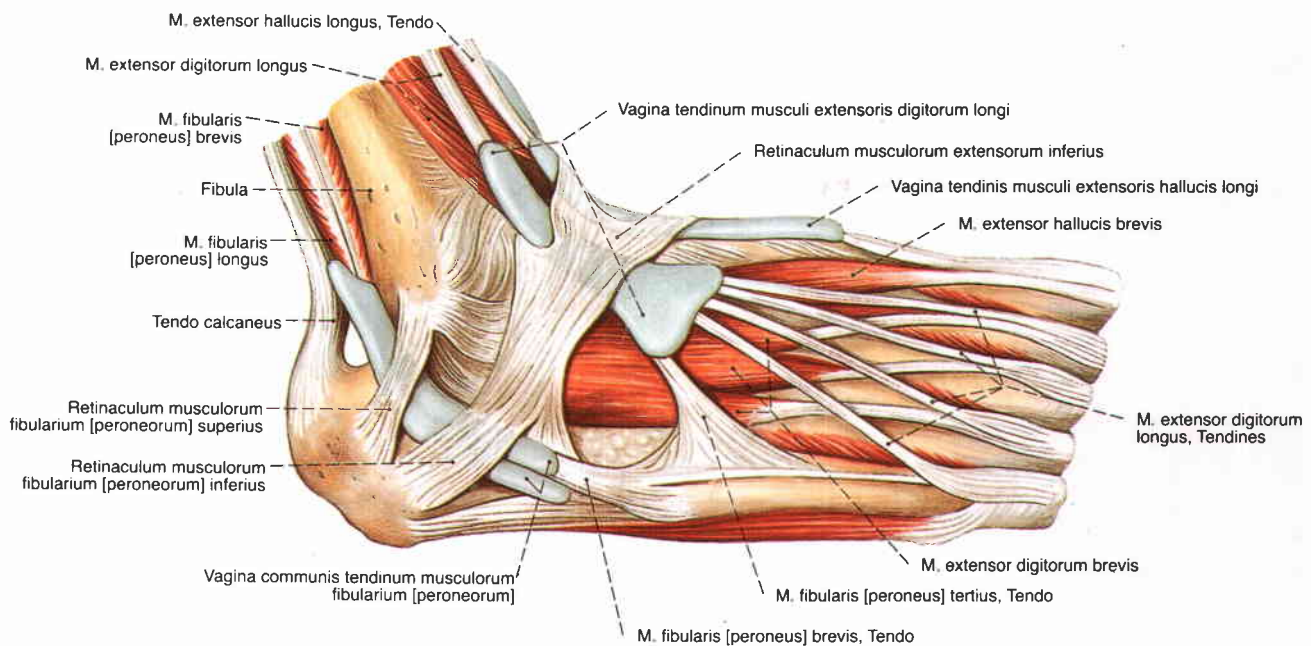


Fig. 1307 Synovial sheaths of the tendons, Vaginae tendinum, of the foot; lateral view (r.).

## Synovial sheaths of the tendons of the foot

**Dorsal tarsal vaginae tendinum:** on the dorsum of the foot and covered by the Retinacula musculorum extensorum superius and inferius, for the tendons of the M. tibialis anterior, M. extensor hallucis longus and M. extensor digitorum longus.

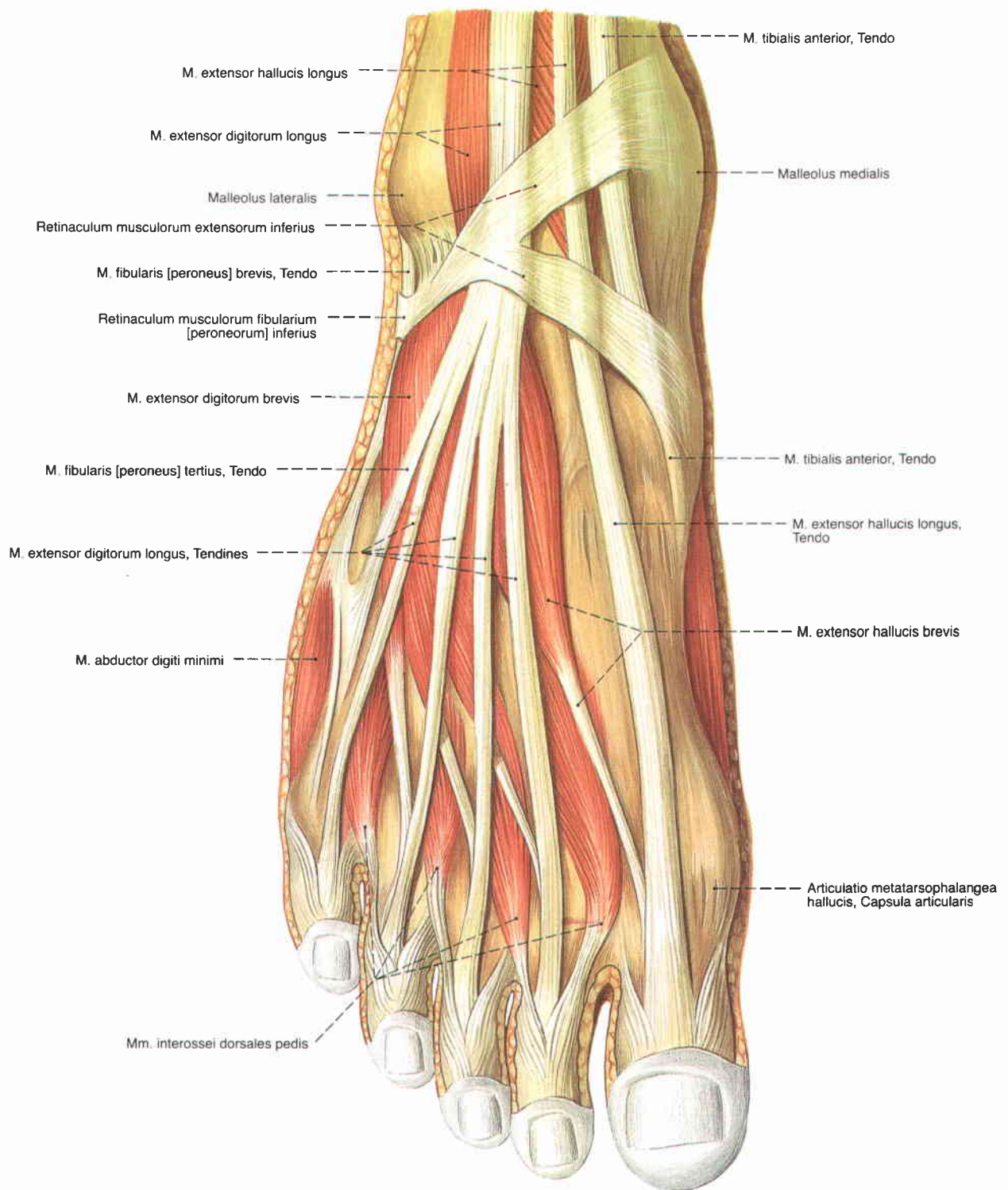
**Medial tarsal vaginae tendinum:** dorsal to the medial malleolus and covered by the Retinacula musculorum flexorum, for the tendons of the M. tibialis posterior, M. flexor digitorum longus and M. flexor hallucis longus.

**Lateral tarsal vaginae tendinum:** dorsal to the lateral malleolus and covered by the Retinacula musculorum fibularium

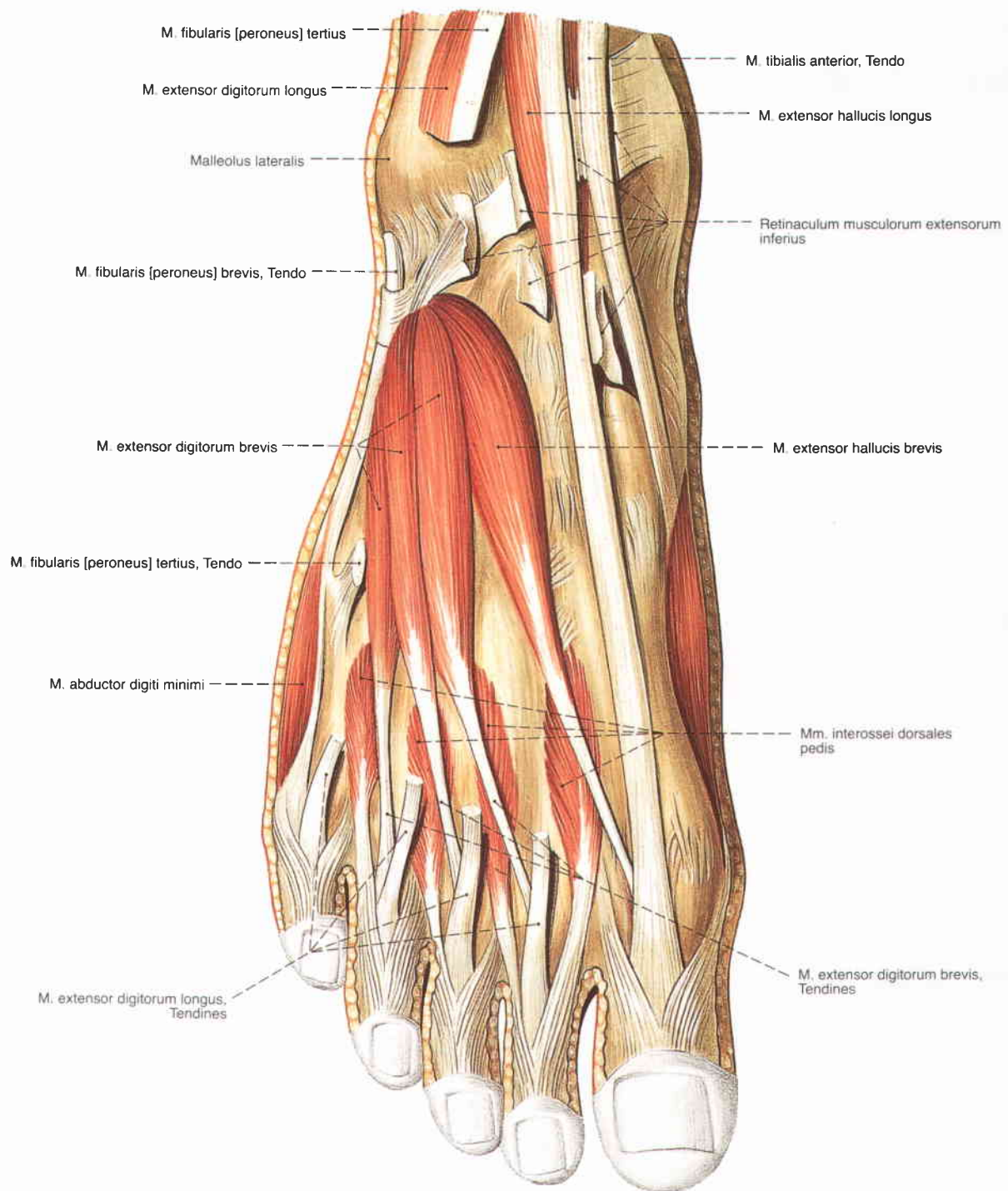
superius and inferius, in most cases a common vagina tendinum for the tendons of the M. fibularis [peroneus] longus and M. fibularis [peroneus] brevis. The synovial sheath continues along the tendon of the M. fibularis [peroneus] longus below the Lig. plantare longum as far as the insertion at the plantar base of the first Os metatarsi and Os cuneiforme mediale.

**Digital plantar vaginae tendinum:** at the plantar side of the toes, for the tendons of the M. flexor digitorum longus and M. flexor digitorum brevis.





**Fig. 1308** Muscles of the foot; the synovial sheaths of the tendons have been removed; dorsal view (r.).



**Fig. 1309** Muscles of the foot; the inferior extensor retinaculum has been sectioned; most of the extensor digitorum longus muscle has been removed; dorsal view (r.).

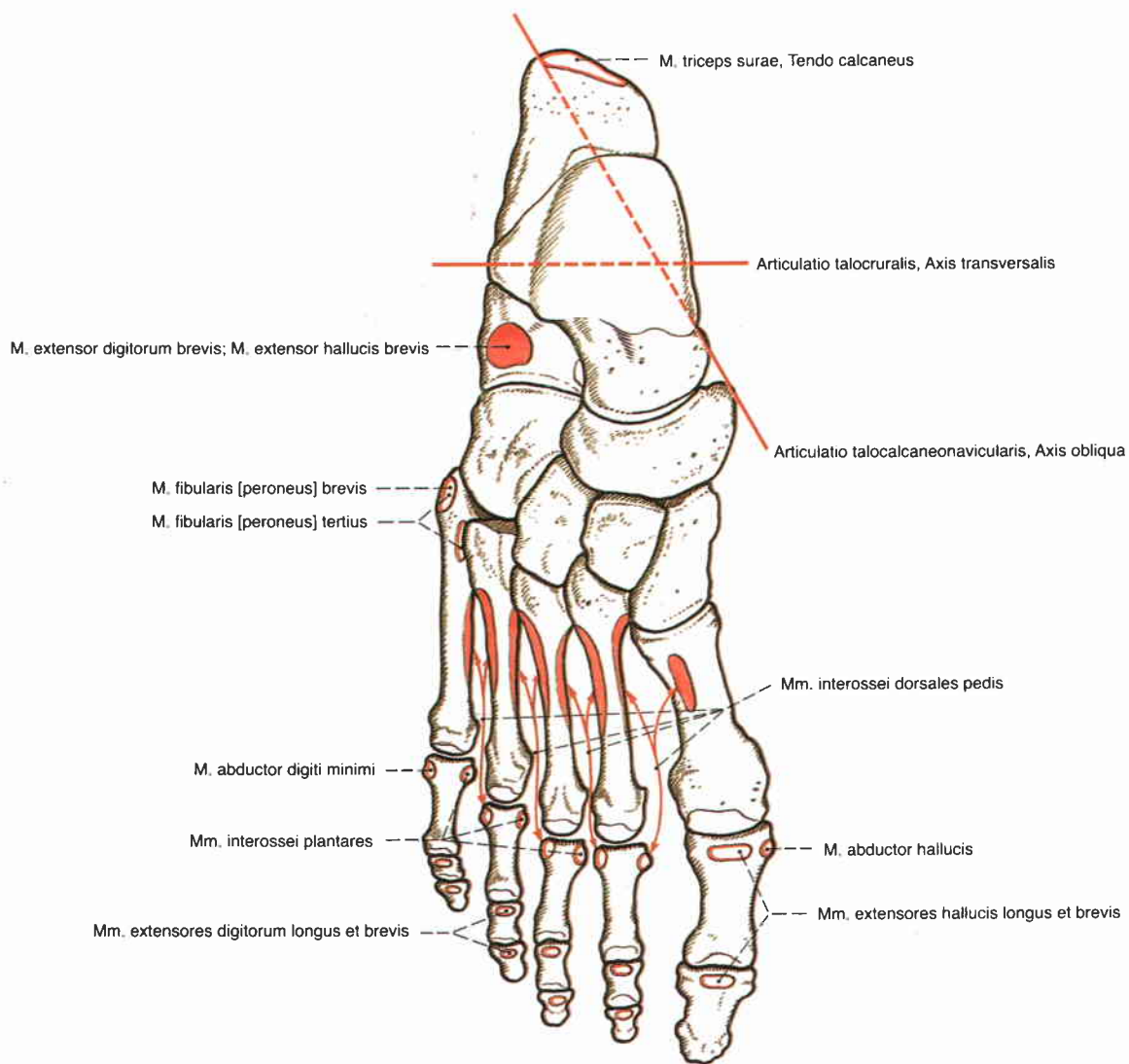


Fig. 1310 Muscular origins and insertions on the bones of the foot; dorsal view (r.).  
The axes of the ankle joint and of the intertarsal joints are shown.

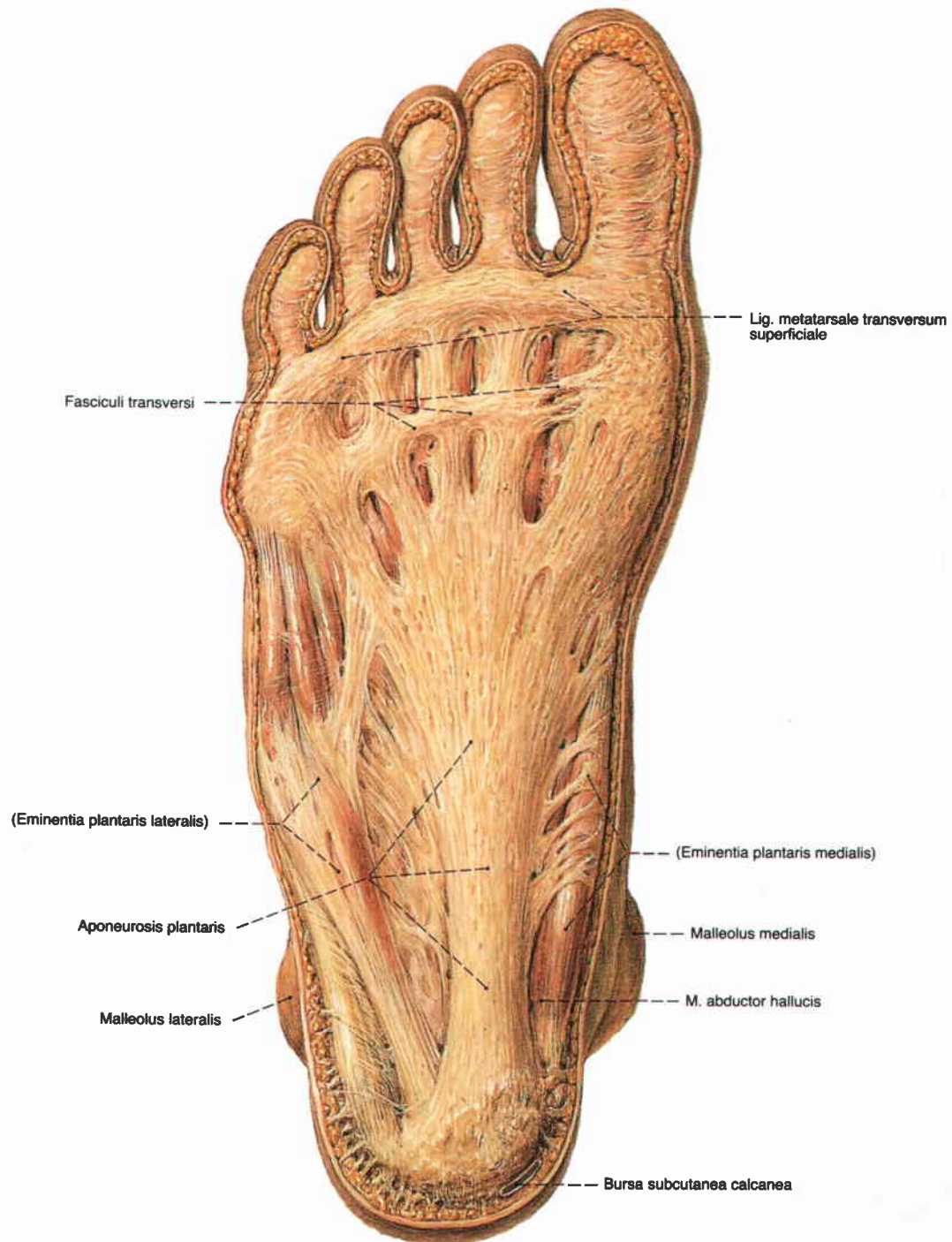
### Muscles of the dorsum of the foot (Fig. 1308)

The two muscles of the dorsum of the foot are barely visible through the skin. From a small site of origin, *M. extensor hallucis brevis* extends to the great toe, *M. extensor digitorum brevis* to the other toes.

Muscle Innervation	Origin	Insertion	Function*
1. <i>M. extensor hallucis brevis</i> <i>N. fibularis profundus</i> ( <i>N. fibularis communis</i> )	Calcaneus (dorsal and lateral surface)	Tendons of 2nd to 4th toes	Toe joints: Extension
2. <i>M. extensor digitorum brevis</i> <i>N. fibularis profundus</i> ( <i>N. fibularis communis</i> )	Calcaneus (dorsal surface), Sinus tarsi	Phalanx proximalis of the great toe	Metatarsophalangeal joint of the great toe: Extension

\* Regarding the foot, plantar flexion is also called flexion, dorsal flexion is called extension





**Fig. 1311** Muscles of the foot;  
the plantar aponeurosis is shown;  
plantar view (r.).

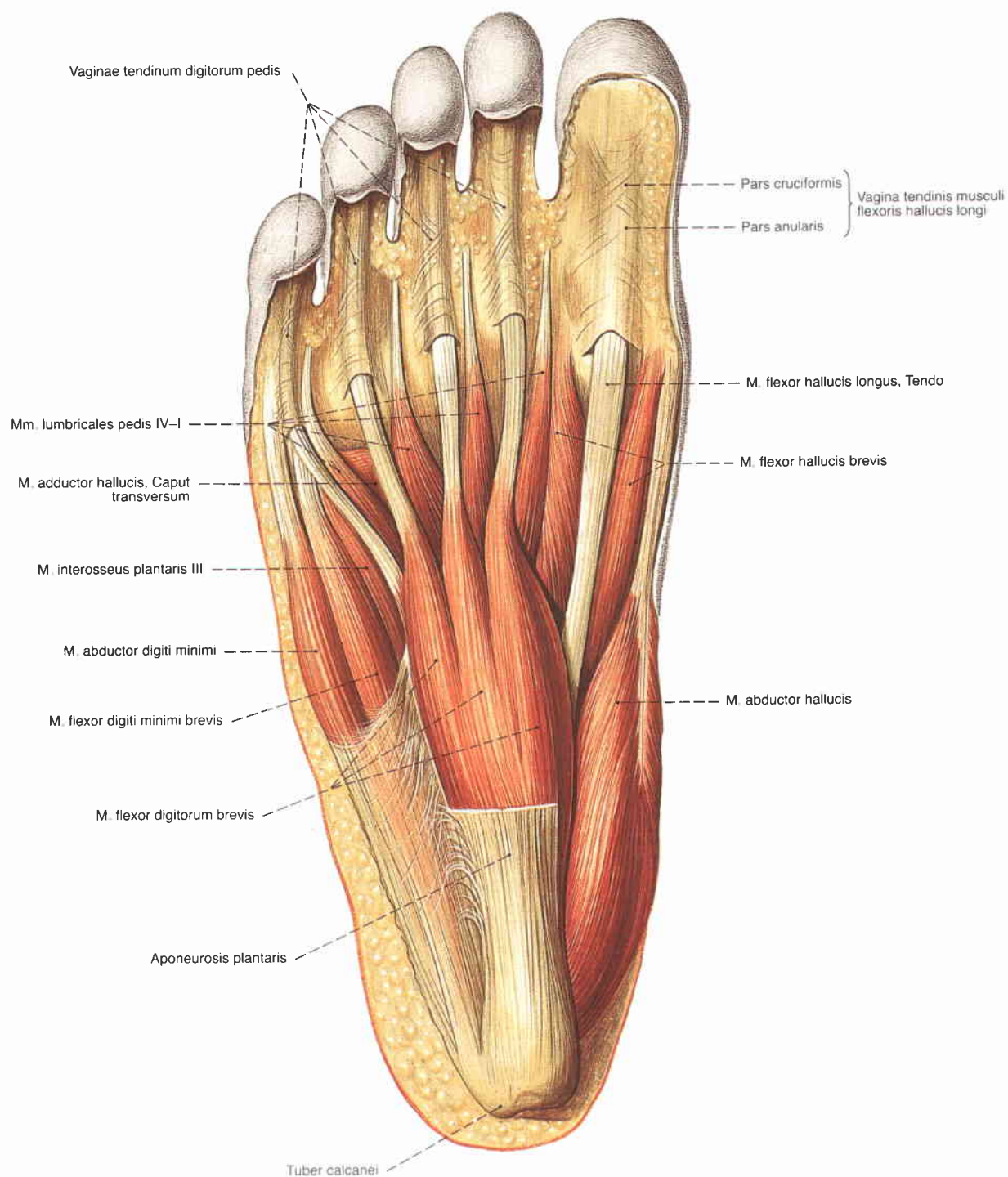
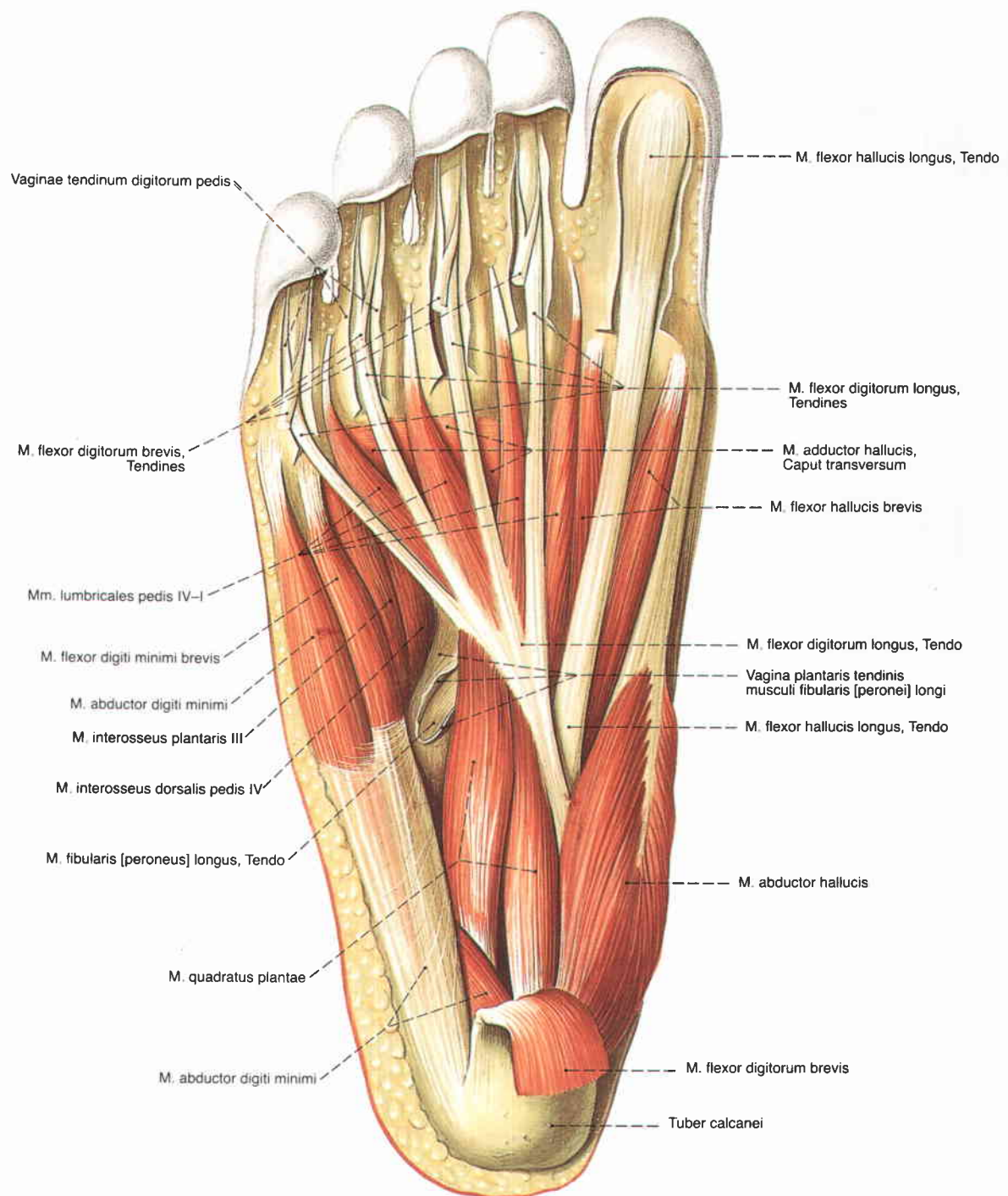
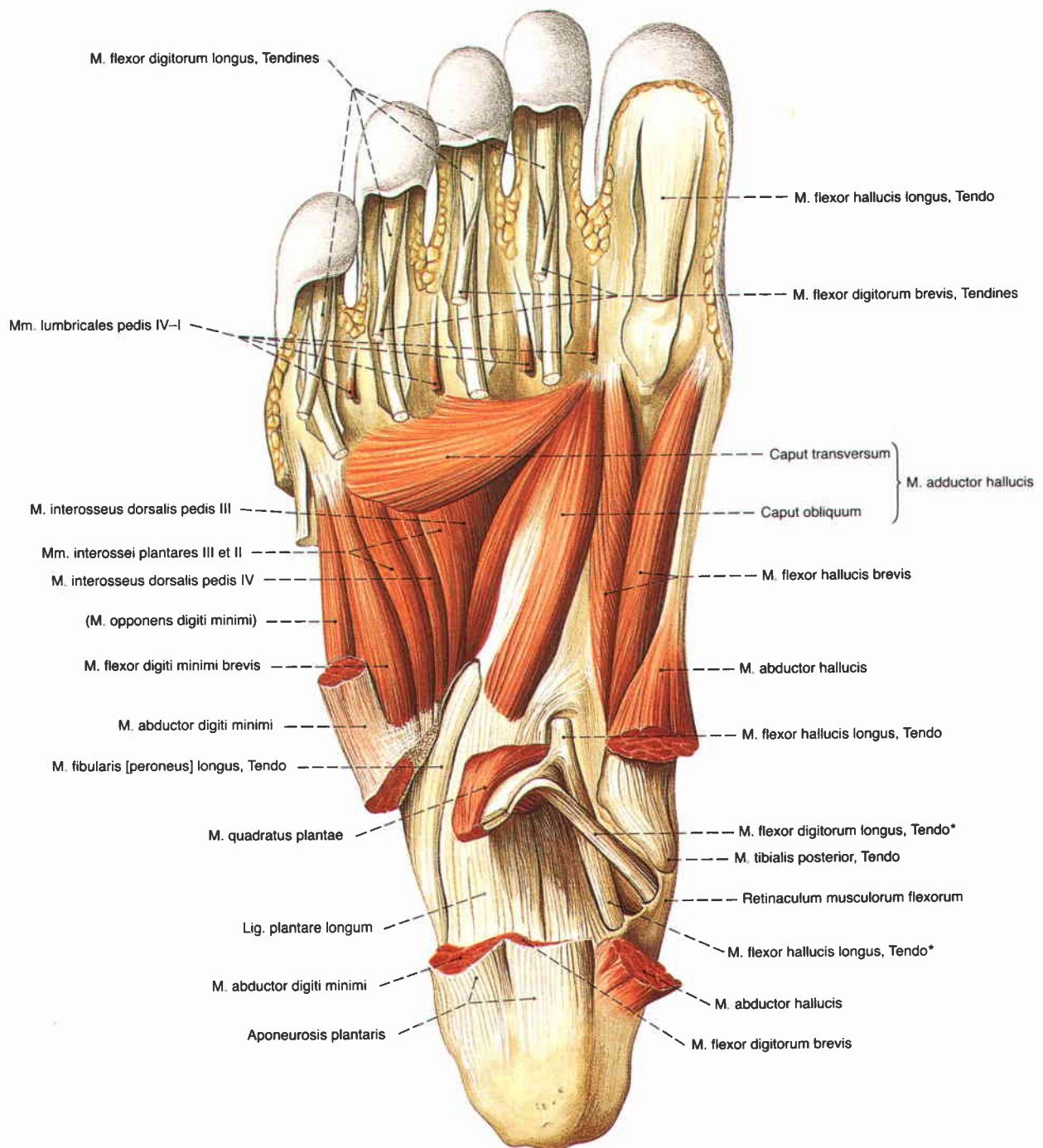


Fig. 1312 Muscles of the foot; most of the plantar aponeurosis has been removed; plantar view (r).



**Fig. 1313** Muscles of the foot; middle layer; most of the plantar aponeurosis has been removed together with the flexor digitorum brevis muscle; plantar view (r.).





**Fig. 1314** Muscles of the foot; deep layer; most of the superficial muscles, the flexor digitorum and the flexor hallucis longus muscles have been removed; plantar view (r.).

\* The place where the tendon of the flexor digitorum longus muscle crosses the tendon of the flexor hallucis longus muscle is called Chiasma plantare.

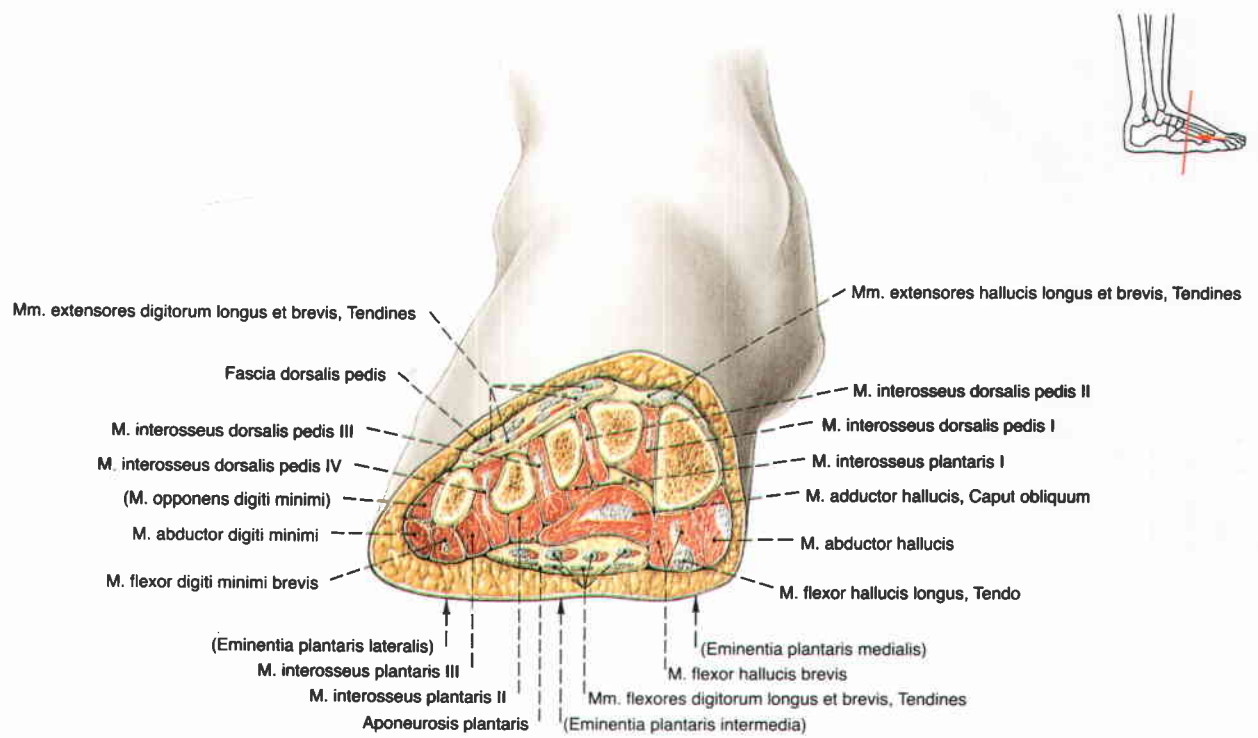


Fig. 1315 Osteofibrous tubes of the foot; frontal section through the metatarsus; distal view (r.).

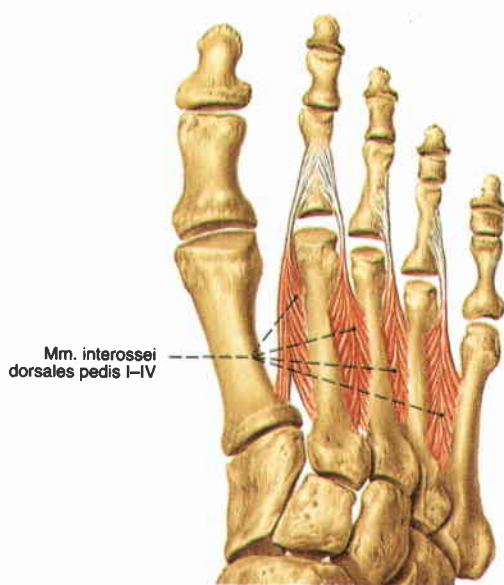


Fig. 1316 Muscles of the foot; dorsal interosseous muscles; dorsal view (r.).

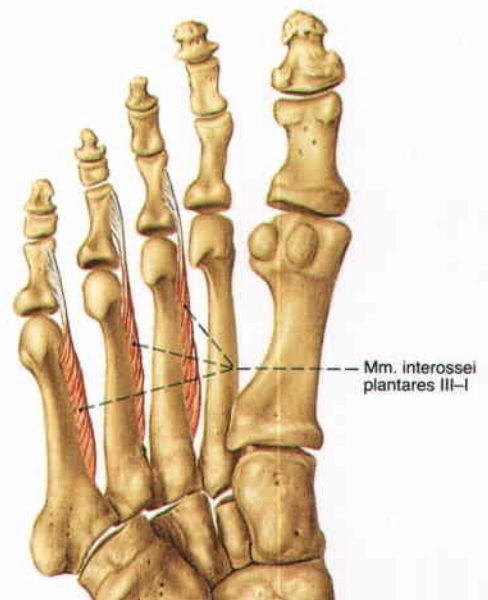


Fig. 1317 Muscles of the foot; plantar interosseous muscles; plantar view (r.).

## Muscles of the medial plantar group (Figs. 1312, 1318)

The contour of the medial rim of the foot, the Eminentia plantaris medialis, is formed primarily by M. abductor hallucis followed by M. flexor hallucis brevis and laterally M. adductor hallucis follow.

Muscle Innervation	Origin	Insertion	Function*
<b>1. M. abductor hallucis</b> <i>N. plantaris medialis</i> ( <i>N. tibialis</i> )	Proc. medialis of Tuber calcanei, Aponeurosis plantaris, Retinaculum musculorum flexorum	Medial sesamoid bone of the capsule of the great toe joint, medial side of the Phalanx proximalis of the great toe	<b>Metatarsophalangeal joint of the great toe:</b> abduction, flexion
<b>2. M. flexor hallucis brevis</b> Medial part: <i>N. plantaris medialis</i> ( <i>N. tibialis</i> ) Lateral part: <i>N. plantaris lateralis</i> ( <i>N. tibialis</i> )	Ossa cuneiformia (plantar surface), Lig. calcaneocuboideum plantare, Lig. plantare longum, tendon of M. tibialis posterior	<b>Medial part:</b> Medial sesamoid bone of the capsule of the metatarsophalangeal joint of the great toe; base of the Phalanx proximalis of the great toe <b>Lateral part:</b> Lateral sesamoid bone of the capsule of the metatarsophalangeal joint of the great toe; base of the Phalanx proximalis of the great toe	<b>Metatarsophalangeal joint of the great toe:</b> flexion
<b>3. M. adductor hallucis</b> <i>N. plantaris lateralis</i> ( <i>N. tibialis</i> )	<b>Caput obliquum:</b> Os cuboideum, Os cuneiforme laterale, Lig. plantare longum, Lig. calcaneocuboideum plantare <b>Caput transversum:</b> Capsules of the metatarsophalangeal joints of 3rd to 5th toes, Lig. metatarsale transversum profundum	Lateral sesamoid bone of the capsule of the metatarsophalangeal joint of the great toe; base of the Phalanx proximalis of the great toe	<b>Metatarsophalangeal joint of the great toe:</b> adduction to the 2nd toe, flexion

\* Regarding the foot, plantar flexion is also called flexion, dorsal flexion is called extension

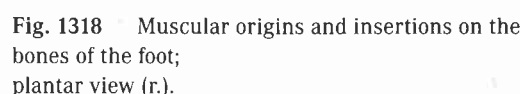
## Muscles of the middle of the sole of the foot (Figs. 1312, 1318)

In the middle of the foot are a number of small muscles. M. flexor digitorum brevis arises from the plantar aponeurosis. Below it M. quadratus plantae and M. flexor digitorum longus form one tendon. From its 4 small tendons arise the Mm. lumbricales pedis I-IV. The Mm. interossei plantares I-III and the Mm. interossei dorsales pedis I-IV fill the spaces between the Ossa metatarsi.

Muscle/Innervation	Origin	Insertion	Function*
<b>1. M. flexor digitorum brevis</b> <i>N. plantaris medialis</i> ( <i>N. tibialis</i> )	Tuber calcanei (plantar surface), Aponeurosis plantaris	Medial phalanges of the 2nd to 4th toes (penetrated by the tendons of M. flexor digitorum longus)	<b>Proximal phalangeal joints:</b> flexion <b>Toe joints:</b> flexion
<b>2. M. quadratus plantae</b> <i>N. plantaris lateralis</i> ( <i>N. tibialis</i> ) (also called M. flexor accessorius)	Calcaneus (plantar surface), Lig. plantare longum	Lateral margin of tendon of M. flexor digitorum longus (before it divides)	Corrects the oblique orientation of M. flexor digitorum longus
<b>3. Mm. lumbricales pedis I-IV</b> <i>Nn. plantares medialis (I) and lateralis (II-IV)</i> ( <i>N. tibialis</i> )	<b>M. lumbricalis pedis I:</b> tendon of M. flexor digitorum longus to the 2nd toe (medial side) <b>Mm. lumbricales pedis II-IV:</b> tendons of M. flexor digitorum longus to the 3rd to 5th toes	Medial side of the proximal phalanges of the 2nd to 5th toes, sometimes inserting into the dorsal aponeurosis	<b>Proximal phalangeal joints:</b> flexion
<b>4. Mm. interossei plantares I-III</b> <i>N. plantaris lateralis</i> ( <i>N. tibialis</i> )	Ossa metatarsi III-V (plantar surface), Lig. plantare longum	Medial side of the bases of the proximal phalanges of the 3rd to 5th toes	<b>Proximal phalangeal joints:</b> flexion, adduction to the 2nd toe
<b>5. Mm. interossei dorsales pedis I-IV</b> <i>N. plantaris lateralis</i> ( <i>N. tibialis</i> )	By two heads from the adjacent sides of the metatarsal bones, Lig. plantare longum	<b>M. interosseus dorsalis I:</b> Medial side of the base of the Phalanx proximalis of the 2nd toe <b>Mm. interossei dorsales II-IV:</b> Lateral side of the bases of the proximal phalanges of the 3rd and 4th toes, inserting into the dorsal aponeuroses	<b>Proximal phalangeal joints:</b> flexion, abduction of the 3rd and 4th toes to the lateral, adduction of the 2nd toe to the medial side <b>Toe joints:</b> extension

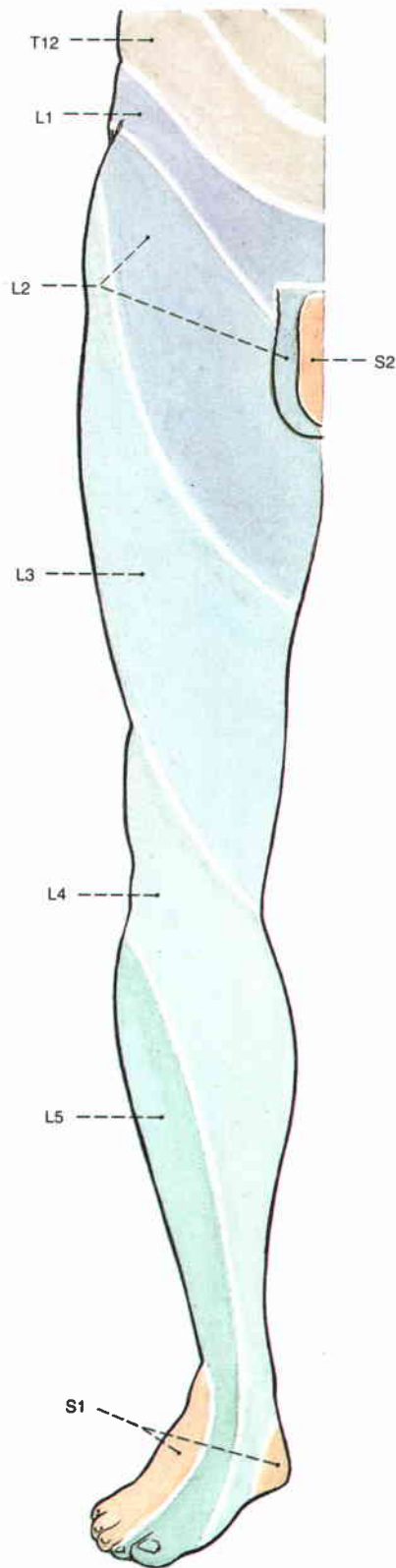
\* Regarding the foot, plantar flexion is also called flexion, dorsal flexion is called extension



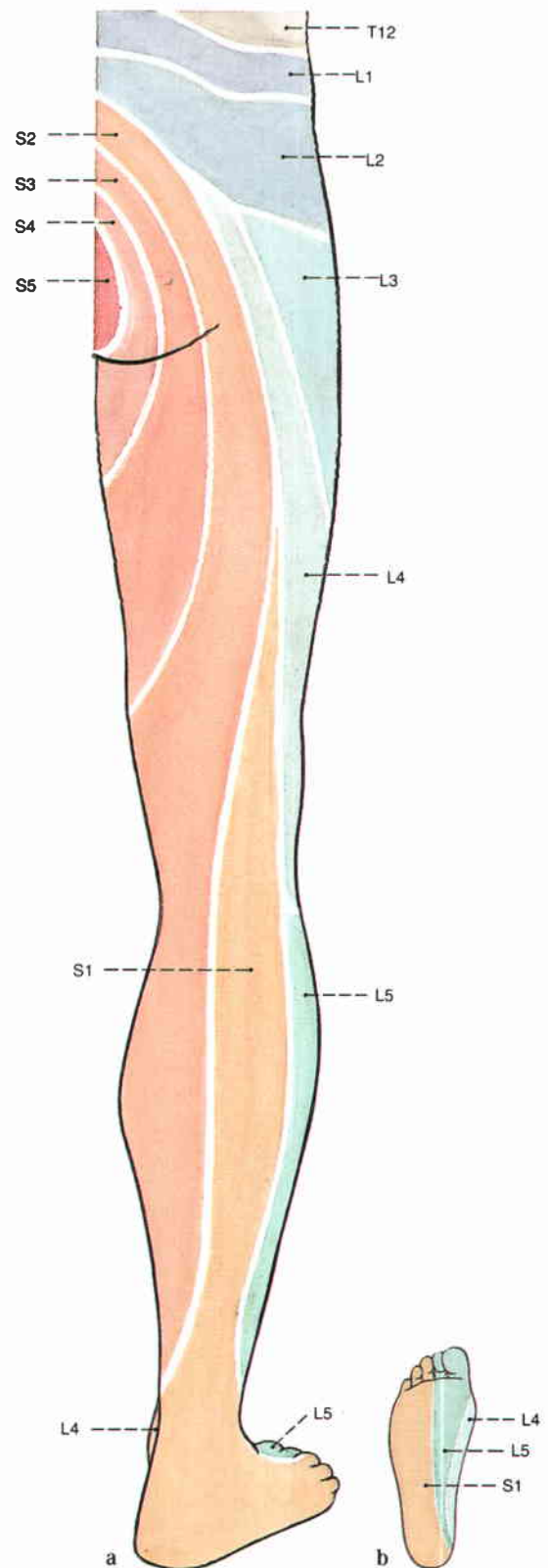


M. abductor digiti minimi is at the lateral side of the foot, Eminentia plantaris lateralis. Under its plantar surface M. flexor digiti minimi brevis and M. opponens digiti minimi can be found.

\* Regarding the foot, plantar flexion is also called flexion, dorsal flexion is called extension



**Fig. 1319** Segmental innervation (dermatomes) of the lower limb;  
ventral view (r.).



**Figs. 1320 a, b** Segmental innervation (dermatomes) of the lower limb.  
a dorsal view (r.)  
b plantar view (r.)

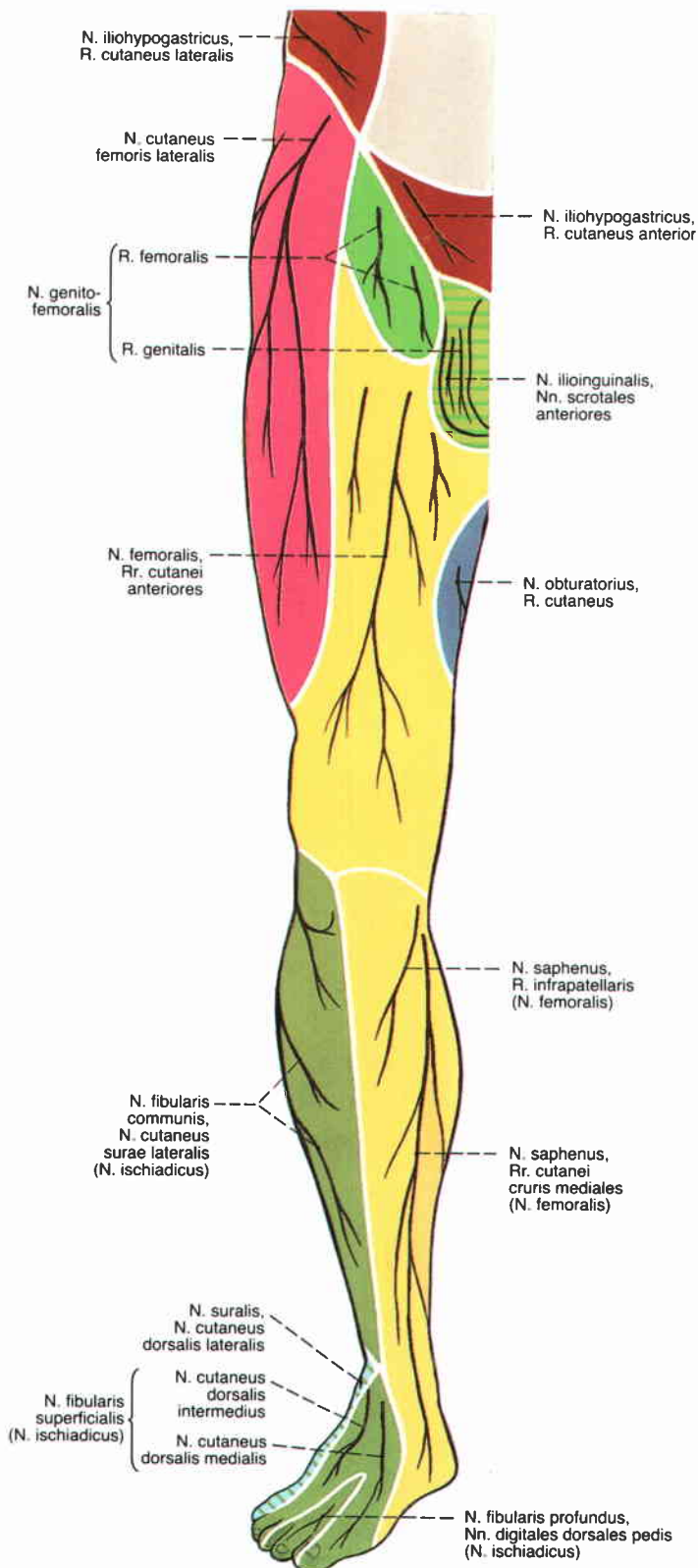


Fig. 1321 Cutaneous nerves of the lower limb; ventral view (r.).

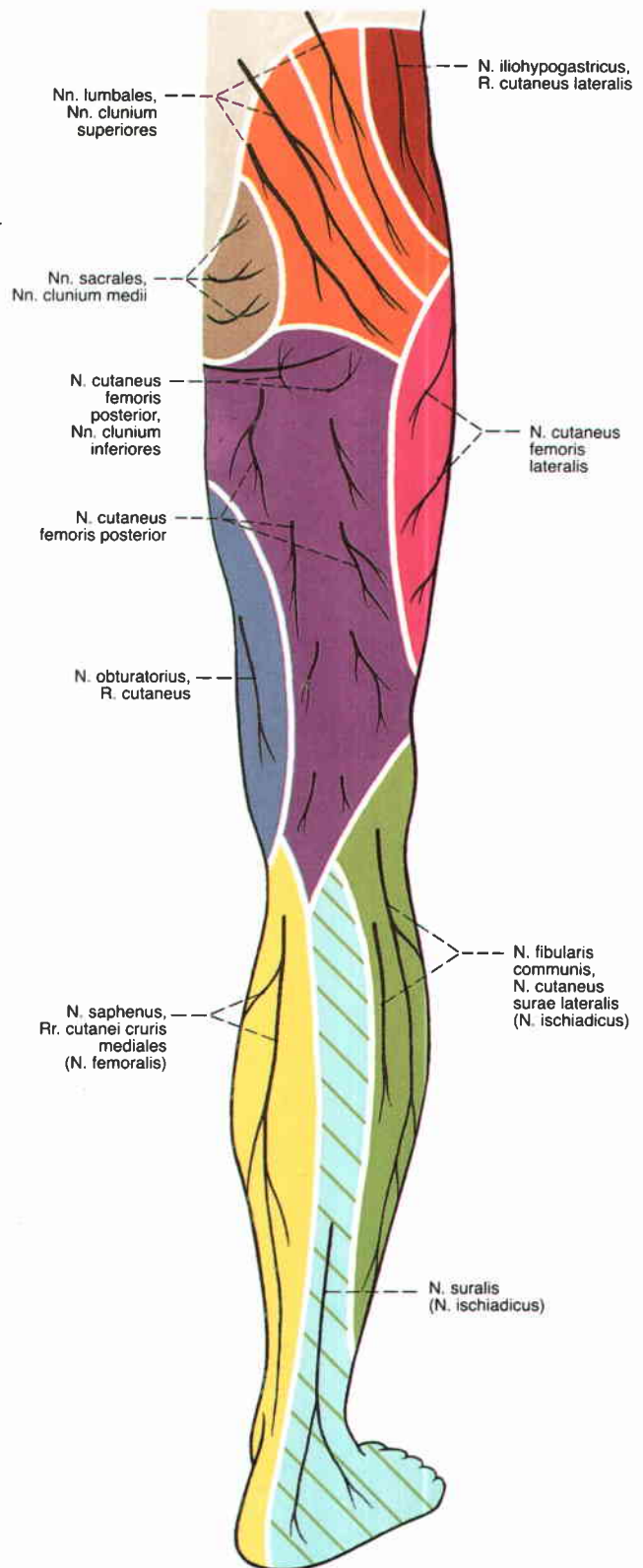


Fig. 1322 Cutaneous nerves of the lower limb; dorsal view (r.).

Nn. lumbales	N. iliohypogastricus	N. genito-femoralis	N. obturatorius	N. fibularis
Nn. sacrales	N. cutaneus femoris lateralis	N. femoralis	N. cutaneus femoris posterior	N. suralis



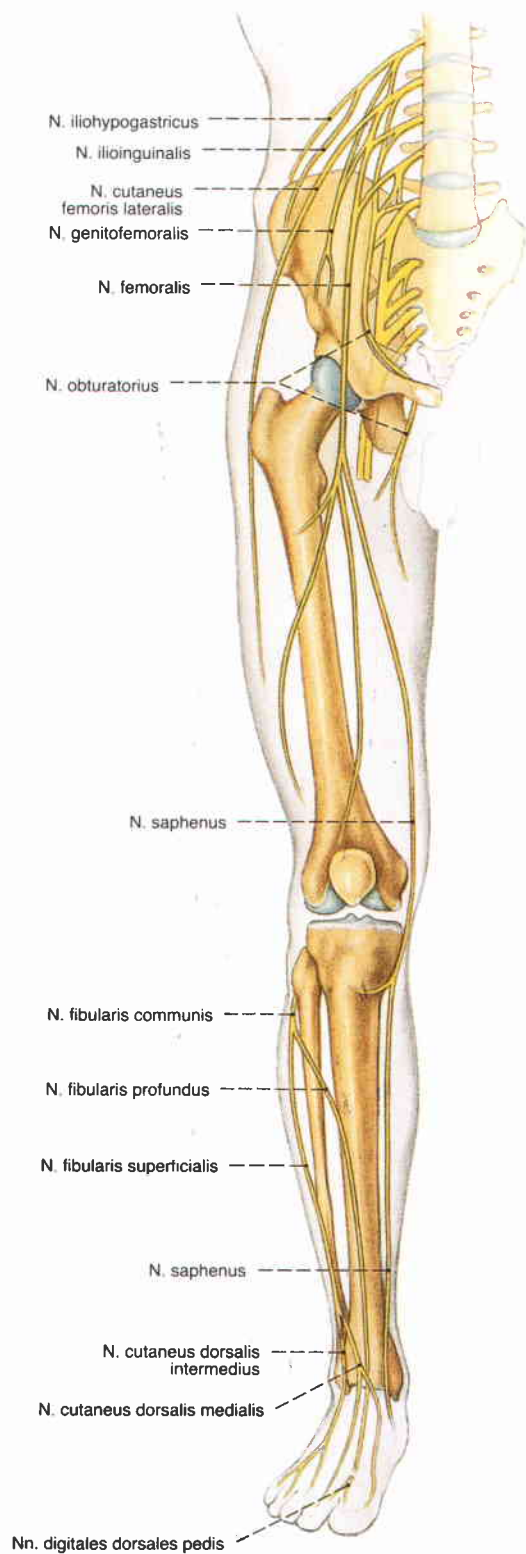


Fig. 1323 Nerves of the lower limb; ventral view (r.).

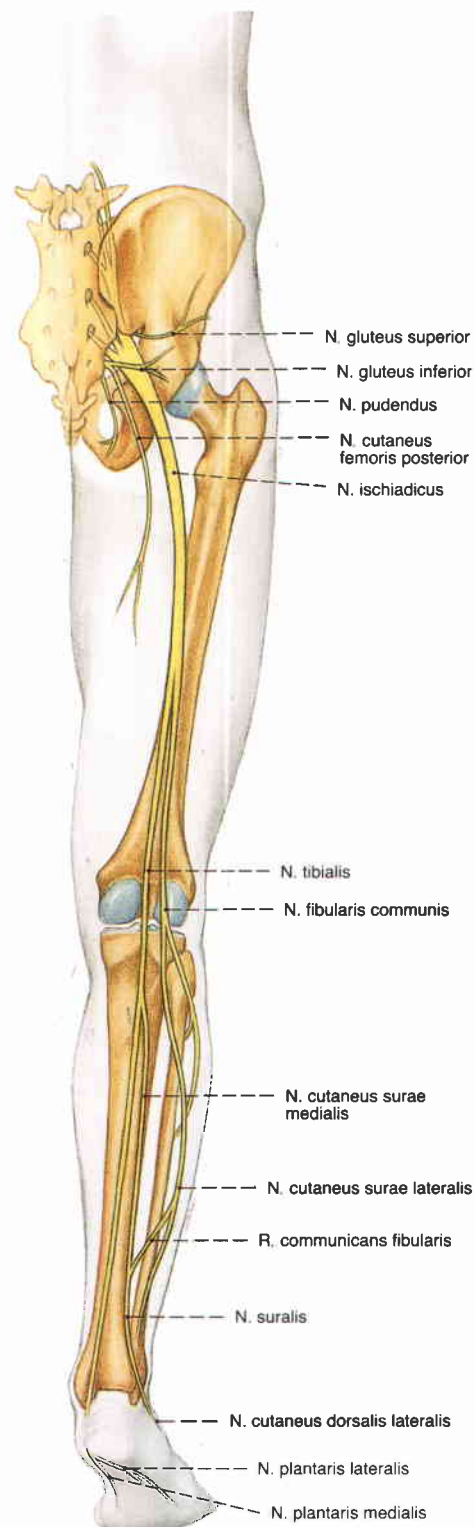
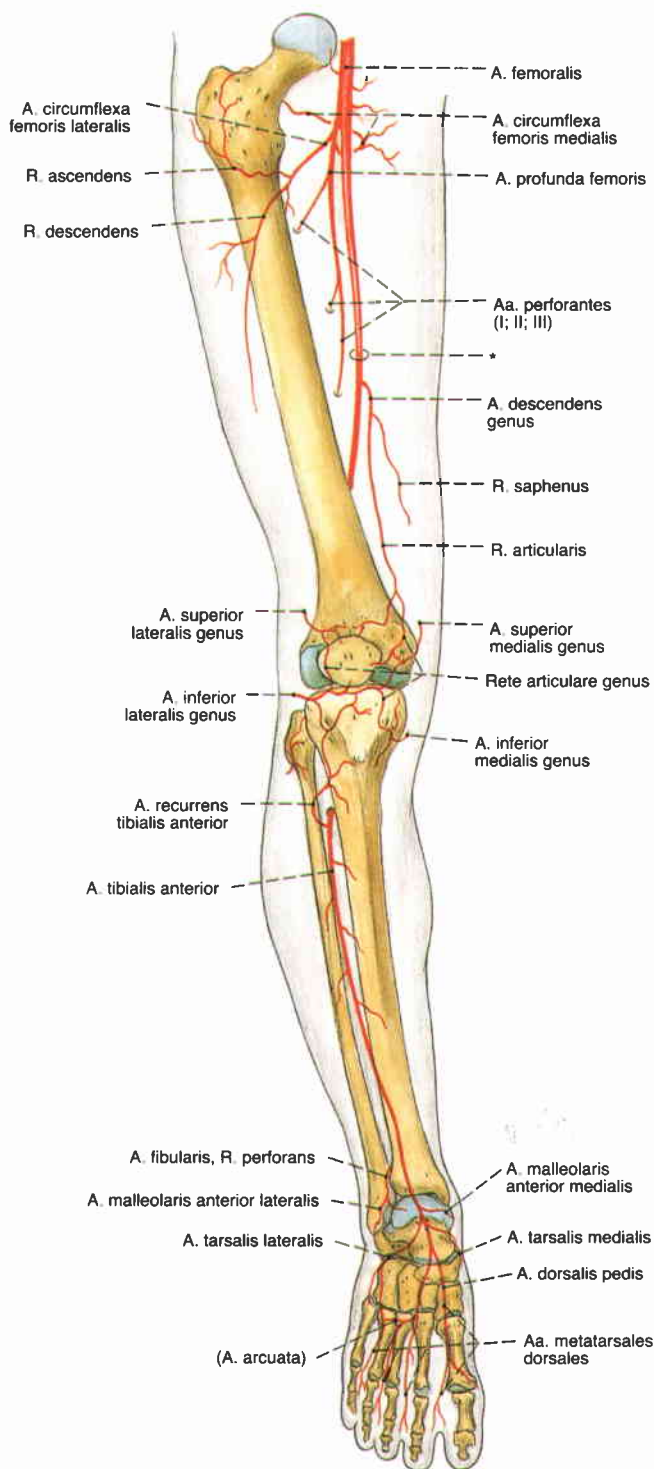
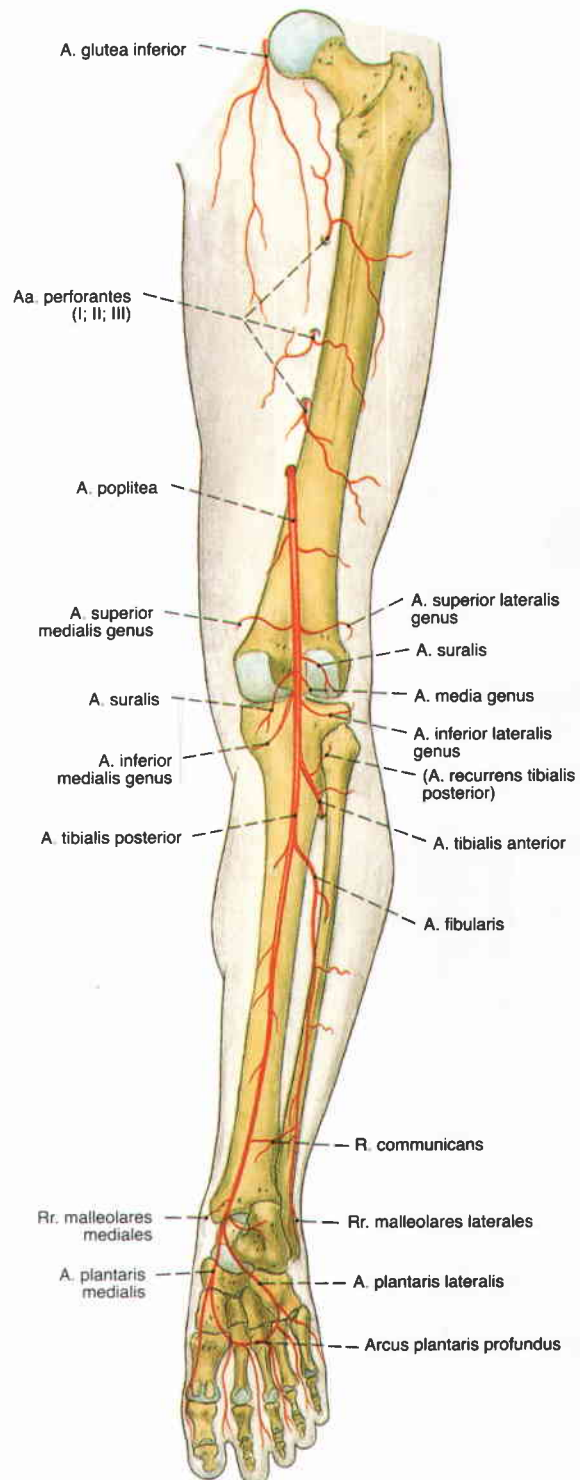


Fig. 1324 Nerves of the lower limb; dorsal view (r.).

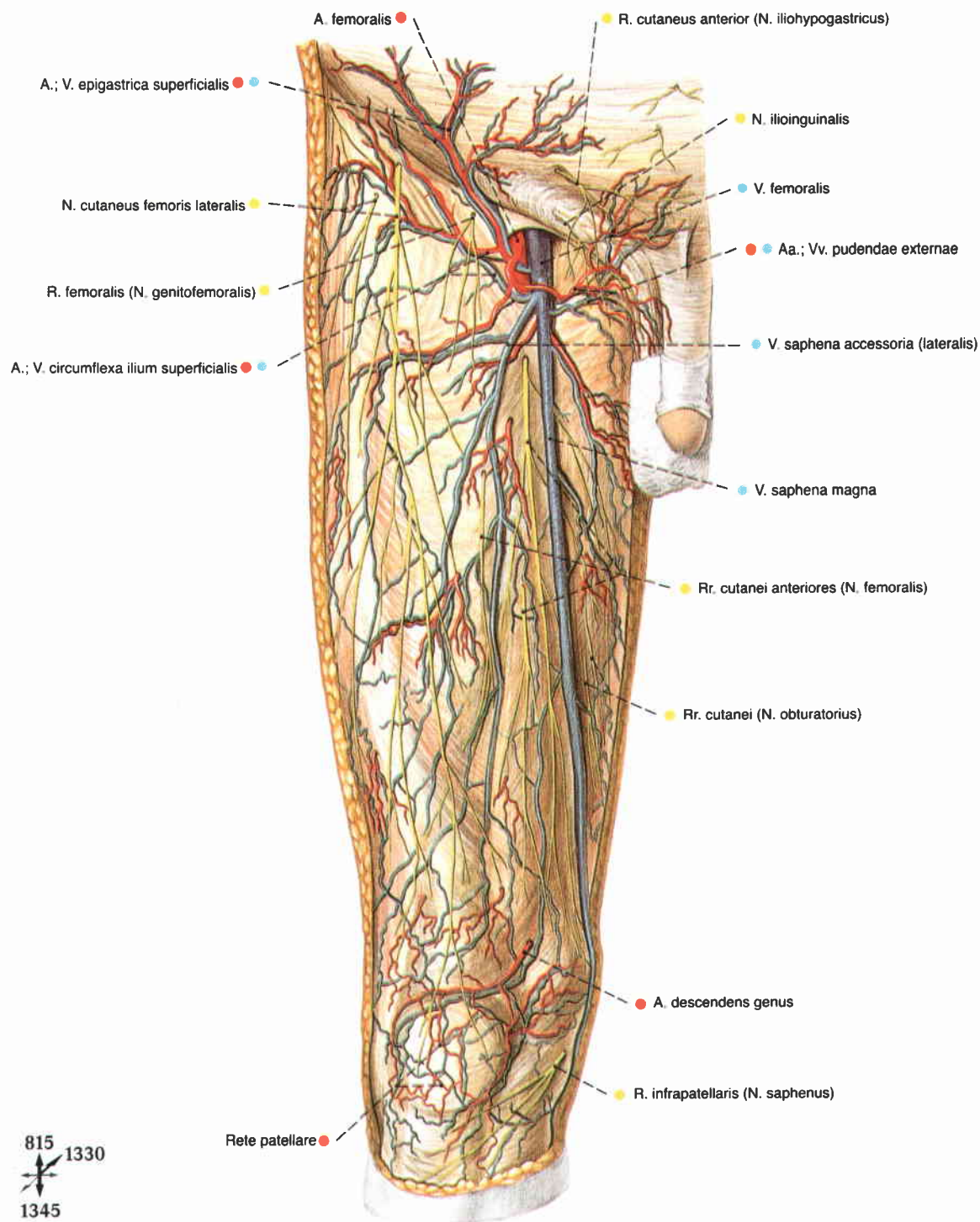


**Fig. 1325** Arteries of the lower limb; ventral view (r.).

The part of the femoral artery between the point where the A. profunda femoris branches off and the point where it enters into the adductor canal, Canalis adductorius, is clinically called the superficial femoral artery.

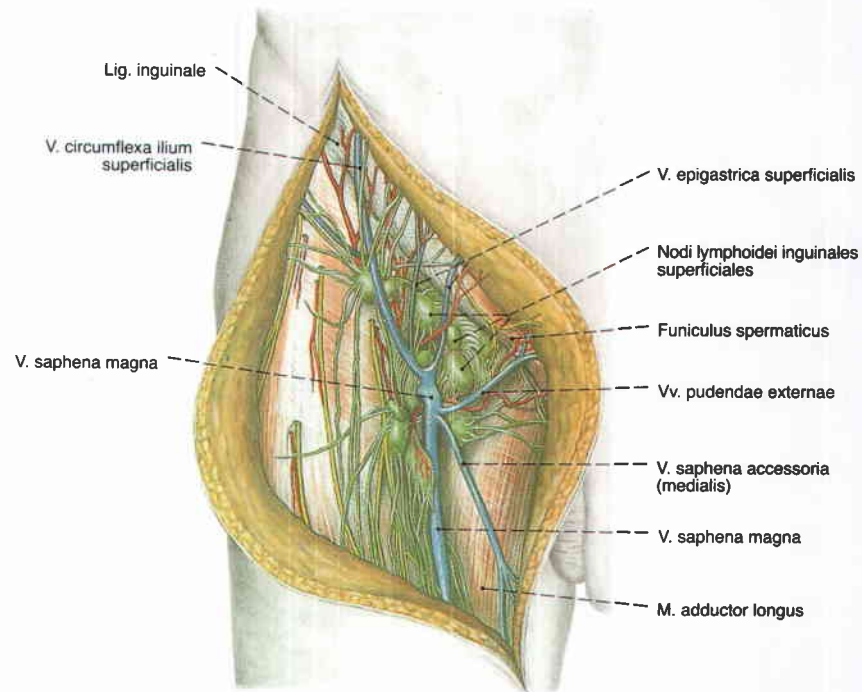


**Fig. 1326** Arteries of the lower limb; dorsal view (r.).

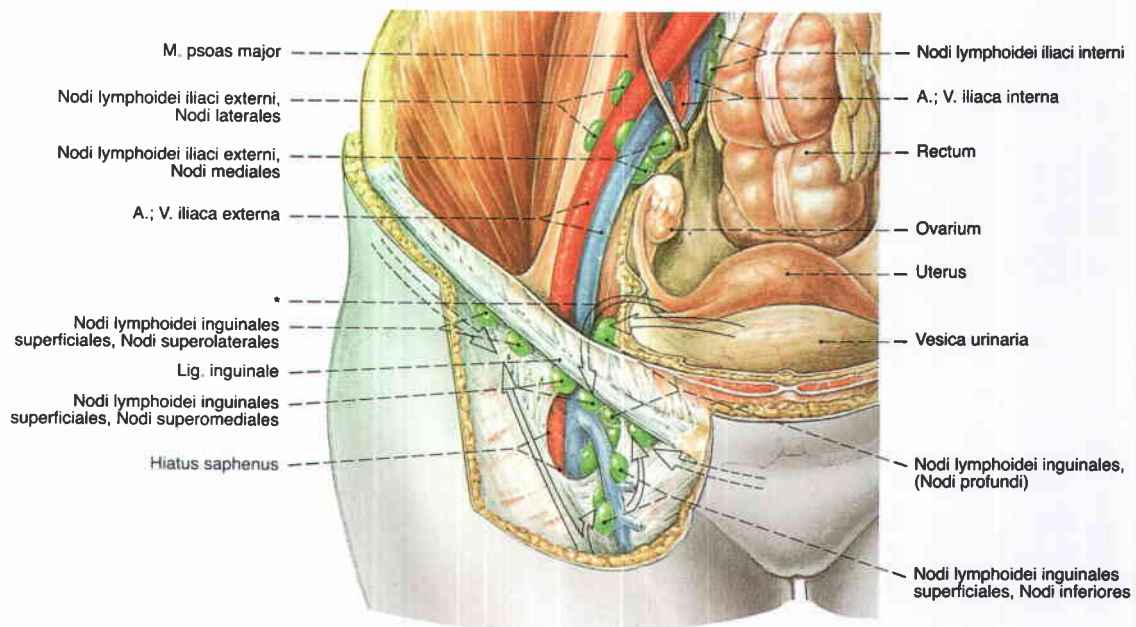


**Fig. 1327** Epifascial vessels and nerves of the inguinal region, Regio inguinalis, the anterior femoral region, Regio femoris anterior, and the anterior knee region, Regio genus anterior; ventral view (r.).





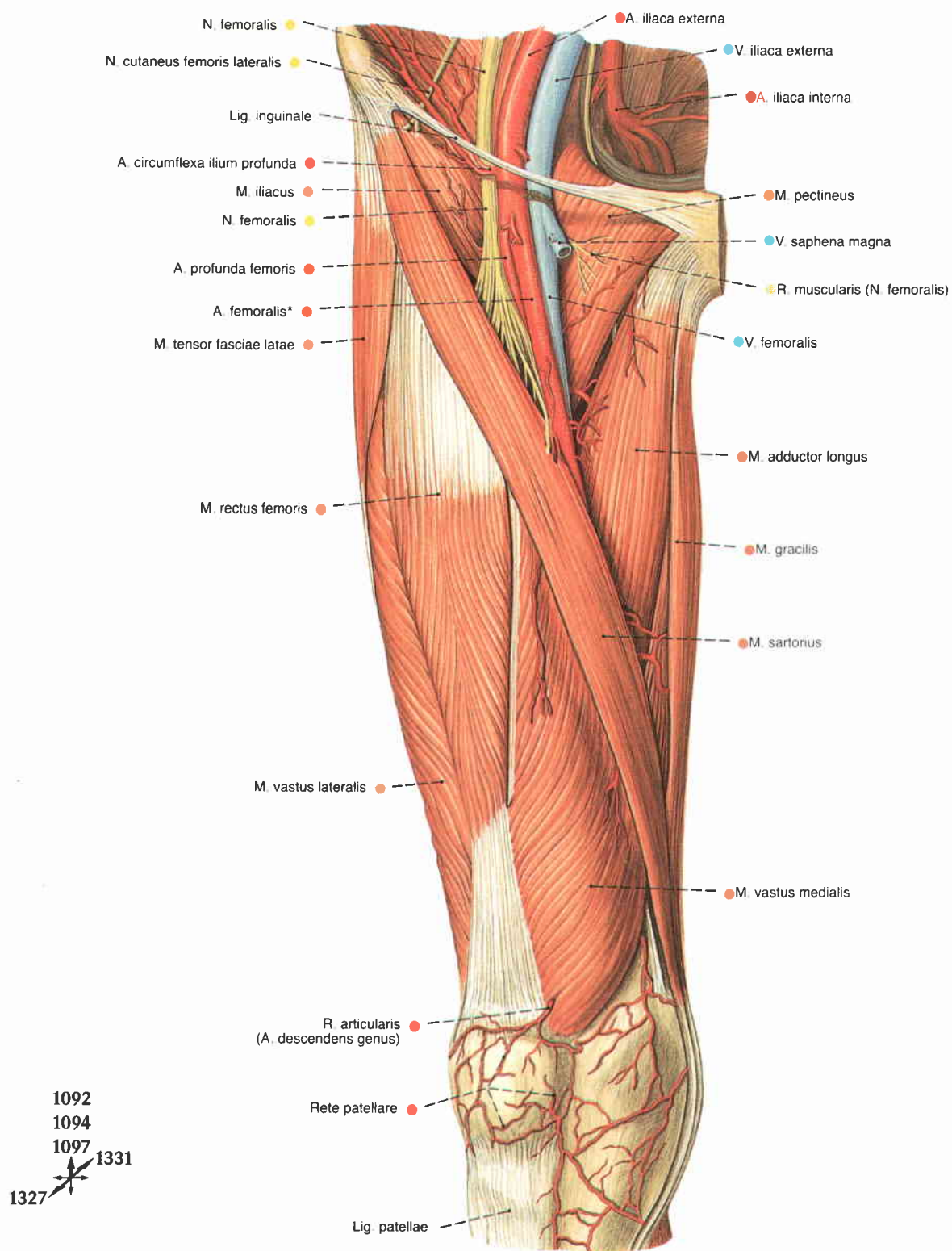
**Fig. 1328** Superficial lymphatic vessels, lymph nodes and main veins of the inguinal region, Regio inguinalis; ventral view (r.).



**Fig. 1329** Draining areas of the lymph nodes of the inguinal region, Regio inguinalis, in the female; ventral view (r.).

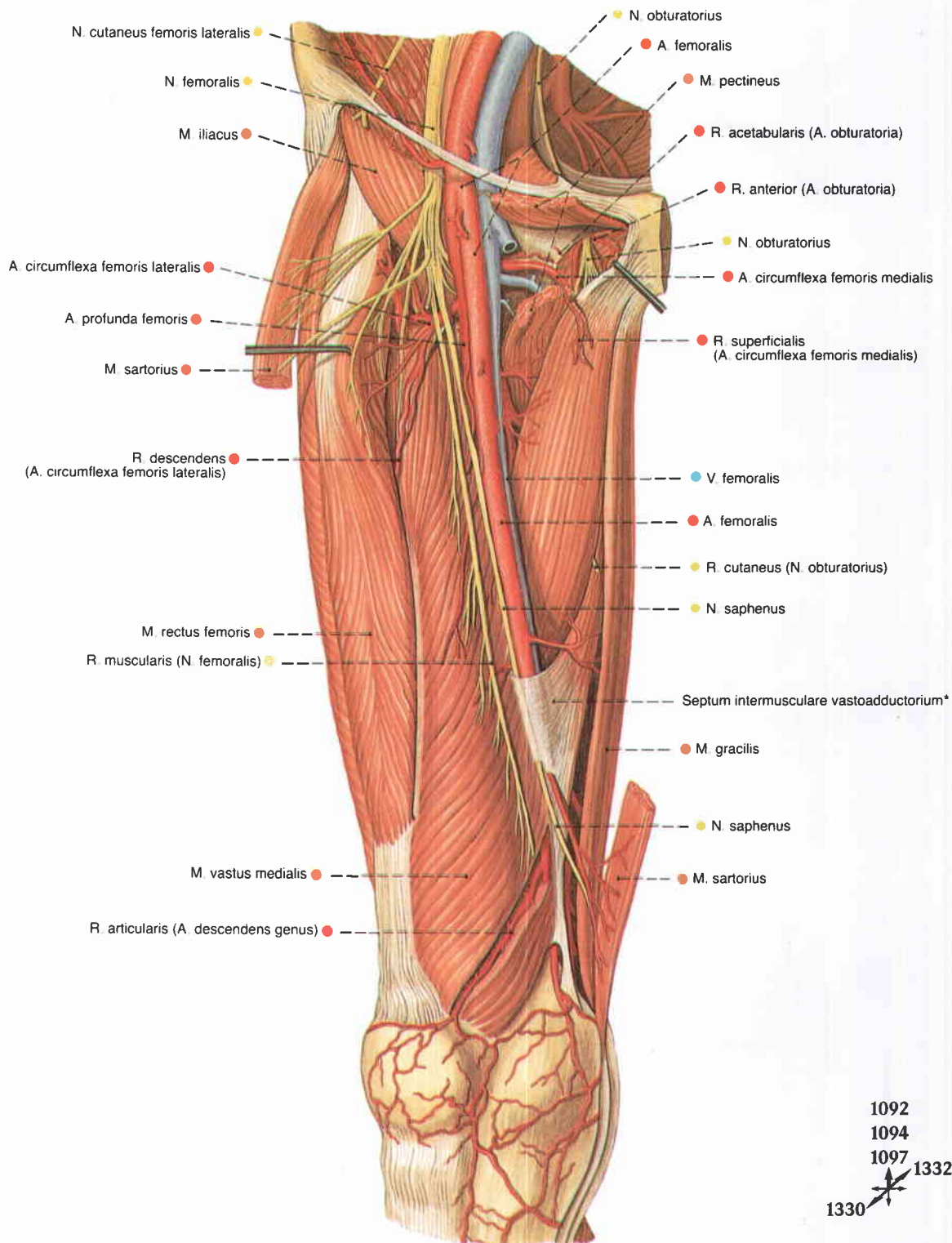
The arrows show the direction of the lymph flow.

\* Lymph fluid can drain from the medial part of the uterine tube and the uterine fundus via the round ligament (Lig. teres uteri) to the superficial lymph nodes of the inguinal region.



**Fig. 1330** Vessels and nerves of the anterior femoral region, Regio femoris anterior; the Fascia lata has been removed, except for the iliotibial tract; ventral view (r.).

\* Clinically the femoral artery is often called superficial femoral artery to differentiate it from the A. profunda femoris (deep femoral artery).

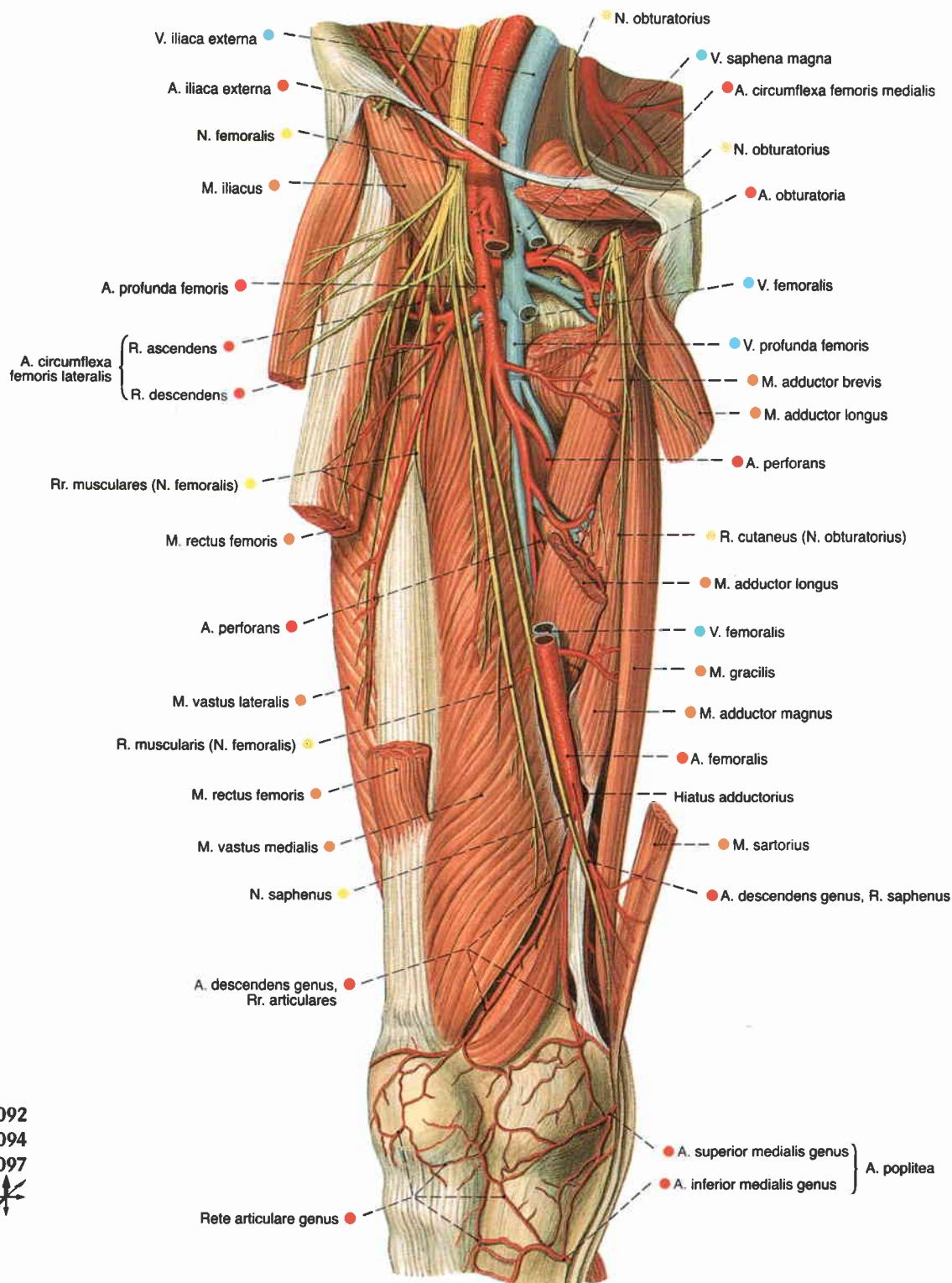


**Fig. 1331** Vessels and nerves of the anterior femoral region, Regio femoris anterior; the sartorius muscle has been partially removed and the pectineus muscle has been sectioned; ventral view (r.).

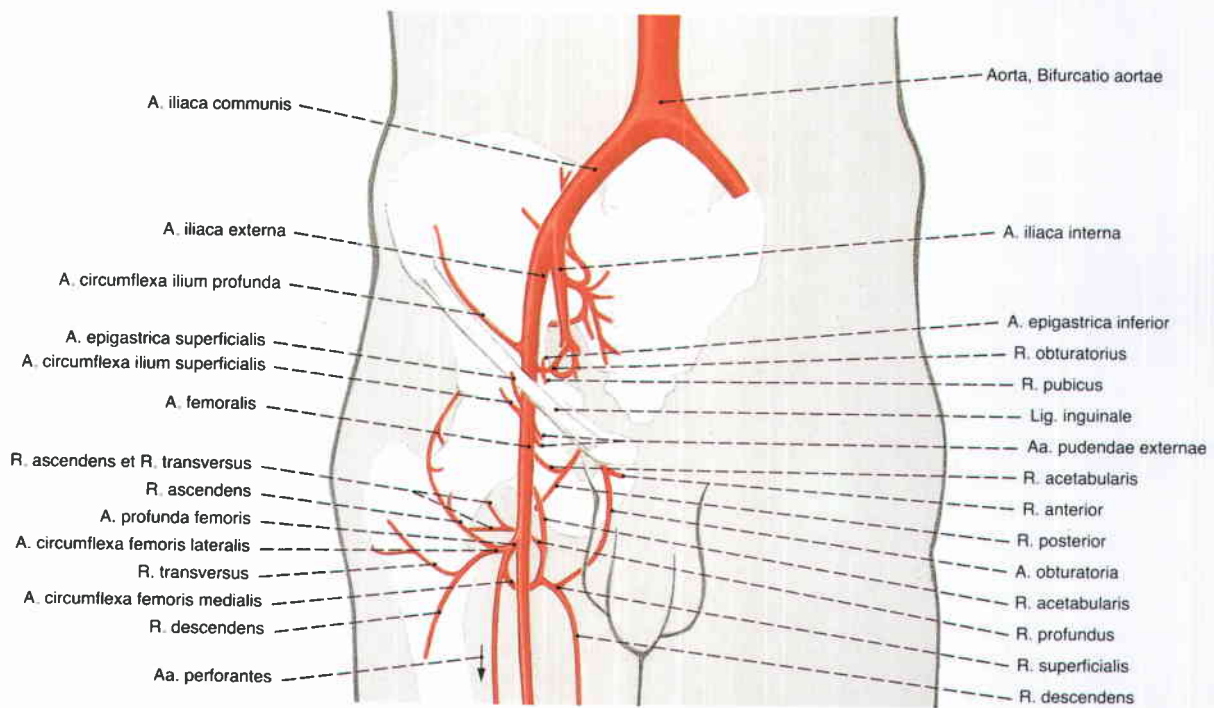
\* The entrance into the adductor canal is formed by the M. vastus medialis, the M. adductor longus and the fibrous membrane between these two muscles (Septum intermusculare vastoadductorium).



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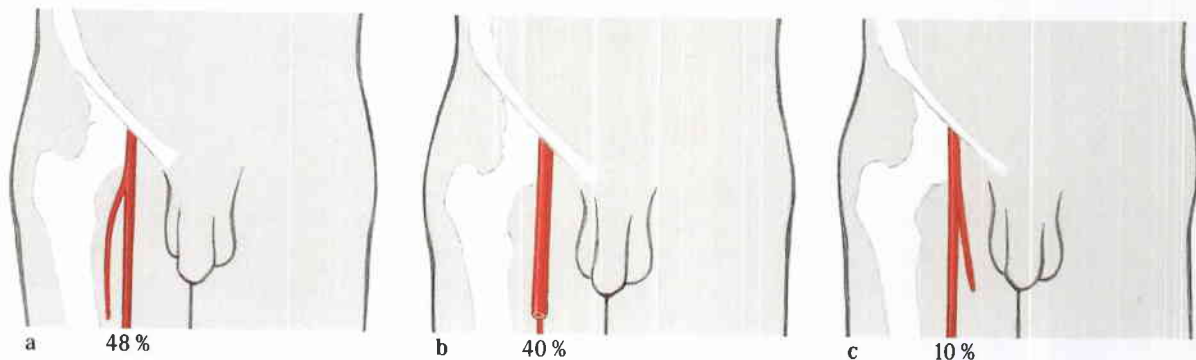


**Fig. 1332** Vessels and nerves of the anterior femoral region.  
Regio femoris anterior;  
deep layer; the sartorius and the rectus femoris muscles have been  
partially removed; the pectineus and the adductor longus muscles  
have been sectioned; the Septum intermusculare vastoadductorium  
has been cut longitudinally, extensively exposing the adductor canal;  
ventral view (r.).



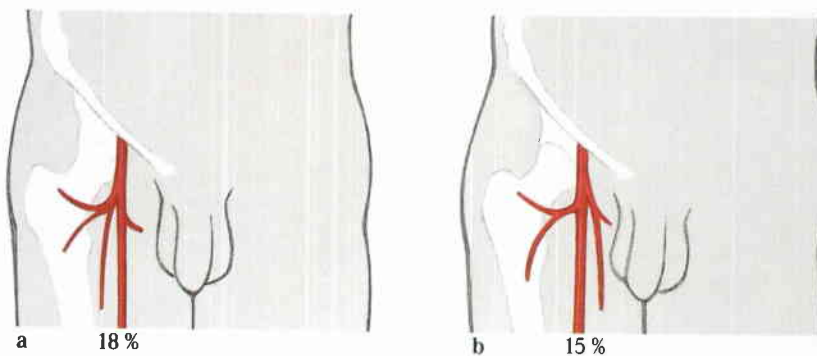
**Fig. 1333** Arteries of the hip and thigh; ventral view (r.).

This variation of origin of the A. profunda femoris is found in about 58% of cases.



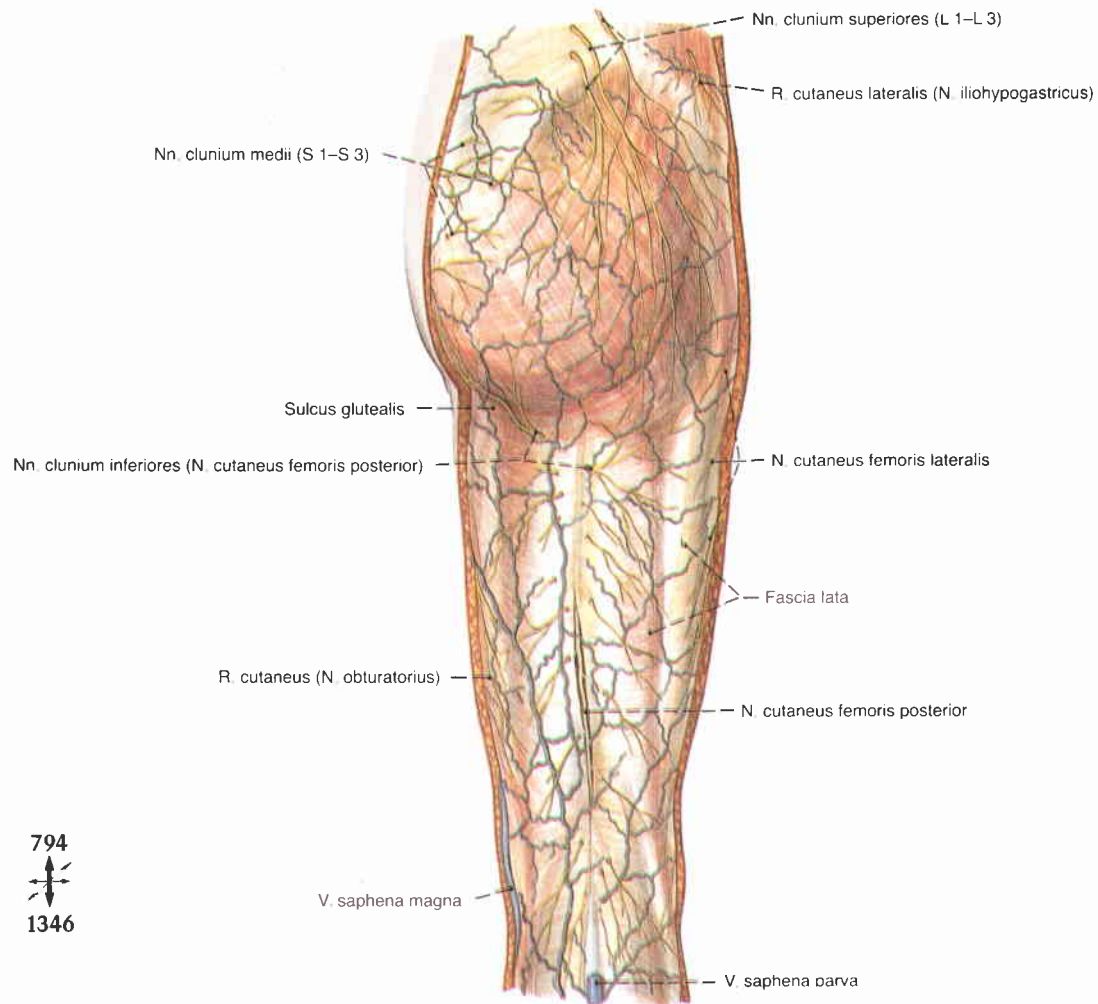
**Figs. 1334 a-c** Variations of the origin of the A. profunda femoris:

- a lateral or laterodorsal of the A. femoralis
- b dorsal of the A. femoralis
- c medial of the A. femoralis



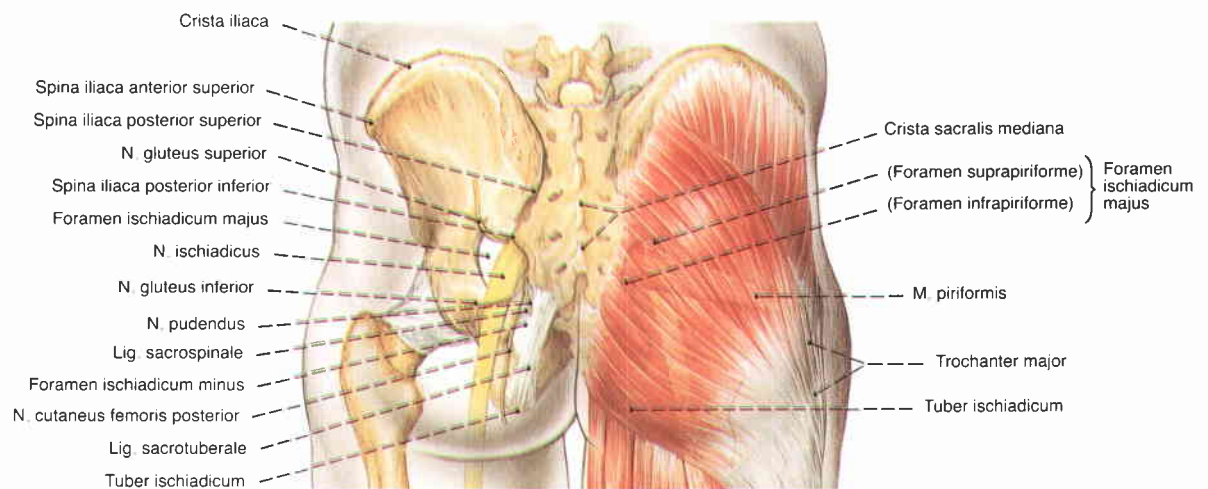
**Figs. 1335 a, b** Variations of the branches of the Aa. circumflexae femoris:

- a independent branch of the A. circumflexa femoris medialis of the A. femoralis
- b independent branch of the A. circumflexa femoris lateralis of the A. femoralis



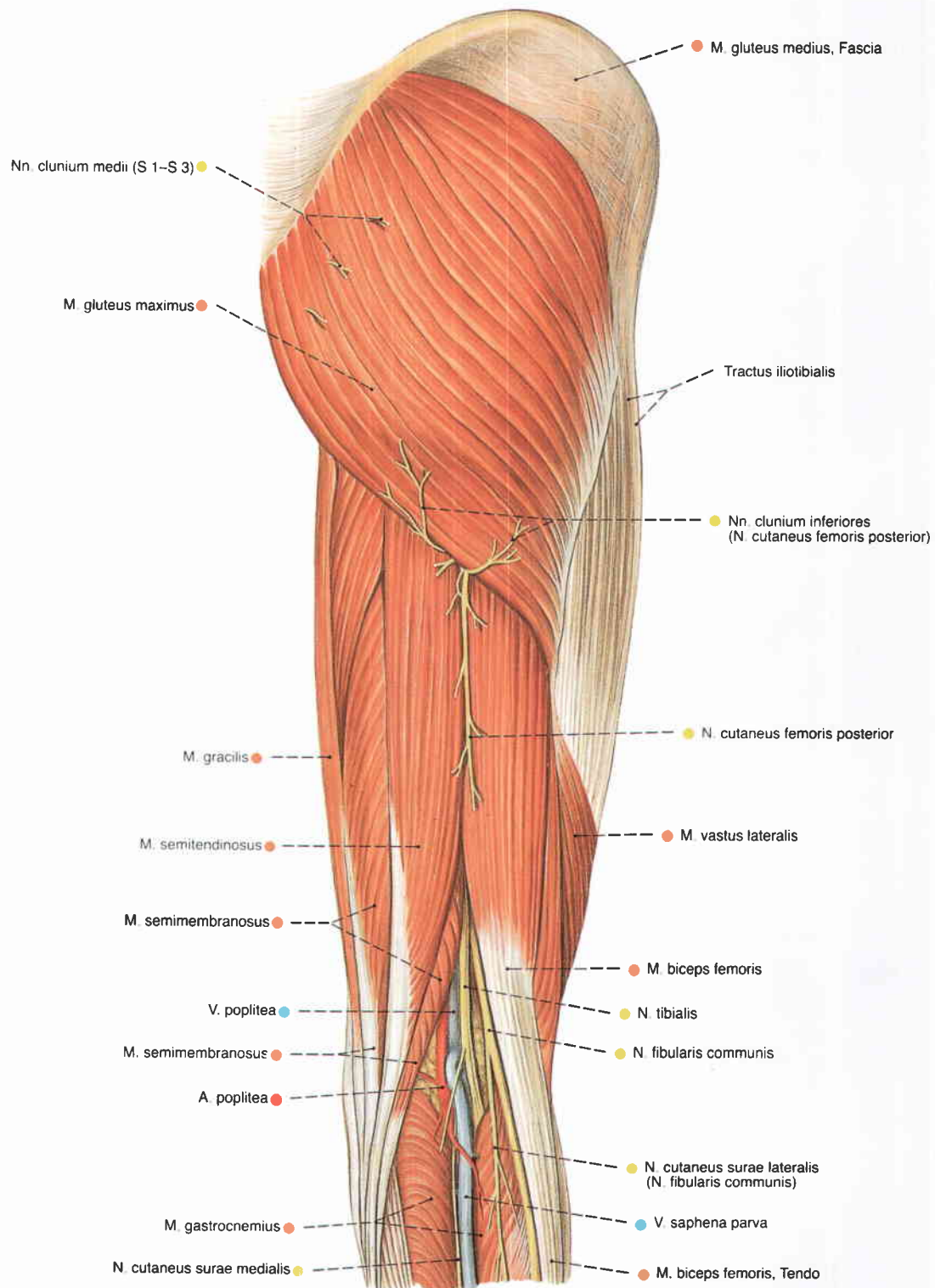
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**Fig. 1336** Superficial veins and nerves of the posterior femoral region, Regio femoris posterior, the gluteal region, Regio glutealis, and the popliteal fossa, Fossa poplitea; dorsal view (r.).

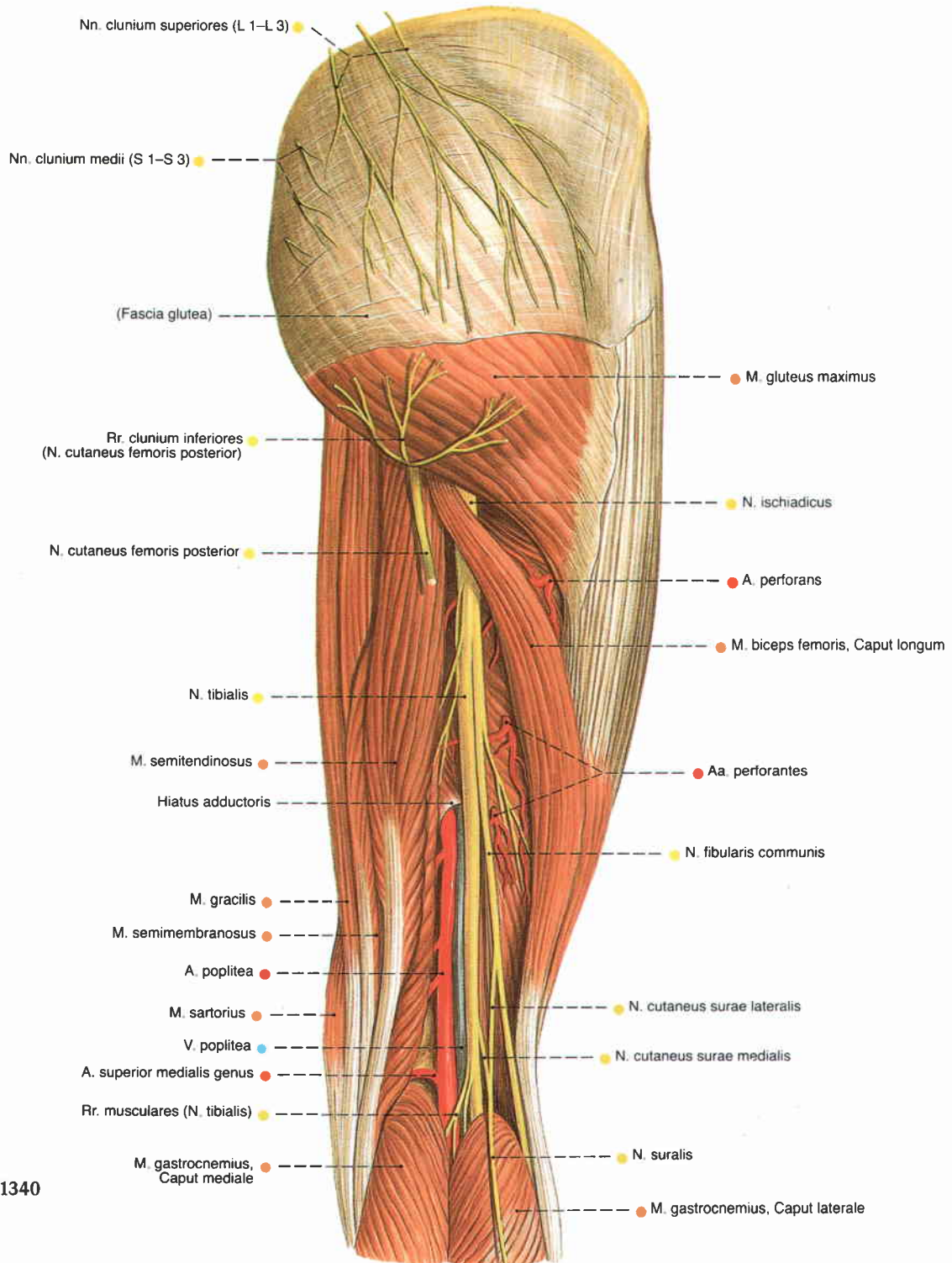


**Fig. 1337** Projection of the skeletal elements and the sciatic nerve onto the surface of the gluteal region, Regio glutealis; dorsal view.



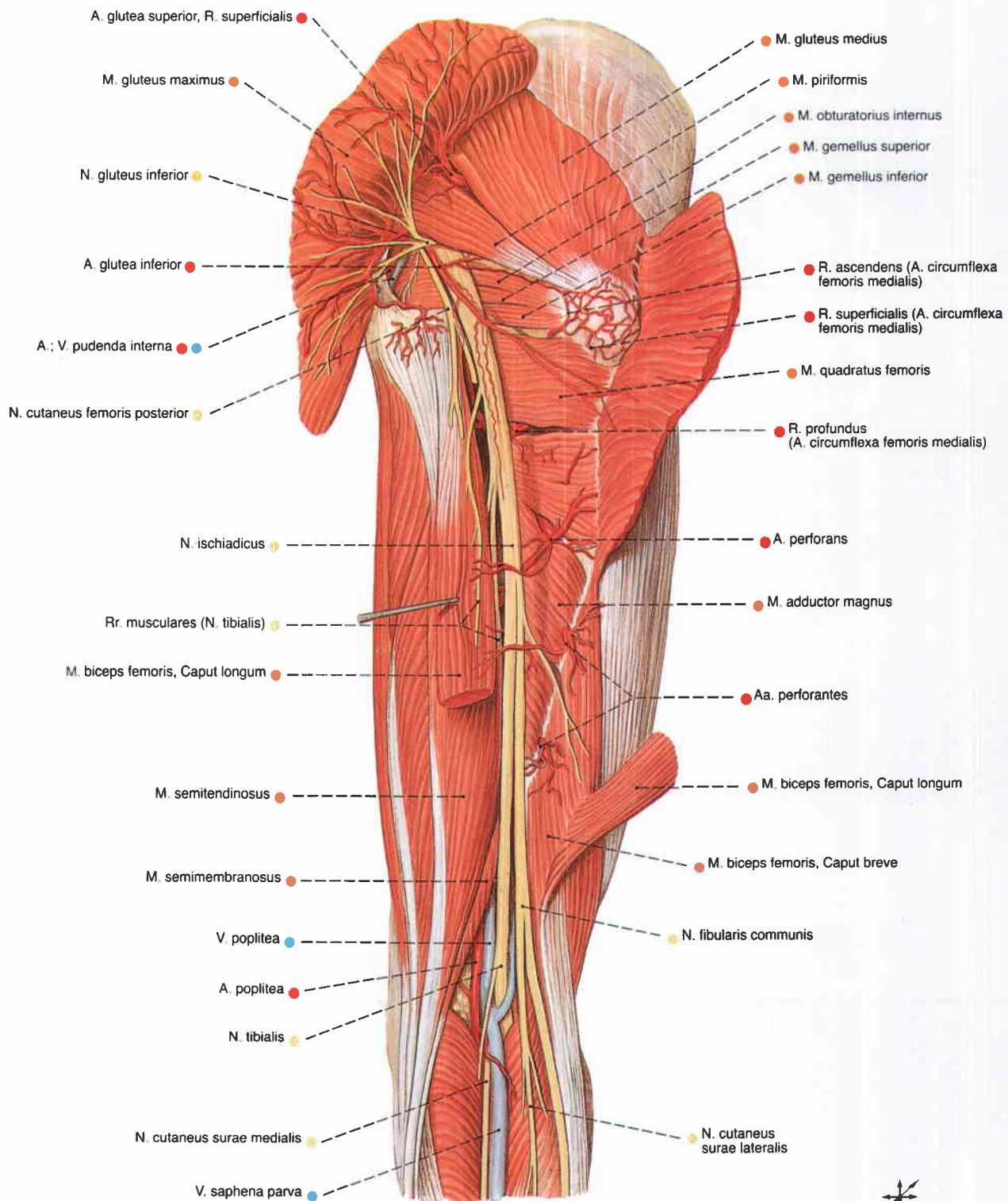


**Fig. 1338** Vessels and nerves of the gluteal region, Regio glutealis, the posterior femoral region, Regio femoris posterior, and the popliteal fossa, Fossa poplitea; the Fascia lata has been removed, except for the iliotibial tract; dorsal view (r.).



**Fig. 1339** Vessels and nerves of the gluteal region, Regio glutealis, the posterior femoral region, Regio femoris posterior, and the popliteal fossa, Fossa poplitea; the Fascia lata has been completely removed; the long head of the biceps femoris muscle has been retracted laterally; dorsal view (r.).

In this specimen the medial and lateral cutaneous nerves branch off quite far proximally.



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**Fig. 1340** Vessels and nerves of the gluteal region, Regio glutealis, the posterior femoral region, Regio femoris posterior, and the popliteal fossa, Fossa poplitea; the M. gluteus maximus and the long head of the biceps femoris muscle have been sectioned; dorsal view (r.).



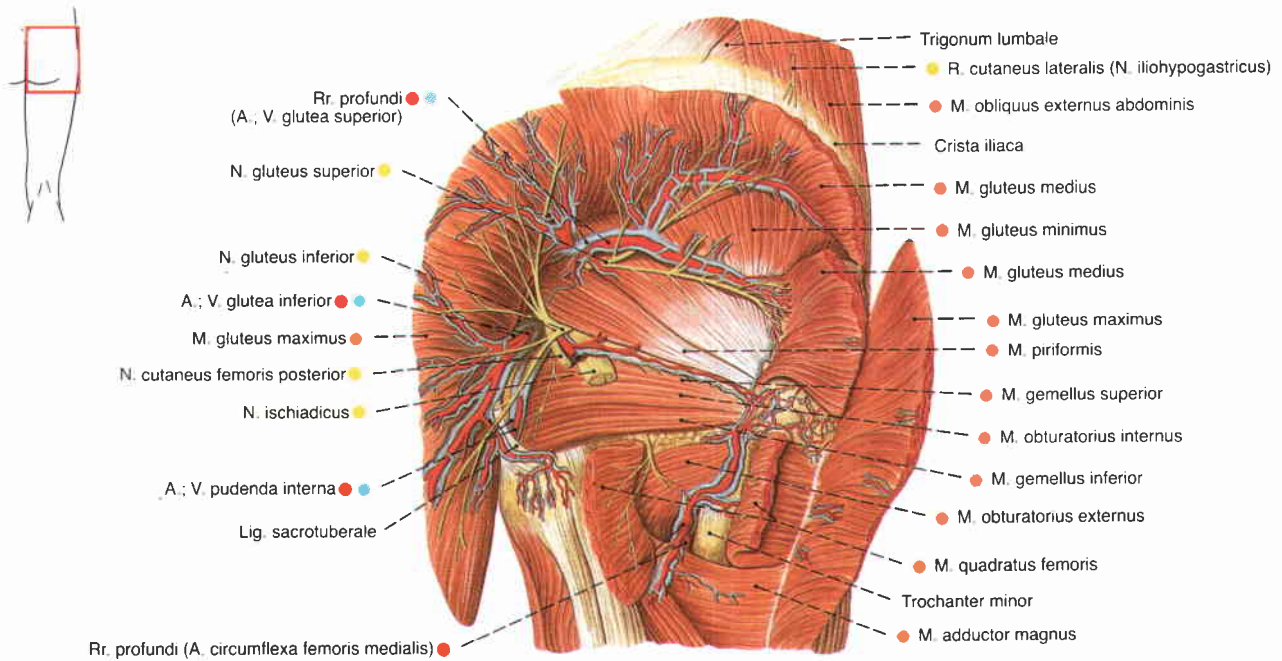


Fig. 1341 Vessels and nerves of the gluteal region, Regio glutealis; the gluteus maximus and medius muscles have been sectioned and partially removed; the sciatic nerve has been sectioned after leaving the infrapiriform foramen; dorsal view (r.).

The Foramen ischiadicum [sciaticum] majus is divided into two parts by the M. piriformis: the Foramen suprapiriforme, containing the N. gluteus superior, A. and V. glutea superior, and the Foramen infrapiriforme, containing the Nn. ischiadicus, gluteus inferior, pudendus, cutaneus femoris

posterior, A. and V. glutea inferior and A. and V. pudenda interna.

The tendons of the M. obturatorius internus, N. pudendus and A. and V. pudenda interna run through the Foramen ischiadicum [sciaticum] minus.

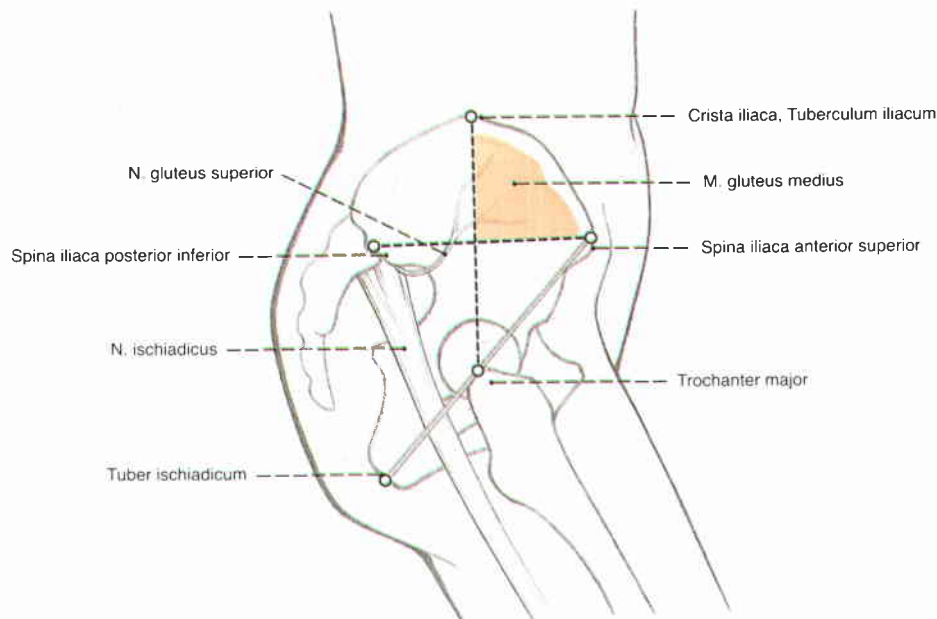
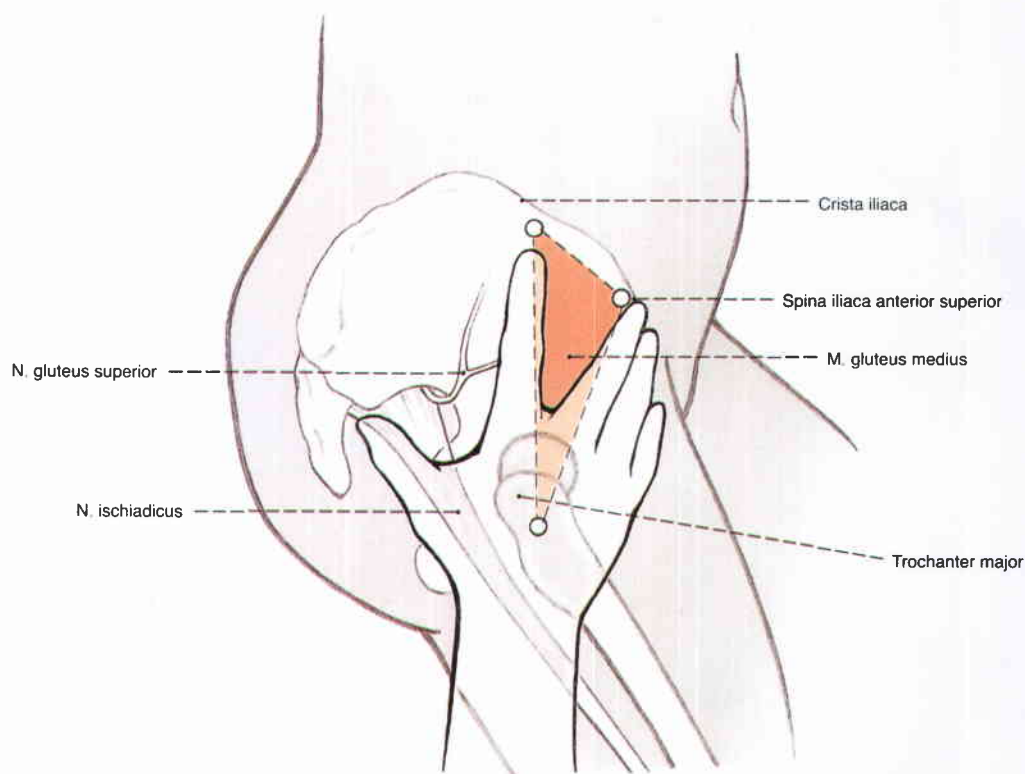
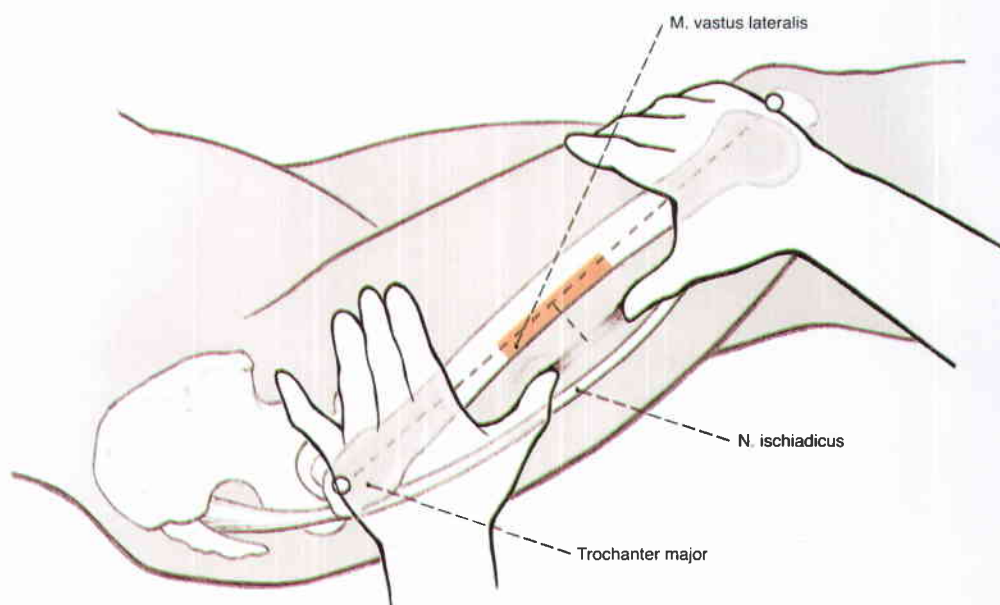


Fig. 1342 Projection of the skeletal elements used to direct intramuscular injections into the M. gluteus medius; lateral view (r.).



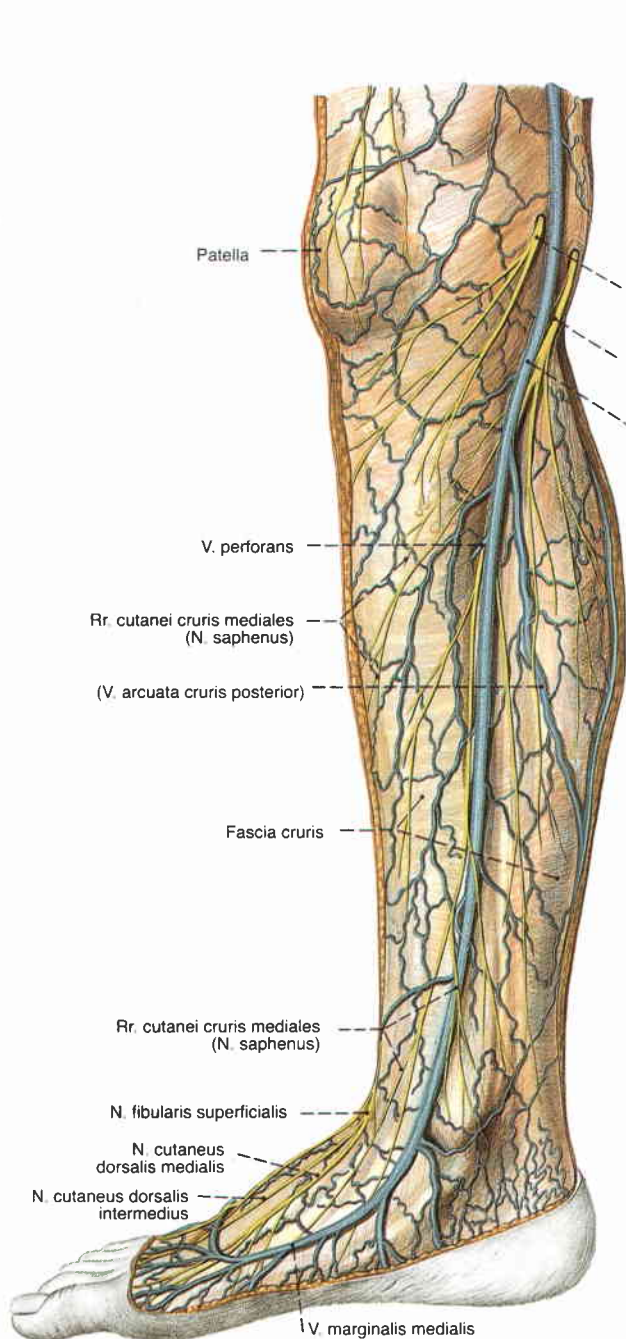
**Fig. 1343** Intragluteal injection (after A. v. HOCHSTETTER). To minimize the risk of damaging the superior gluteal nerve and artery, the injection should be given in the triangular area defined by the two spread fingers and the iliac crest. The middle finger - or when using the left hand, the second finger - is placed on the anterior superior iliac spine and the palm of

the hand on the Trochanter major. For the injection to enter the gluteus medius muscle and be as far away from the vessels as possible, the lines of the triangle should not be crossed by the needle. A certain risk remains for the branch that runs from the superior gluteal nerve to the tensor fasciae latae muscle.



**Fig. 1344** Intramuscular injection into the vastus lateralis muscle (after A. v. HOCHSTETTER). Apart from some small branches of the lateral cutaneous femoral nerve no great vessels or nerves are found in the middle of the

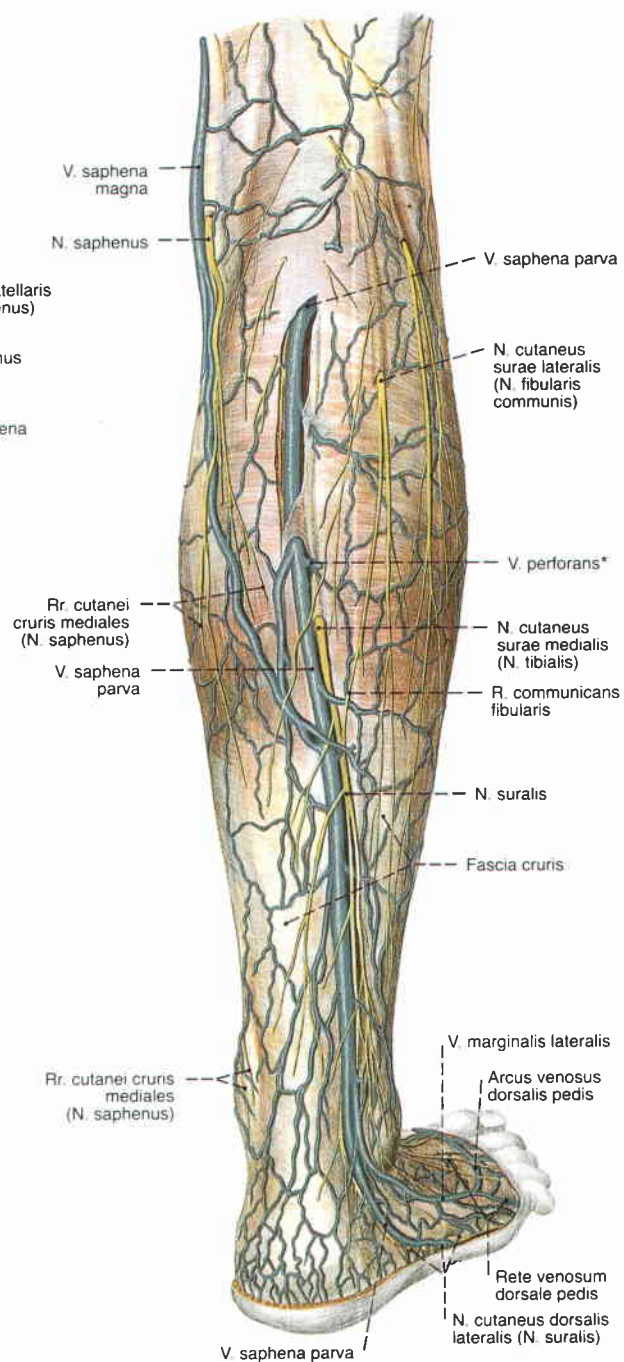
external aspect of the thigh. After ascertaining the position of the femur, the needle is inserted transversely into the belly of the vastus lateralis muscle.



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**Fig. 1345** Superficial veins and nerves of the crus and foot, *Regiones cruris et pedis*; medial view (r.).



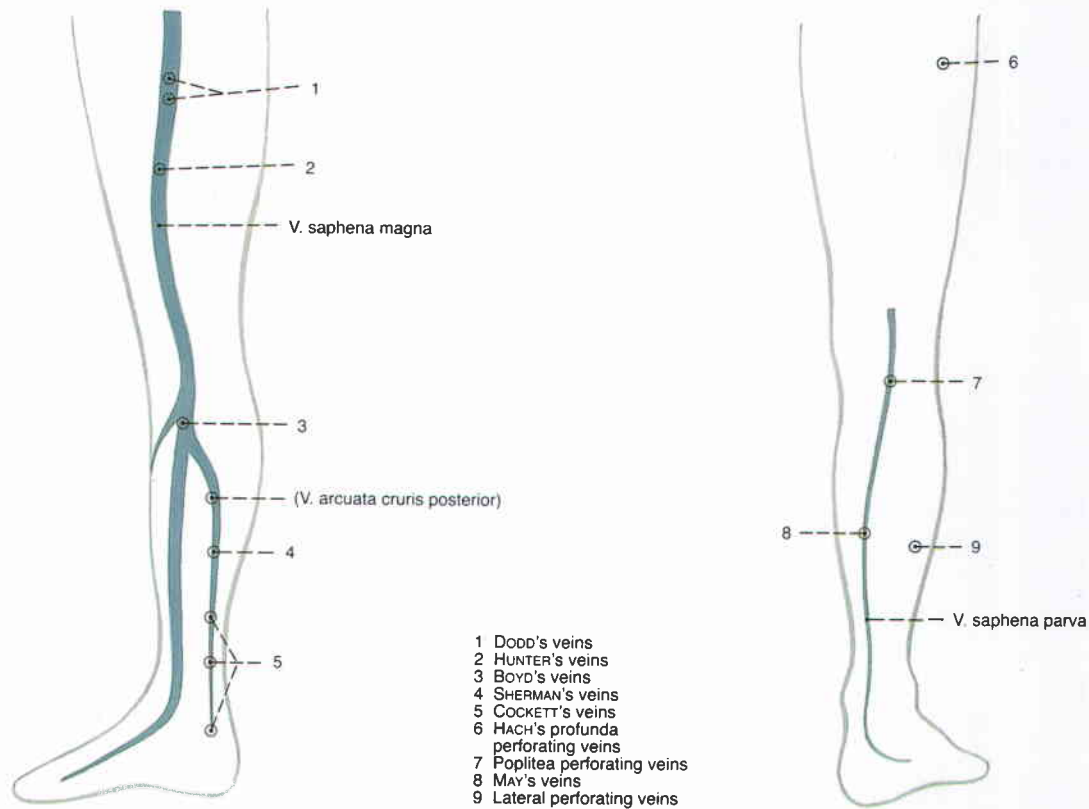
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**Fig. 1346** Superficial veins and nerves of the crus and foot, *Regiones cruris et pedis*; the crural fascia has been opened proximally; dorsal view (r.).

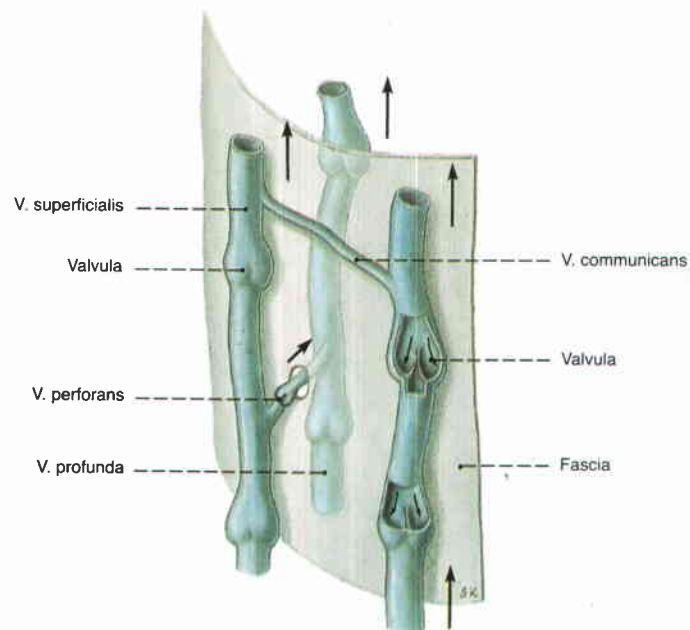
\* clinical: MAY's vein





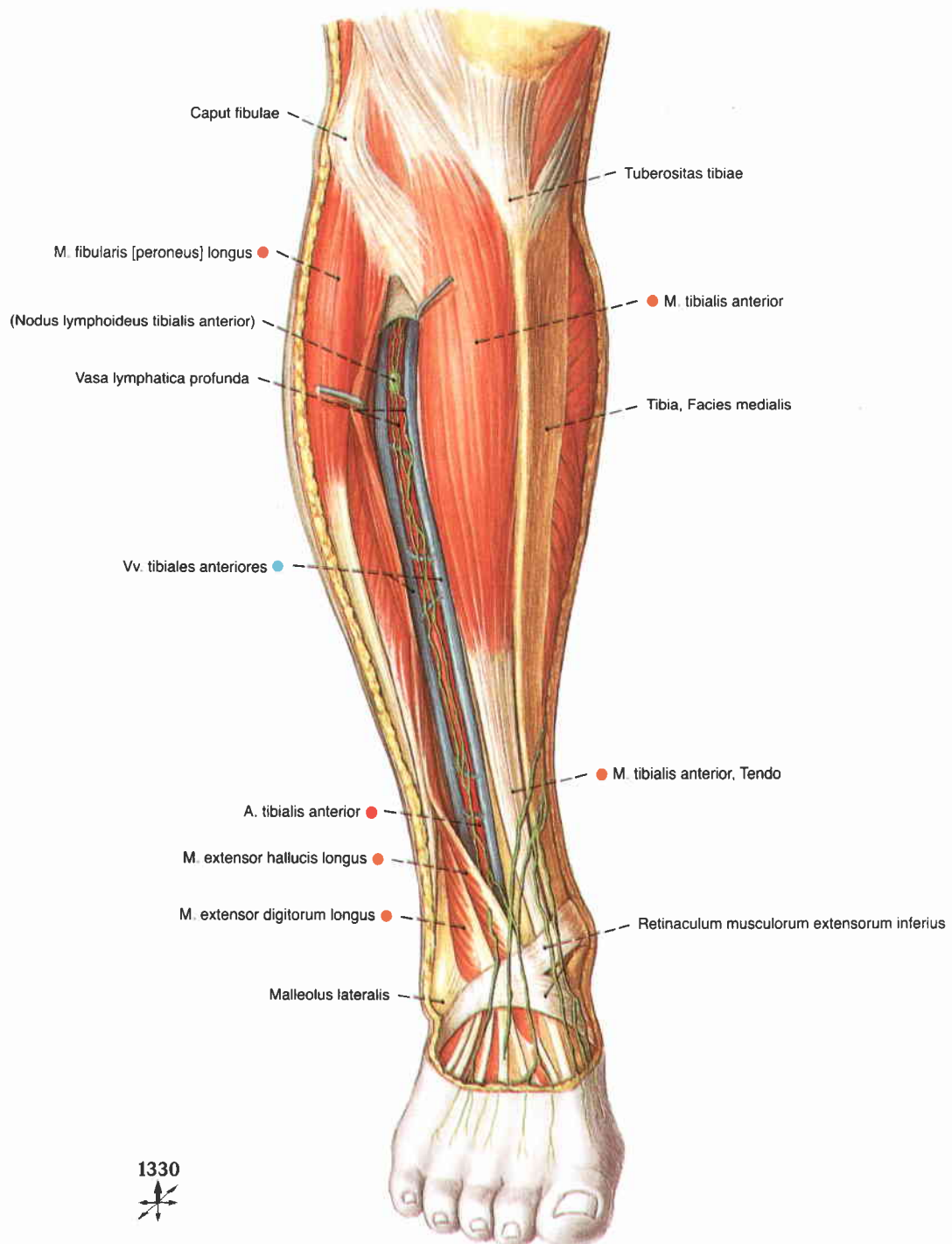
**Fig. 1347** Connections between the superficial and the deep veins in the draining area of the great saphenous vein, Vv. perforantes; (after HACH, 1986); medial view (r.).

**Fig. 1348** Connections between the superficial and the deep veins in the draining area of the small saphenous vein, Vv. perforantes; (after HACH, 1986); dorsal view (r.).



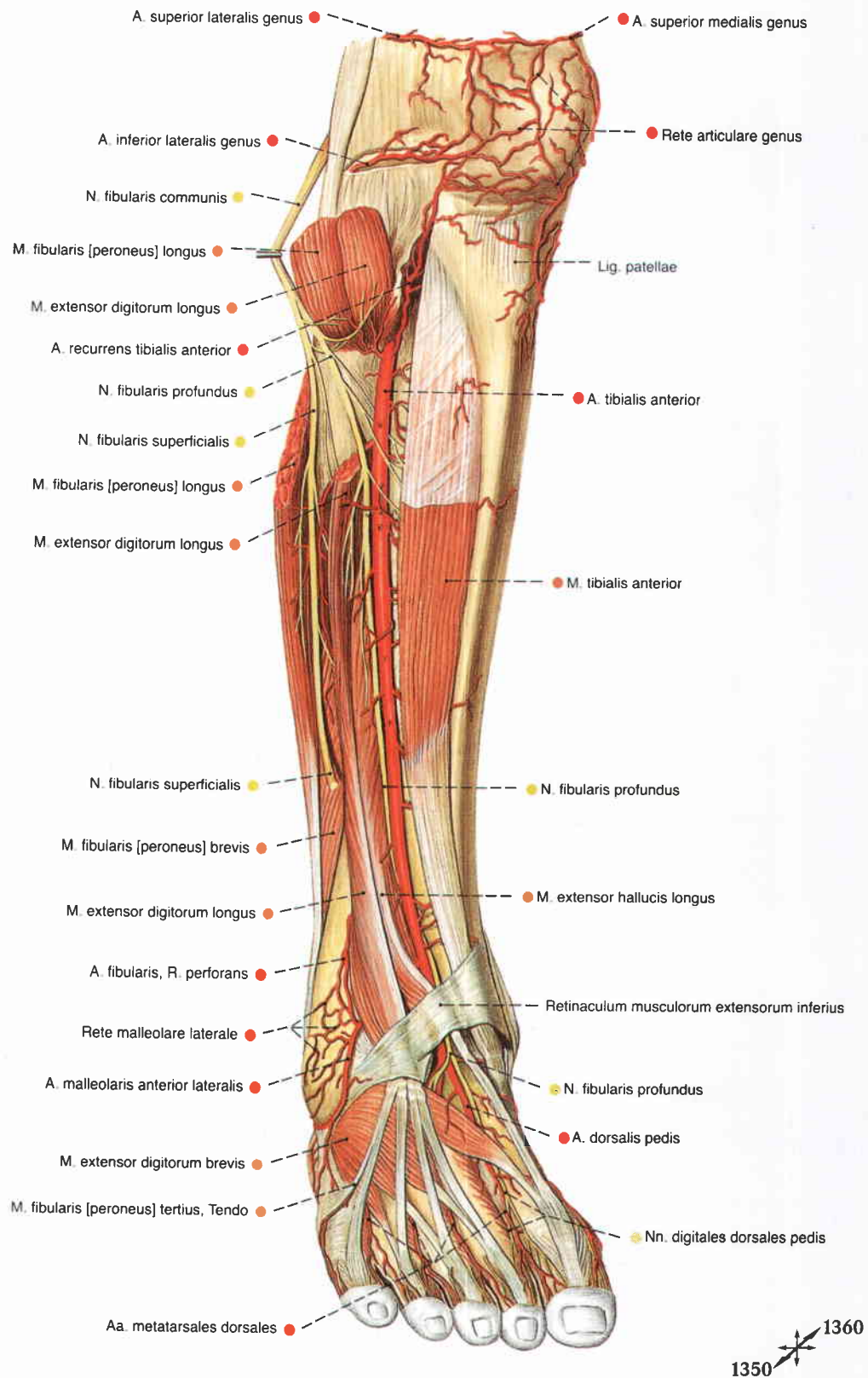
**Fig. 1349** Veins of the lower limb; schematic representation of the venous system. Disturbances in the drainage of the veins of the lower limb,

especially varicosis, are common. If one of the venous systems is completely closed, the perforating veins play a critical role in maintaining the drainage of the lower limb.



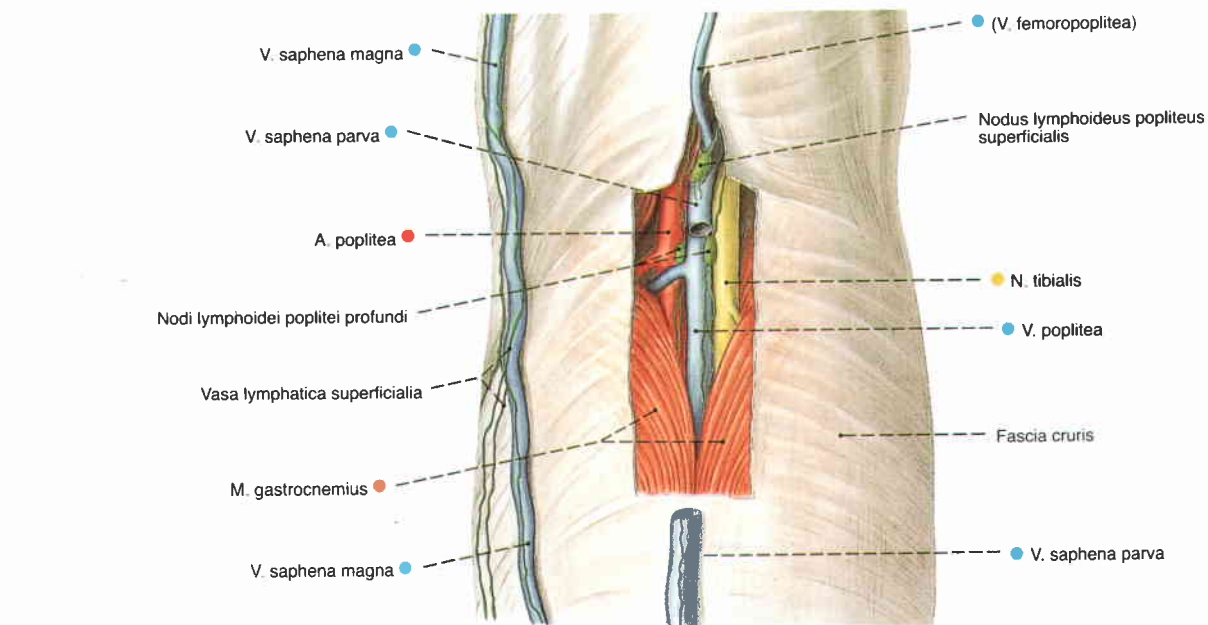
**Fig. 1350** Vessels of the anterior crural region, Regio cruris anterior; the fascia of the crus has been removed and the extensor muscles have been spread out; ventral view (r.).

The superficial lymphatic vessels follow the major superficial veins converging along the great saphenous vein to the medial side of the crus. The deep lymphatic vessels run in the fibrous sheaths of the deep crural arteries and veins.

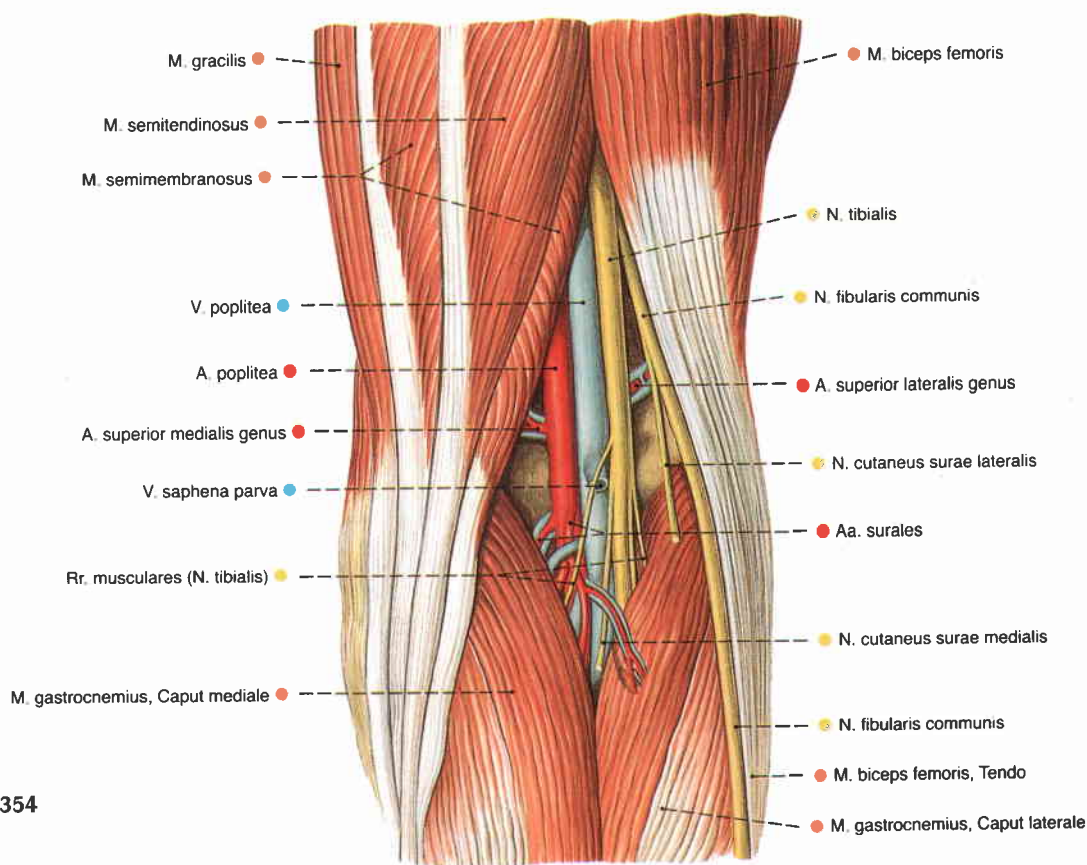


**Fig. 1351** Arteries and veins of the anterior crural region, Regio cruris anterior, and of the back of the foot, Dorsum pedis; the fascia of the crus has been removed; the extensor digitorum longus and the long peroneus muscles have been sectioned; ventral view (r.).

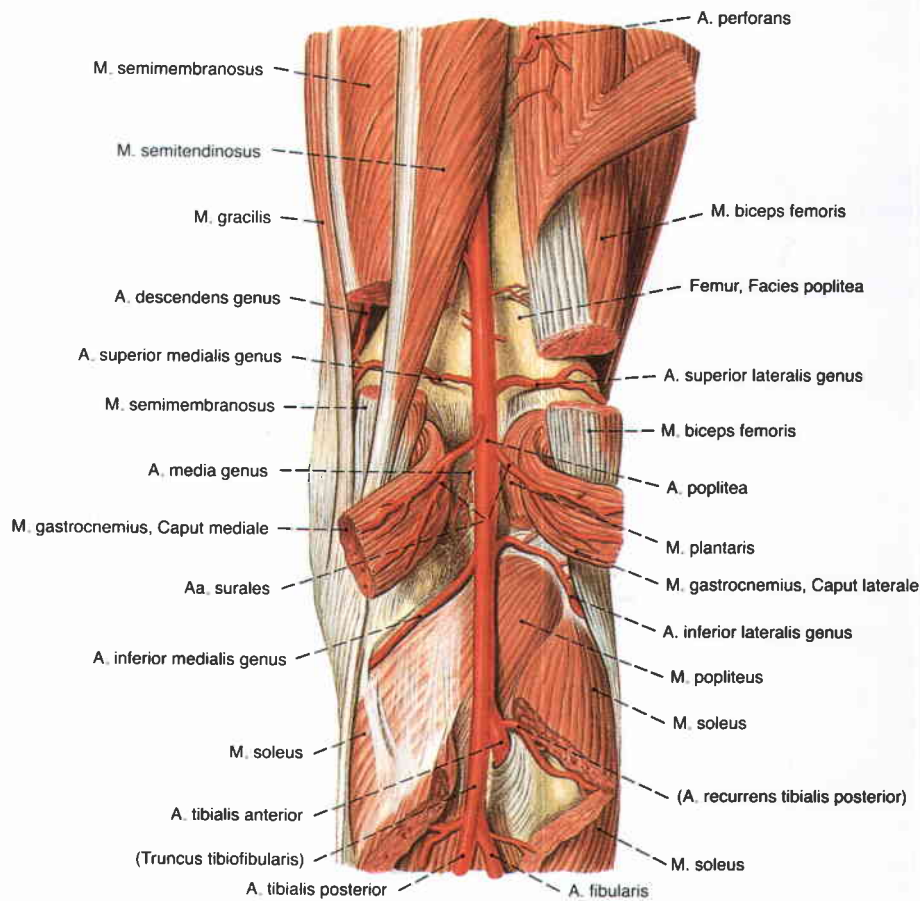




**Fig. 1352** Vessels and nerves of the popliteal fossa, Fossa poplitea; the crural fascia has been opened and the small saphenous vein partially removed; dorsal view (r.).

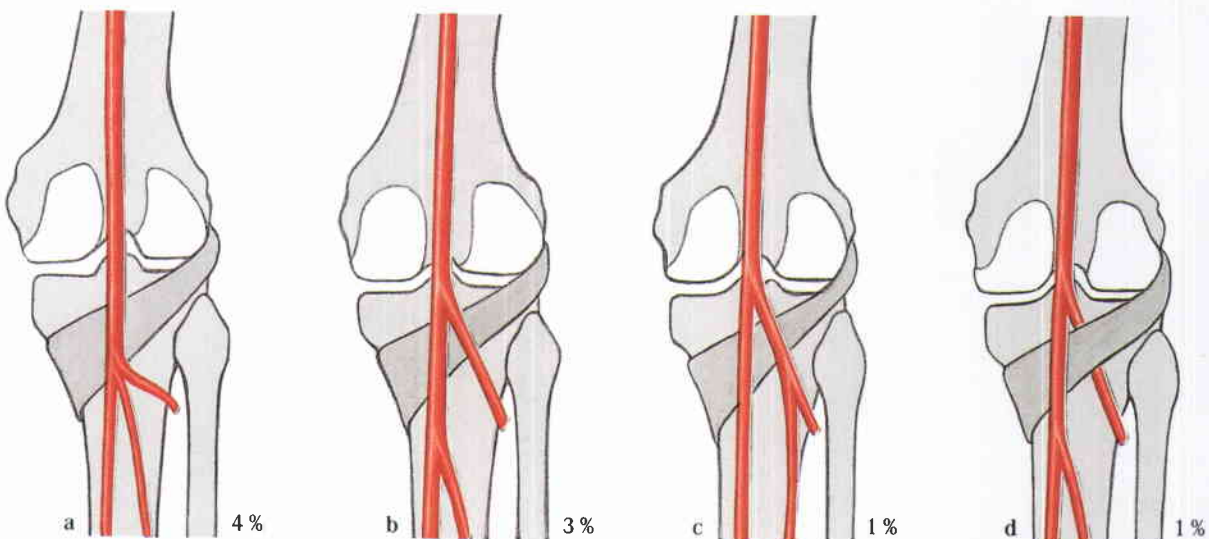


**Fig. 1353** Vessels and nerves of the popliteal fossa, Fossa poplitea; the crural fascia and the Fascia lata have been removed; dorsal view (r.).



**Fig. 1354** Arteries of the popliteal fossa, Fossa poplitea; the muscles covering the fossa have been partially removed to show the arterial supply; dorsal view (r.).  
This pattern of branches is found in about 90%.

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**Figs. 1355 a-d** Variations of the branches of the popliteal artery.

- a common origin of Aa. tibiales anterior and posterior and A. fibularis
- b branching of A. poplitea proximal of the upper margin of M. popliteus
- c proximal truncus of A. tibialis posterior and A. fibularis
- d A. tibialis anterior running ventrally of M. popliteus

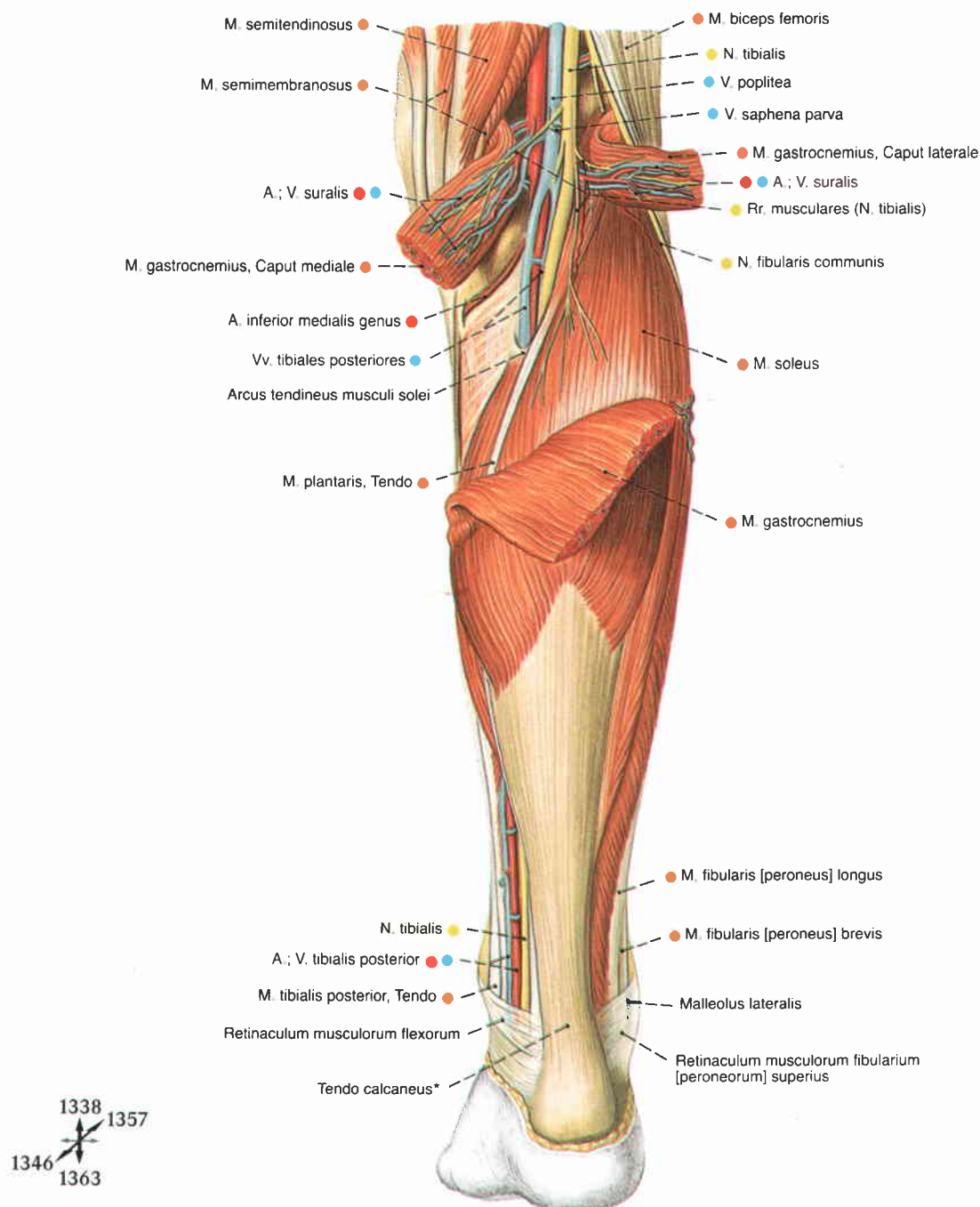


Fig. 1356 Vessels and nerves of the popliteal fossa, Fossa poplitea, and the posterior crural region, Regio cruris posterior; the crural fascia has been removed and the gastrocnemius muscle sectioned; dorsal view (r).

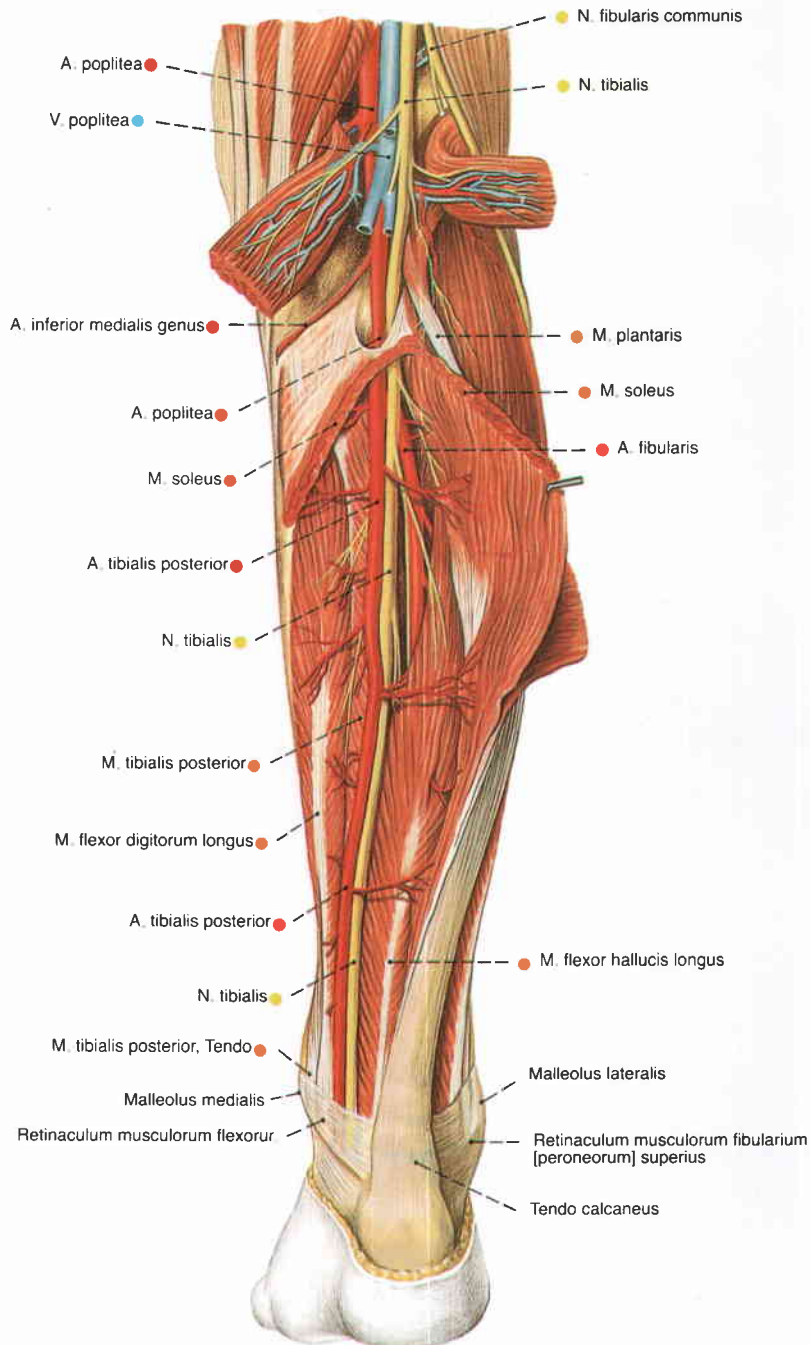
\* also: Achilles tendon

The Retinaculum musculorum flexorum forms a canal in the medial retromalleolar space, which connects the deep regions of the calf with the planta. From anterior to posterior, this canal contains the tendons of the Mm. tibialis posterior and flexor digitorum longus, the Vasa tibialia, the tendon of the M. flexor hallucis longus and the N. tibialis. The distal part

of the canal extending below the M. abductor hallucis is called the "tarsal tunnel" (see Fig. 1364).

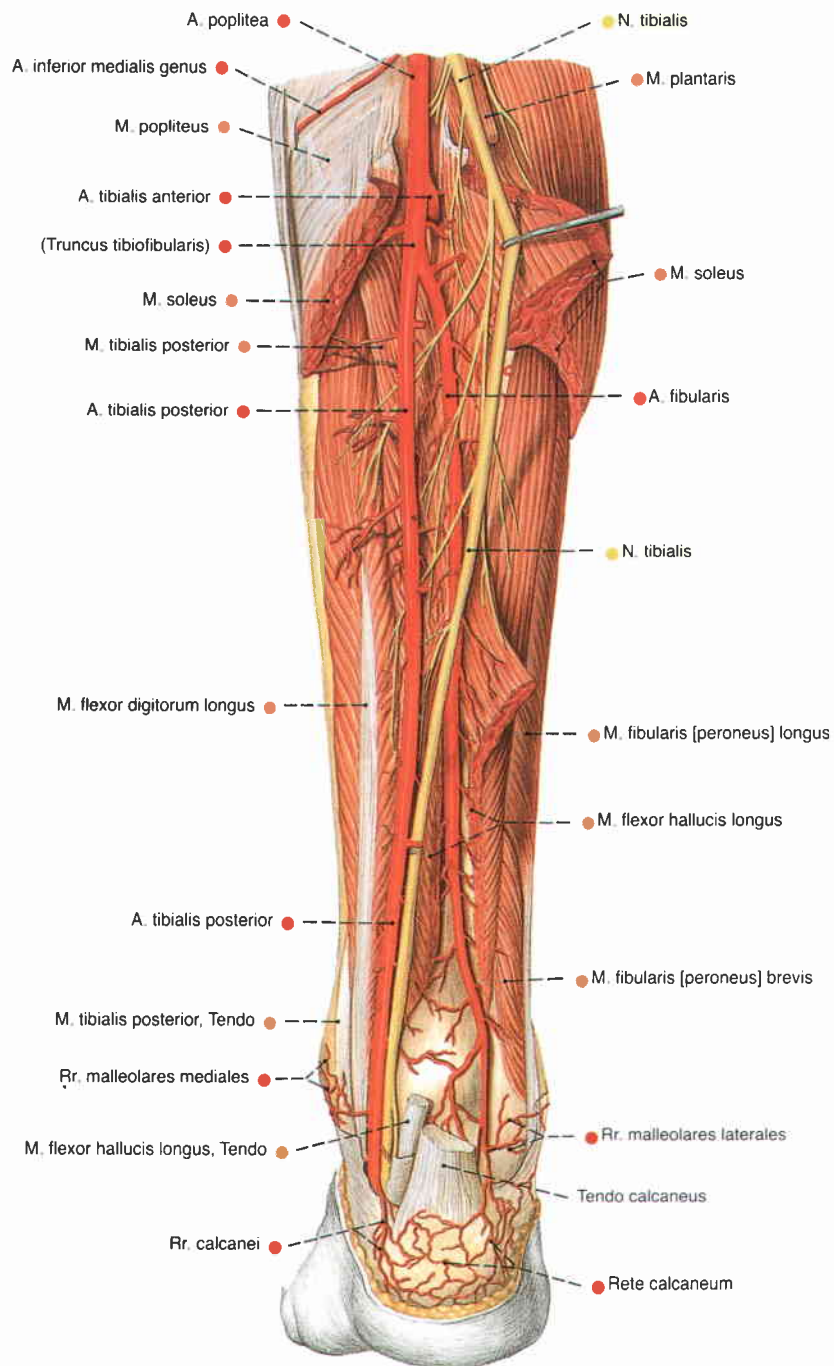
The lateral retromalleolar space is covered by the Retinacula musculorum fibularium [peroneorum] superius and inferius and contains the tendons of the Mm. fibulares [peronei] brevis (anterior region) and longus (posterior region).





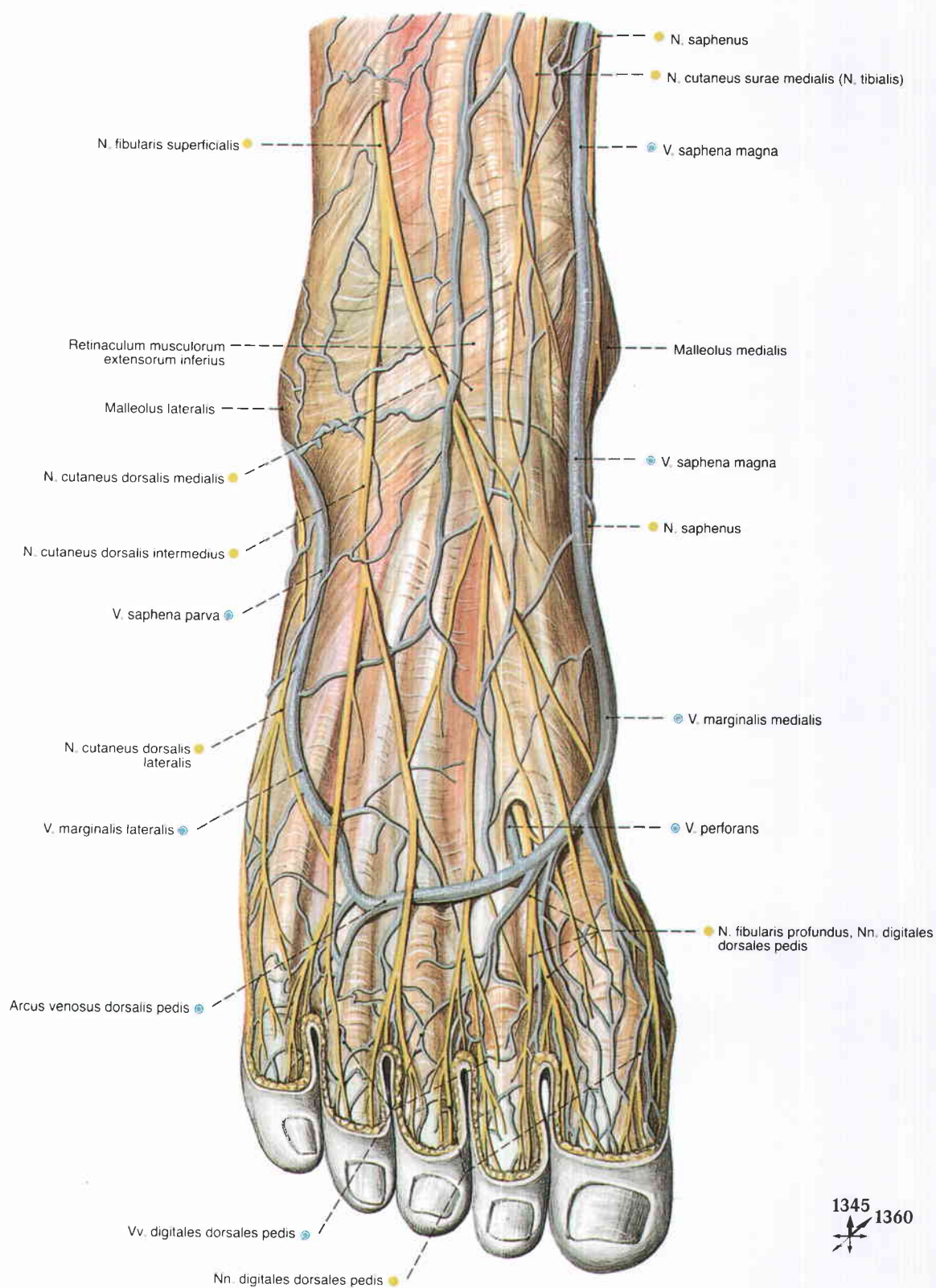
**Fig. 1357** Vessels and nerves of the popliteal fossa, Fossa poplitea, and the posterior crural region, Regio cruris posterior; deep layer; most of the gastrocnemius muscle has been removed; the soleus muscle has been sectioned and retracted; dorsal view (r.).





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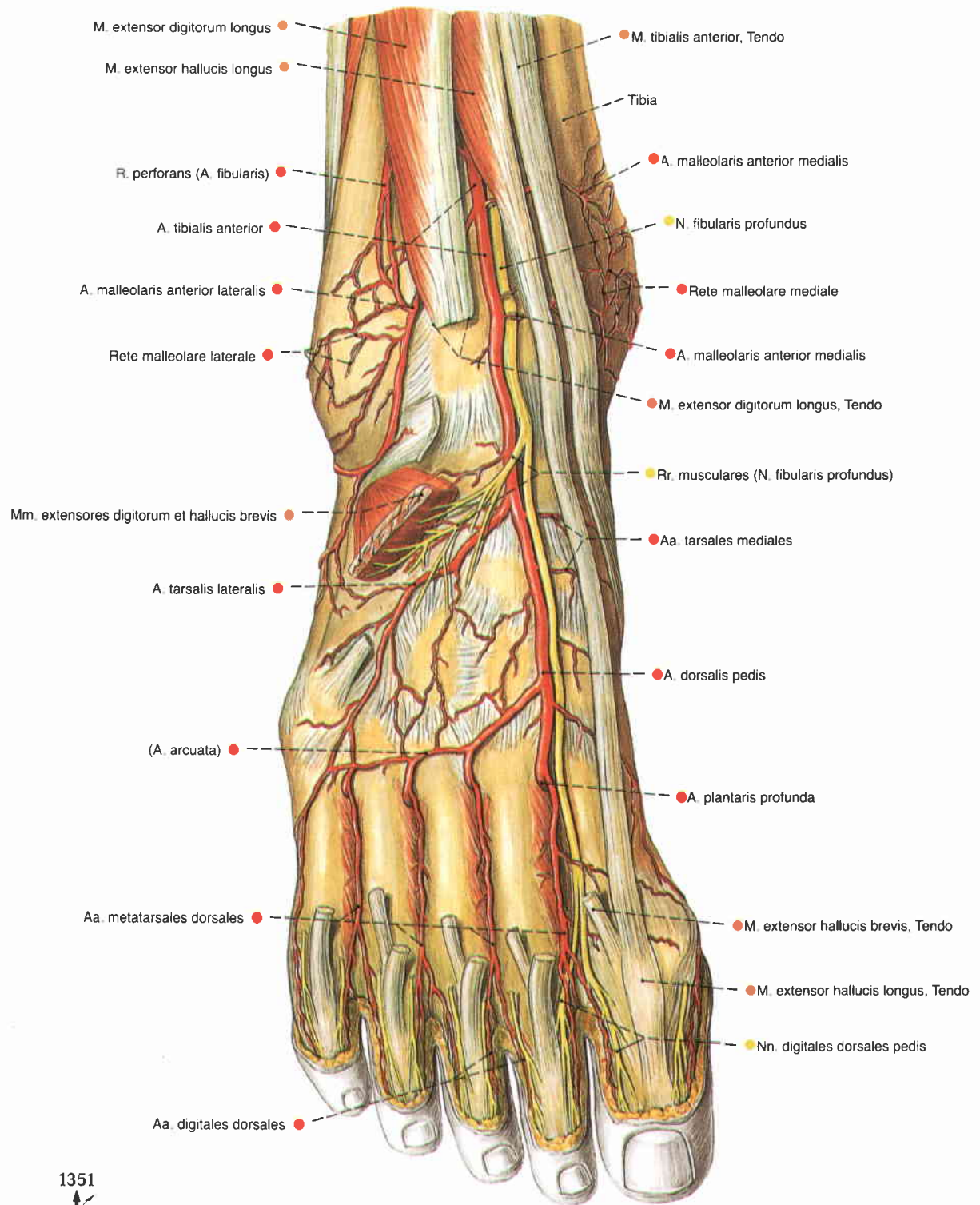
**Fig. 1358** Arteries and nerves of the popliteal fossa, Fossa poplitea, and the posterior crural region, Regio cruris posterior; most of the triceps surae and the extensor hallucis longus muscles have been removed; dorsal view (r.).



1345 1360

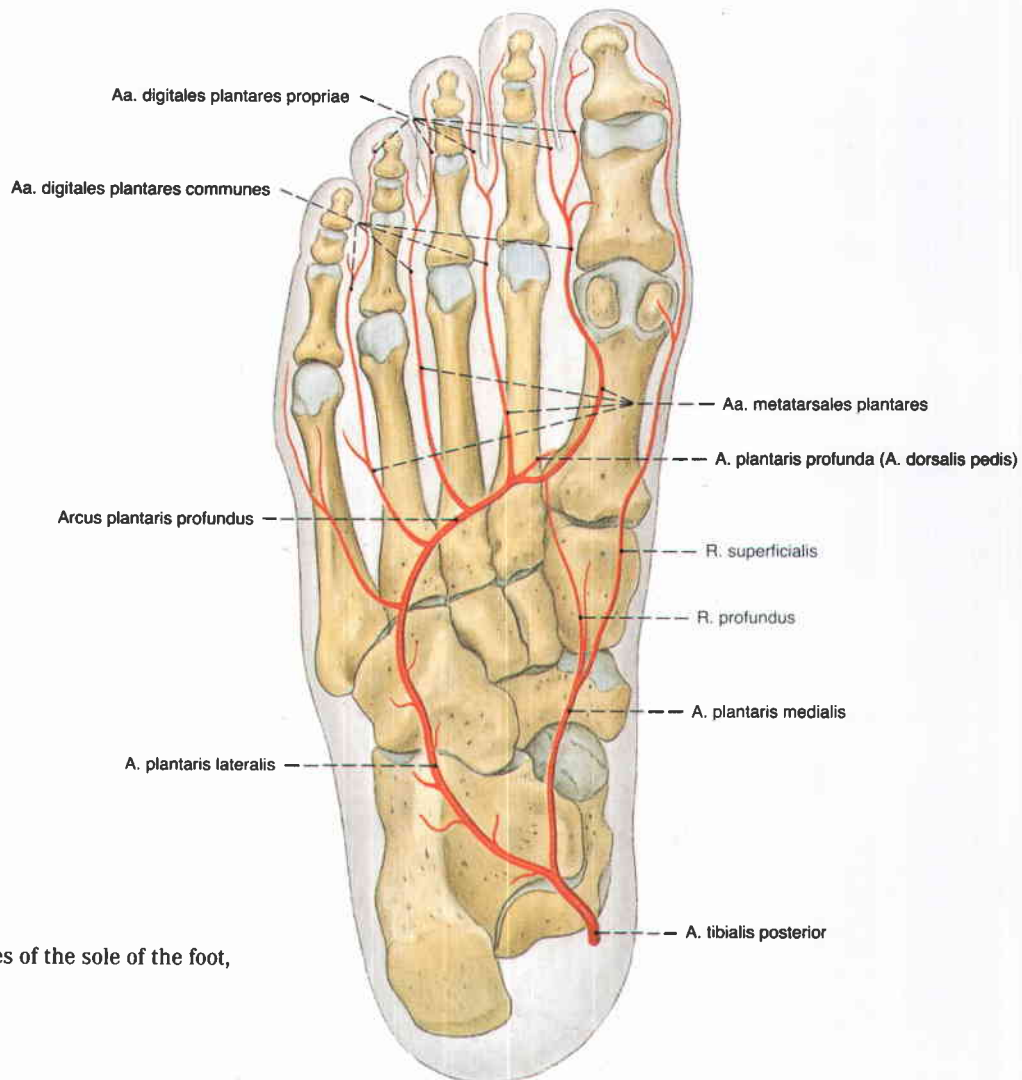
**Fig. 1359** Superficial veins and nerves of the back of the foot, Dorsum pedis; dorsal view (r.).



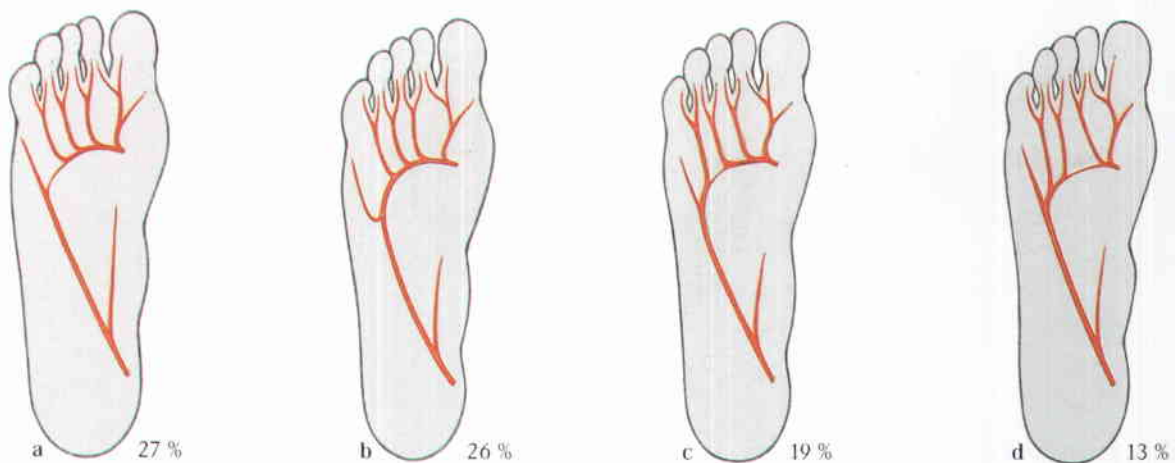


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**Fig. 1360** Arteries and nerves of the back of the foot, Dorsum pedis; the fascia of the back of the foot has been removed, the extensor digitorum longus and extensor hallucis longus muscles have been partially removed; dorsal view (r.).



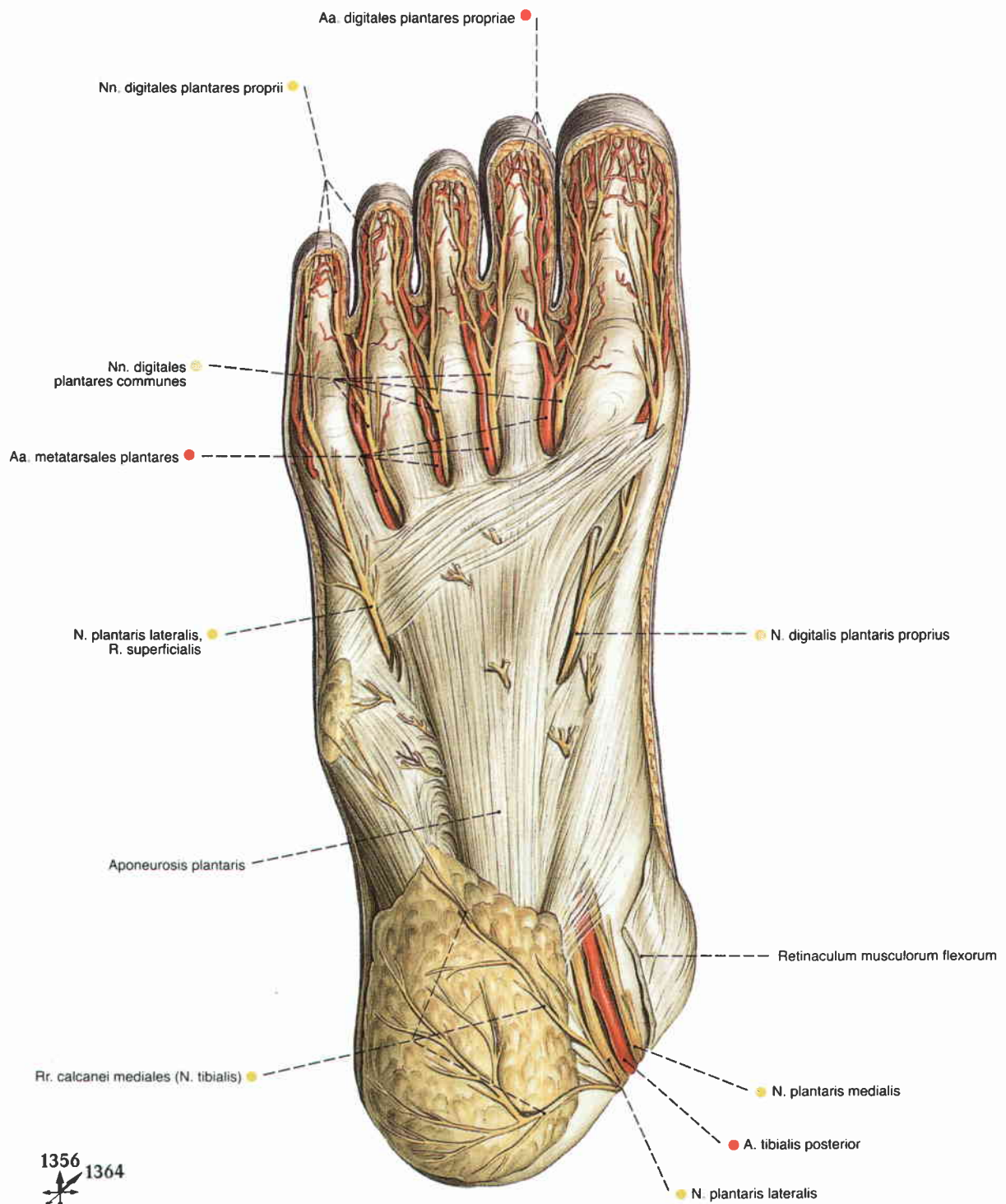
**Fig. 1361** Arteries of the sole of the foot, Planta; plantar view (r.).



**Figs. 1362 a–d** Variations of the arteries of the sole of the foot, Planta.

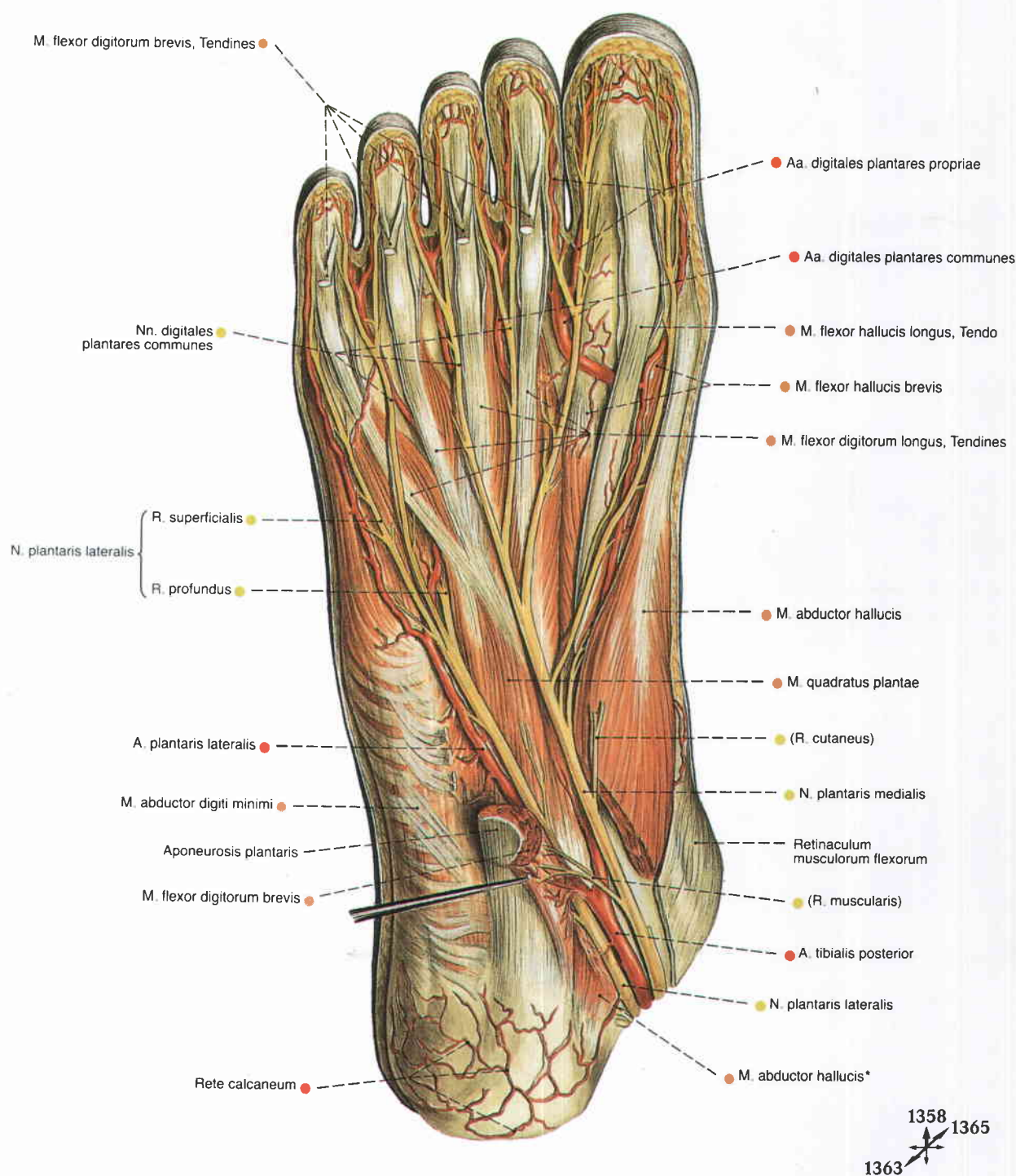
- a The Arcus plantaris profundus is mainly supplied by the A. dorsalis pedis.
- b The Arcus plantaris profundus is mainly supplied by the A. tibialis posterior.

- c The arteries that supply the 5th and the lateral part of the 4th toe branch off A. tibialis posterior, the more medial toes are supplied by A. dorsalis pedis.
- d The arteries that supply the 5th, 4th and the lateral part of the 3rd toe branch off A. tibialis posterior, the more medial toes are supplied by A. dorsalis pedis.



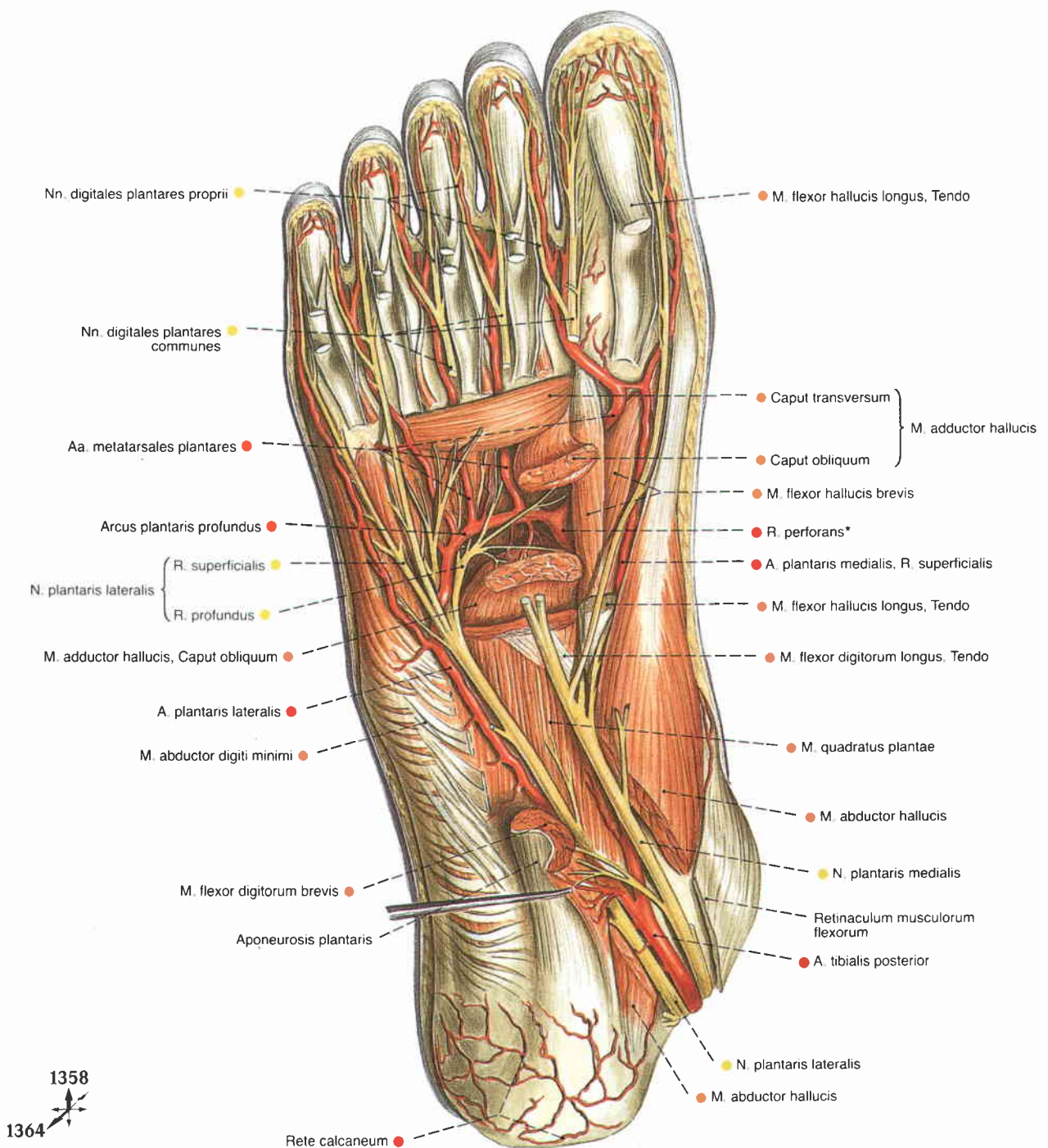
**Fig. 1363** Arteries and nerves of the sole of the foot, Planta; the retinaculum of the flexor muscles has been sectioned; plantar view (r.).





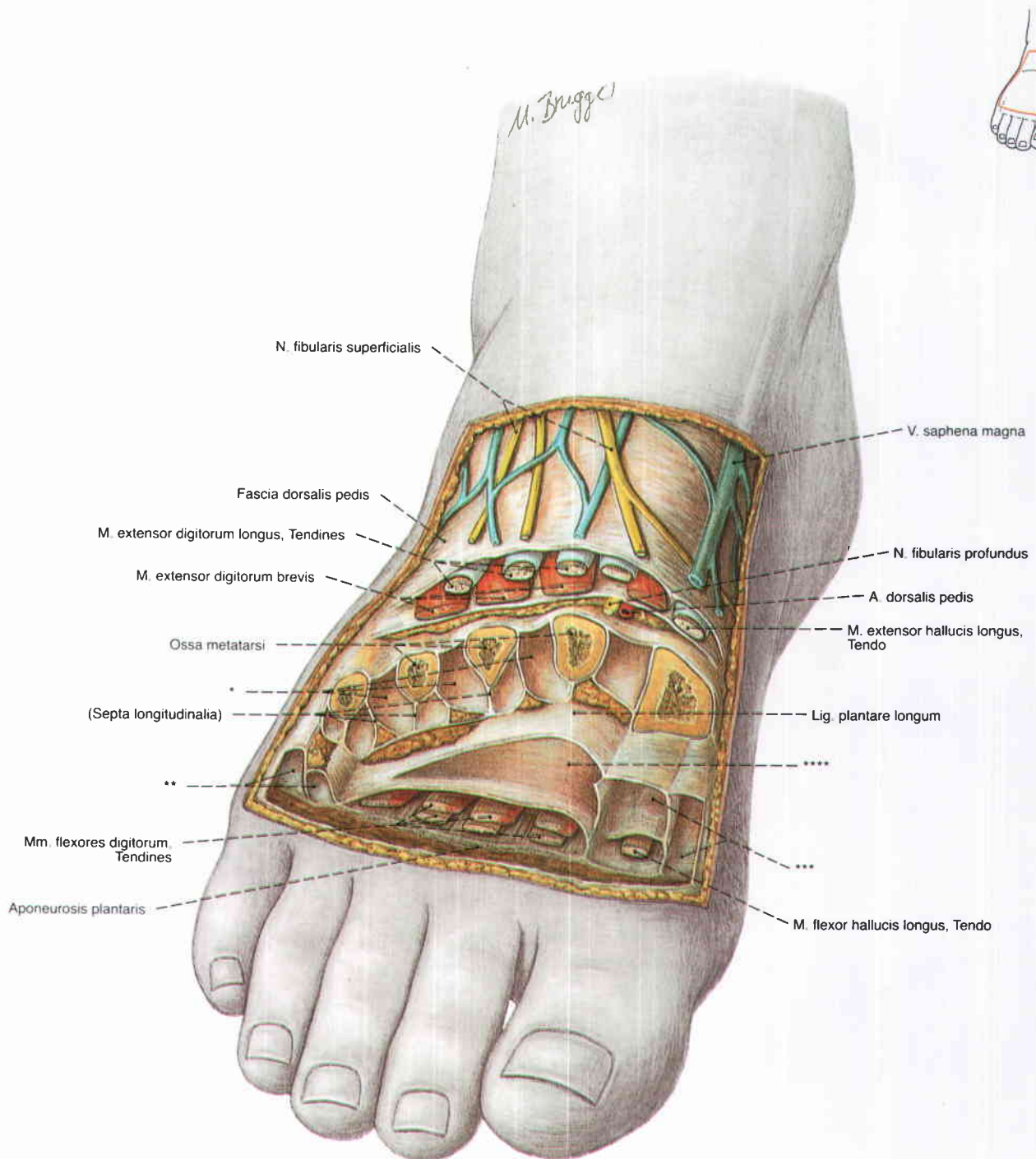
**Fig. 1364** Arteries and nerves of the sole of the foot, Planta; most of the plantar aponeurosis and the flexor digitorum brevis muscle have been removed; the abductor hallucis muscle has been sectioned; plantar view (r.).

\* The distal extension of the medial retromalleolar space below the abductor hallucis muscle is also called the tarsal tunnel (see also page 370).



**Fig. 1365** Arteries and nerves of the sole of the foot, Planta; most of the flexor digitorum brevis and longus and the flexor hallucis longus muscles have been removed; the M. abductor hallucis and the oblique head of the adductor hallucis muscle have been sectioned; plantar view (r).

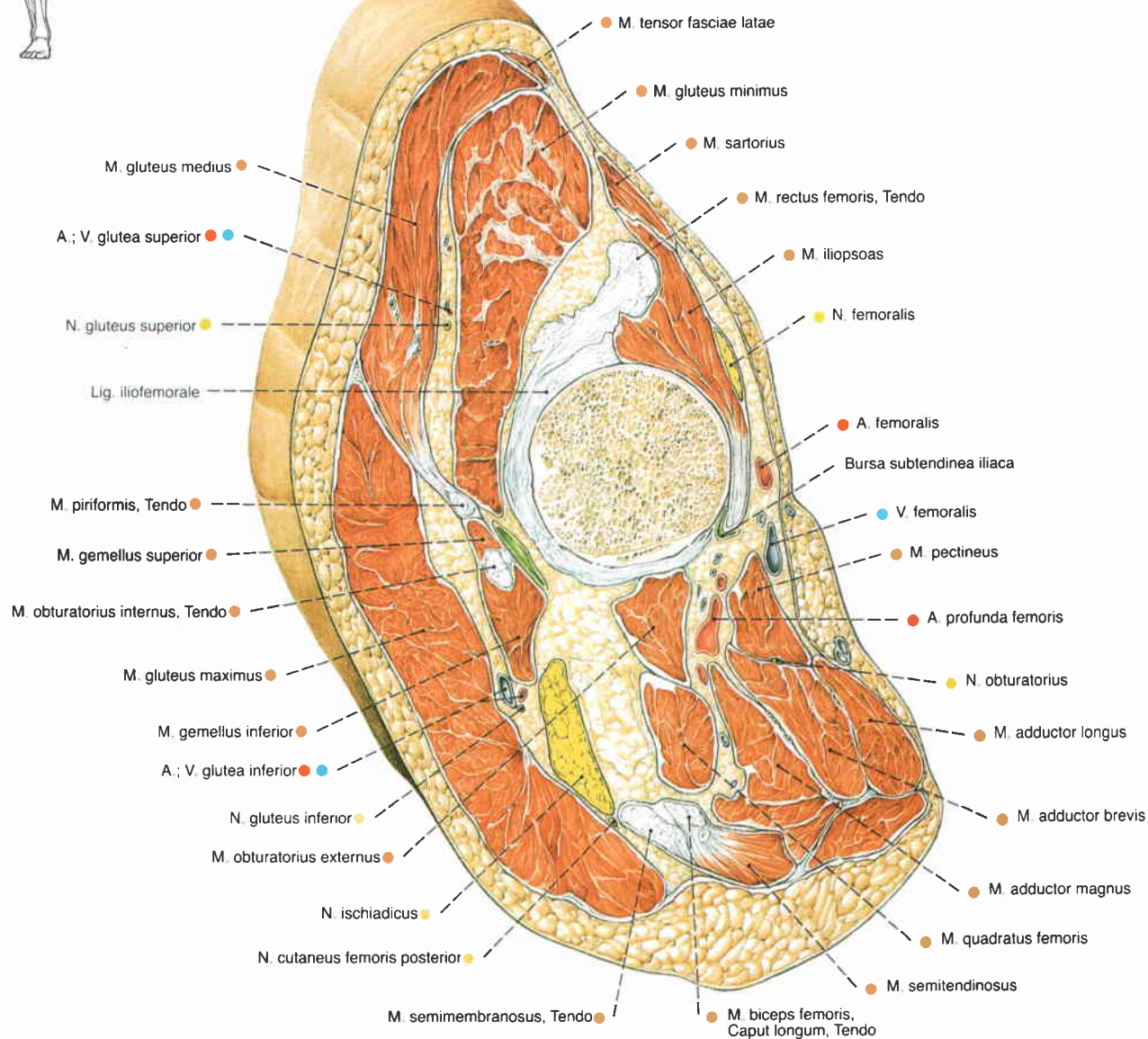
\* Anastomosis to A. dorsalis pedis



**Fig. 1366** Compartments of the foot, sectioned in layers; dorsofrontal view (r, 30%).

- \* spaces for Mm. interossei
- \*\* lateral compartment
- \*\*\* medial compartment
- \*\*\*\* central compartment





**Fig. 1367** Thigh, Femur;  
oblique section through the hip joint;  
distal view (r.).

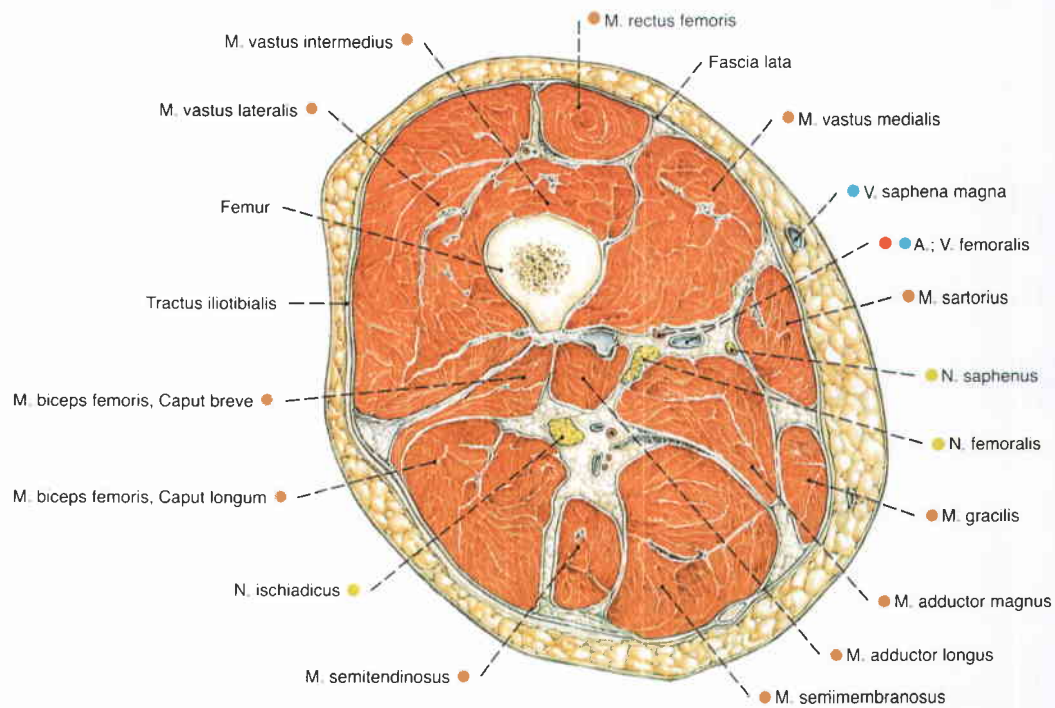


Fig. 1368 Thigh, Femur;  
cross section through the middle of the thigh;  
distal view (r.).

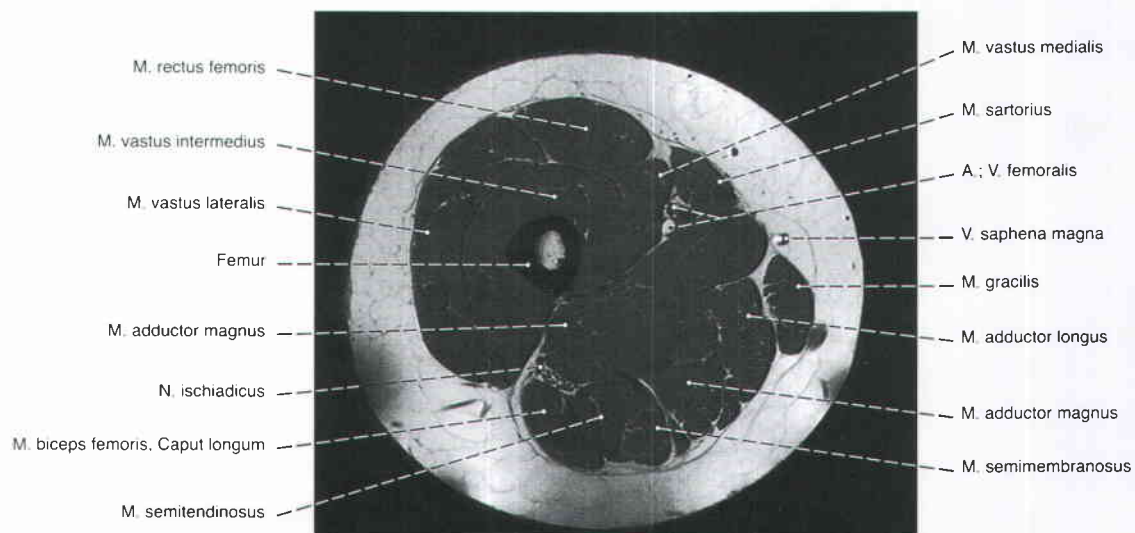


Fig. 1369 Thigh, Femur;  
cross-sectional image slightly above the middle of the  
thigh obtained with magnetic resonance tomography  
(MRT);  
distal view (r.).

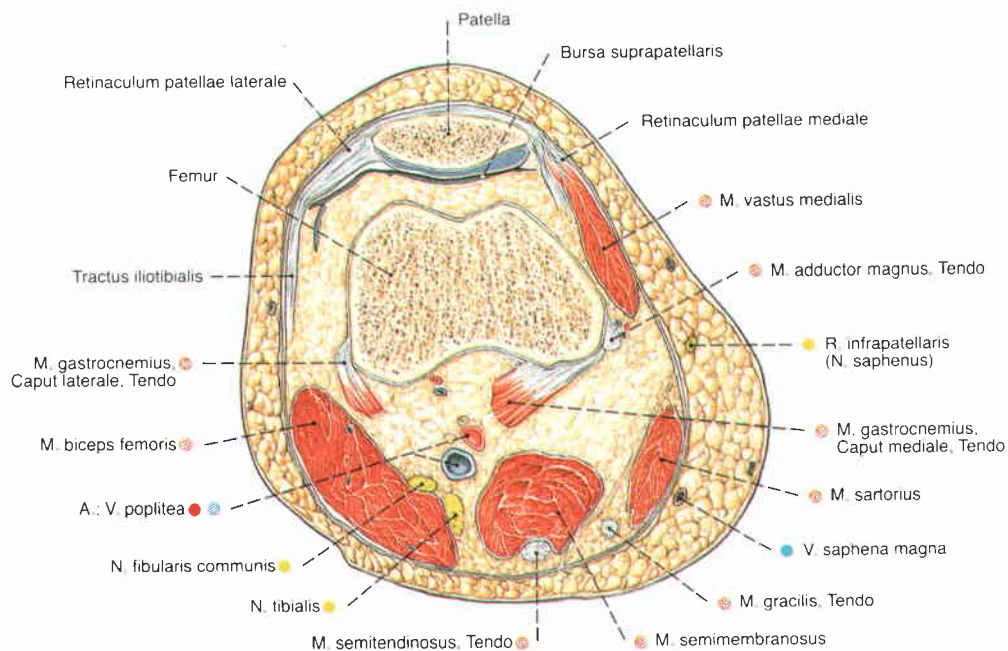


Fig. 1370 Thigh, Femur;  
cross section through the distal end of the thigh  
through the basis of the patella;  
distal view (r.).

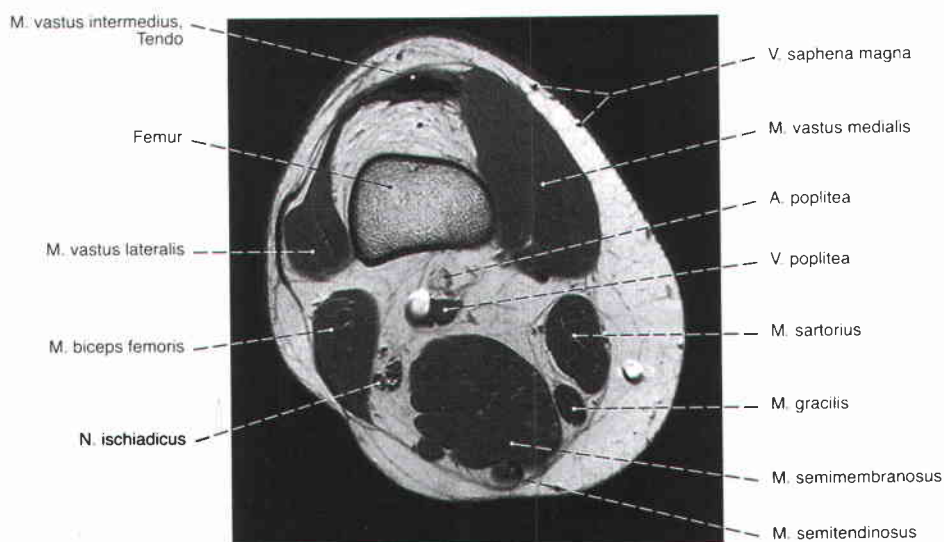
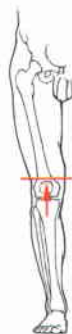


Fig. 1371 Thigh, Femur;  
cross-sectional image through the lower third of  
the thigh slightly above the patella obtained with  
magnetic resonance tomography (MRT);  
distal view (r.).



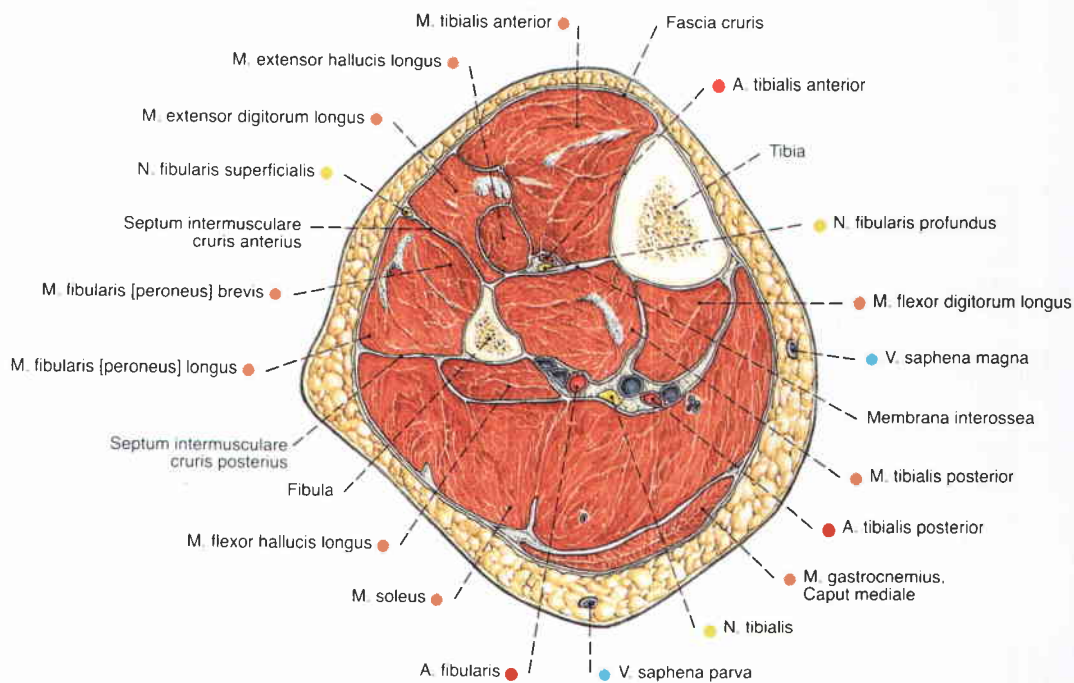


Fig. 1372 Crus, Crus;  
cross section through the middle of the crus;  
distal view (r.).  
Compare to Fig. 1295.

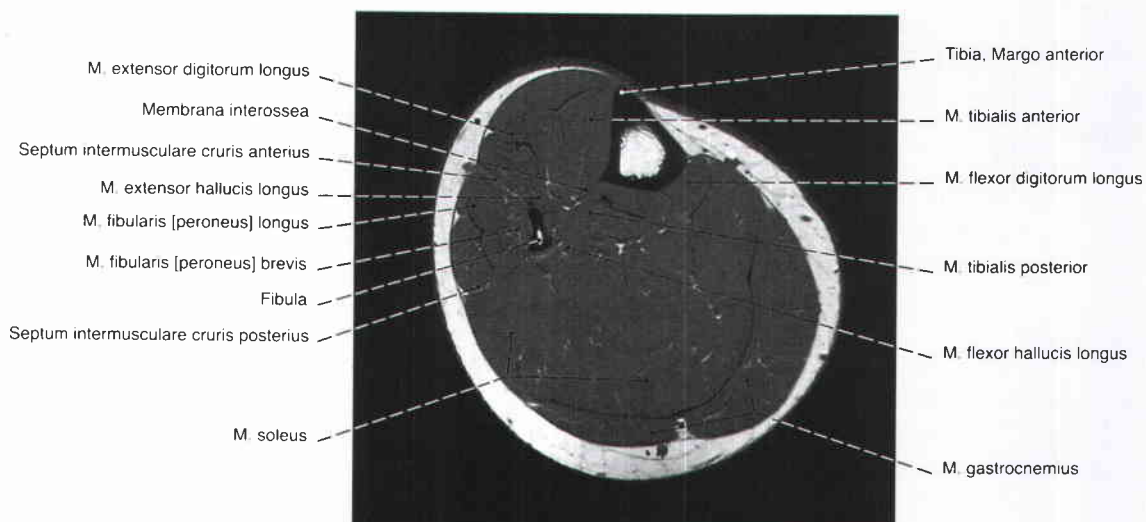
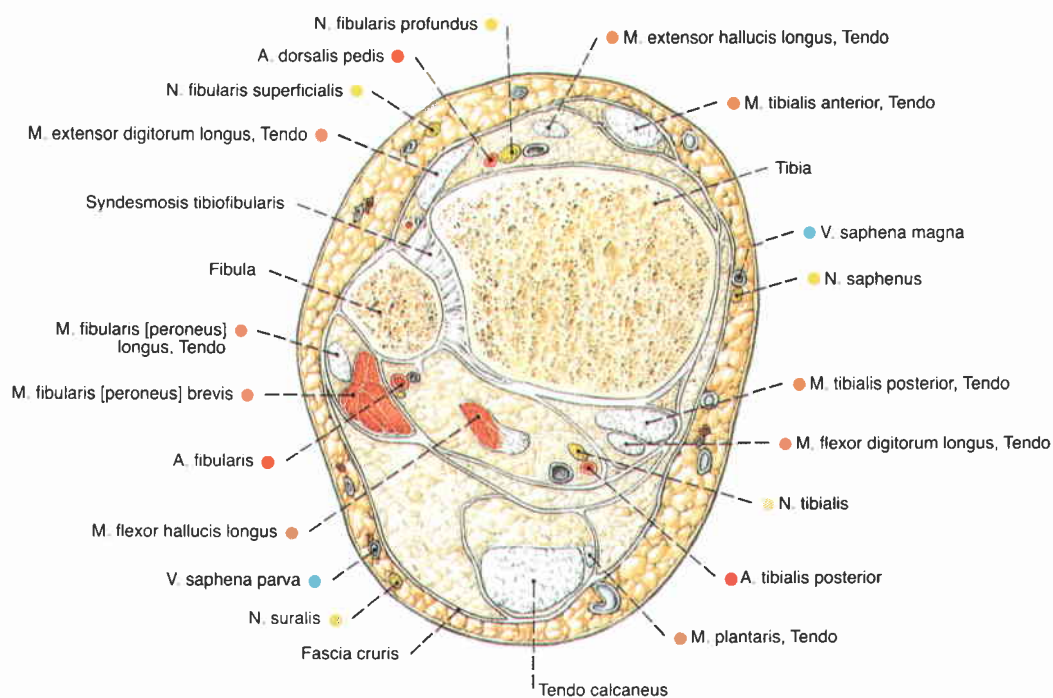
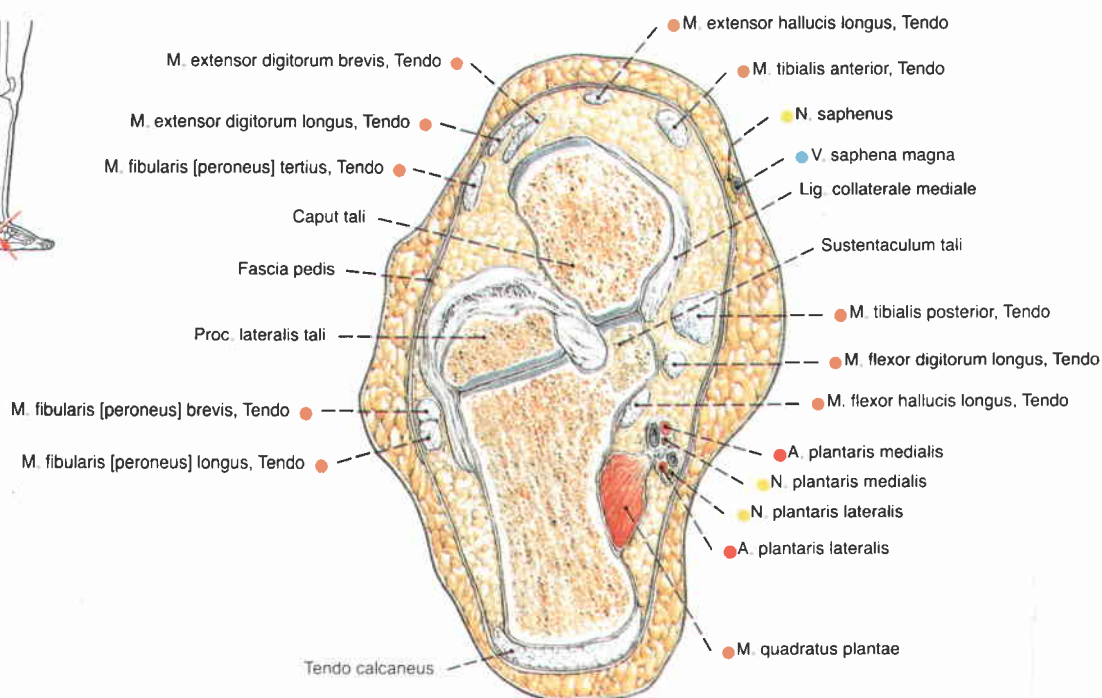


Fig. 1373 Crus, Crus;  
cross-sectional image through the middle of the crus  
obtained with magnetic resonance tomography (MRT);  
distal view (r.).





**Fig. 1374** Crus, Crus;  
cross section just above the ankle joint;  
distal view (r.).



**Fig. 1375** Foot, Pes;  
oblique section through the calcaneus and head of the talus;  
distal view (r.).

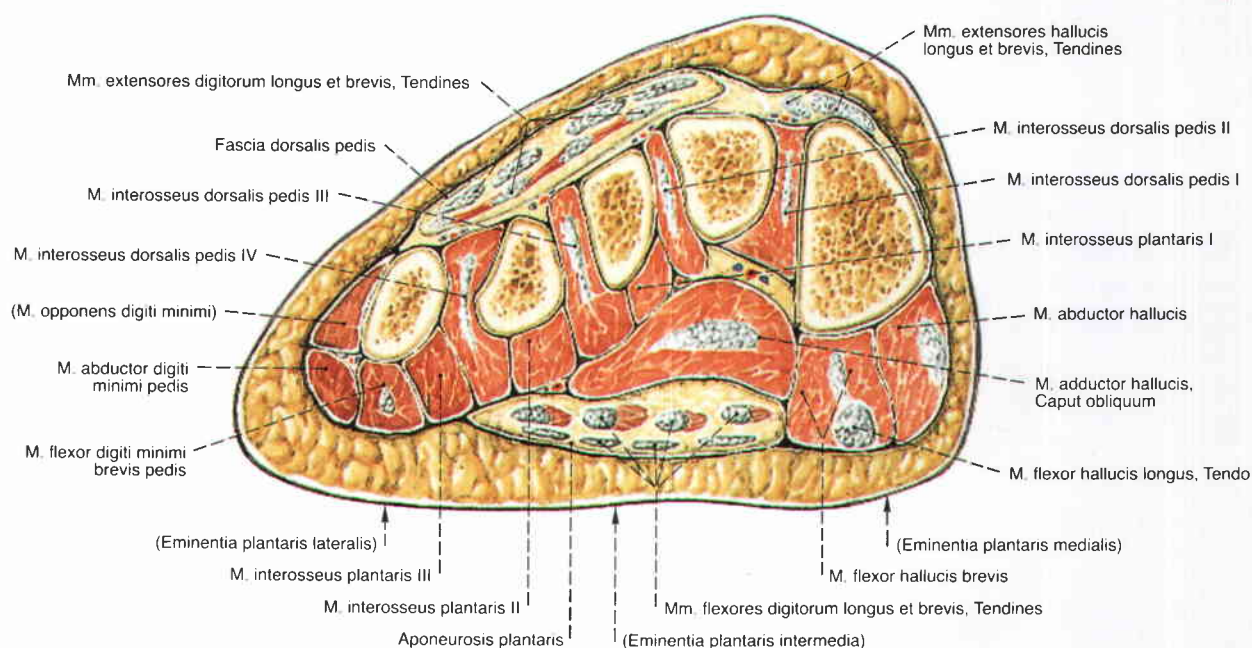


Fig. 1376 Foot, Pes;  
frontal section through the metatarsus;  
distal view (r.).

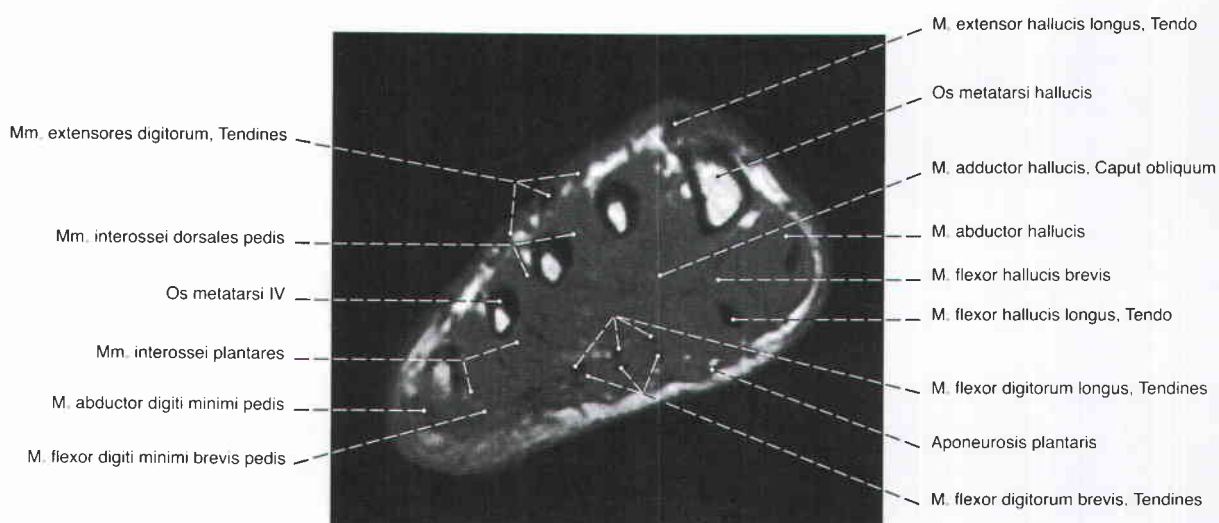


Fig. 1377 Foot, Pes;  
cross-sectional image through the metatarsus obtained  
with magnetic resonance tomography (MRT);  
distal view (r.).



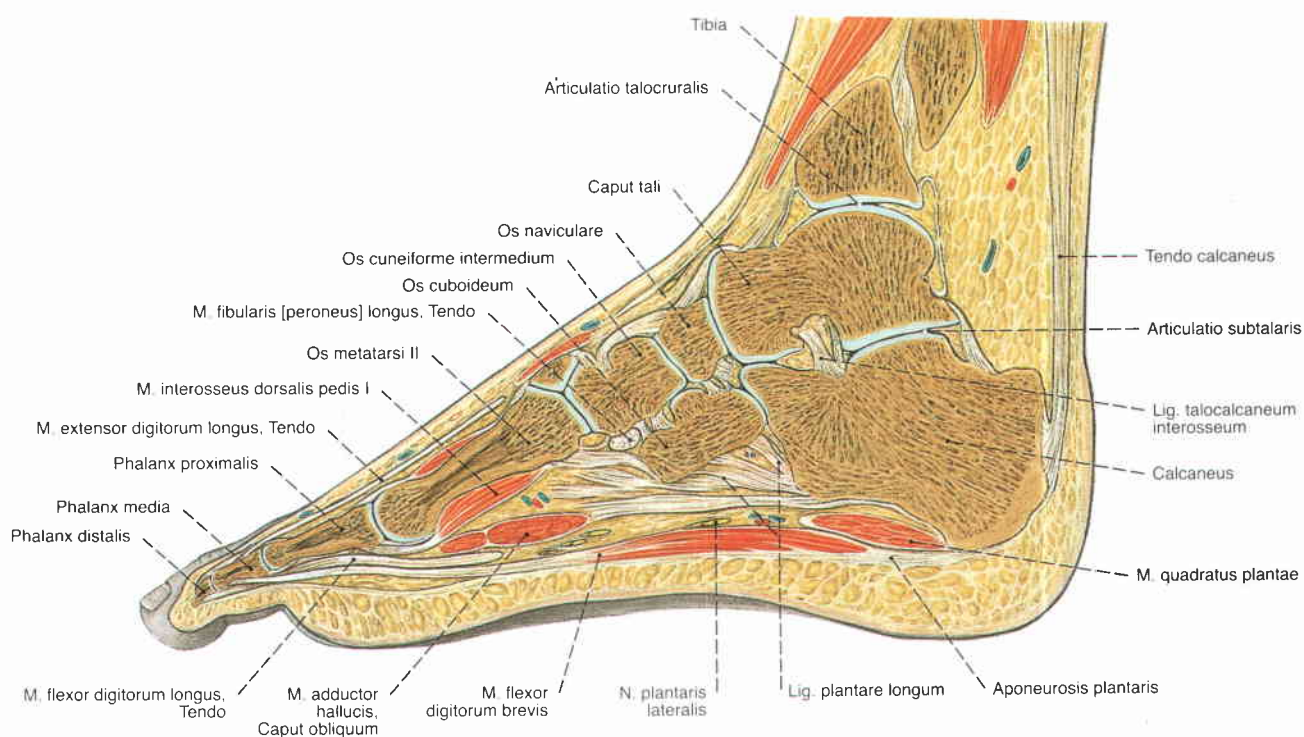


Fig. 1378 Foot, Pes;  
sagittal section through the second toe;  
medial view.

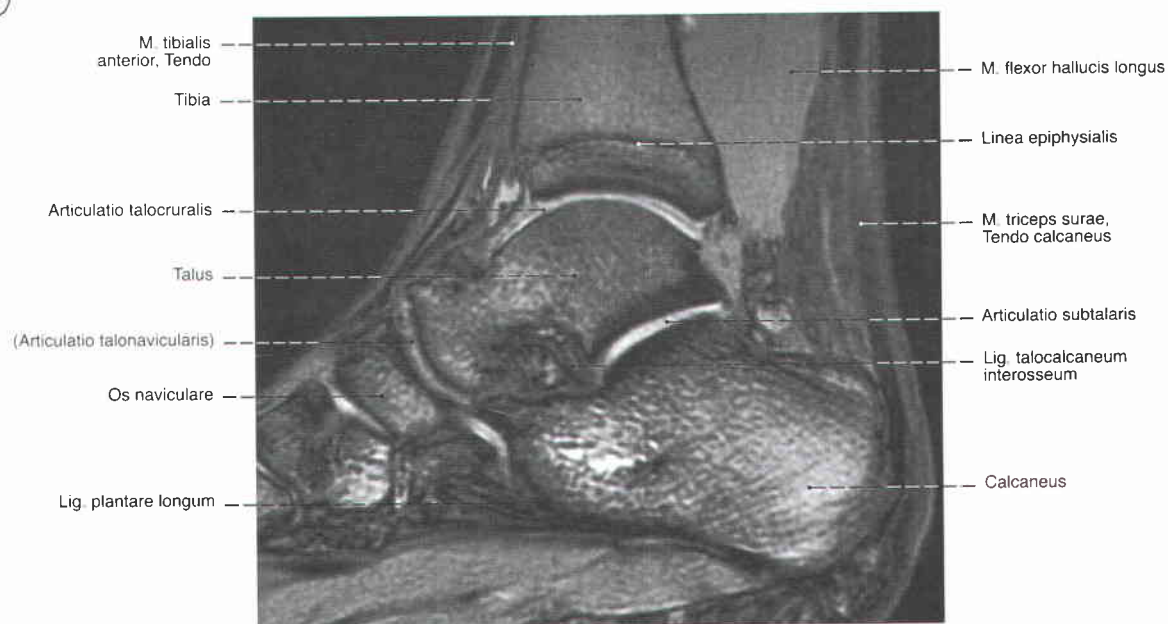
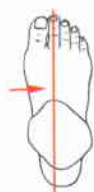


Fig. 1379 Foot, Pes;  
longitudinal-sectional image slightly medial of the longitudinal axis of  
the Collum tali obtained with magnetic resonance tomography (MRT);  
medial view (r.).

## Distribution of the nerves of the Plexus lumbosacralis (T 12) L 1 – S 4 (S 5)

	Motor	Sensory
<b>Plexus lumbalis</b> (T 12) L1–L3 (L 4)		
<b>N. iliohypogastricus</b> T 12, L 1 R. cutaneus lateralis R. cutaneus anterior	Mm. rectus abdominis, obliquus externus abdominis, obliquus internus abdominis, transversus abdominis	Skin of the hip Skin cranial of the inguinal region and the Mons pubis
<b>N. ilioinguinalis</b> (T 12) L 1 (L 2) Nn. scrotales anteriores/ Nn. labiales anteriores	Mm. rectus abdominis, obliquus externus abdominis, obliquus internus abdominis, transversus abdominis	Skin of the inguinal region, root of penis and scrotum Skin of the inguinal region and Labia majora
<b>N. genitofemoralis</b> L 1, L 2 R. genitalis R. femoralis	M. cremaster	Fascia of testis (including Tunica dartos) Skin over Hiatus saphenus
<b>N. cutaneus femoris lateralis</b> L 2, L 3		Skin of the lateral and anterior side of the thigh to the knee
<b>N. obturatorius</b> L 2–L 4 R. anterior  R. cutaneus R. posterior Rr. musculares	M. obturatorius externus, Mm. pectineus, adductor brevis, adductor longus, gracilis  M. adductor magnus, (M. adductor brevis), M. adductor minimus	Capsule of the hip joint  Skin of the medial side of the thigh, proximal to the knee Capsule of the hip joint, periosteum of the dorsal surface of the femur
<b>N. obturatorius accessorius</b> L 3, L 4	M. pectineus	Capsule of the hip joint
<b>N. femoralis</b> L 2–L 4 Rr. musculares Rr. cutanei anteriores  N. saphenus R. infrapatellaris Rr. cutanei cruris mediales	Mm. iliopsoas, pectineus, sartorius, quadriceps femoris	Capsule of the hip joint  Skin of the anterior and medial side of the thigh to the knee, periosteum of the anterior side of the femur Skin of the medial and anterior side of the knee, medial side of the crus and the foot
<b>Plexus sacralis</b> (L 4) L 5–S 3 (S 4)		
<b>N. m. obturatorii interni</b> L 5–S 2	M. obturatorius internus	
<b>N. m. piriformis</b> S 1, S 2	M. piriformis	
<b>N. m. quadrati femoris</b> L 5–S 1 (S 2)	M. quadratus femoris	
<b>N. gluteus superior</b> L 4–S 1	Mm. glutei medius und minimus, tensor fasciae latae	
<b>N. gluteus inferior</b> L 5–S 2	M. gluteus maximus	
<b>N. cutaneus femoris posterior</b> S 1–S 3 Nn. clunium inferiores Nn. perineales		Skin of the posterior thigh and the proximal crus  Skin over the M. gluteus maximus Perineum, skin of the scrotum or the Labia majora
<b>N. ischiadicus</b> L 4–S 3	Flexors of the thigh, all muscles of the crus and the foot	
<b>N. fibularis communis</b> L 4–S 2 N. cutaneus surae lateralis R. communicans fibularis	M. biceps femoris, Caput breve	Capsule of the knee joint Skin of the calf to the lateral malleolus Connecting branch to N. suralis
<b>N. fibularis superficialis</b> Rr. musculares N. cutaneus dorsalis medialis  N. cutaneus dorsalis intermedius Nn. digitales dorsales pedis	Mm. fibulares [peronei] longus and brevis	Skin of the crus and the dorsum of the foot to 1st to 3rd toes Skin of the lateral side of the foot Skin of the dorsum of the toes with the exception of the 1st interdigital space and the lateral side of the 5th toe

Continuation → p. 388

	Motor	Sensory
<b>N. fibularis profundus</b> Rr. musculares	Mm. tibialis anterior, extensor digitorum longus, extensor hallucis longus, extensor digitorum brevis and extensor hallucis brevis	Periosteum of the bones of the crus and capsule of the ankle joint
Nn. digitales dorsales pedis		Skin of the 1st interdigital space
<b>N. tibialis L 4-S 3</b> Rr. musculares	Mm. triceps surae, plantaris, popliteus, tibialis posterior, flexor digitorum longus, flexor hallucis longus	Capsule of the knee joint
N. interosseus cruris		Periosteum of the bones of the crus and capsule of the ankle joint
N. cutaneus surae medialis N. suralis		Unites with N. cutaneus surae lateralis to N. suralis
N. cutaneus dorsalis lateralis		Skin of lateral foot and lateral side of little toe
Rr. calcanei laterales		Skin of the lateral side of the heel
Rr. calcanei mediales		Skin of the medial side of the heel
N. plantaris medialis	Mm. abductor hallucis and flexor digitorum brevis, flexor hallucis brevis (Caput mediale), lumbricales pedis I, II	Skin of the medial sole of foot
Nn. digitales plantares communes Nn. digitales plantares proprii		Skin of the plantar side of medial 3 ½ toes and their nail region
N. plantaris lateralis R. superficialis Nn. digitales plantares communes Nn. digitales proprii	Mm. abductor digiti minimi, quadratus plantae Mm. flexor digiti minimi brevis, opponens digiti minimi, interossei of the 4th intermetatarsal space	Skin of the plantar side of the lateral 1 ½ toes and their nail region
R. profundus	Mm. lumbricales pedis II-IV, adductor hallucis (Caput transversum), interossei of the 4th intermetatarsal space	
<b>N. pudendus (S 1) S 2-S 4</b> Nn. rectales [anales] inferiores S 3, S 4 Nn. perineales Nn. scrotales posteriores/ Nn. labiales posteriores Rr. musculares	Mm. transversi perinei superficialis and profundus, bulbospongiosus and ischiocavernosus, sphincter ani externus	Skin of anal and perineal region  Skin of scrotum/Labia majora and minora, mucosa of the urethra, Vestibulum vaginae
N. dorsalis penis/ N. dorsalis clitoris	M. transversus perinei profundus	Skin of penis, glans/clitoris, prepuce
<b>N. coccygeus S 4, S 5 (Co 1)</b> Plexus coccygeus S 4, S 5 (Co 1) N. anococcygeus	M. ischiococcygeus [coccygeus], M. levator ani	Skin over the coccyx and between coccyx and anus

### Muscles used in clinical diagnosis of segmental innervation of the lower limb

Spinal cord segment or segmental spinal nerve	Affected muscle(s) or tendon reflex(es)
L 3	M. quadriceps femoris (paralysis and loss of patellar tendon reflex)
L 4	M. quadriceps femoris and M. tibialis anterior (weakening of patellar tendon reflex)
L 5	M. extensor hallucis longus, sometimes also brevis (paralysis and atrophy)
S 1 tendon reflex)	Mm. fibulares (peronei), sometimes also M. triceps surae and Mm. glutei (loss of the Achilles



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**Website: [www.roshanketab.com](http://www.roshanketab.com)**

**Email: [info@roshanketab.com](mailto:info@roshanketab.com)**

**TelFax: 021- 66950639**

**021- 66963783-6**