

Sobotta

Atlas of Human Anatomy

Edited by R. Putz and R. Pabst

In collaboration with Renate Putz

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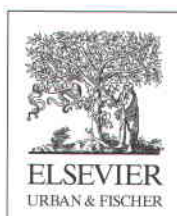
Volume 1

Head, Neck, Upper Limb

14th edition, newly edited

727 colour plates with 1070 figures

Booklet (tables of muscles, joints and nerves)



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Sobotta

Atlas of Human Anatomy

Volume 1

Head, Neck, Upper Limb

Correspondence and feedback should be addressed to:

Elsevier GmbH, Urban & Fischer Verlag, Department for Medical Student Information, Alexander Gattnarzik, Karlstraße 45, 80333 Munich, Germany
e-mail: medizinstudium@elsevier.de

Addresses of the editors:

Professor Dr. med. Reinhard Putz
Vorstand des Anatomischen Instituts
der Ludwig-Maximilians-Universität
Pettenkoferstraße 11
80336 München
Germany
e-mail: reinhard.putz@med.uni-muenchen.de

Professor Dr. med. Reinhard Pabst
Leiter der Abteilung
Funktionelle und Angewandte Anatomie
Medizinische Hochschule Hannover
Carl-Neuberg-Straße 1
30625 Hannover
Germany
e-mail: pabst.reinhard@mh-hannover.de

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Volume 1: Head, Neck, Upper Limb

Volume 2: Trunk, Viscera, Lower Limb

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Preface

It was just over a hundred years ago that Johannes Sobotta set out to publish the first edition of his Atlas of Human Anatomy. Since then, this piece of work has evolved step by step as a result of the constant interaction between students, lecturers and editors. It has not only been the most modern basis for the complex subject of macroscopic anatomy throughout many generations of doctors, but has also developed into a lasting work of reference for both clinical training and advanced medical education. All in all, it has become a book for a medical doctor's life. Once again, in this new edition the additional figures have been drawn strictly on the basis of original specimens.

The 14th edition has been particularly designed to meet the demands of a reformed medical curriculum, emphasizing the integration of clinical medicine into the preclinical curriculum. For this purpose, the new edition has been extended to include the following features:

- Surface anatomy including projection of internal organs (45 colour photos)
- Anatomical diagrams next to imaging figures
- Integration of imaging techniques to a greater extent (ultrasound, X-ray, CT, MRI; 119 figures)
- Endoscopic, intraoperative colour images and figures exemplifying techniques of puncture and examination (54 figures)
- Images of patients presenting with typical palsies
- Diagrams of the most important arterial variations (93 figures)
- Frequent variations in the location of internal organs (24 figures)
- Integration of histology at low magnification of important internal organs (intestine, liver, kidney, etc.)

In order to improve the presentation of the knowledge, the following features have been introduced:

- Clear-cut arrangement of the chapters according to the different regions of the body
- Thematically corresponding figures presented on double pages
- A concise, separate booklet (included in Volume 1) contains tables of muscles, joints and nerves, enabling the reader to place it next to any figure in the atlas

One particular aim of the new edition is to facilitate finding of specific structures. The SOBOTTA depicts anatomical structures precisely without the reader losing the greater picture. Therefore, specific didactic tools have been improved and new aspects included:

- Each chapter has been allocated to a particular colour
- A "menu bar" on each double page ensures precise orientation within a given chapter
- The number of outlines depicting spatial orientation has been significantly increased (270 figures)
- Overviews of total body regions ensure general orientation
- New diagrams of particular muscles clarify their location and course (24 figures)

- Confusion is kept to a minimum by only depicting limbs of the right side of the body
- "Compass roses" point to adjacent figures, thus facilitating following a given structure over several pages
- Continuous leader lines facilitate finding of structures
- Coloured dots at the end of leader lines in topographic diagrams mark arteries, veins, nerves, and muscles
- The figures in the booklet relate directly to the figures in the atlas
- The larger dimensions of the book improve clarity

With the exception of discussions about the general concept of the atlas and mutual correction, the editors have worked separately on individual chapters, with the work divided as follows:

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

R. Pabst: Head, neck, thoracic and abdominal walls, thoracic, abdominal and pelvic viscera.

The inclusion of a large number of new figures is the result of the extraordinary capability of the following medical illustrators: Ulrike Brugger, Rüdiger Himmelhan and Horst Ruß. It is to their credit that the classic "SOBOTTA style" has been retained. Several of the diagrams have been generated on the computer by Henriette Rintelen. We also gratefully acknowledge our clinical colleagues for making clinical illustrations available to us (see picture credits). We owe a debt of gratitude to our colleagues from the institutes for their understanding and helpful suggestions. Dr. N. Sokolov and A. Buchhorn have put meticulous efforts into generating the specimen preparations. S. Fryk and G. Hoppmann have supported us in text processing.

The staff of the editorial office of Elsevier publishers, in particular Dr. D. Hennessen and A. Gattnarzik, has our sincere thanks. Some of the creative development of the work is a result of very fruitful discussions. We would also like to thank R. Hausdorf for tremendous efforts in the production of the atlas. R. Putz together with G. Meier were responsible for the proofreading and simplification of page design and legends. Our special thanks go to Dr. U. Osterkamp-Baust for generating the index, and all others involved in the corrections. With our joint efforts, the SOBOTTA has been once more modernized both in contents and design.

We have included many of the helpful suggestions made over the years by students and colleagues, and would therefore ask all readers of this edition to pass on to us any criticism or suggestions on the new format of this atlas.

Munich and Hannover, September 2005
R. Putz and R. Pabst

Univ.-Prof. Dr. med. Reinhard Putz



Born in Innsbruck/Austria
 1962–1968 Studied medicine at the Leopold-Franzens-University of Innsbruck
 1968 Received a doctorate
 1968–1982 University assistant at the Institute of Anatomy at the University of Innsbruck
 1978 Lecturer in anatomy
 1979 Consultant for anatomy
 1982–1989 Chair of the Anatomical Institute at the Albert-Ludwigs-University of Freiburg
 since 1989 Chair of the Anatomical Institute at the Ludwig-Maximilians-University of Munich
 1992–1994 President of the European Association of Clinical Anatomists
 1993 Registration to practise medicine
 1998–1999 Chairman of the Anatomical Society
 1999 Member of the Akademie der Naturforscher und Ärzte (Leopoldina)
 2002 Dr. h.c. of the University of Constanta, Romania
 2003 Prorector I of the Ludwig-Maximilians-University of Munich

Research and fields of interest

- Functional anatomy of the passive locomotor system
- Evolution and functional anatomy of the vertebral column
- Form-function-relations of joints
- Applied anatomy (anatomical basics of orthopaedics, surgery, radiology)
- Questions about the contents and organisation of the medical curriculum
- Development of didactic training programmes at universities

Univ.-Prof. Dr. med. Reinhard Pabst



Born in Posen, grown up in Lüneburg
 1965–1970 Studied medicine at the Hannover Medical School, and in Glasgow/Scotland
 1970 University degree and doctorate
 1971 Registration to practise medicine
 1971–76 Scientific associate in the Department of Clinical Physiology, University of Ulm
 1976 Lecturer for Clinical Physiology, University of Ulm, and new lectureship at the Hannover Medical School
 1976–80 Senior assistant in the Department of Functional and Applied Anatomy, Hannover Medical School
 1978 Extension of the Venia legendi to include anatomy
 1980–1992 Head of the Department of Topographic Anatomy and Biomechanics
 since 1992 Head of the Department of Functional and Applied Anatomy, Hannover Medical School
 1986–1990 Prorector for studies and education, Hannover Medical School
 1993–1997 Dean of the Hannover Medical School
 1997–1998 Chairman of the Anatomical Society
 1999–2003 Prorector of Research of the Hannover Medical School
 2001 Member of the Akademie der Naturforscher und Ärzte (Leopoldina)

Research and fields of interest

- Functional anatomy of lymphatic organs
- Proliferation and migration of lymphocytes
- Development of the intestinal immune system
- Function of the pulmonary immune system
- Questions of a clinically orientated anatomy in the medical curriculum
- Evaluation of teaching

Picture credits

The editors sincerely thank all clinical colleagues that made ultrasound, computed tomographic and magnetic resonance images as well as endoscopic and intraoperative pictures available:

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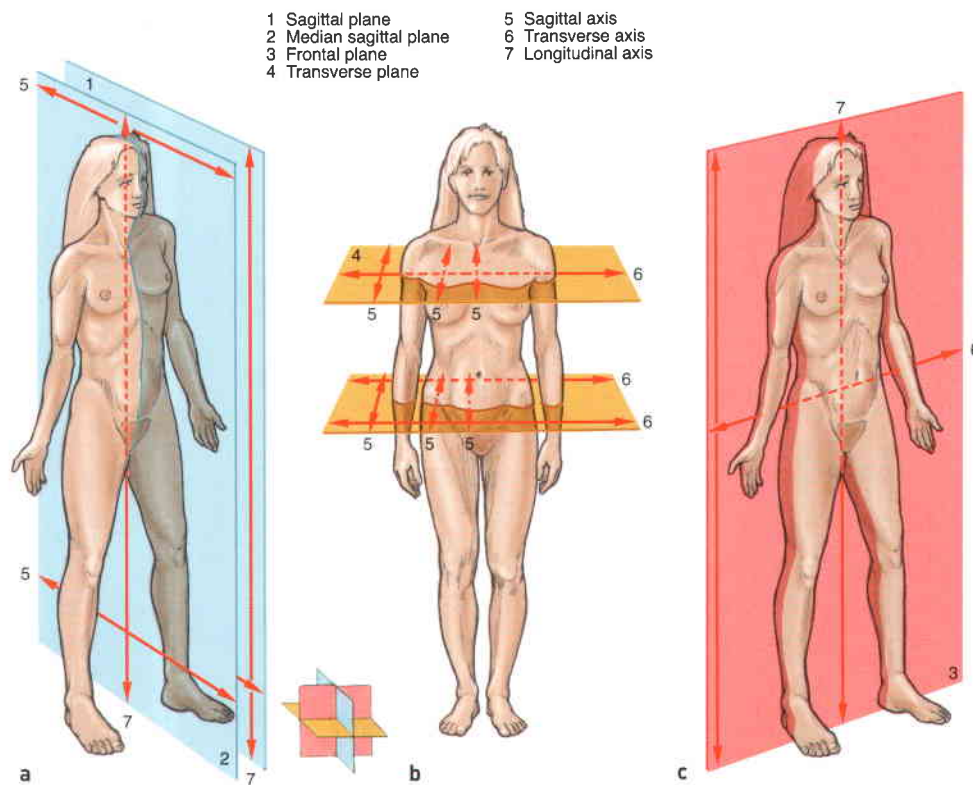


Fig. 1 a–c Planes and axes.

a Sagittal plane, Planum sagittale, sagittal and longitudinal axes

b Transverse plane (= horizontal plane), Planum transversale, transverse and sagittal axes

c Frontal plane (= coronal plane), Planum frontale, longitudinal and transverse axes

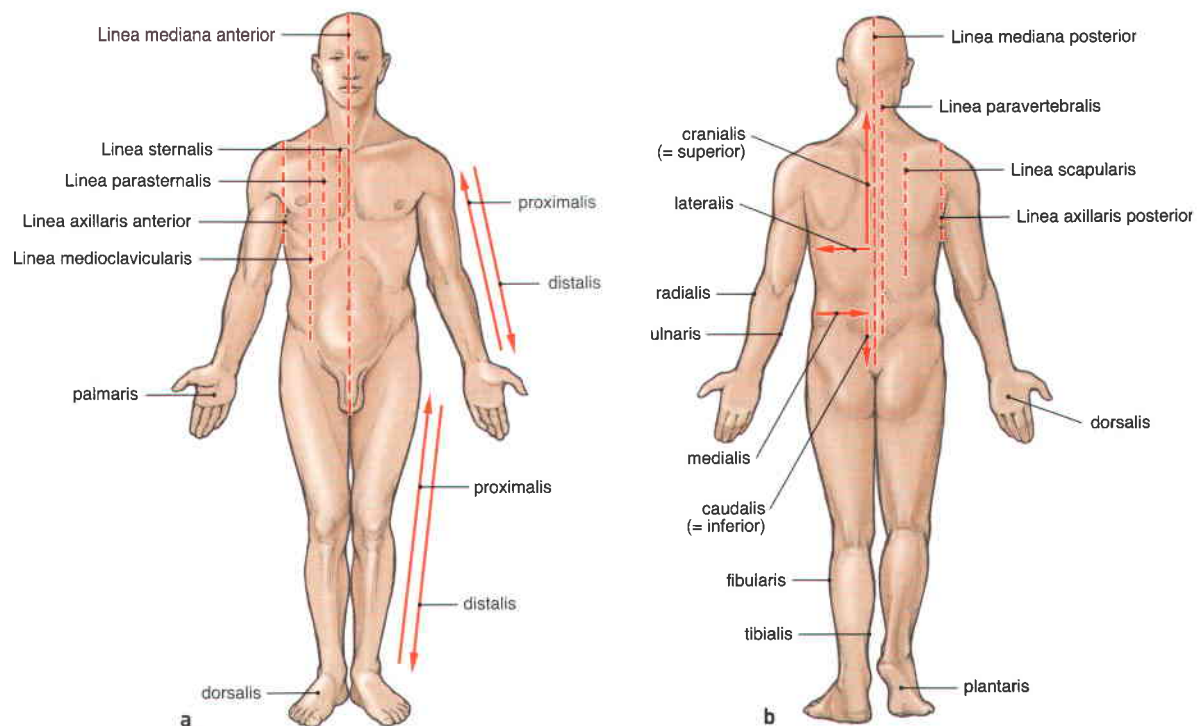
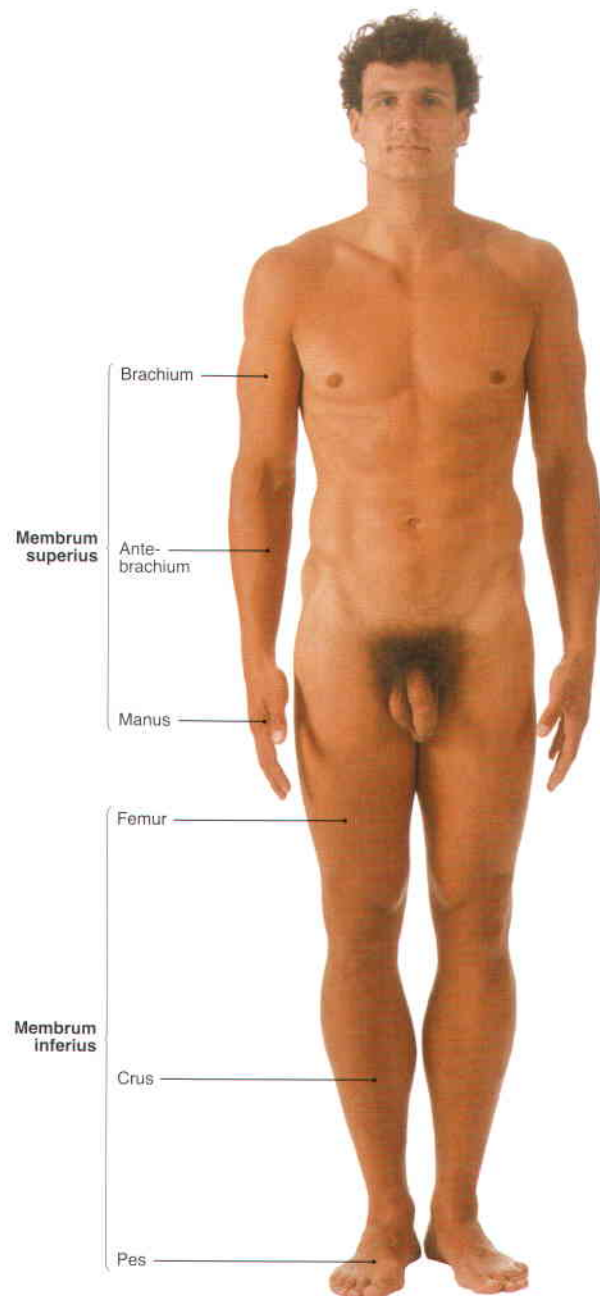
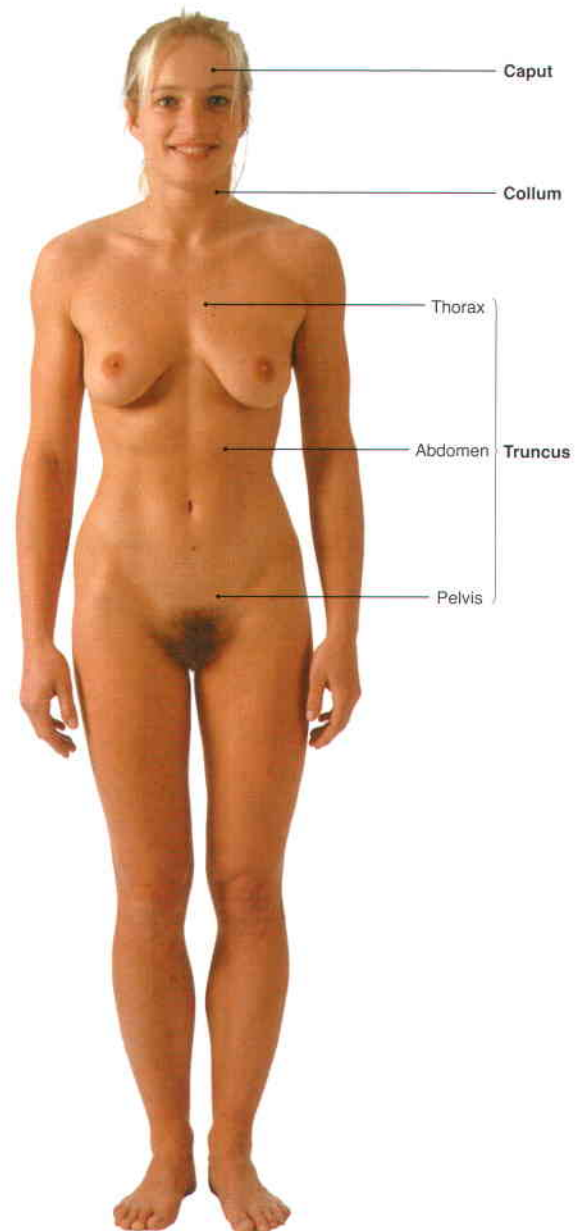
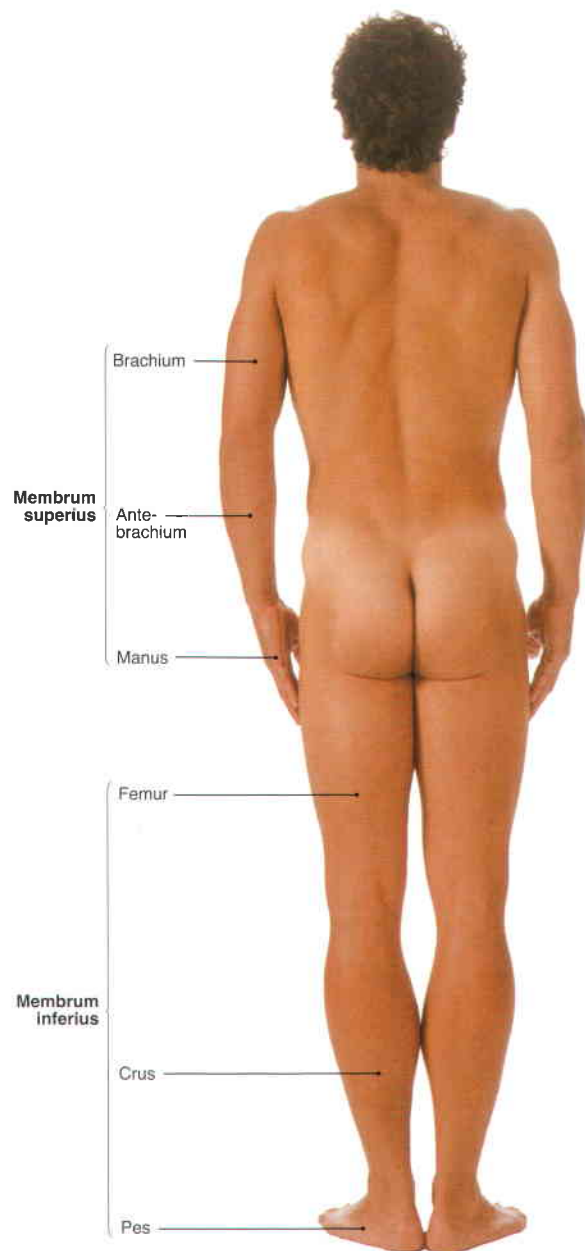
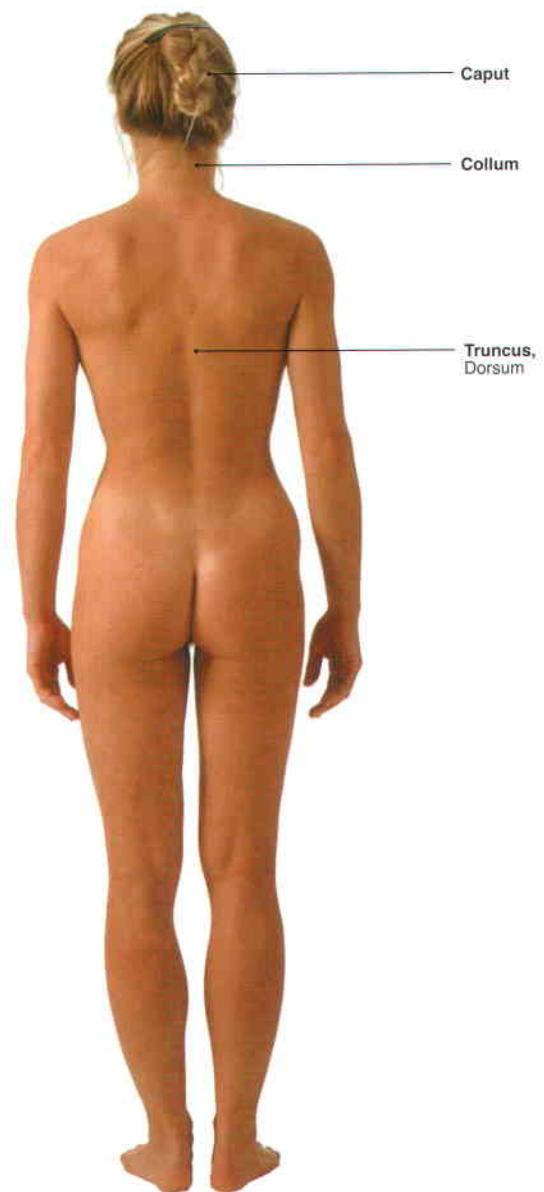


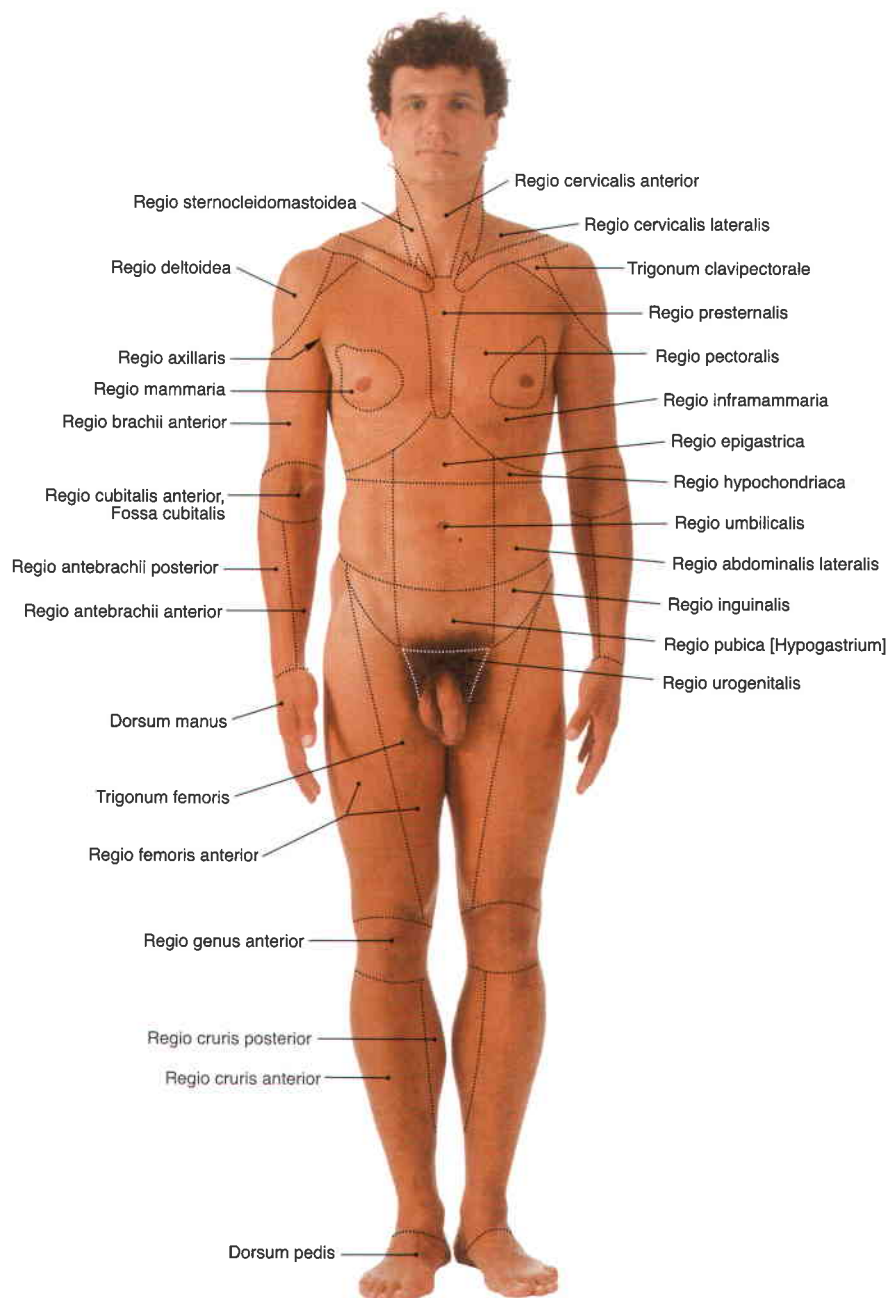
Fig. 2 a, b Orientation lines of the human body and terms of direction and position.

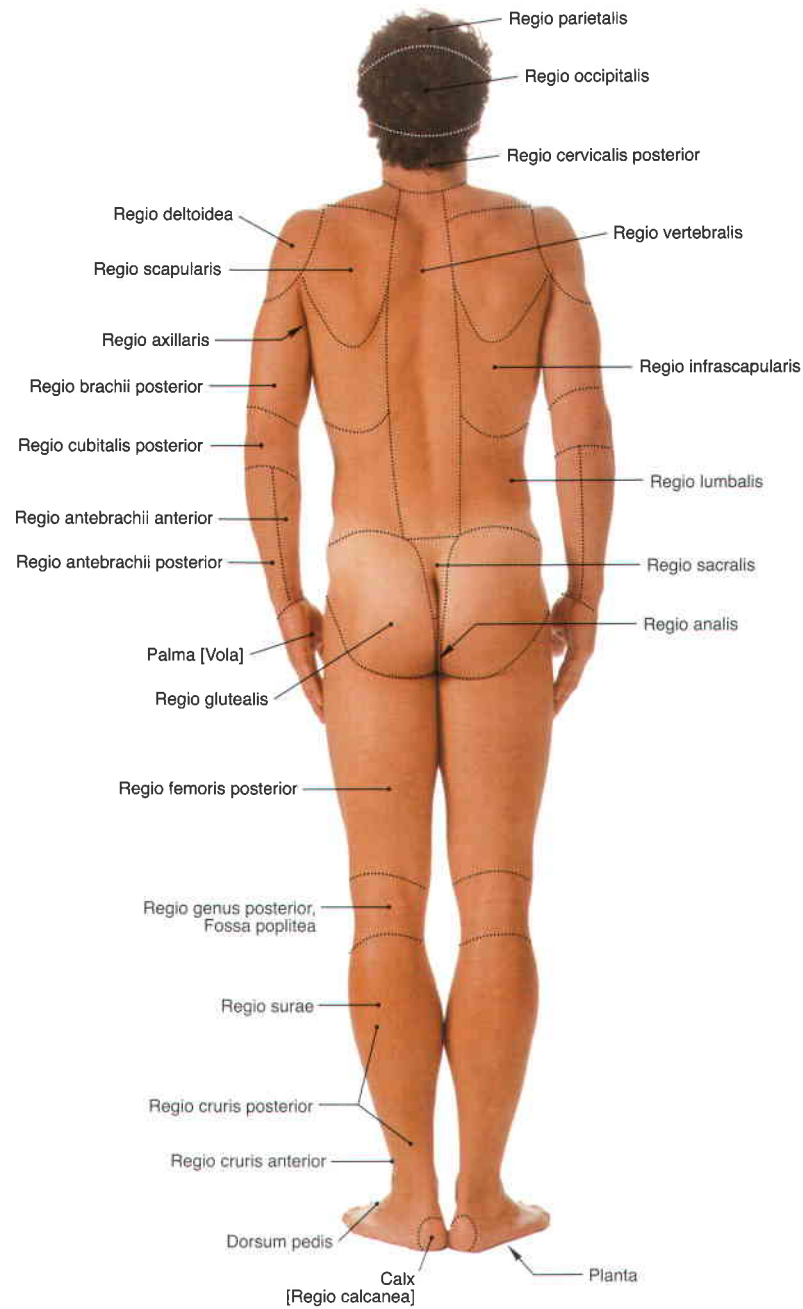
a Ventral view (ventralis, anterior)

b Dorsal view (dorsalis, posterior)

Parts of the human body**Fig. 3** Surface anatomy of the male.**Fig. 4** Surface anatomy of the female.

**Fig. 5** Surface anatomy of the male.**Fig. 6** Surface anatomy of the female.

Regions of the human body**Fig. 7** Regions of the human body, *Regiones corporis*.

Regions of the human body**Fig. 8** Regions of the human body, *Regiones corporis*.

Skeleton

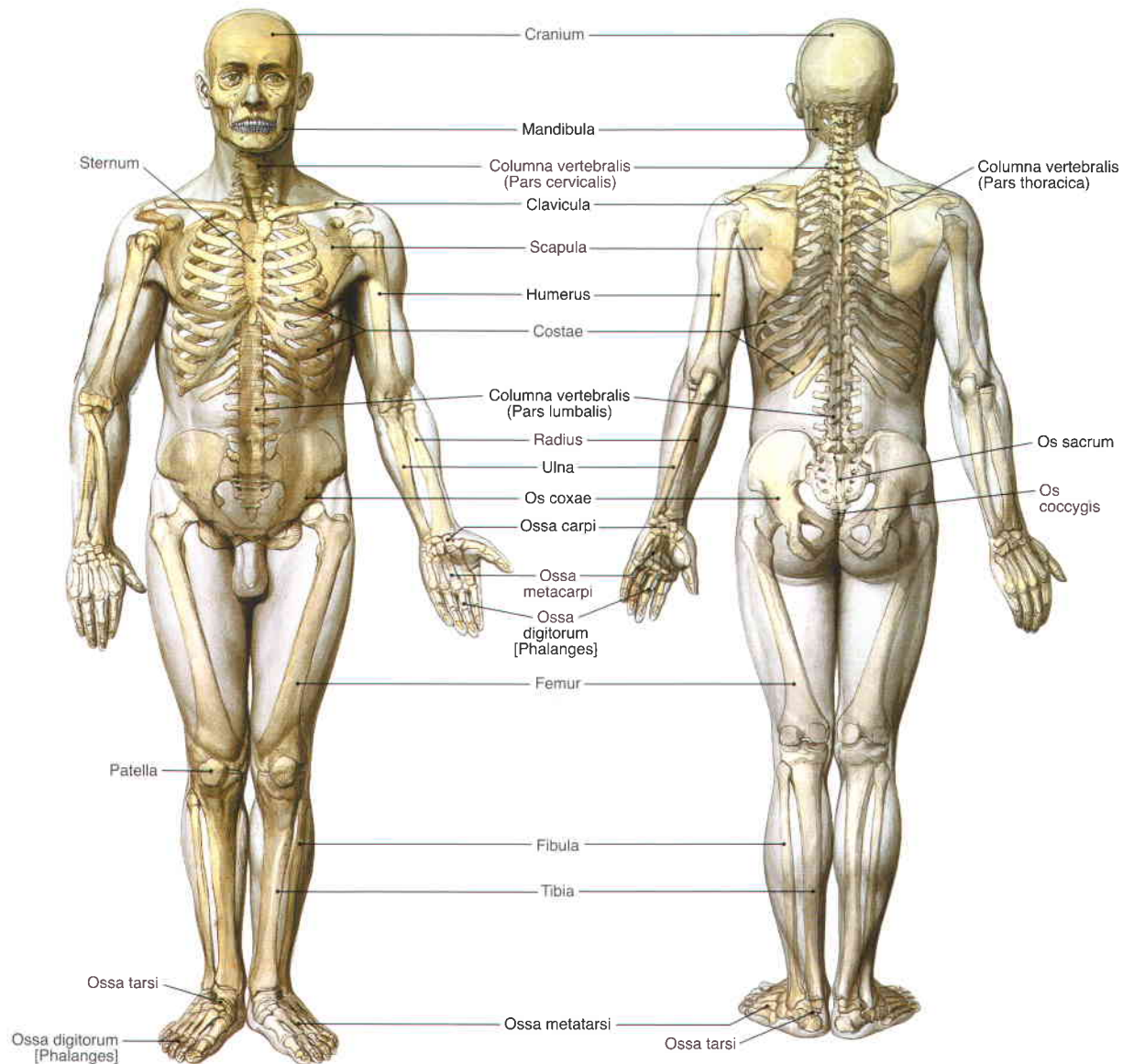


Fig. 9 Overview of the skeleton, *Systema skeletale*.

Fig. 10 Overview of the skeleton, *Systema skeletale*.

Parts of the human body

Head, Caput

Neck, Collum

Trunk, Truncus

Thorax, Thorax

Abdomen, Abdomen

Pelvis, Pelvis

Upper limb, Membrum superius

Shoulder girdle, Cingulum pectorale [Cingulum membri superioris]; Arm, Pars libera membri superioris

Lower limb, Membrum inferius

Pelvic girdle, Cingulum pelvici [Cingulum membri inferioris]; Leg, Pars libera membri inferioris

Skeleton

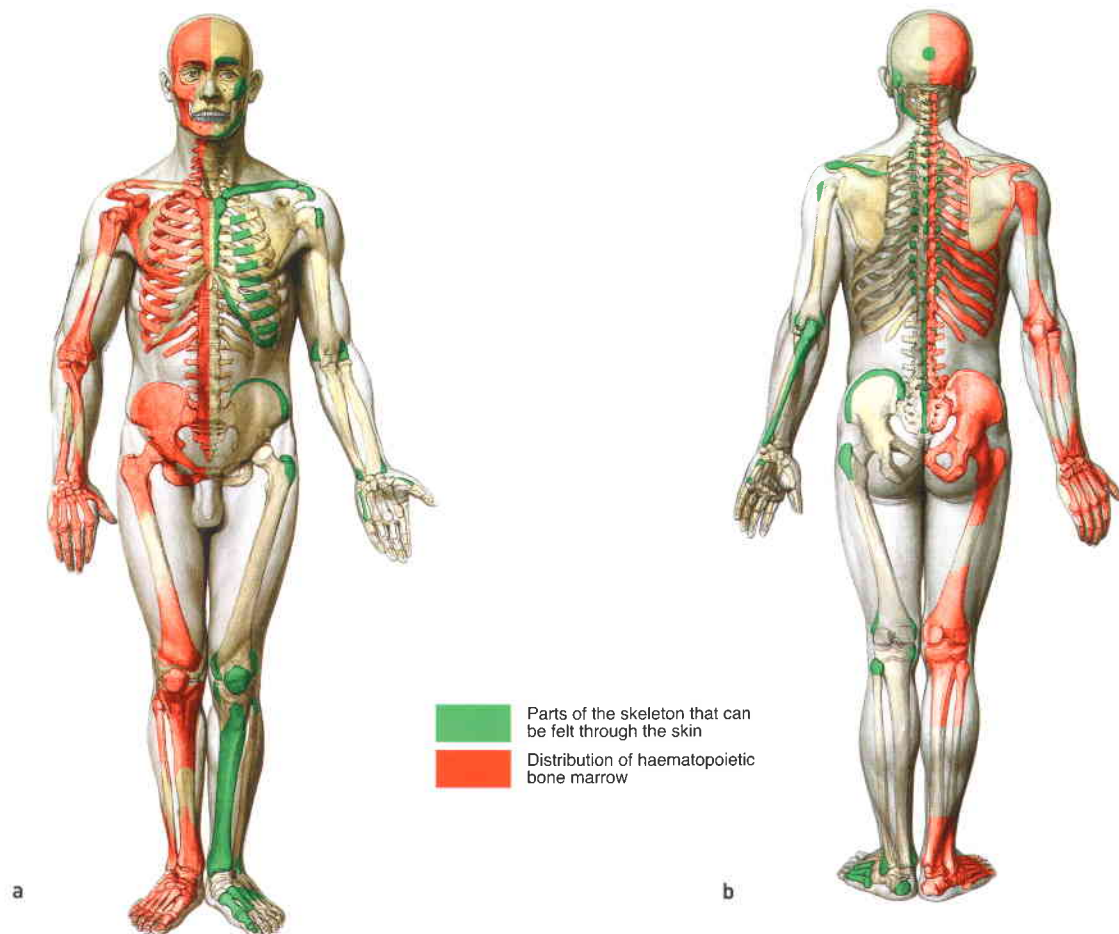


Fig. 11a, b Skeleton, Systema skeletale.

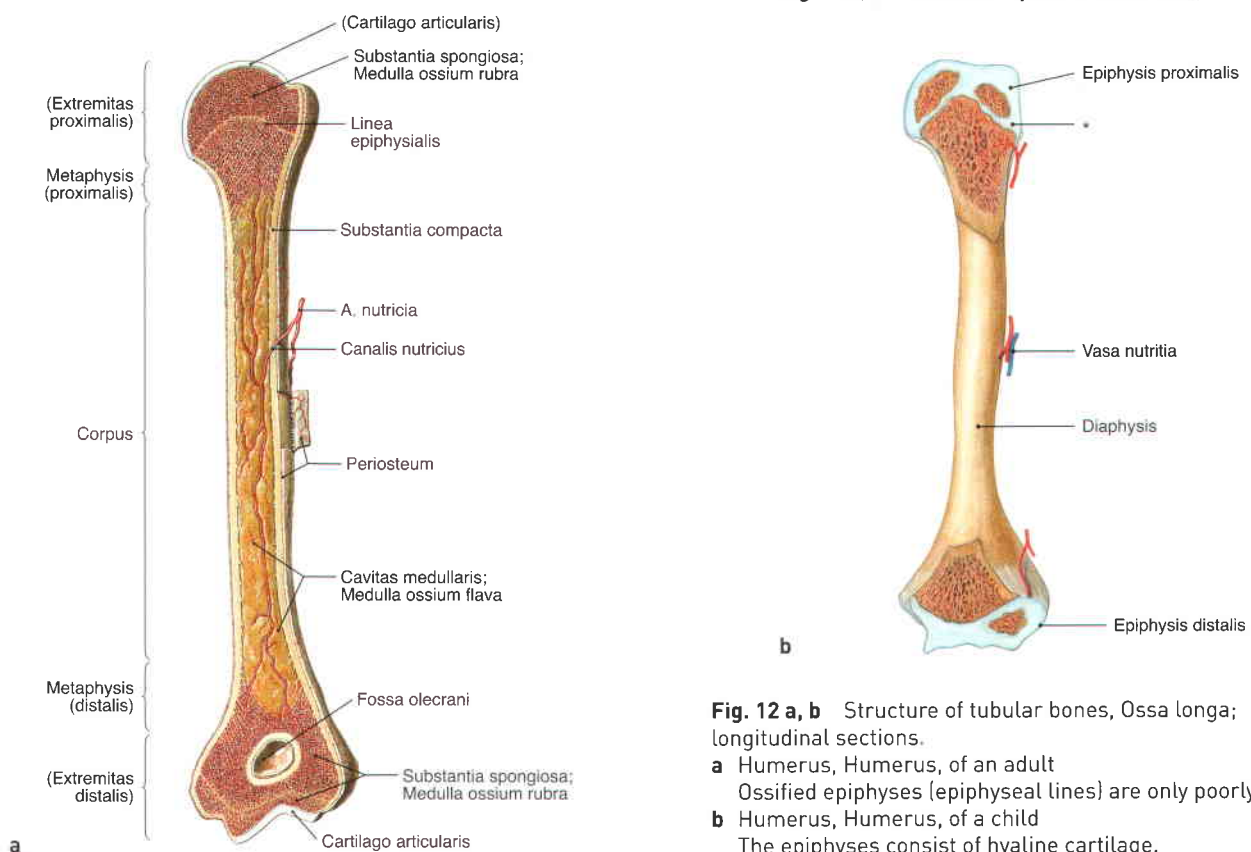
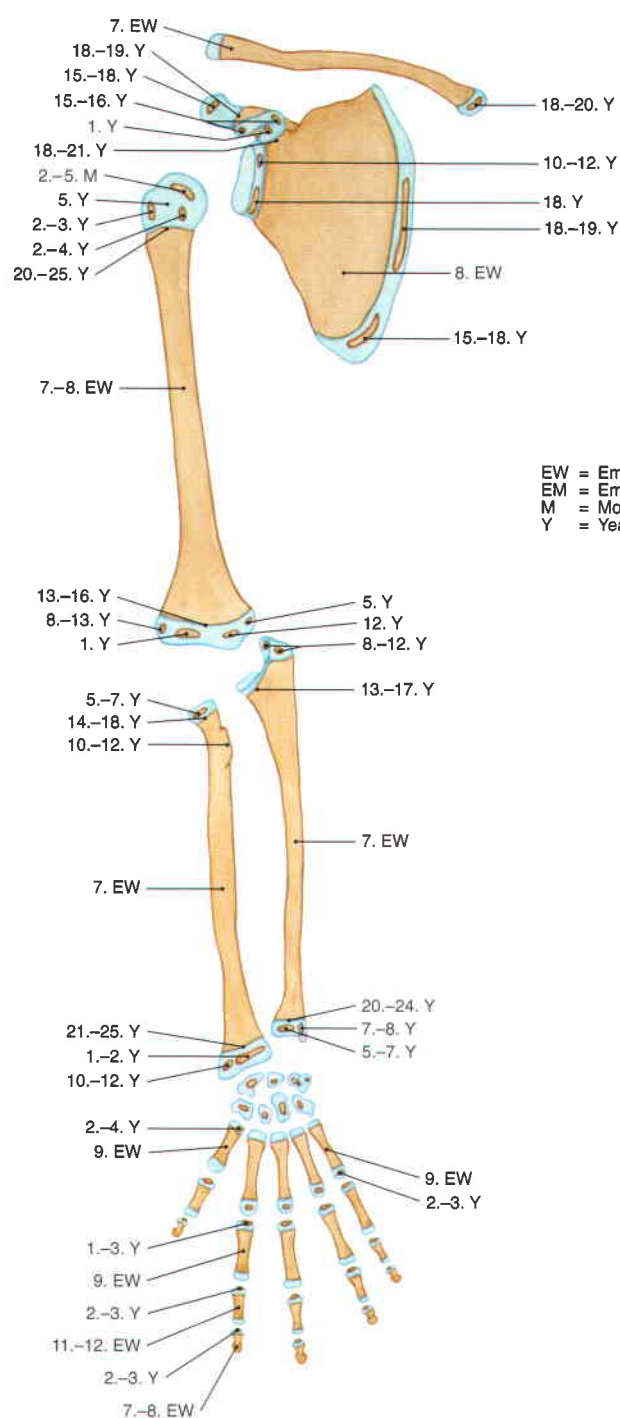


Fig. 12 a, b Structure of tubular bones, Ossa longa; longitudinal sections.

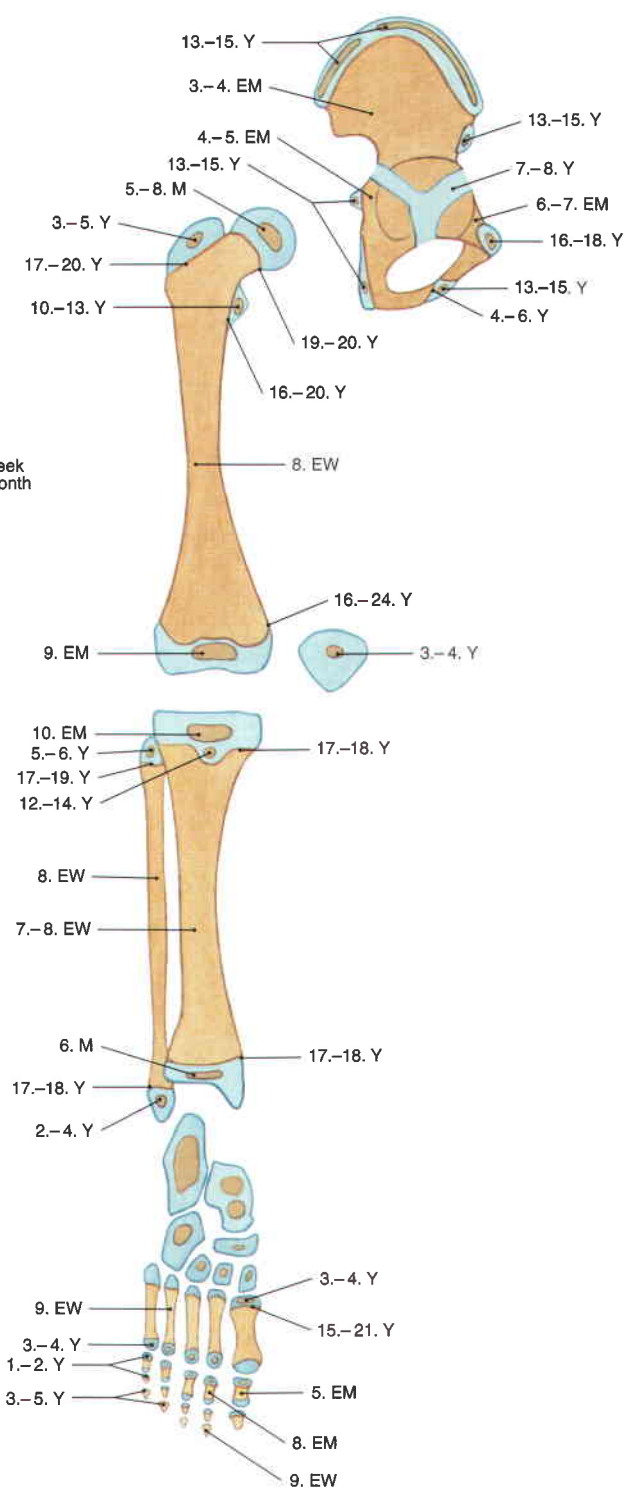
- a** Humerus, Humerus, of an adult
 Ossified epiphyses (epiphyseal lines) are only poorly visible.
- b** Humerus, Humerus, of a child
 The epiphyses consist of hyaline cartilage.
- * Epiphysis, epiphyseal plate



Os scapuloideum 3.-6. M
Os lunatum 3.-6. Y
Os trapezium 3.-8. Y
Os trapezoideum 3.-7. Y

Os pisiforme 8.-12. Y
Os triquetrum 1.-4. Y
Os hamatum 2.-5. M
Os capitatum 2.-4. M

EW = Embryonic week
EM = Embryonic month
M = Month of life
Y = Year of life



Talus 7. EM
Calcaneus 5.-6. EM
Os naviculare 4. Y
Os cuboideum 10. EM

Os cuneiforme mediale 2.-3. Y
Os cuneiforme intermedium 3.-4. Y
Os cuneiforme laterale 12. M

Fig. 13 Appearance of ossification centres and synossification at the epiphyses of the upper limb (means according to v. LANZ, 1956; EXNER, 1990; HEUCK and BAST, 1994).

Fig. 14 Appearance of ossification centres and synossification at the epiphyses of the lower limb (means according to v. LANZ, 1956; EXNER, 1990; HEUCK and BAST, 1994).



Fig. 15 Fibrous joint, *Articulatio fibrosa*, exemplified by the sutures of the skull.



Fig. 16 Cartilaginous joint, *Articulatio cartilaginea*, exemplified by the pubic bone symphysis.

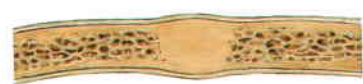
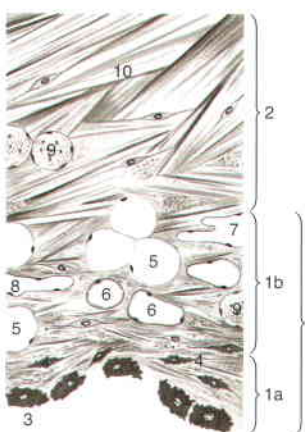


Fig. 17 Osseous joint, *Articulatio ossea*, exemplified by the sacrum.



b

- 1 Synovial membrane
- 1a Synovial intima, Intima
- 1b Subintimal layer, Subintima
- 2 Fibrous membrane
- 3 A-cells (macrophages)
- 4 B-cells (fibroblasts)
- 5 Fat cells
- 6 Capillary vessels with fenestration
- 7 Venules
- 8 Lymphatics
- 9 Nerves
- 10 Collagen fibres

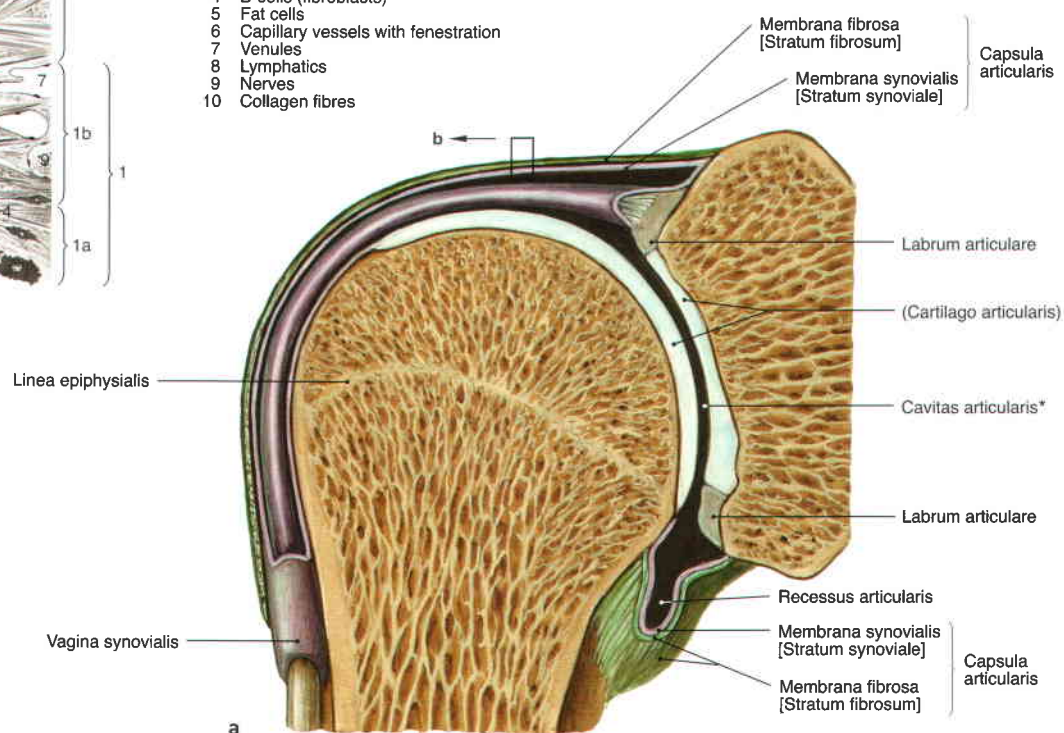


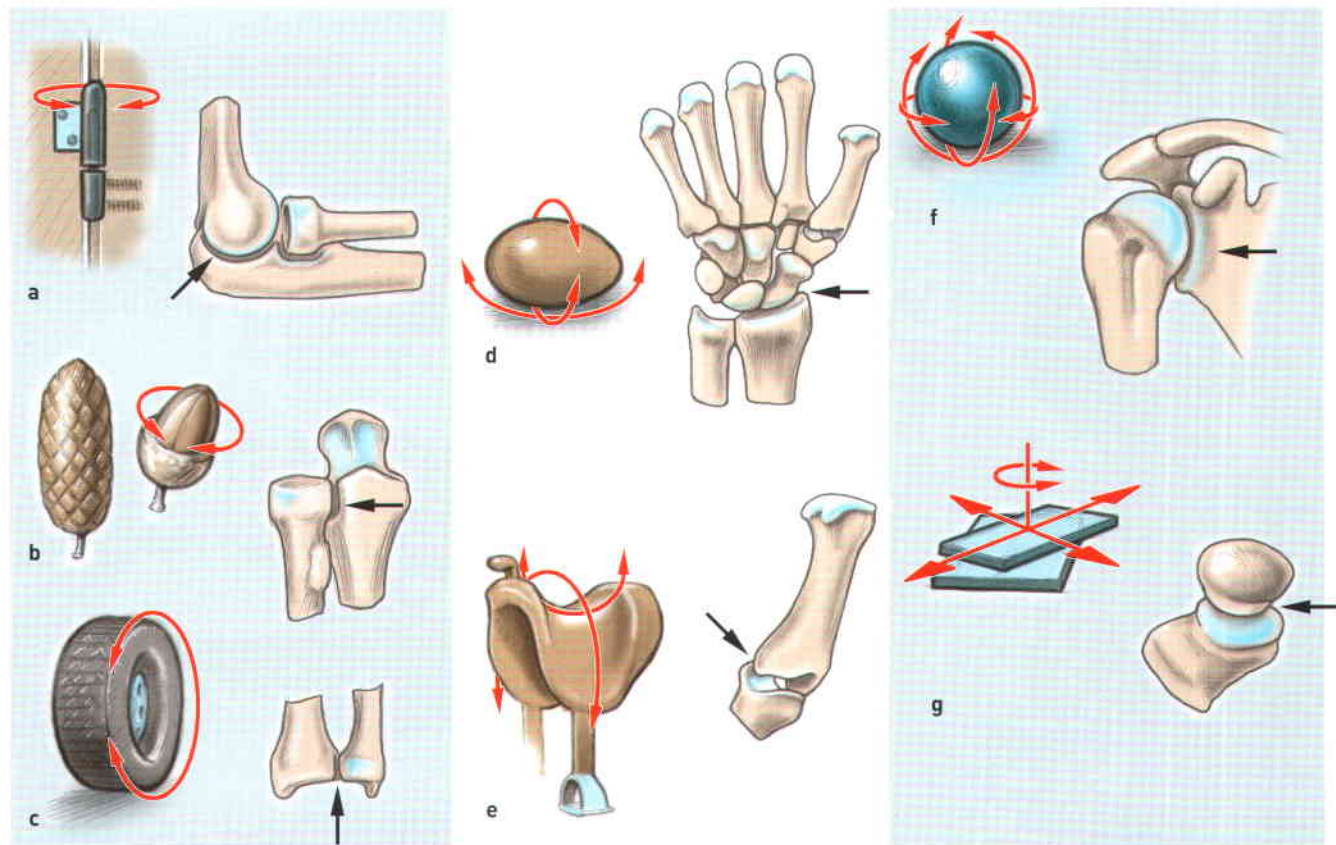
Fig. 18 a, b Synovial joint, *Articulatio synovialis*, exemplified by the shoulder joint.

a Section in the scapular plane

b Structure of the joint capsule

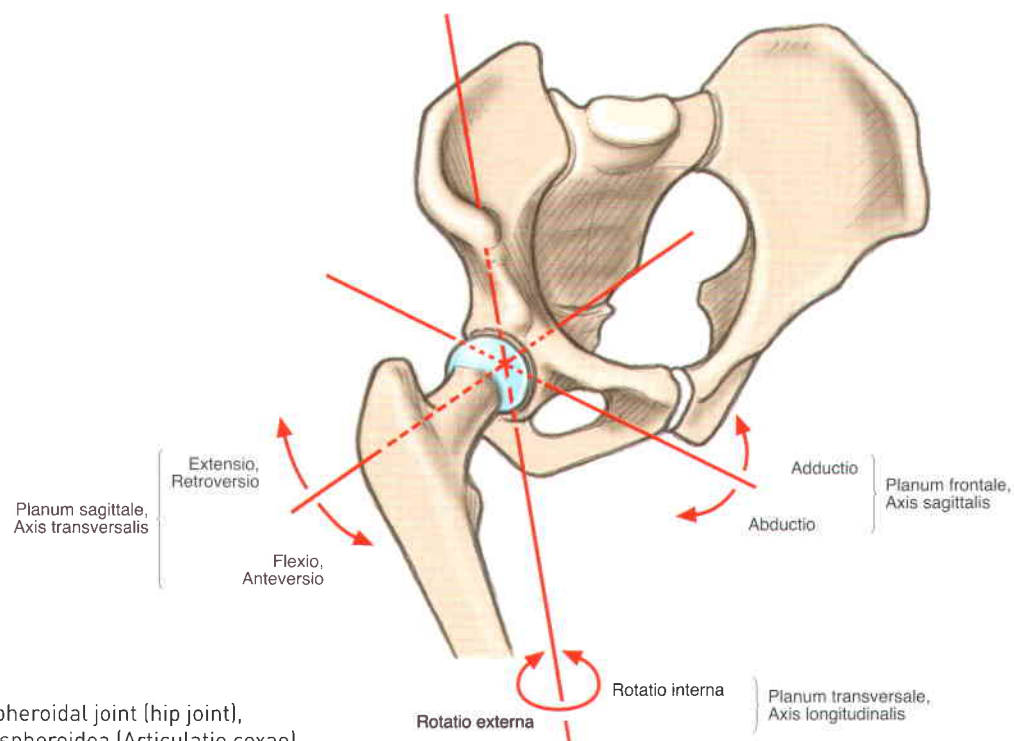
* The joint cavity, *Cavitas articularis*, is illustrated broader to enhance visibility.

Joints

**Fig. 19 a-g** Joints, *Juncturae synoviales*.

a Hinge joint, *Articulatio cylindrica*
b Conoid joint, *Articulatio conoidea*
c Pivot joint, *Articulatio trochoidea*

d Condylar joint, *Articulatio ovoidea*
e Saddle joint, *Articulatio sellaris*
f Spheroidal joint, *Articulatio spheroidea*
g Plane joint, *Articulatio plana*

**Fig. 20** Spheroidal joint (hip joint), *Articulatio spheroidea* (*Articulatio coxae*).

Active locomotor system

Muscles

- 1 Line of force of the muscle
- 2 Virtual lever arm of the muscle
- 3 Axis of rotation of the joint

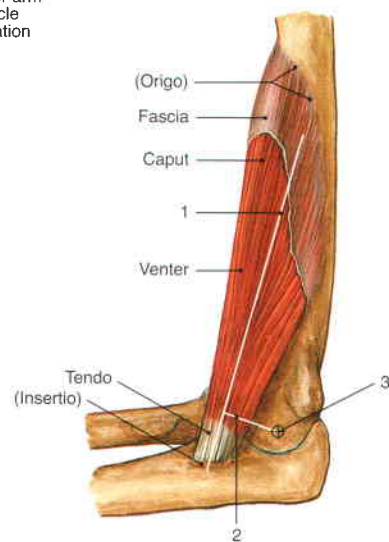


Fig. 21 Organisation principle of skeletal muscles, exemplified by the brachial muscle, M. brachialis.

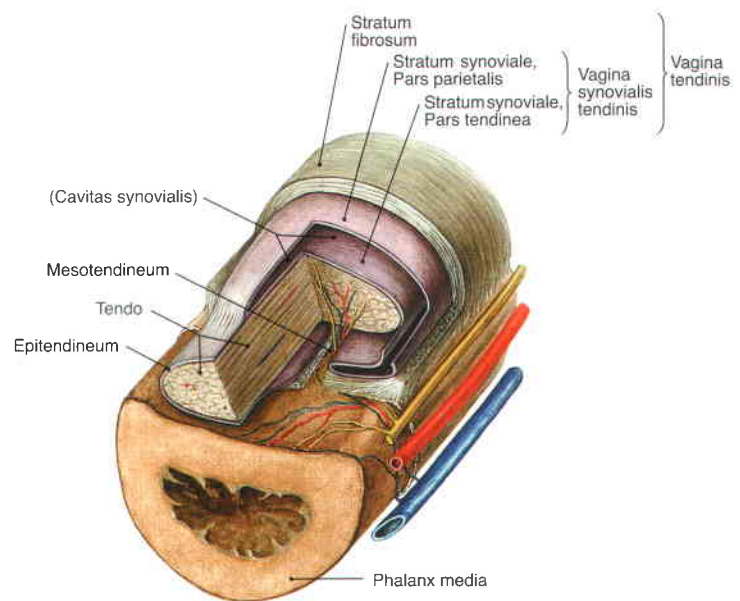


Fig. 22 Structure of a tendon sheath, Vagina tendinis, exemplified by a finger.



a Musculus fusiformis



b Musculus biceps



c Musculus biventer



d Musculus planus



e Musculus intersectus



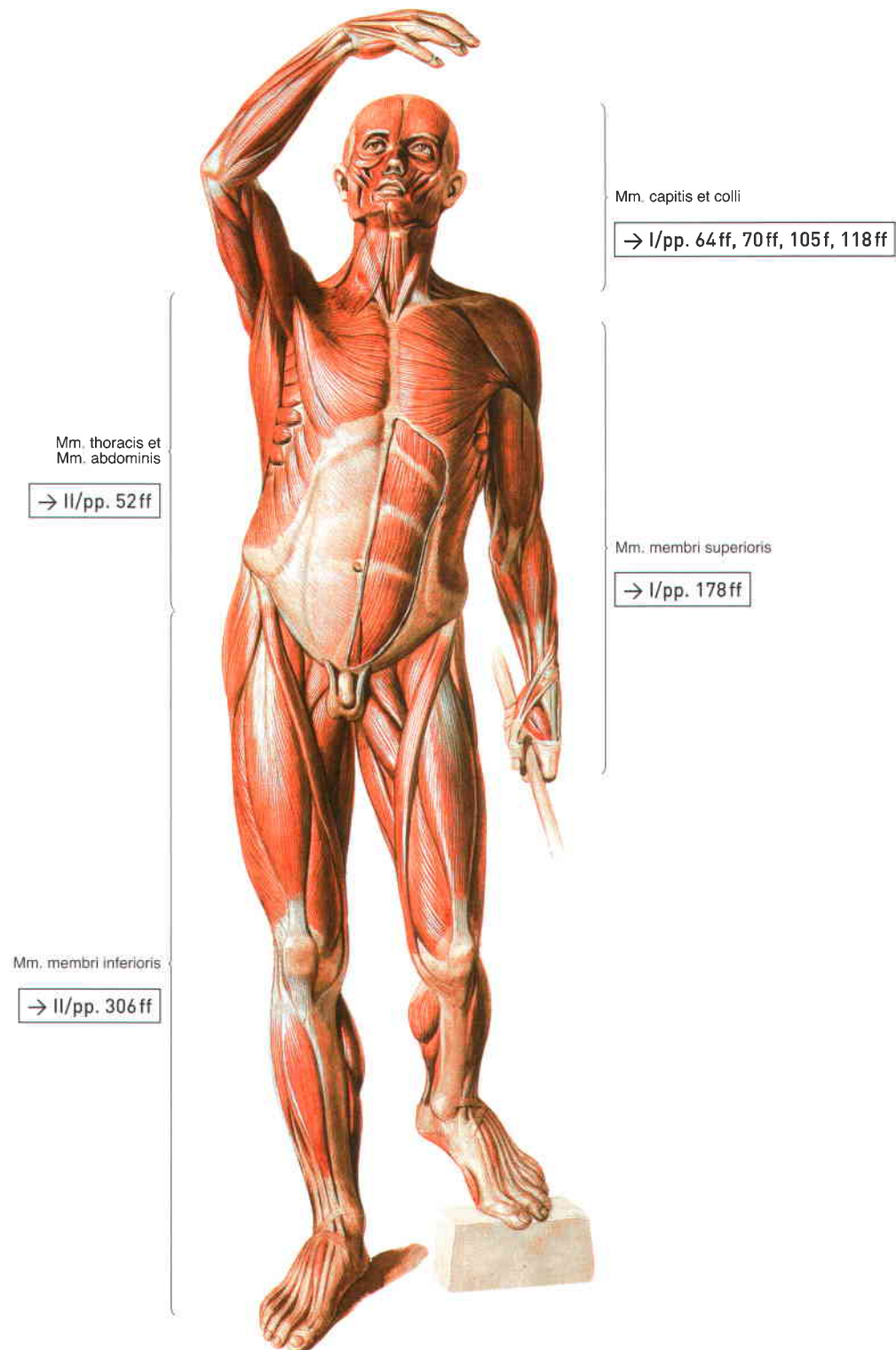
f Musculus semipennatus



g Musculus pennatus

Fig. 23 a-g Types of muscles.

- a** Single head, parallel muscle fibres
- b** Double head, parallel muscle fibres
- c** Double belly, parallel muscle fibres
- d** Multi-head, flat muscle
- e** Multi-belly muscle with tendinous intersections
- f** Unipennate muscle
- g** Bipennate muscle

**Fig. 24** Overview of the skeletal muscles.

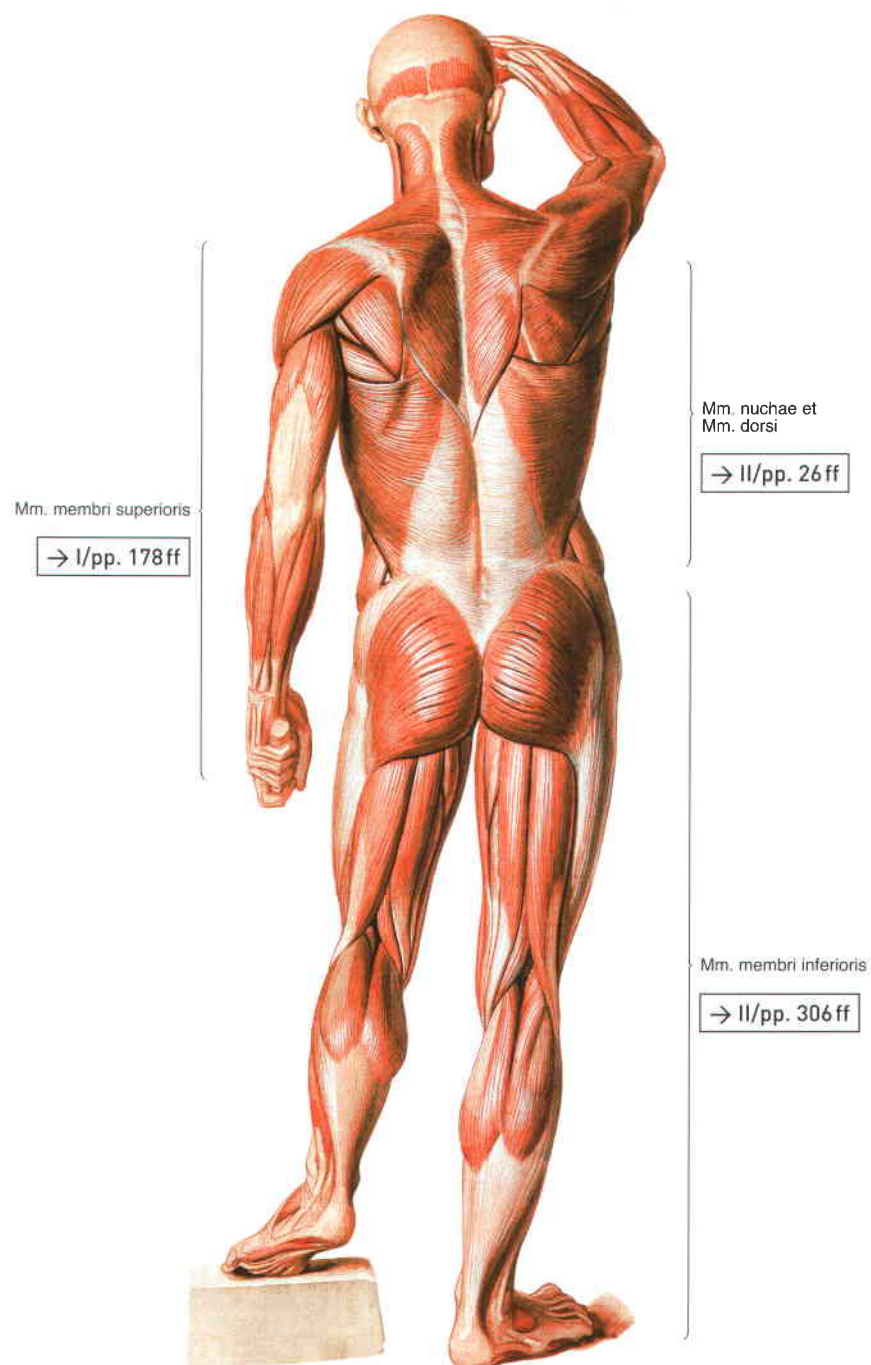
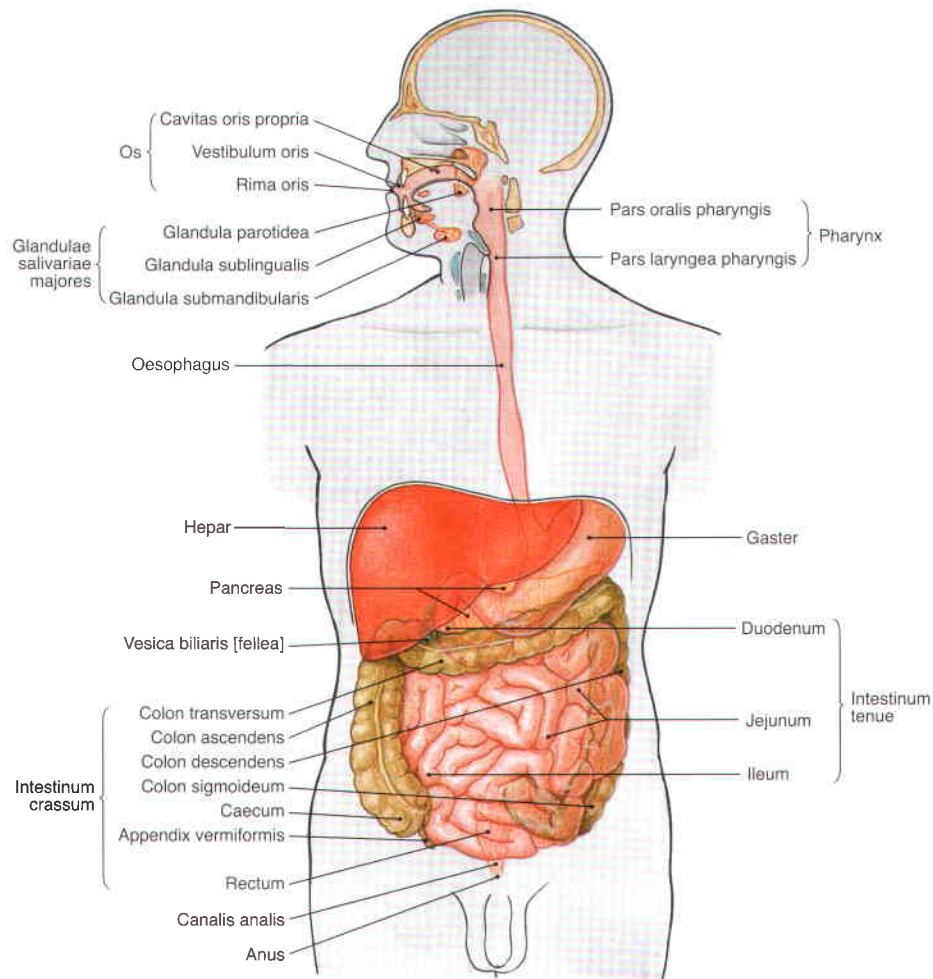
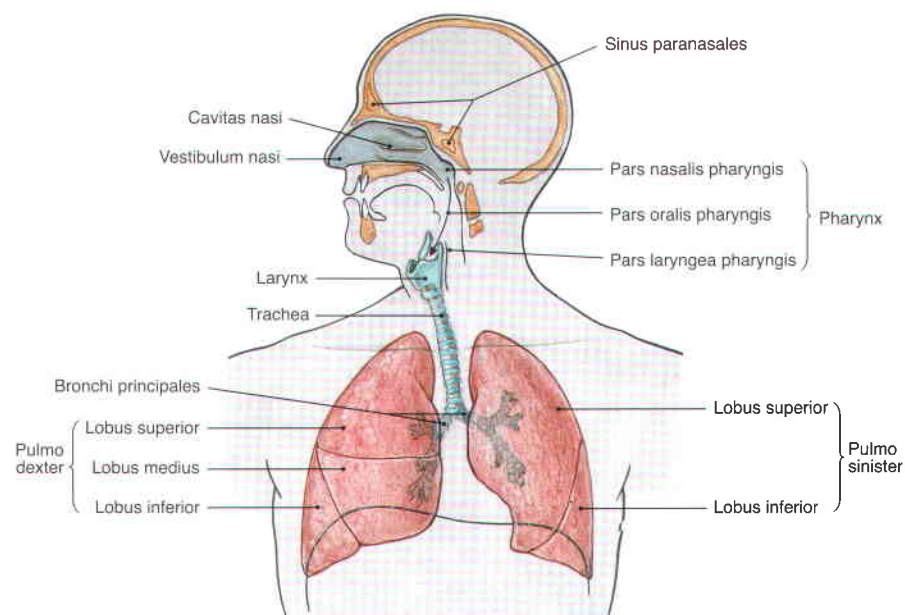


Fig. 25 Overview of the skeletal muscles.

Digestive and respiratory system**Fig. 26** Overview of the digestive system.**Fig. 27** Overview of the respiratory system.

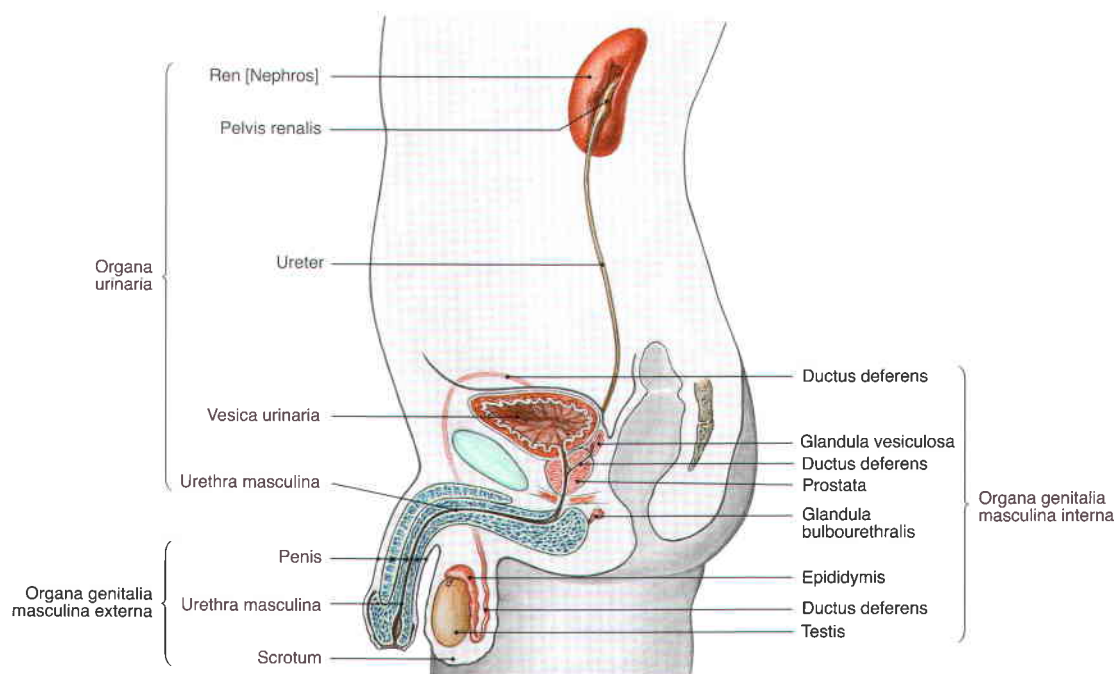


Fig. 28 Overview of the urinary and genital system of the male.

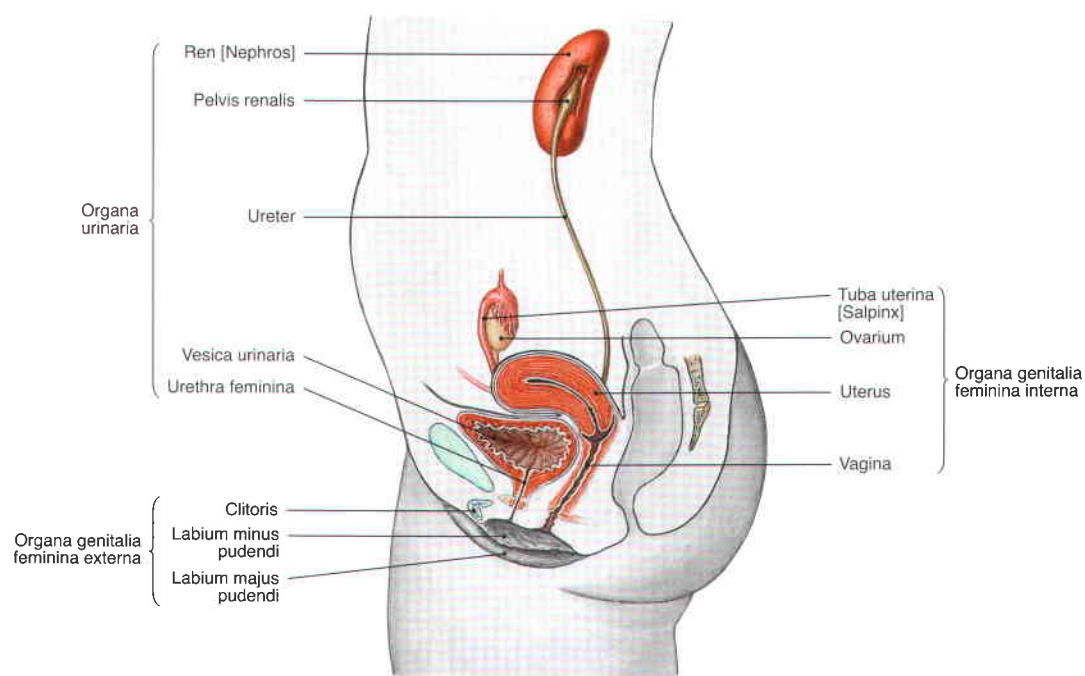


Fig. 29 Overview of the urinary and genital system of the female.

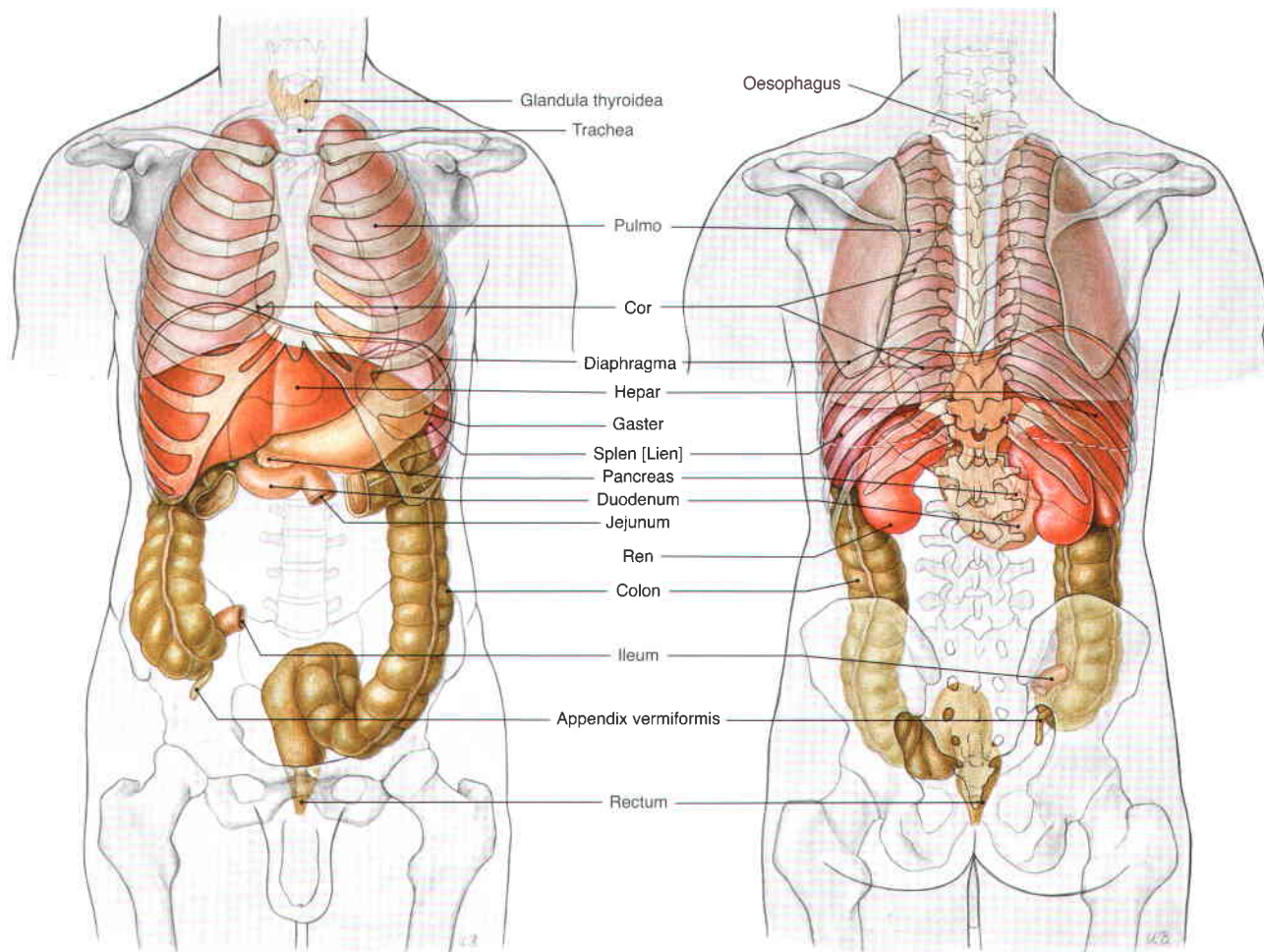


Fig. 30 Projection of the internal organs onto the surface of the body.

Fig. 31 Projection of the internal organs onto the surface of the body.

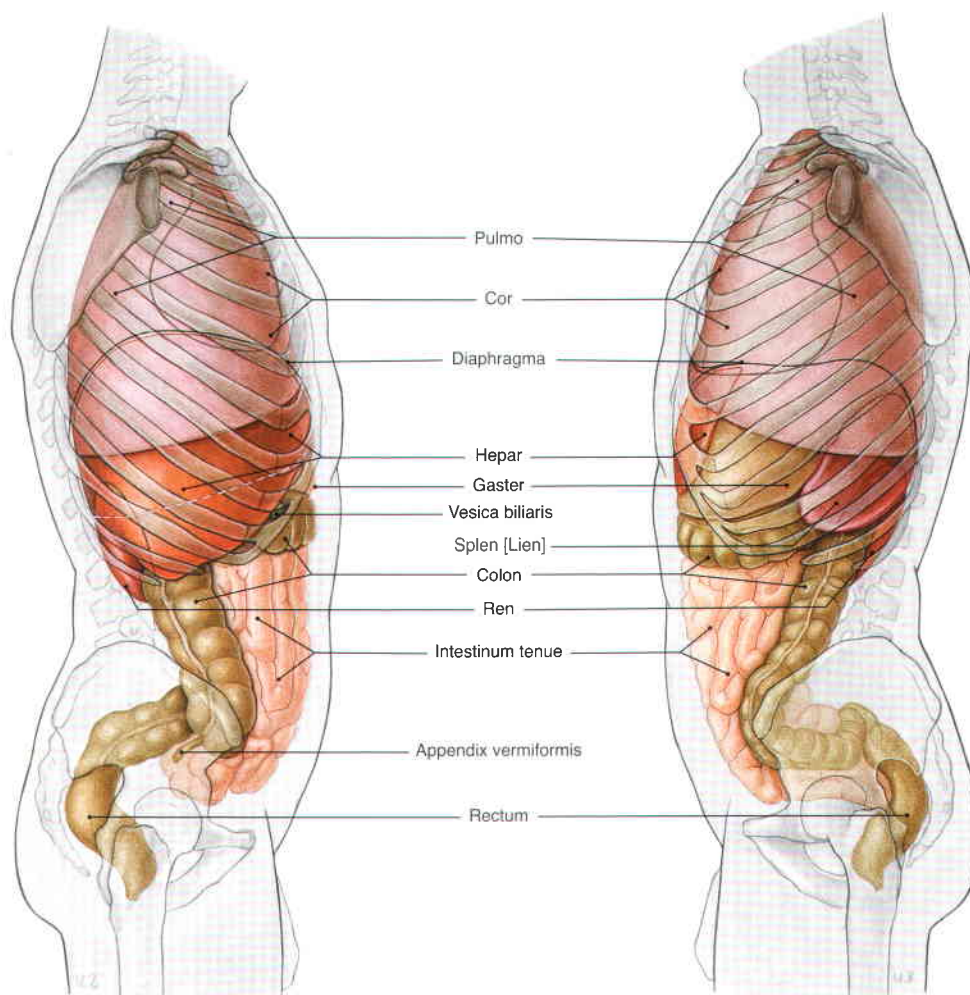


Fig. 32 Projection of the internal organs onto the surface of the body.

Fig. 33 Projection of the internal organs onto the surface of the body.

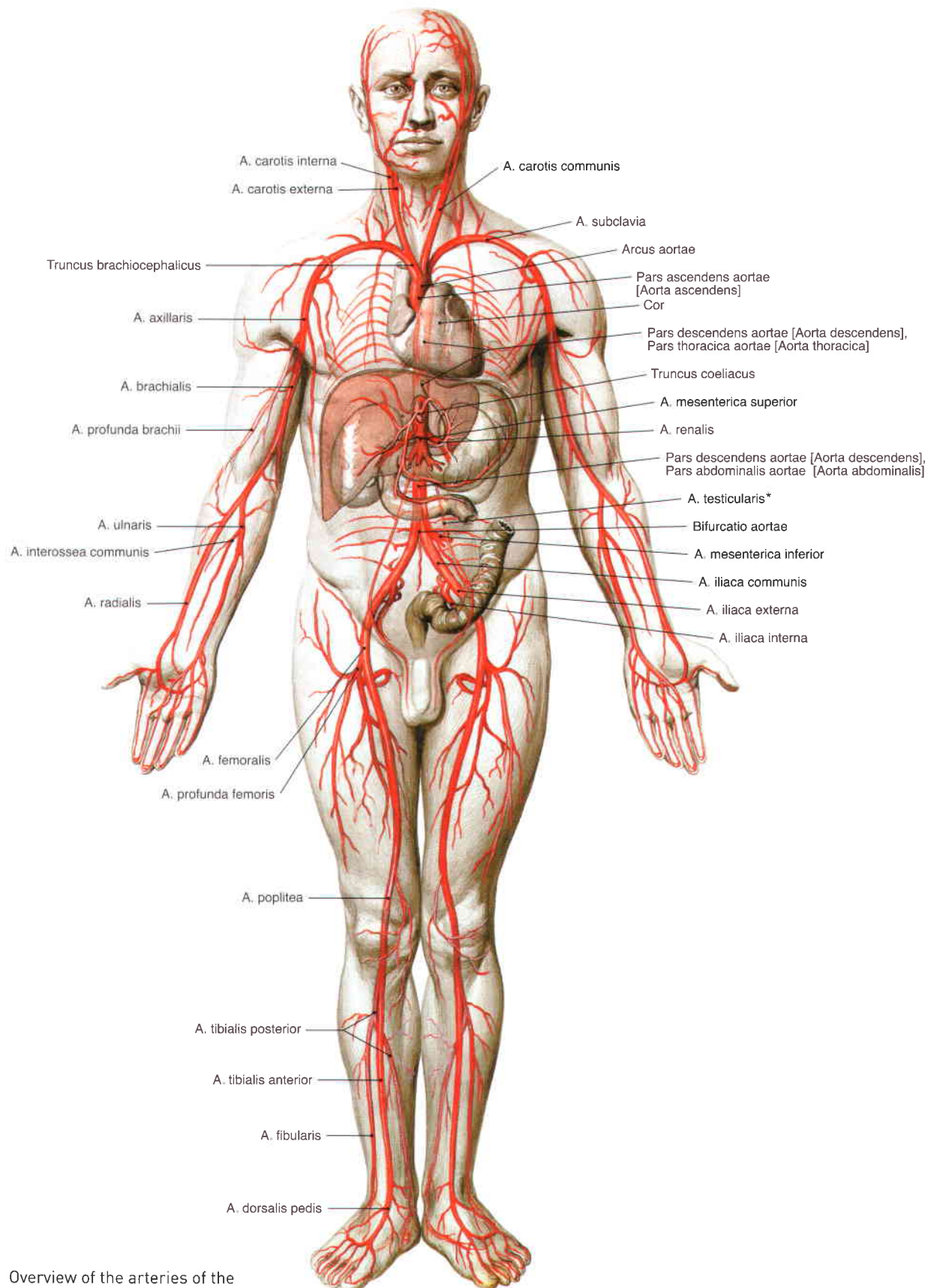
Arteries

Fig. 34 Overview of the arteries of the systemic circulation.

* In the female: ovarian artery, A. ovarica

Arteries

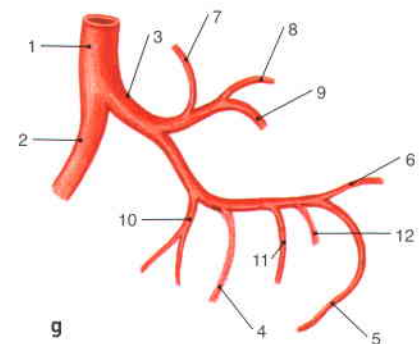
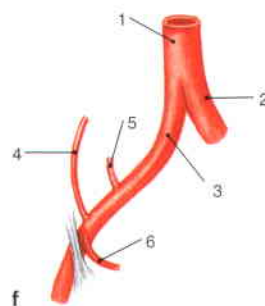
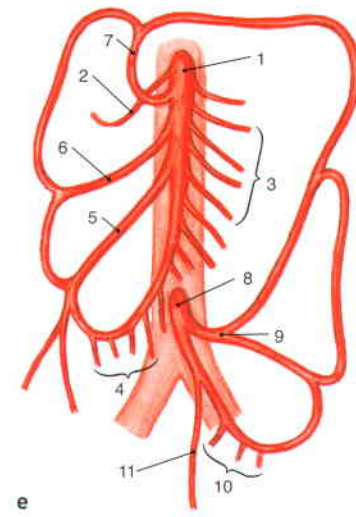
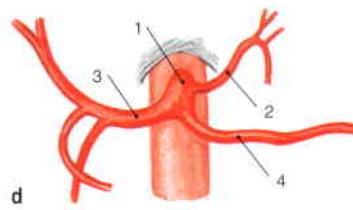
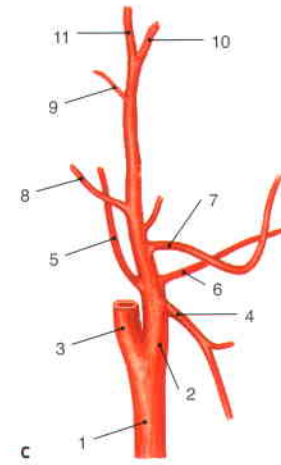
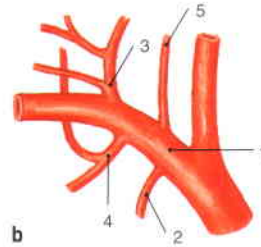
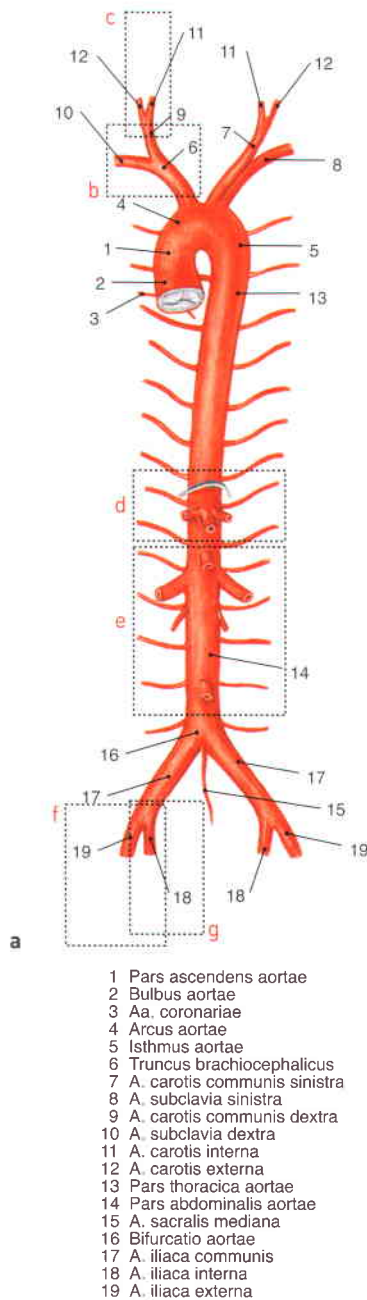


Fig. 35 a–g Aorta, Aorta, and greater arteries; schema of the branching pattern.
a Aorta, Aorta
b Subclavian artery, A. subclavia
c External carotid artery, A. carotis externa
d Coeliac trunk, Truncus coeliacus
e Superior and inferior mesenteric artery, Aa. mesentericae superior et inferior
f External iliac artery, A. iliaca externa
g Internal iliac artery, A. iliaca interna

Veins

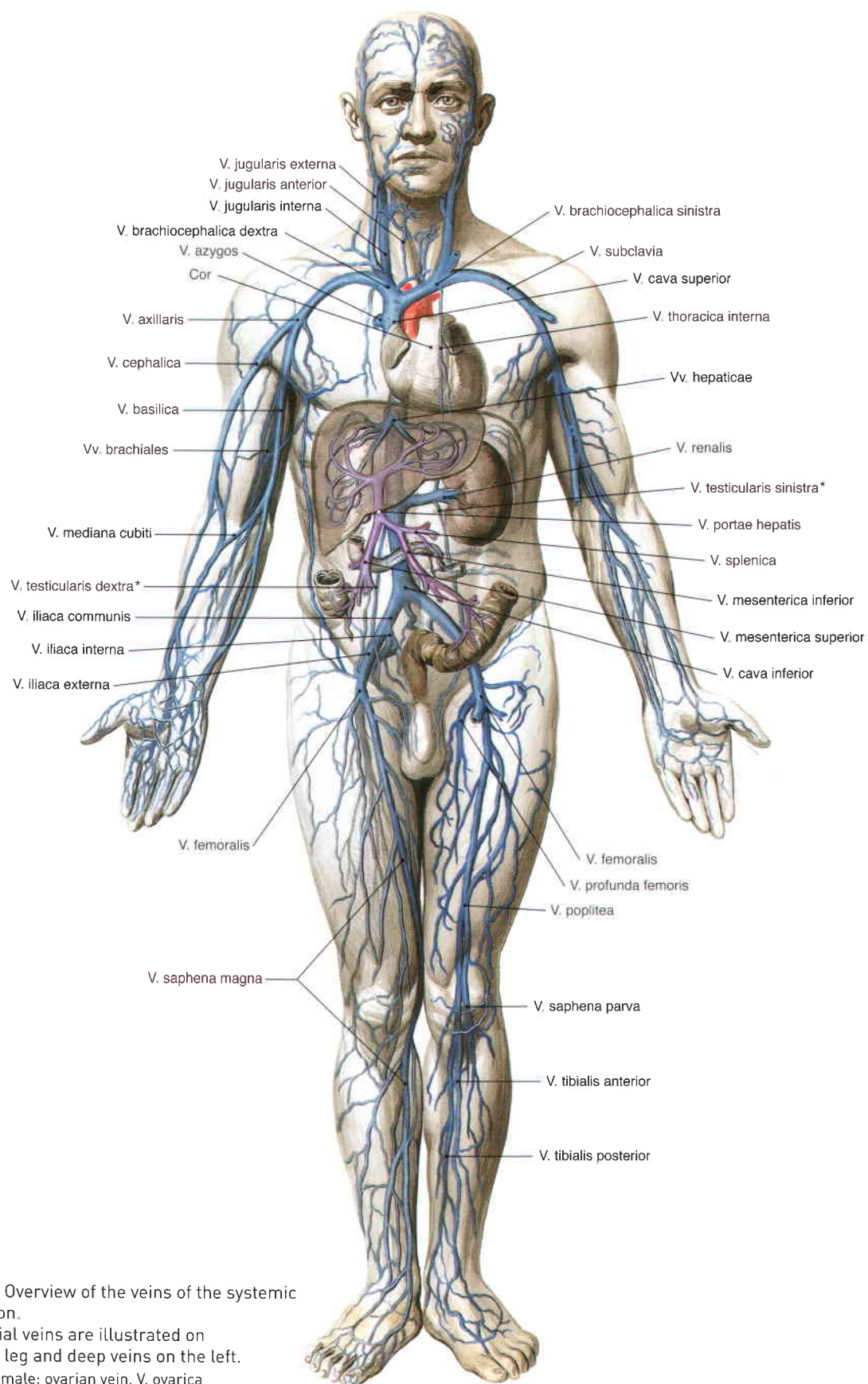
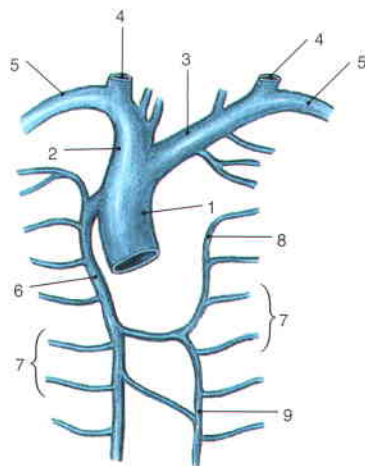


Fig. 36 Overview of the veins of the systemic circulation.

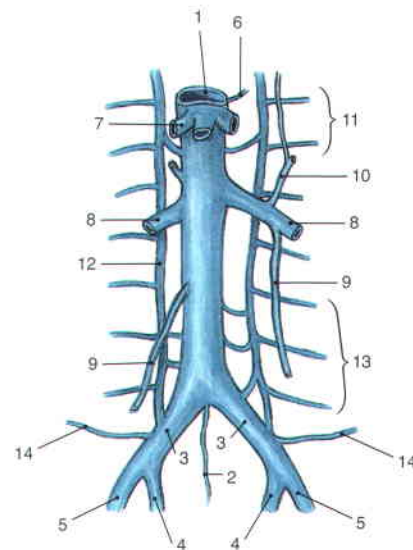
Superficial veins are illustrated on the right leg and deep veins on the left.

* In the female: ovarian vein, V. ovarica



- | | |
|--------------------------------|---------------------------------|
| 1 V. cava superior | 6 V. azygos |
| 2 V. brachiocephalica dextra | 7 Vv. intercostales posteriores |
| 3 V. brachiocephalica sinistra | 8 V. hemiazygos accessoria |
| 4 V. jugularis interna | 9 V. hemiazygos |
| 5 V. subclavia | |

Fig. 37 Superior vena cava, V. cava superior; schema of the tributaries.



- | | |
|------------------------|----------------------------------|
| 1 V. cava inferior | 8 V. renalis |
| 2 V. sacralis mediana | 9 V. testicularis/ovarica |
| 3 V. iliaca communis | 10 V. suprarenalis |
| 4 V. iliaca interna | 11 Vv. intercostales posteriores |
| 5 V. iliaca externa | 12 V. lumbalis ascendens |
| 6 V. phrenica inferior | 13 Vv. lumbales |
| 7 Vv. hepaticae | 14 V. iliolumbalis |

Fig. 38 Inferior vena cava, V. cava inferior; schema of the tributaries.

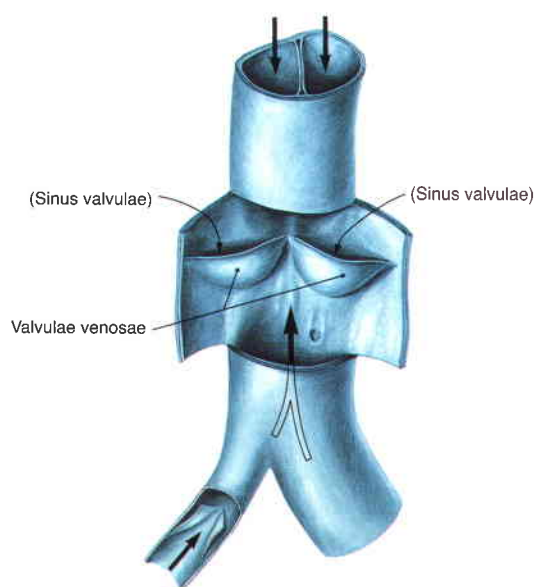
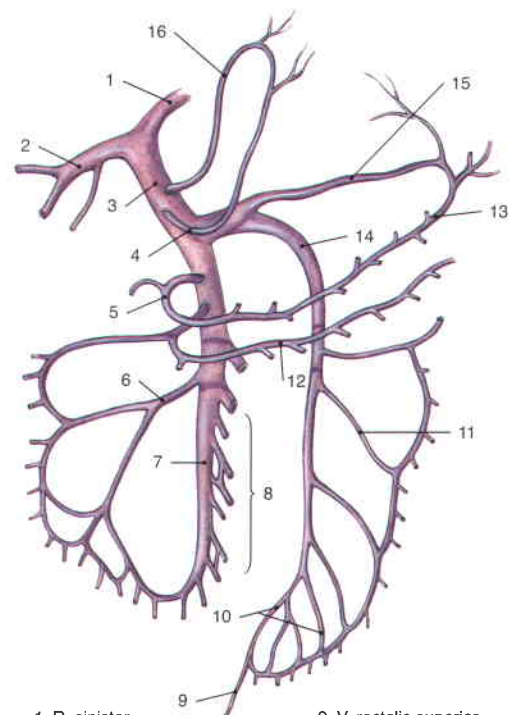
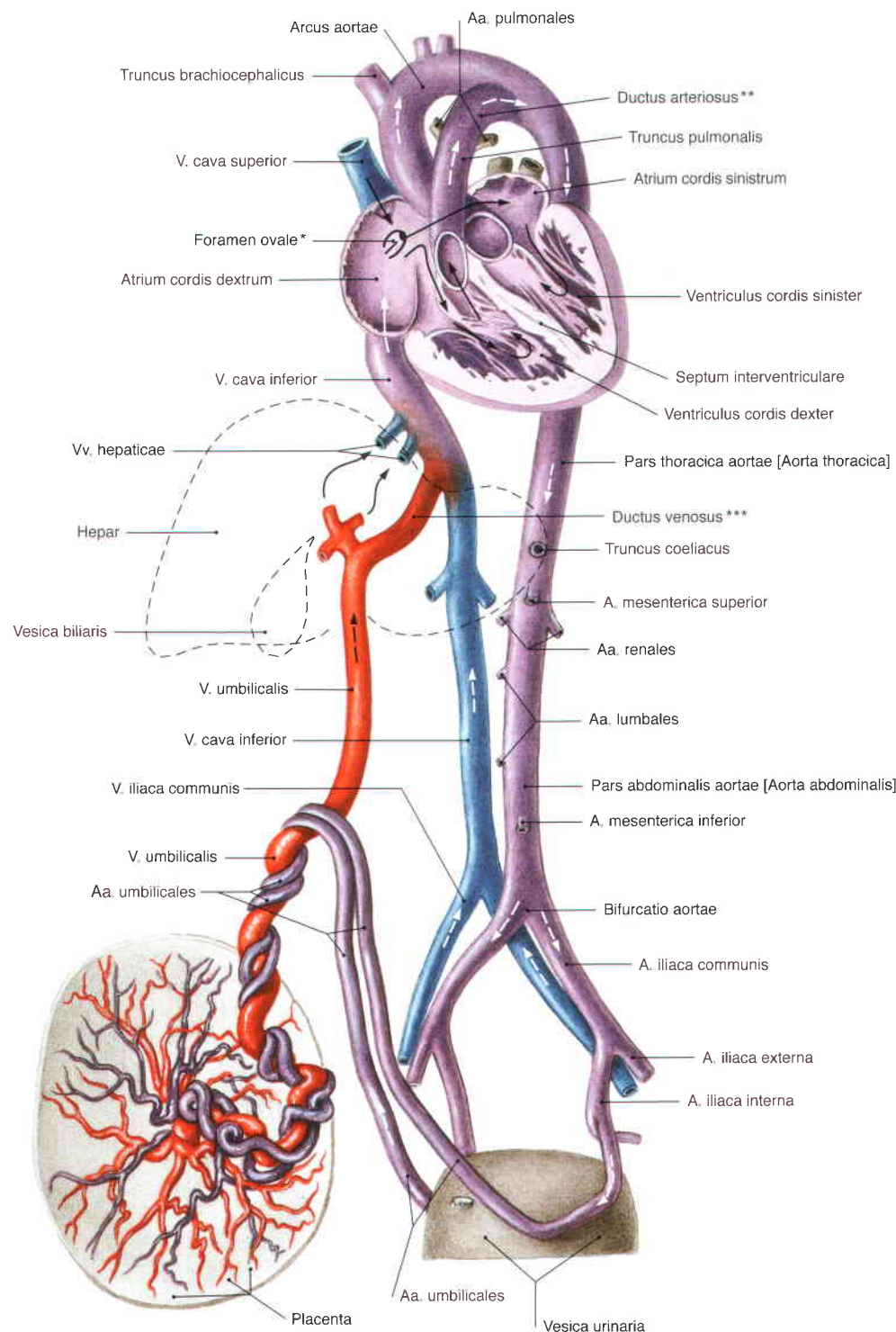


Fig. 39 Functional principle of venous valves. The arrows pointing upwards indicate the flow of blood. The valves close upon backflow of the blood [arrows pointing downwards].



- | | |
|----------------------------|-------------------------------|
| 1 R. sinister | 9 V. rectalis superior |
| 2 R. dexter | 10 Vv. sigmoideae |
| 3 V. portae hepatis | 11 V. colica sinistra |
| 4 V. gastrica dextra | 12 V. colica media |
| 5 V. gastroenterica dextra | 13 V. gastroenterica sinistra |
| 6 V. colica dextra | 14 V. mesenterica inferior |
| 7 V. mesenterica superior | 15 V. splenica |
| 8 Vv. jejunes et ilei | 16 V. gastrica sinistra |

Fig. 40 Hepatic portal vein, V. portae hepatis.

Foetal circulation**Fig. 41** Schema of foetal circulation.

The different colours indicate the oxygen content in the blood:
 red = rich in oxygen,
 blue = poor in oxygen,
 purple = mixed blood.

Arrows indicate the direction of the blood flow.

* Short-circuit between the right and the left atrium

** Short-circuit between the pulmonary trunk and the arch of aorta

*** Short-circuit between the umbilical vein and the inferior vena cava

Conversion from foetal to postnatal circulation:

* The valve-like connection between the right and the left atrium via the foramen ovale is passively closed at the onset of respiratory activity in the lungs.

** The ductus arteriosus (BOTALLO), on the other hand, closes only during the first months of life as its lumen gradually obliterates by epithelial proliferation and increased tension of the wall.

*** The ductus venosus (ARANTIUS) obliterates after birth and becomes the ligamentum venosum in the portal area of the liver.

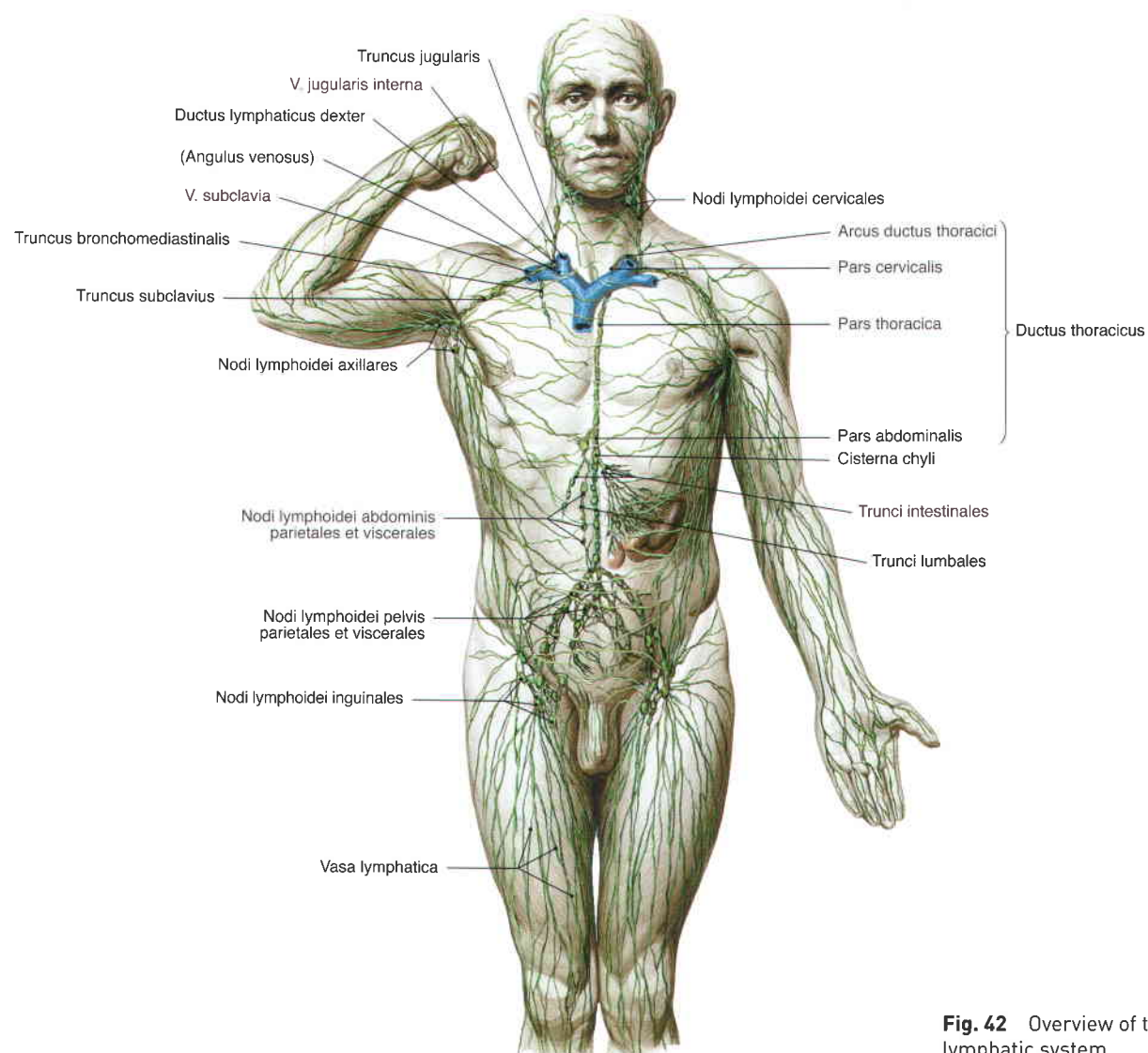
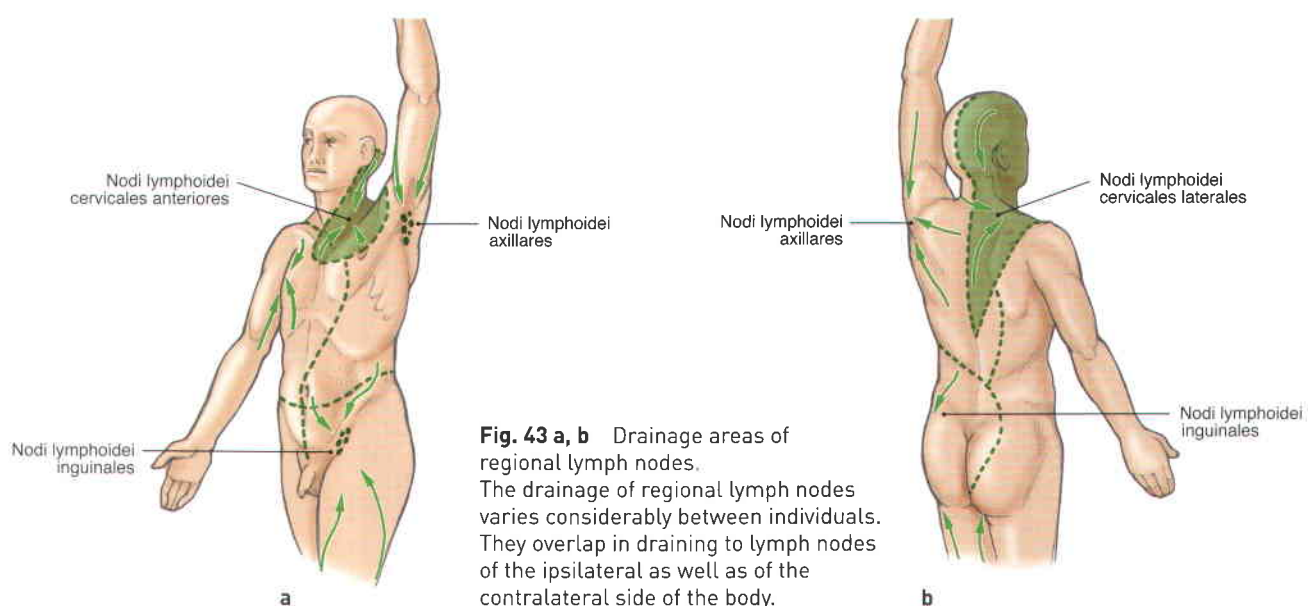


Fig. 42 Overview of the lymphatic system.



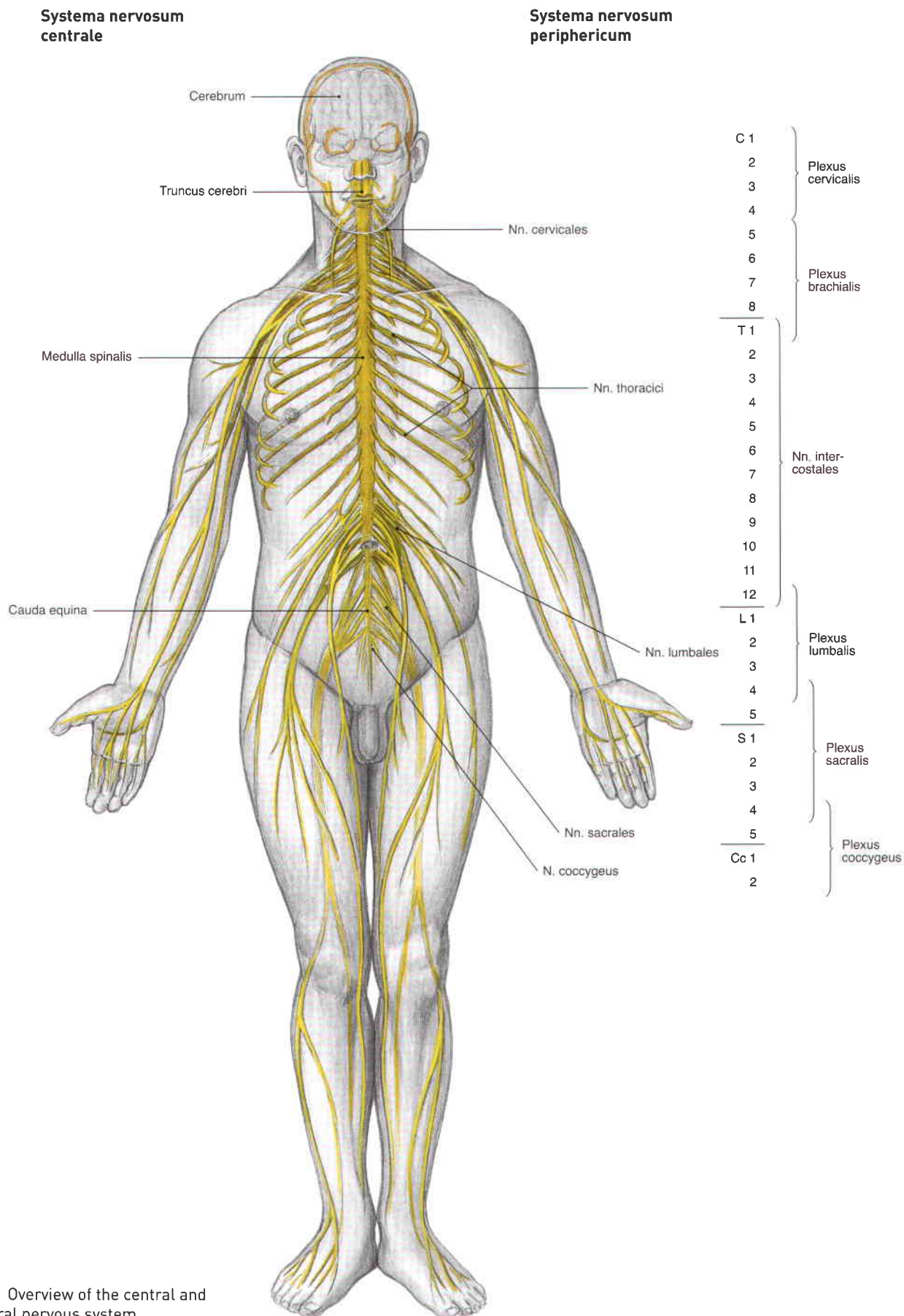


Fig. 44 Overview of the central and peripheral nervous system.

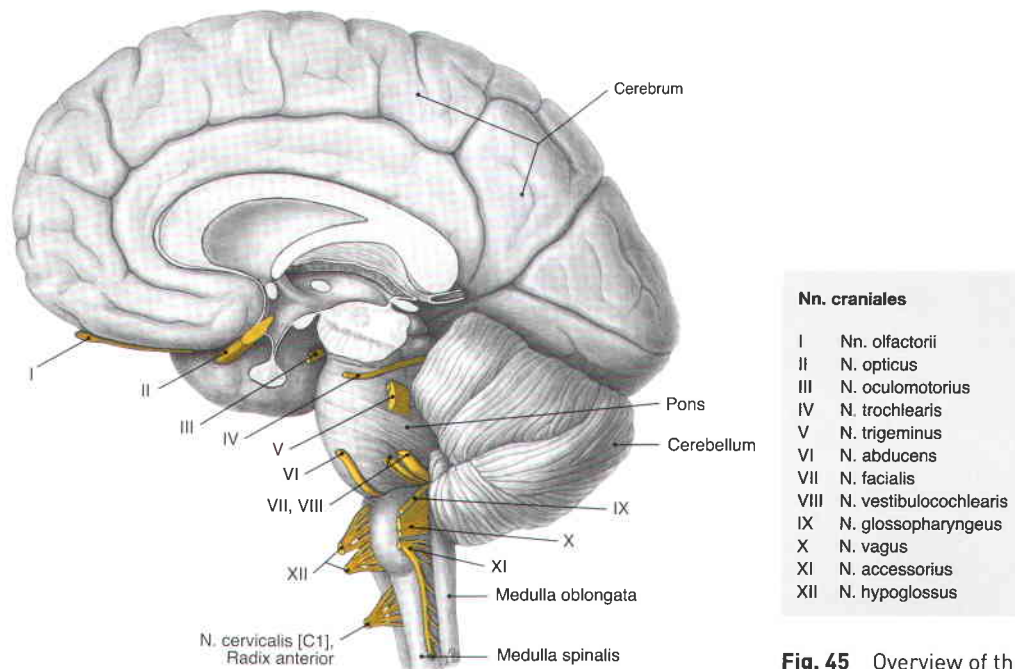


Fig. 45 Overview of the brain and the cranial nerves.

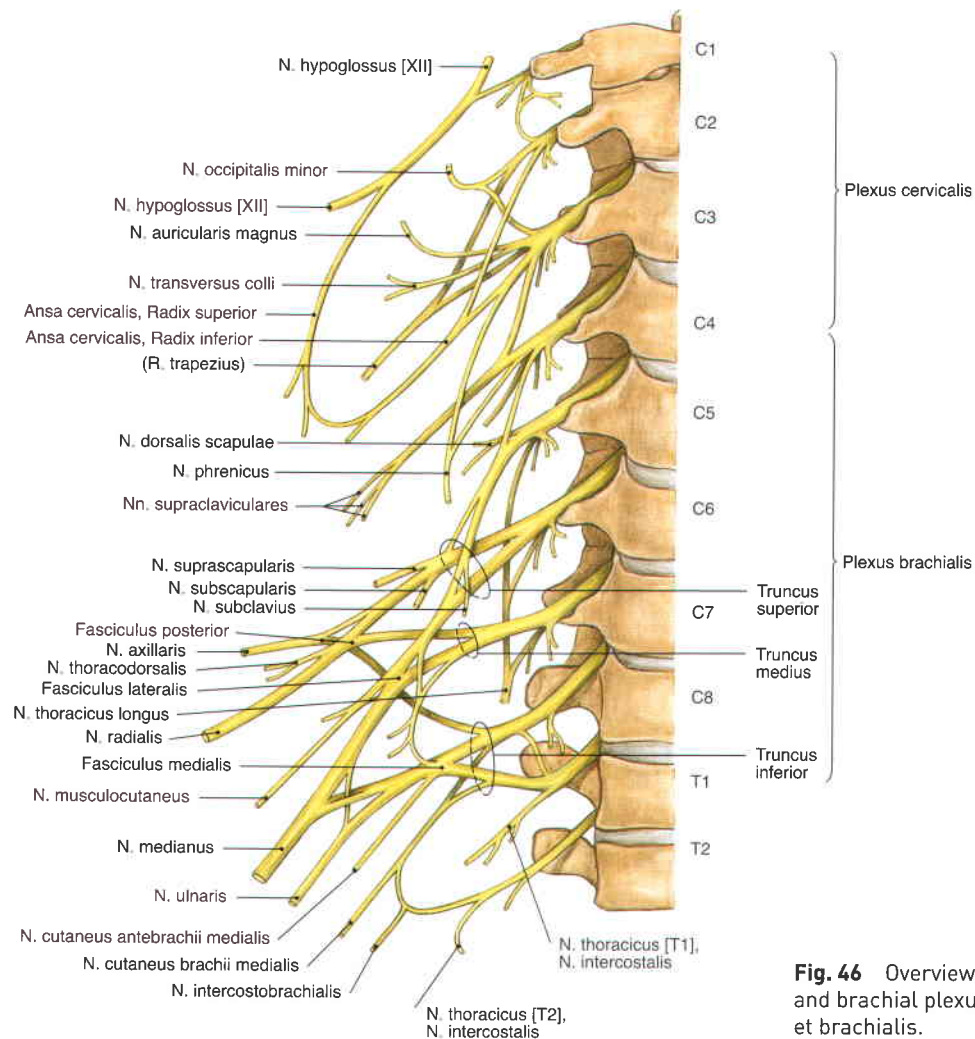


Fig. 46 Overview of the cervical and brachial plexus, Plexus cervicalis et brachialis.

Peripheral nervous system

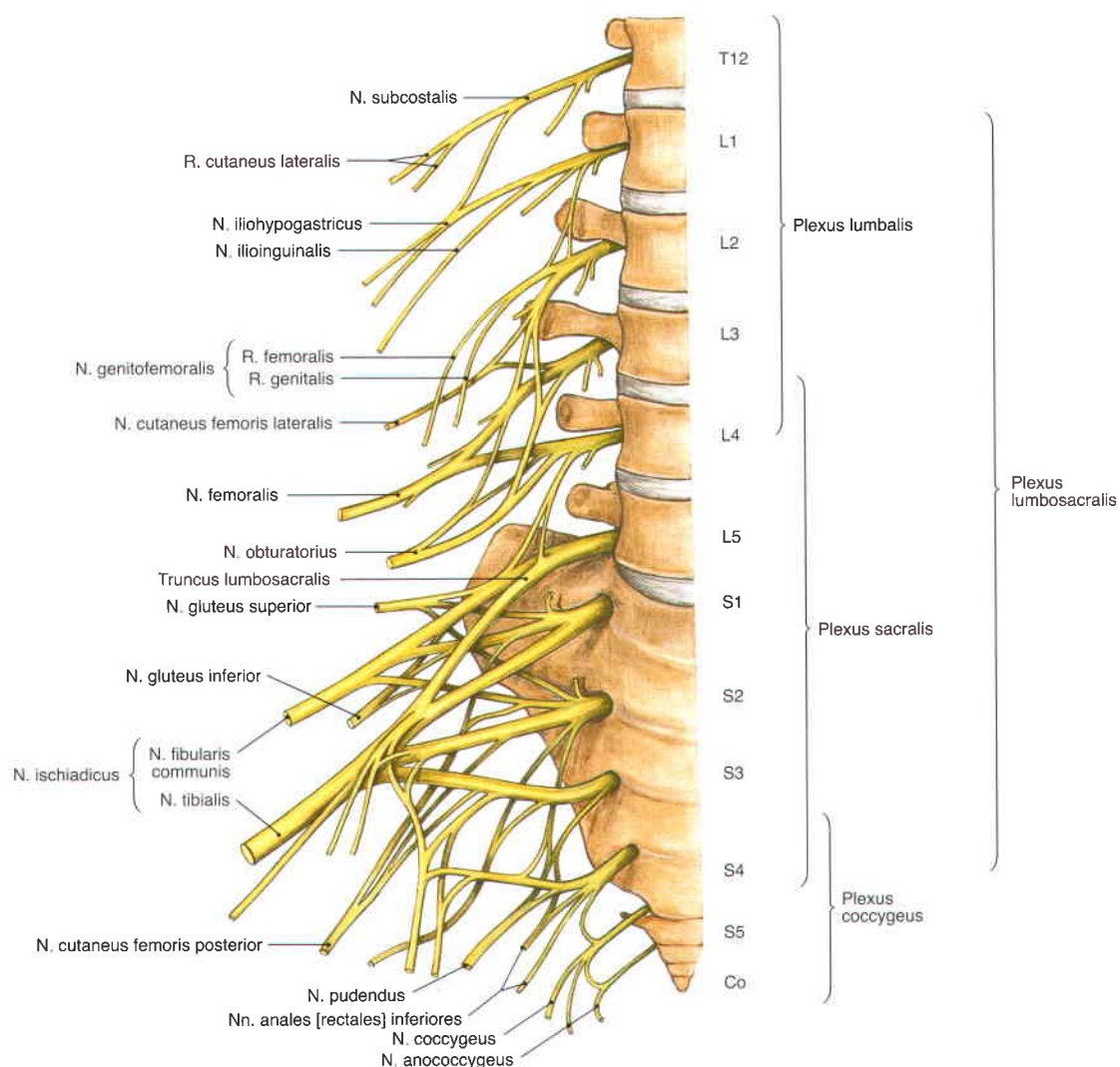


Fig. 47 Overview of the lumbosacral plexus, Plexus lumbosacralis [Plexus lumbalis et sacralis], and the coccygeal plexus, Plexus coccygeus.

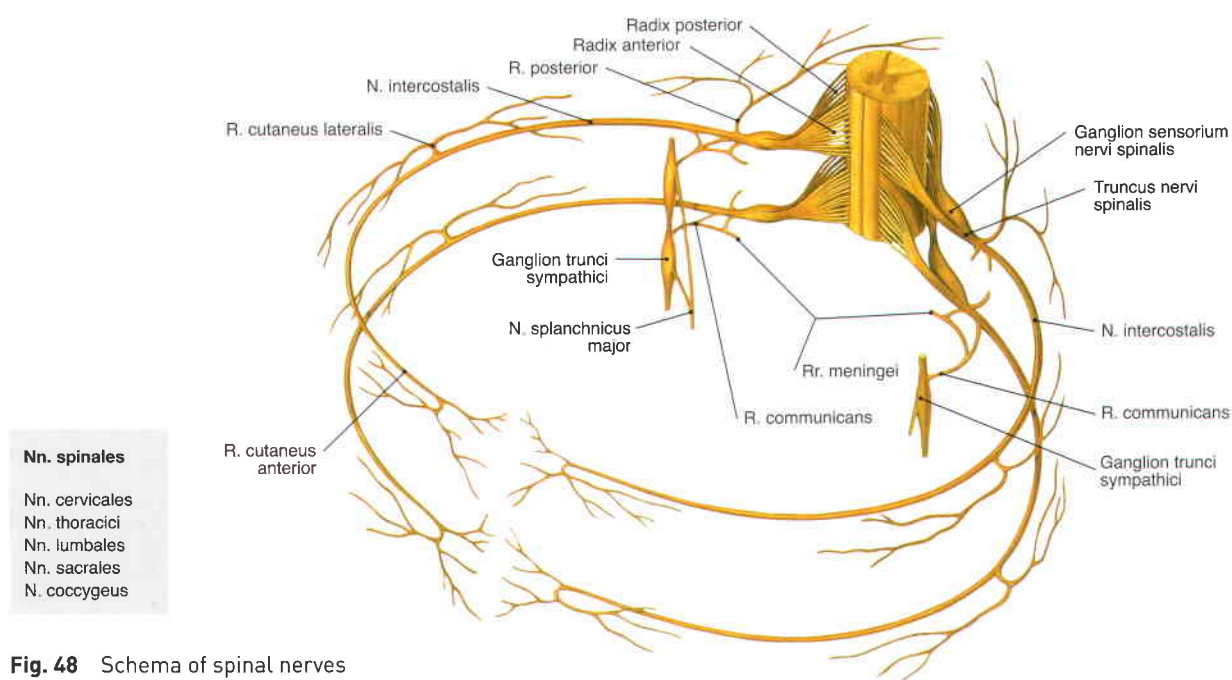
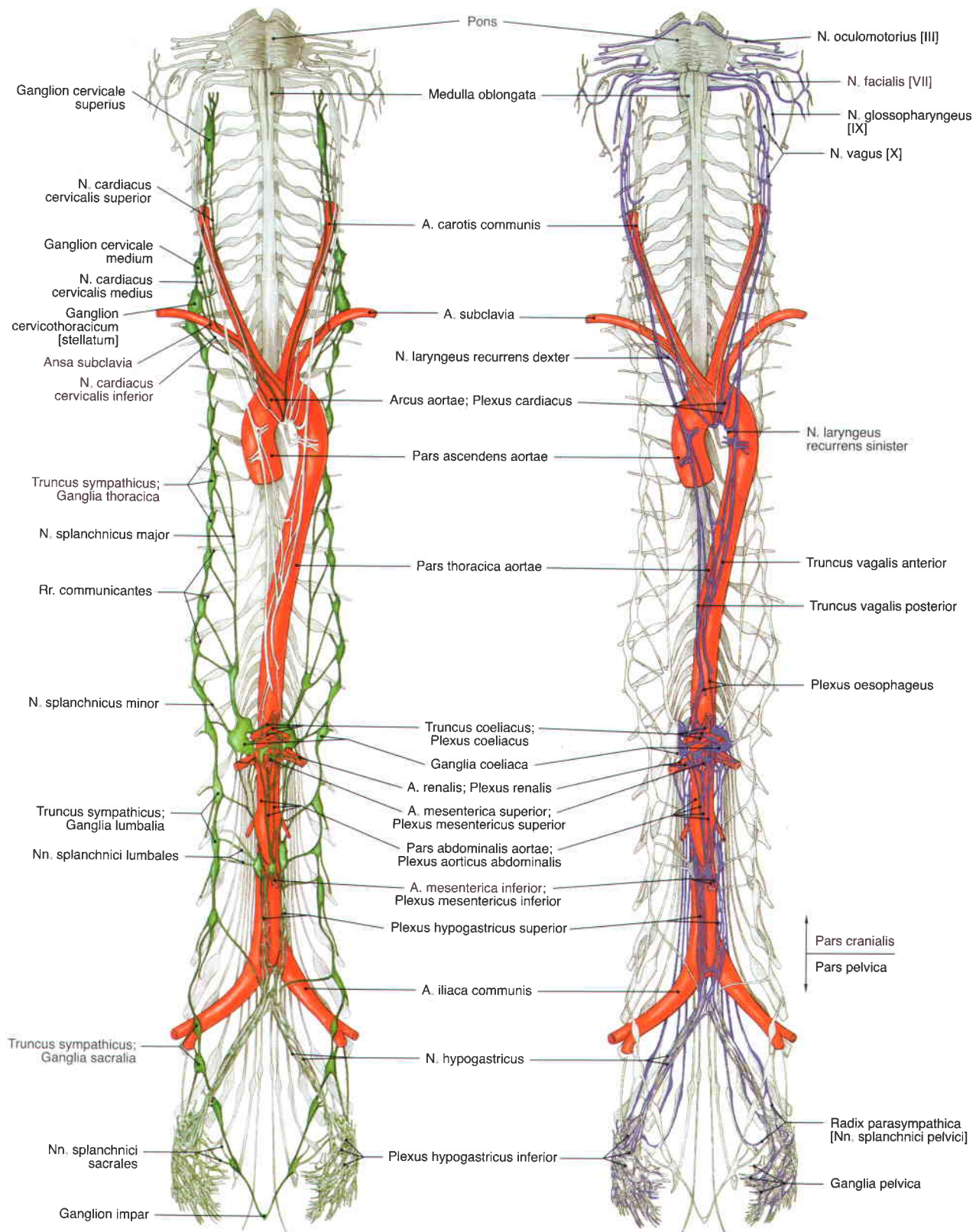


Fig. 48 Schema of spinal nerves exemplified by two thoracic nerves.

Autonomous nervous system



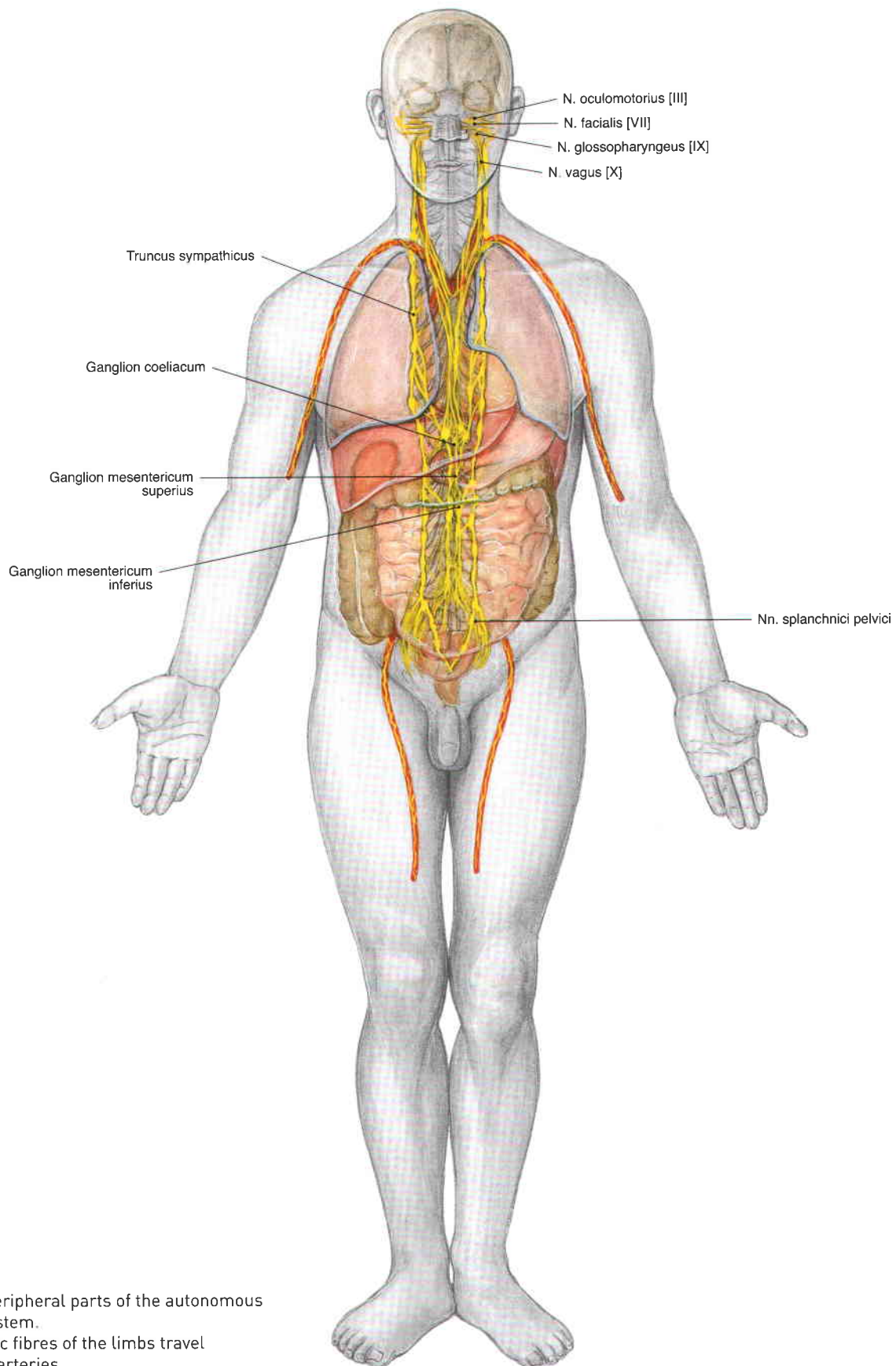
Pars sympathica**Pars parasympathica**

Fig. 51 Peripheral parts of the autonomous nervous system.
Sympathetic fibres of the limbs travel along with arteries.

Pars sympathica

Pars parasympathica

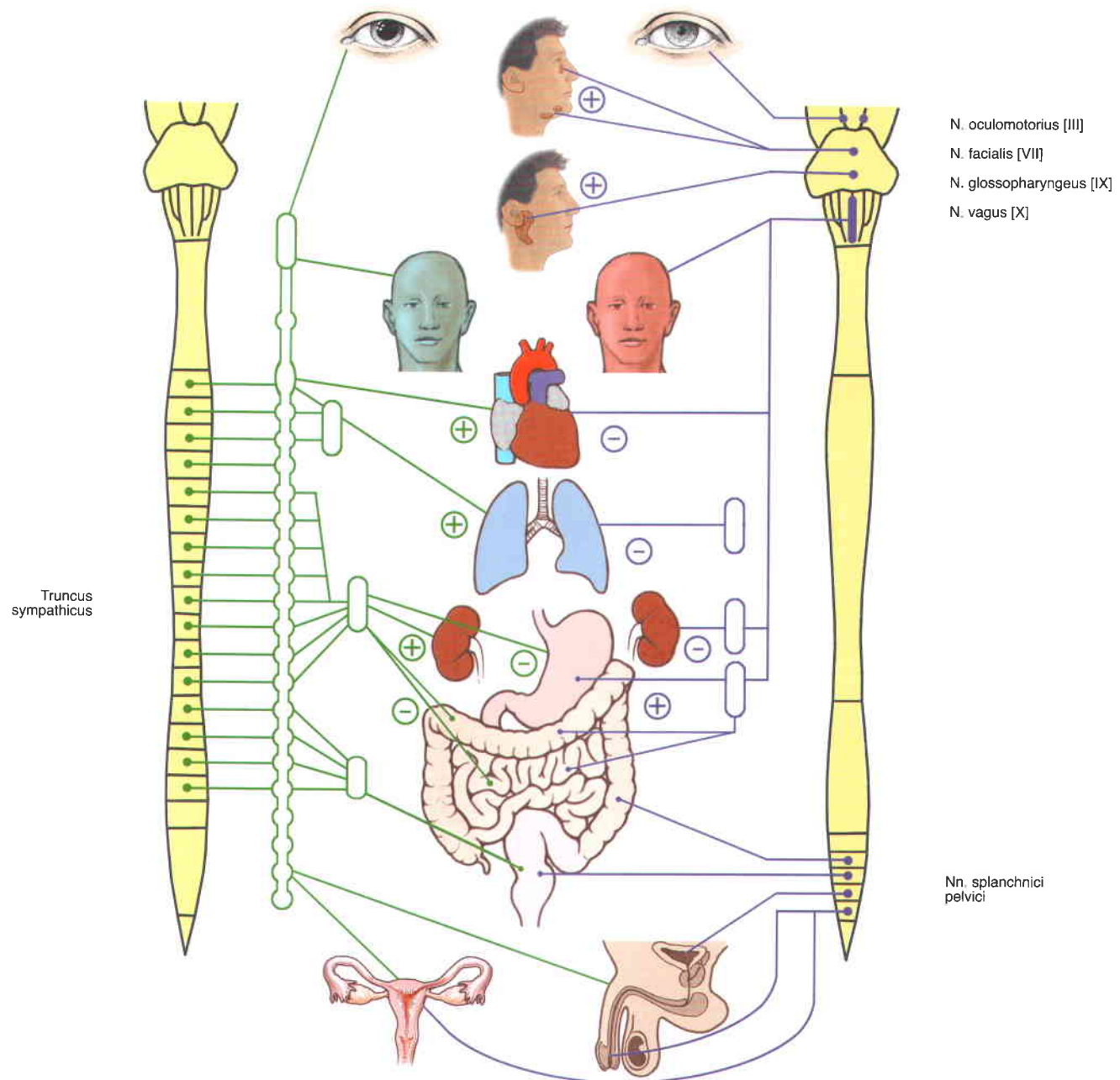


Fig. 52 Overview of the functions of the autonomous nervous system.

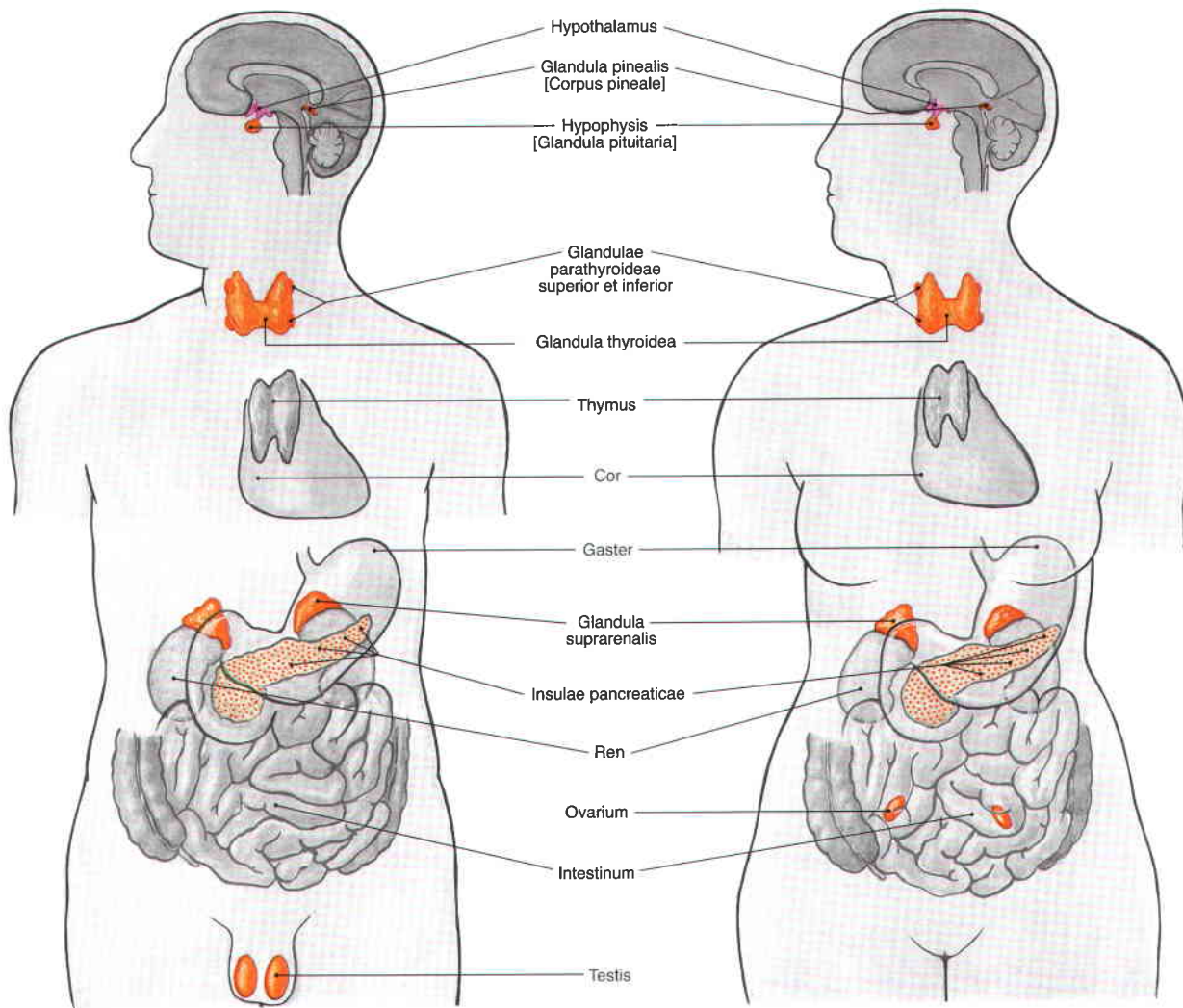


Fig. 53 Endocrine organs of the male.

Fig. 54 Endocrine organs of the female.

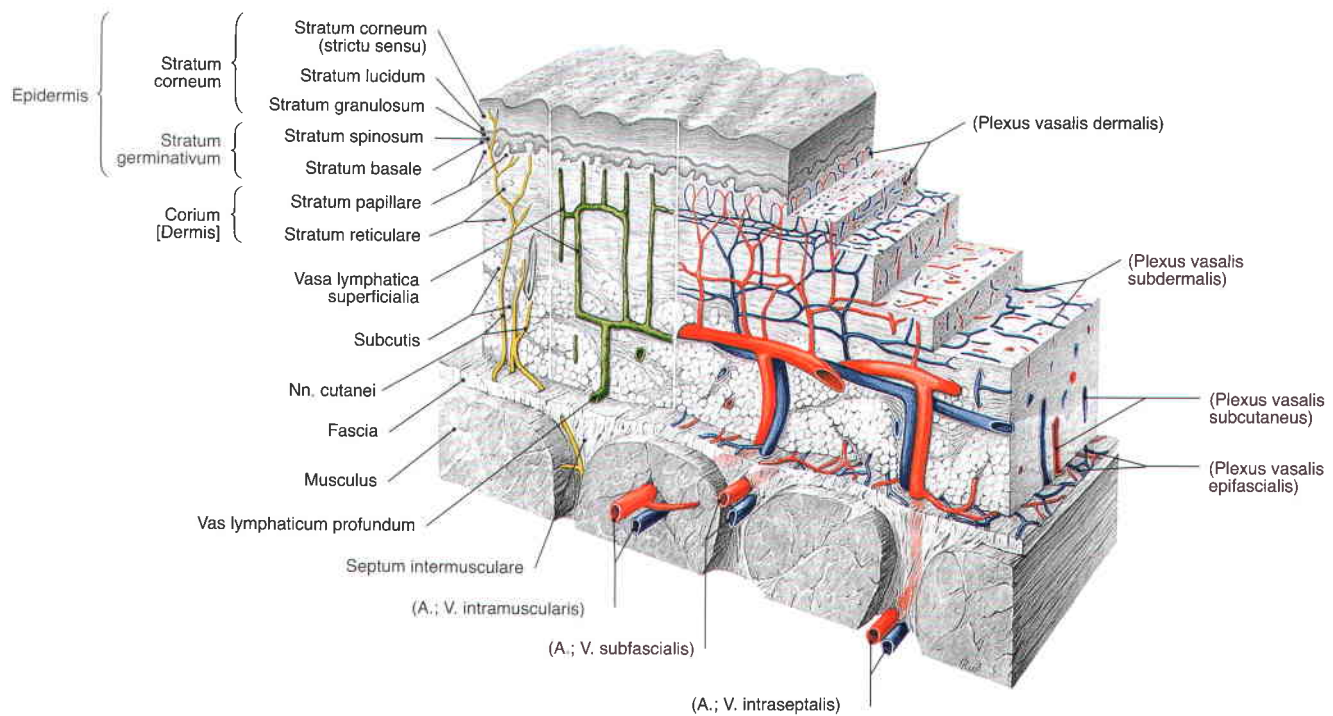


Fig. 55 Section through the skin; approximately 11-fold magnification.

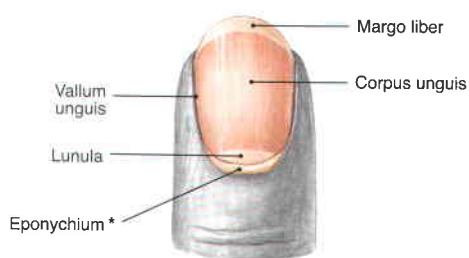


Fig. 56 Distal phalanx of a digit with fingernail.

* The epidermis of the nail is also known as cuticle.

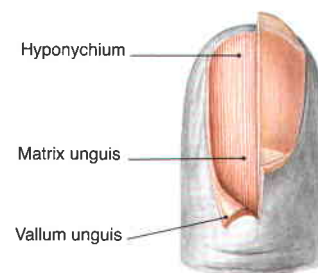


Fig. 57 Distal phalanx of a digit; the nail has been partly removed.

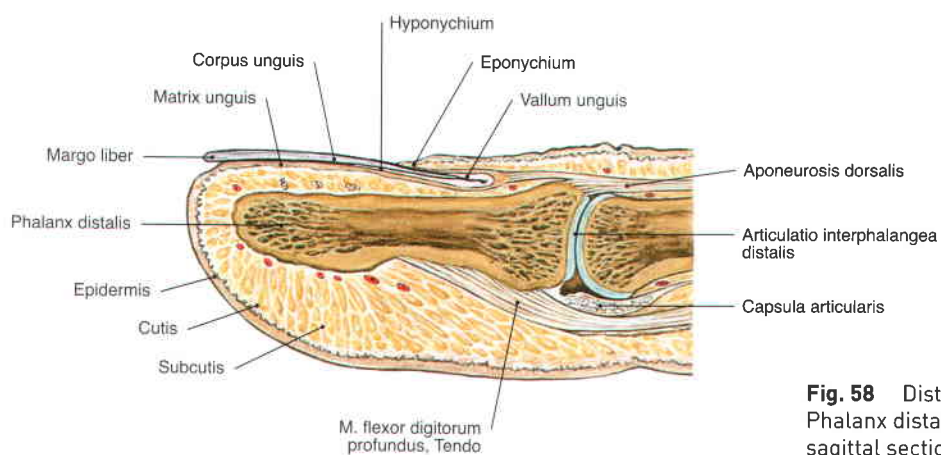


Fig. 58 Distal phalanx of a digit, Phalanx distalis; sagittal section.

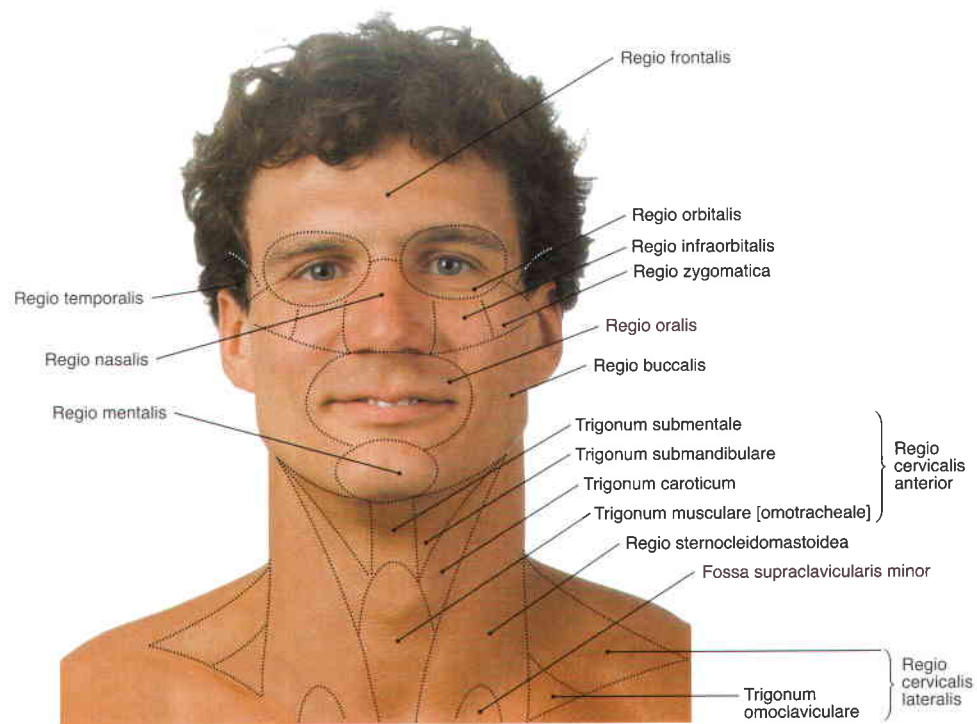
Regions

Fig. 59 Regions of the head and the neck, *Regiones capitis et colli*.

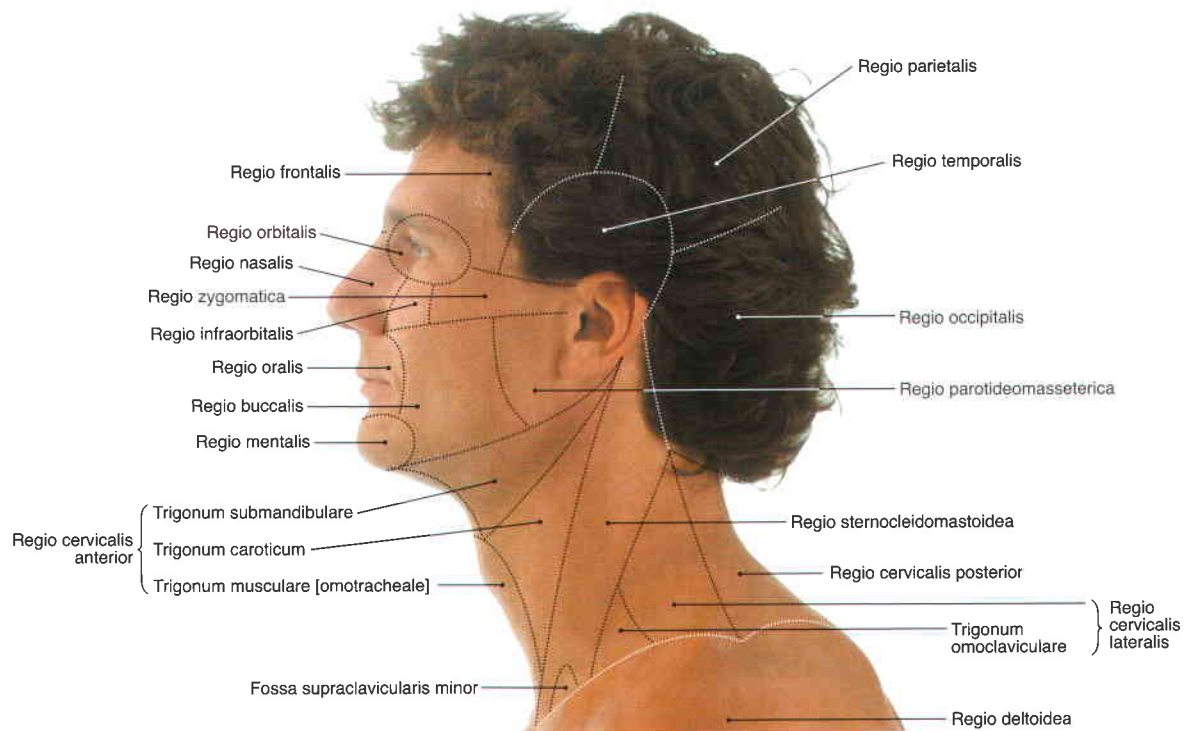


Fig. 60 Regions of the head and the neck, *Regiones capitis et colli*.

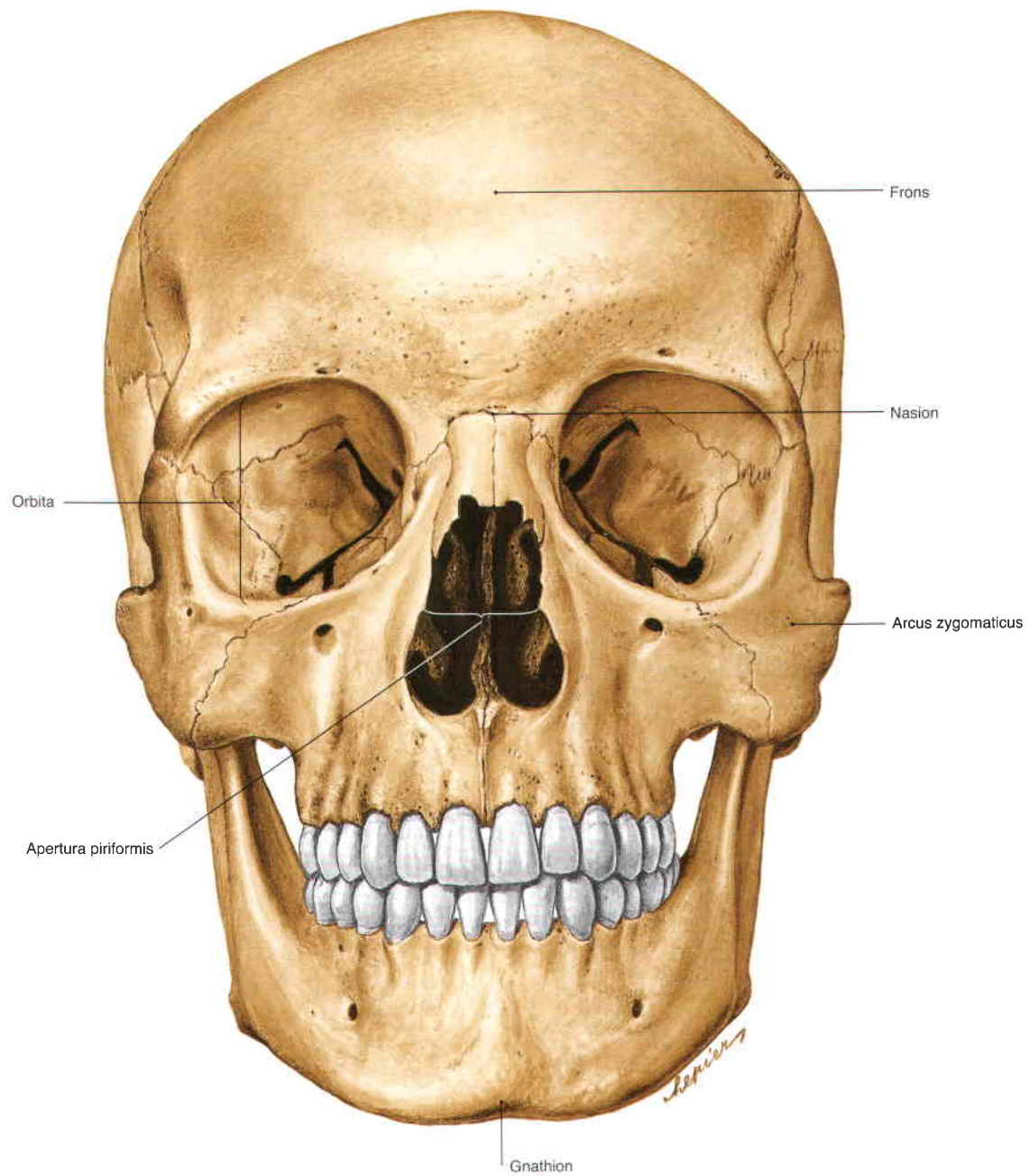
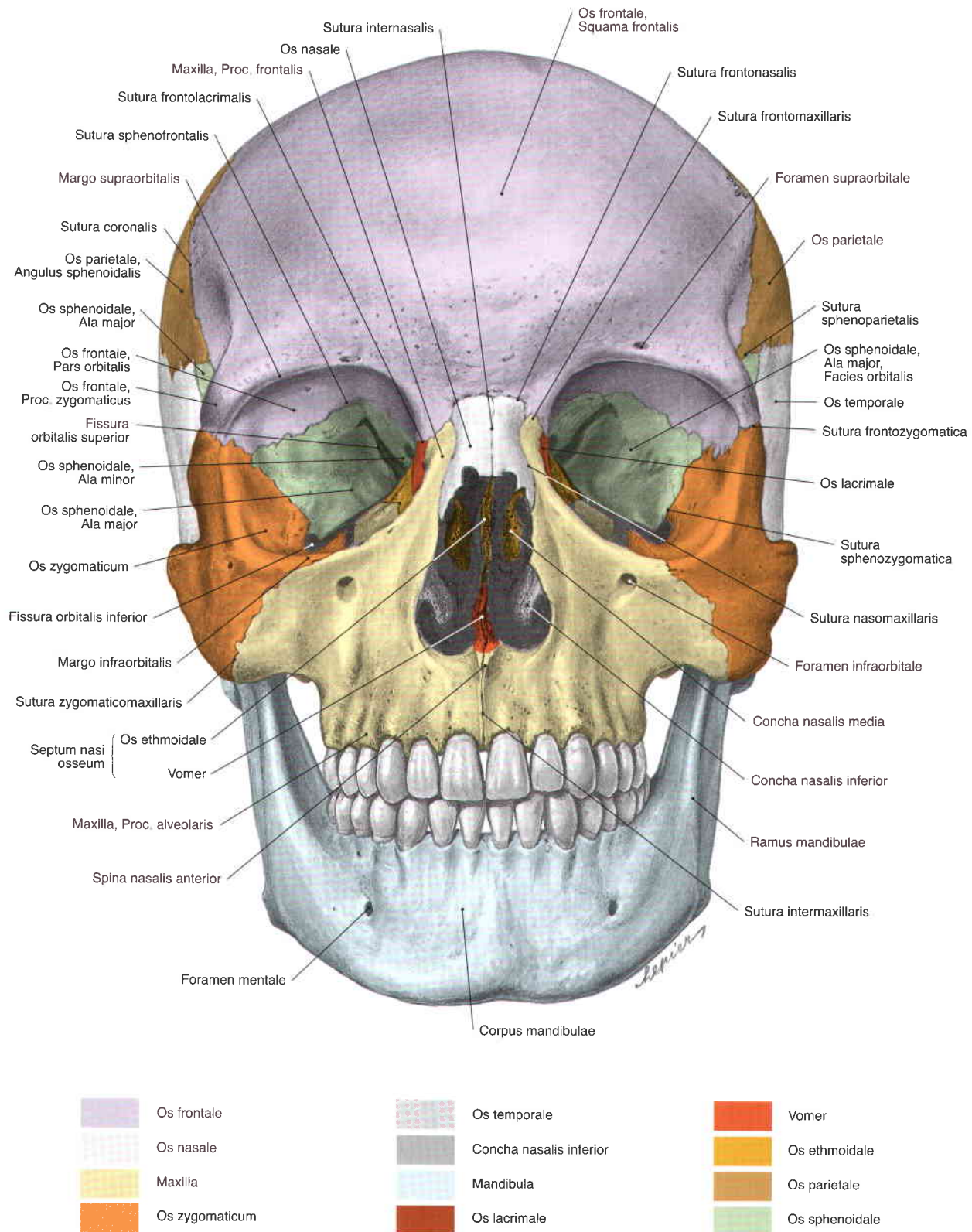


Fig. 61 Skull, Cranium.

Bones of the skull**Fig. 62** Bones of the skull, Ossa cranii.

Bones of the skull

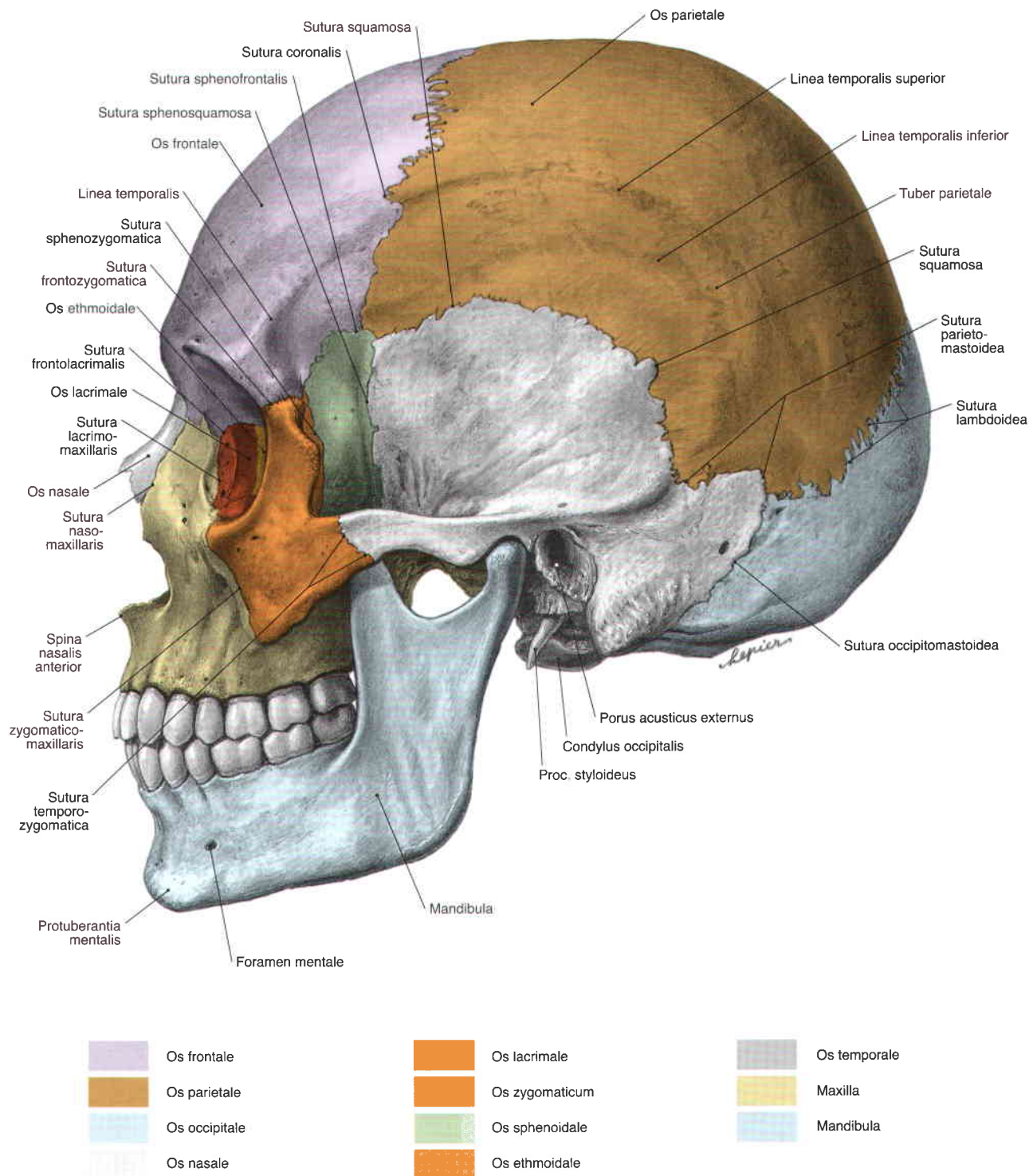


Fig. 63 Bones of the skull, Ossa cranii.

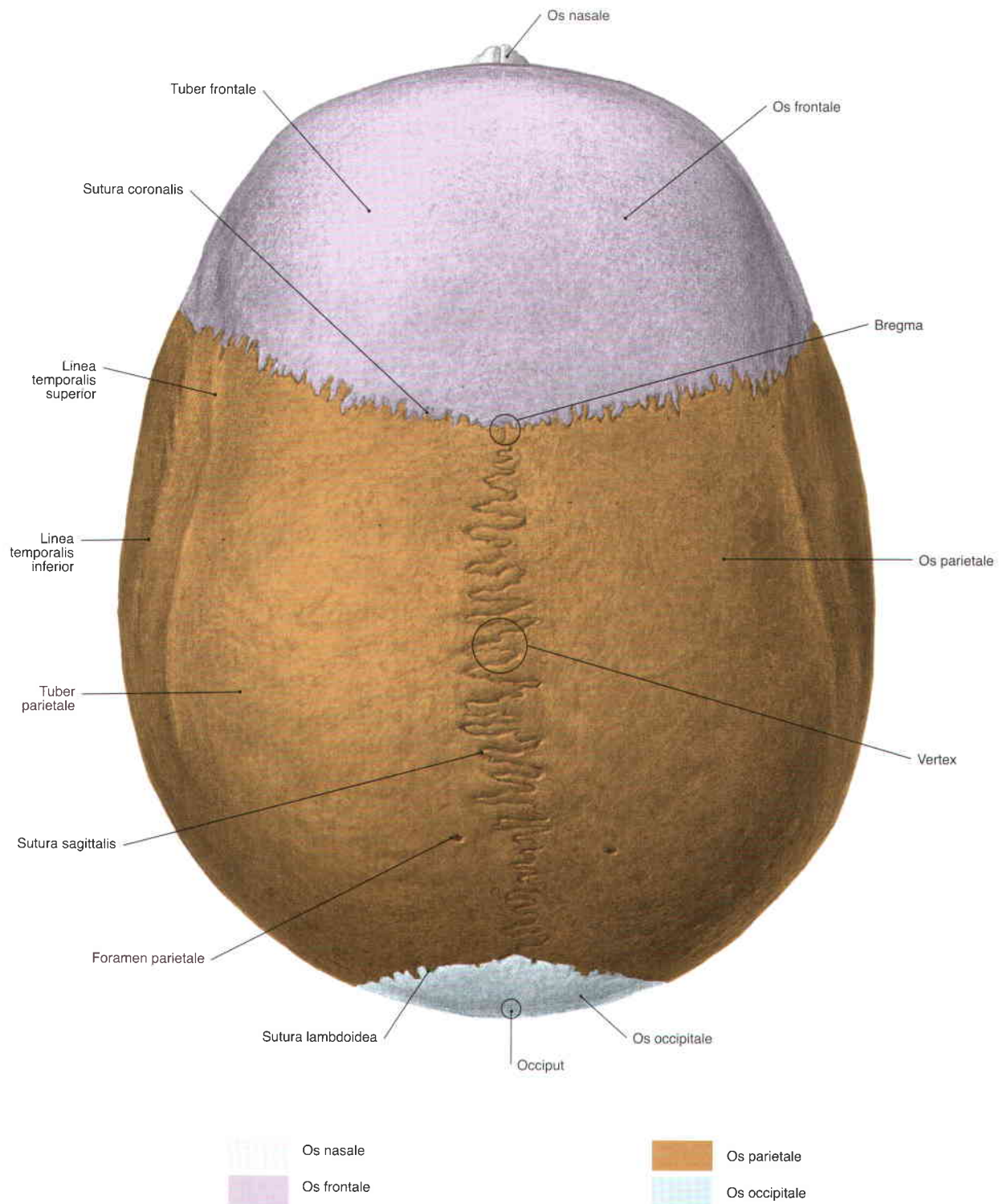
Bones of the skull

Fig. 64 Bones of the skull, Ossa cranii; superior view.

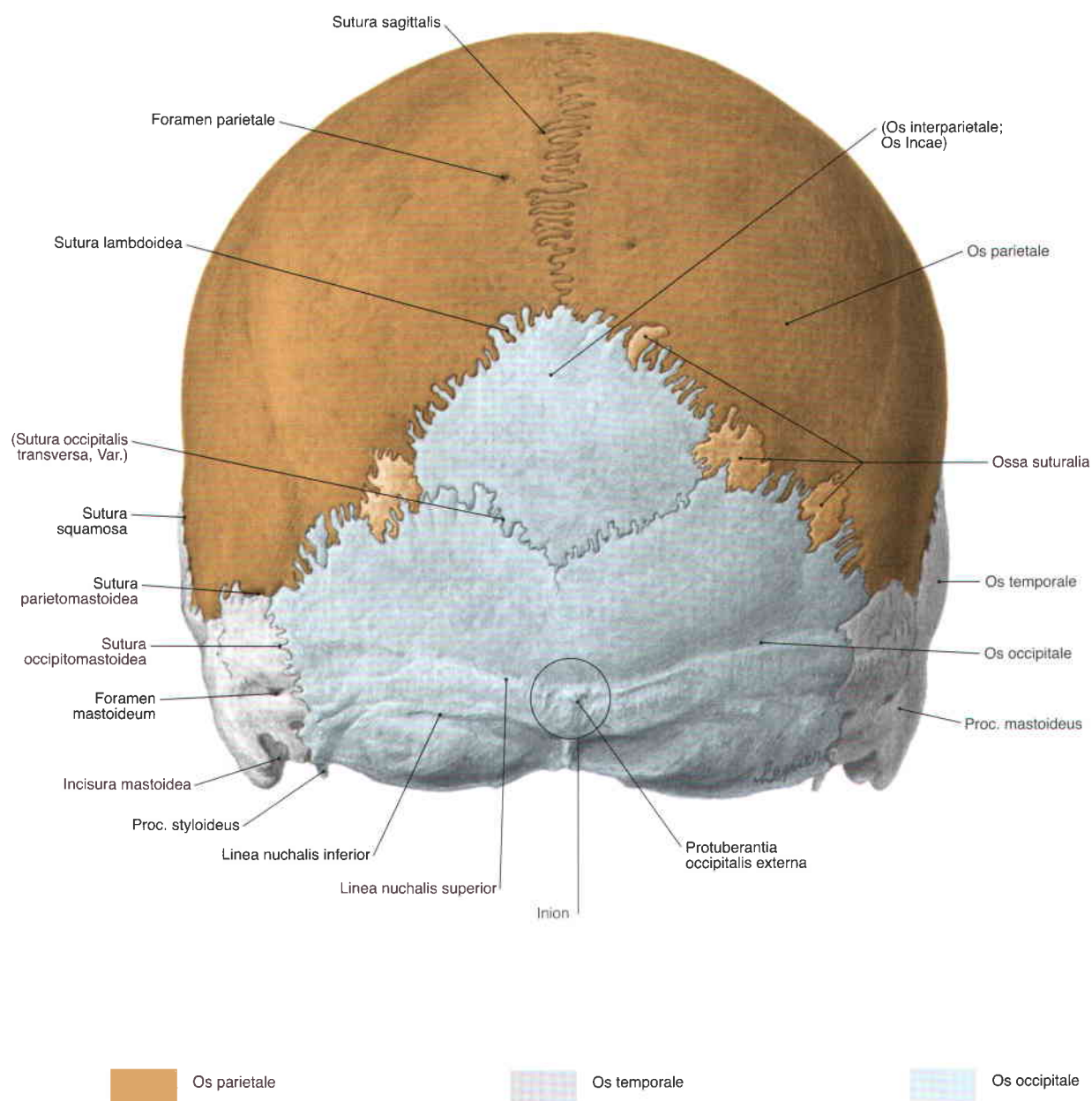
Bones of the skull

Fig. 65 Bones of the skull, Ossa cranii; posterior view.

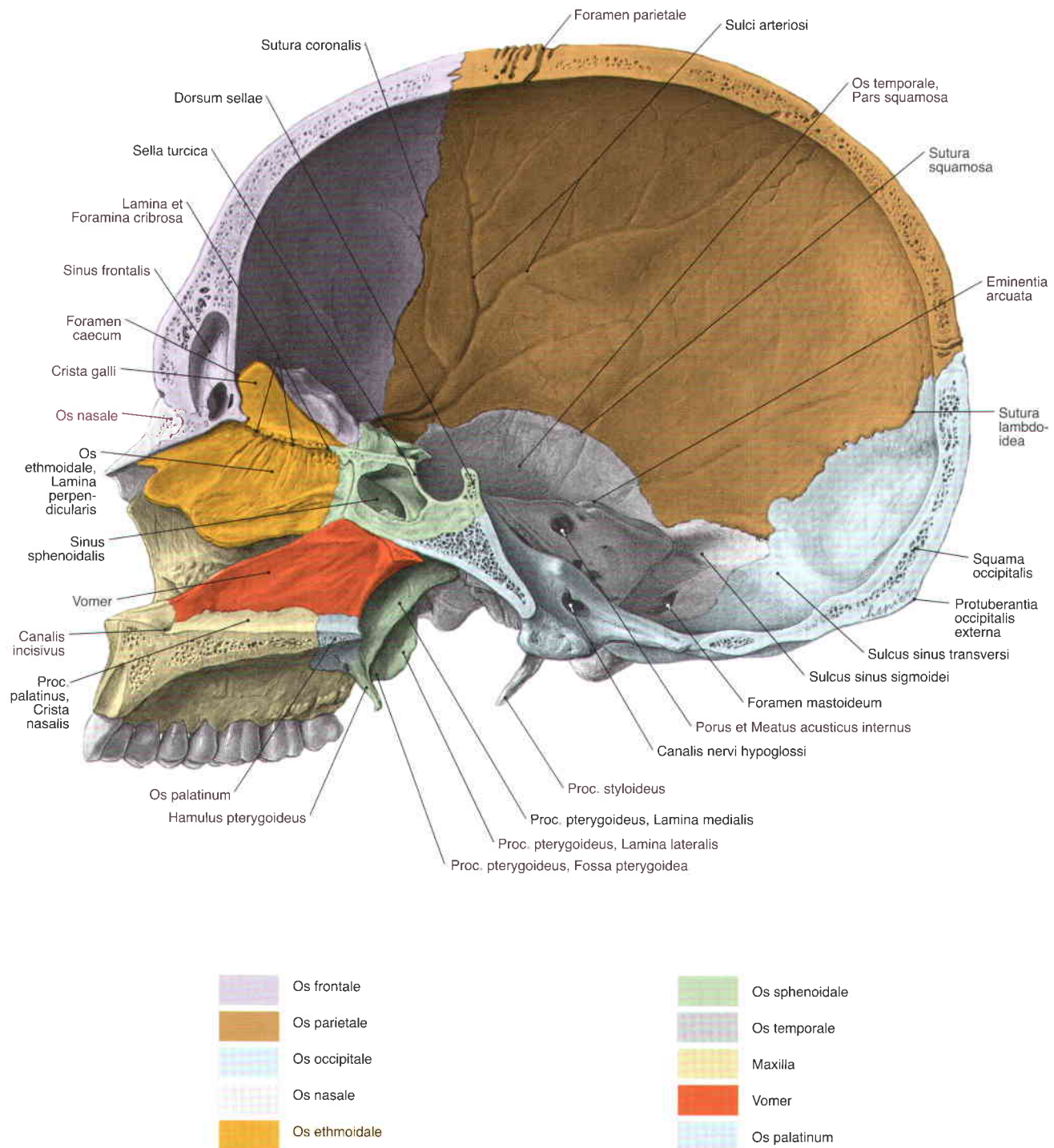
Bones of the skull

Fig. 66 Bones of the skull, Ossa cranii; medial view.

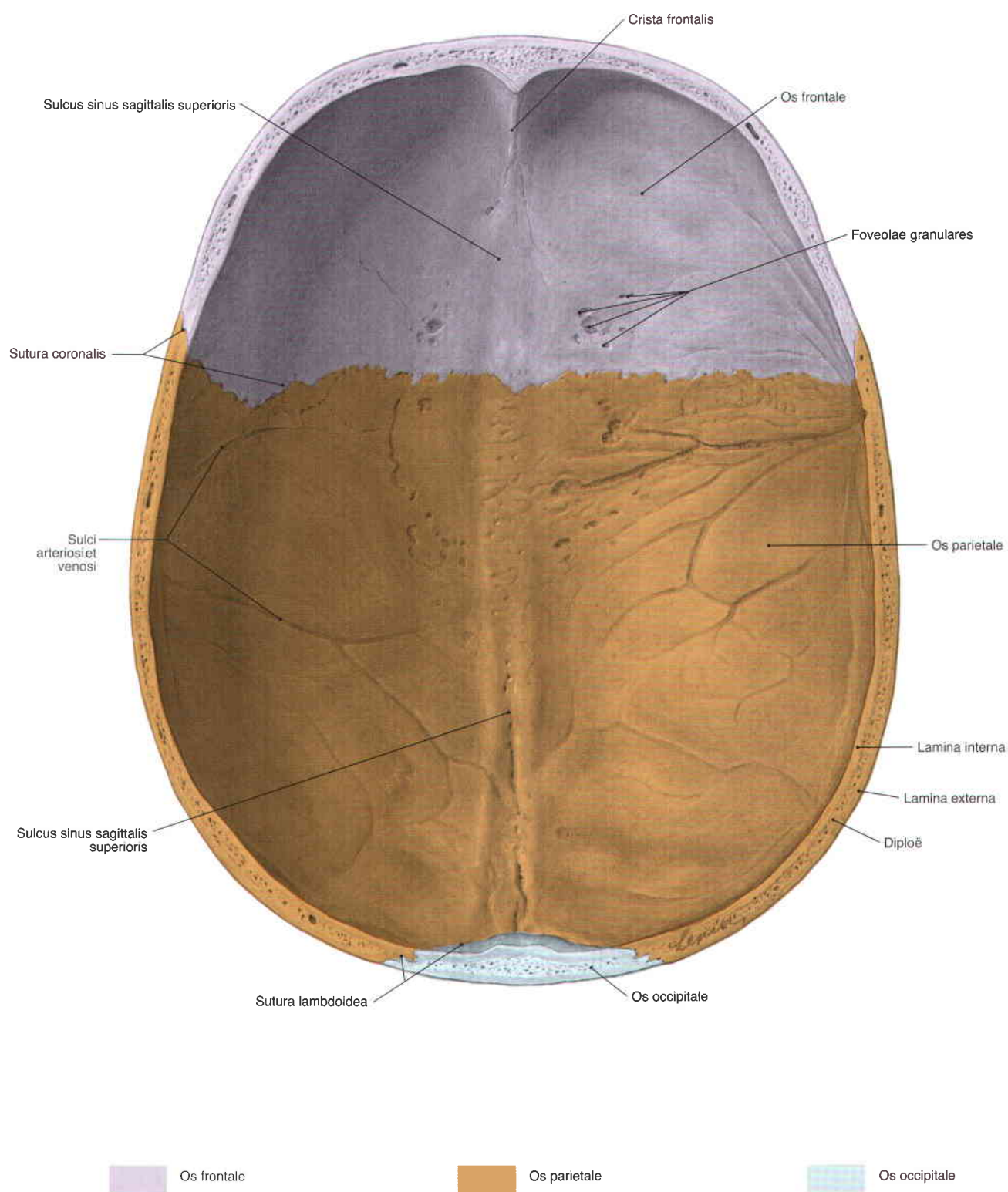
Bones of the skull

Fig. 67 Calvaria, Calvaria;
internal aspect.

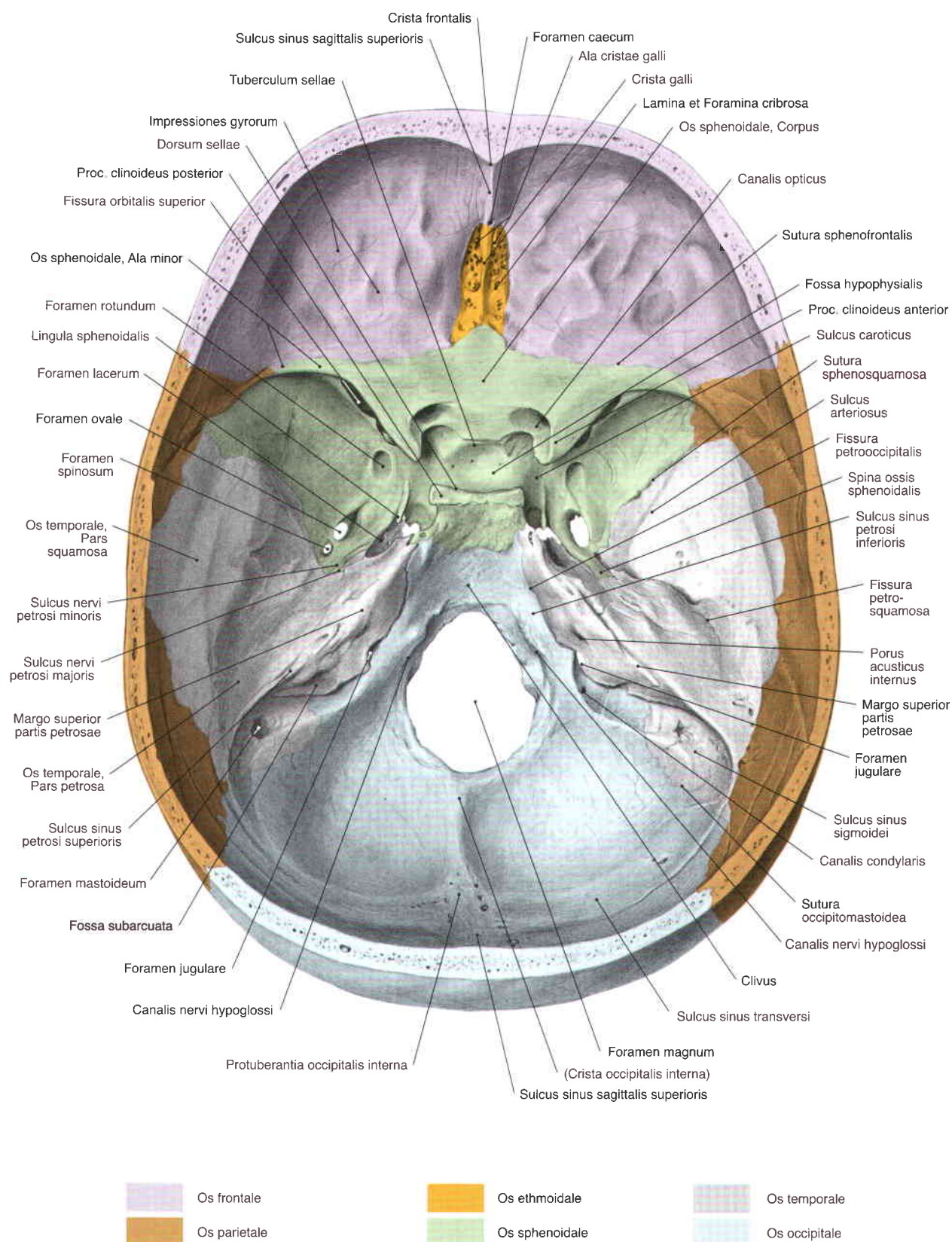
Bones of the skull

Fig. 68 Internal surface of the base of the skull, Basis cranii interna.

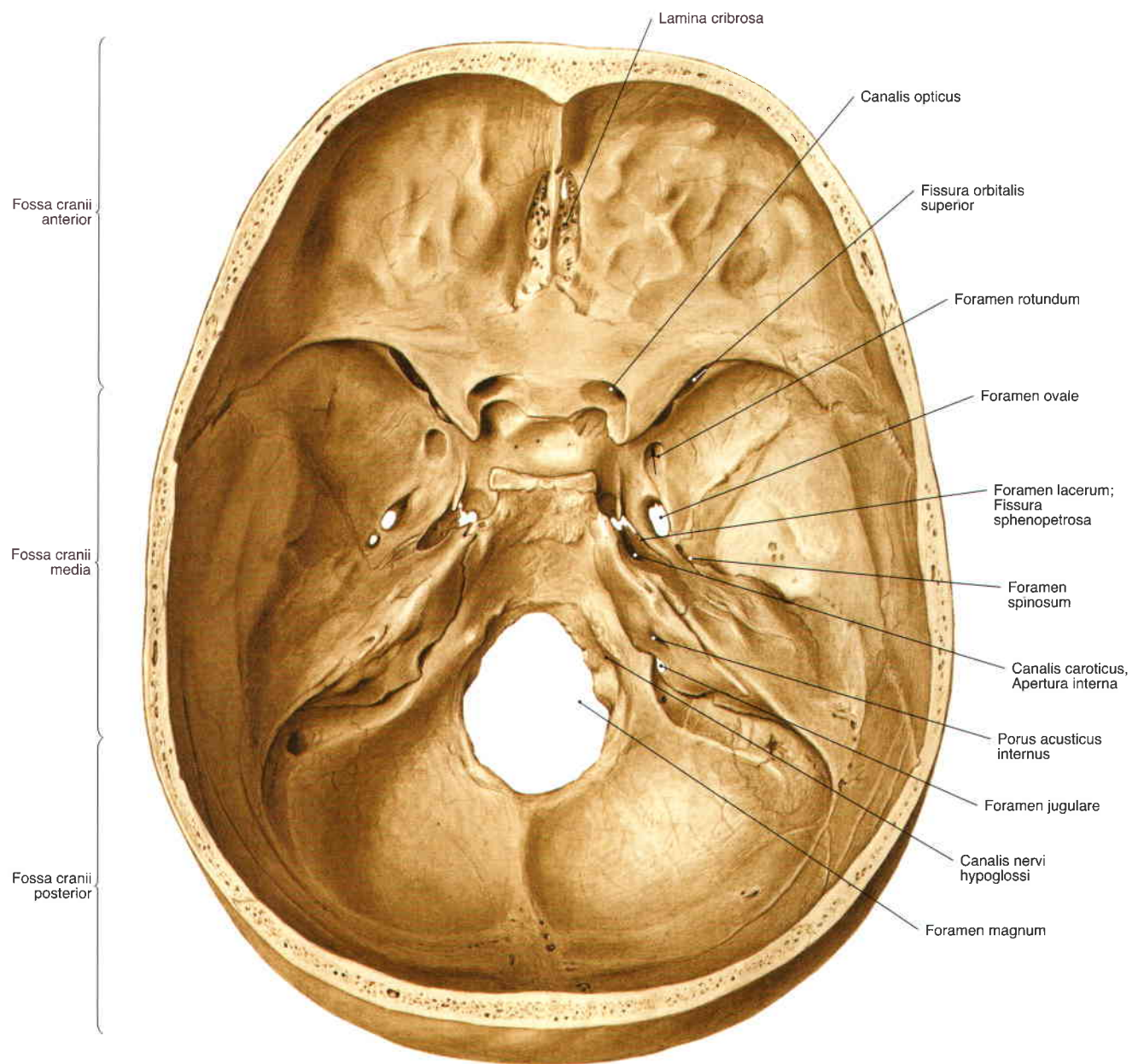


Fig. 69 Internal surface of the base of the skull, Basis cranii interna, and foramina, Foramina.

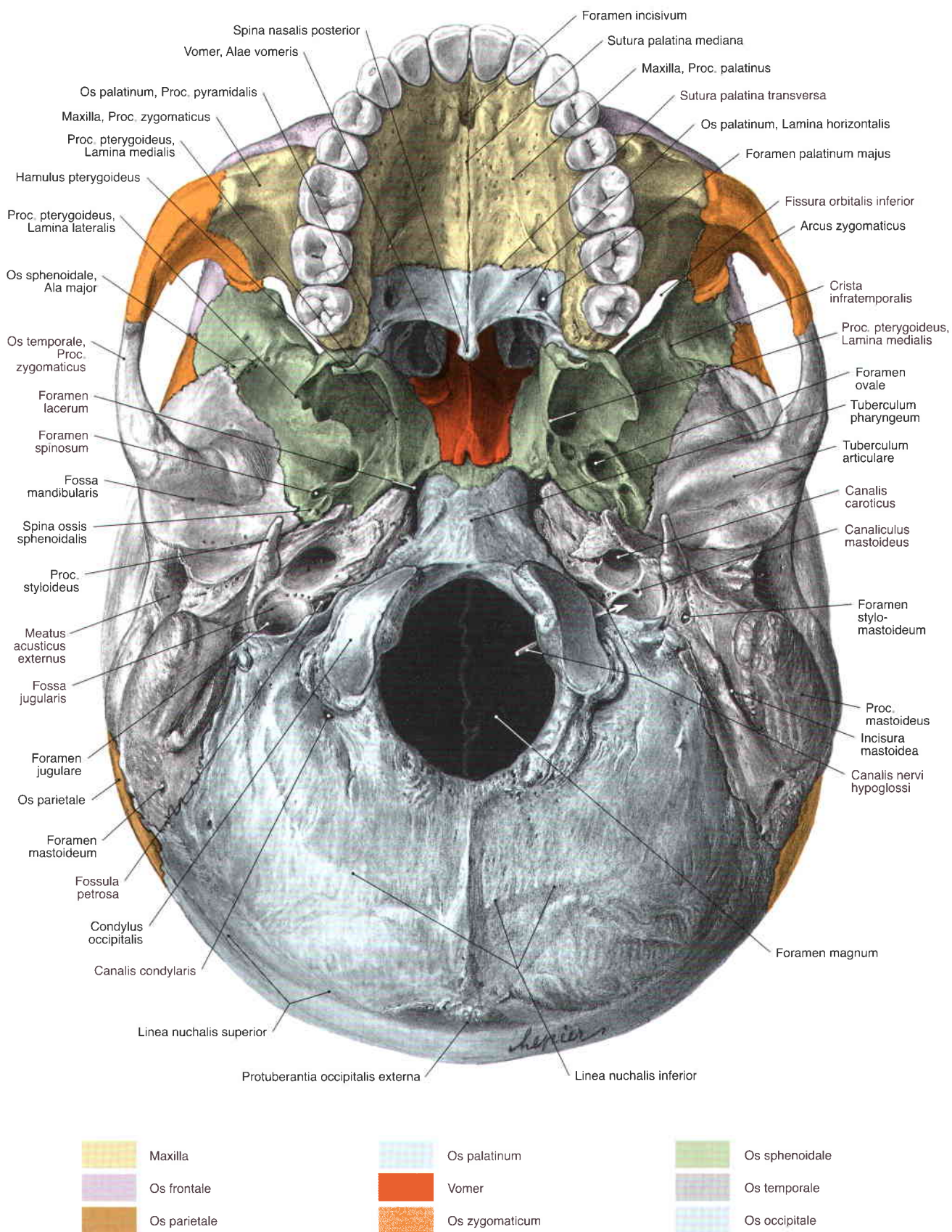
Bones of the skull

Fig. 70 External surface of the base of the skull, Basis cranii externa.

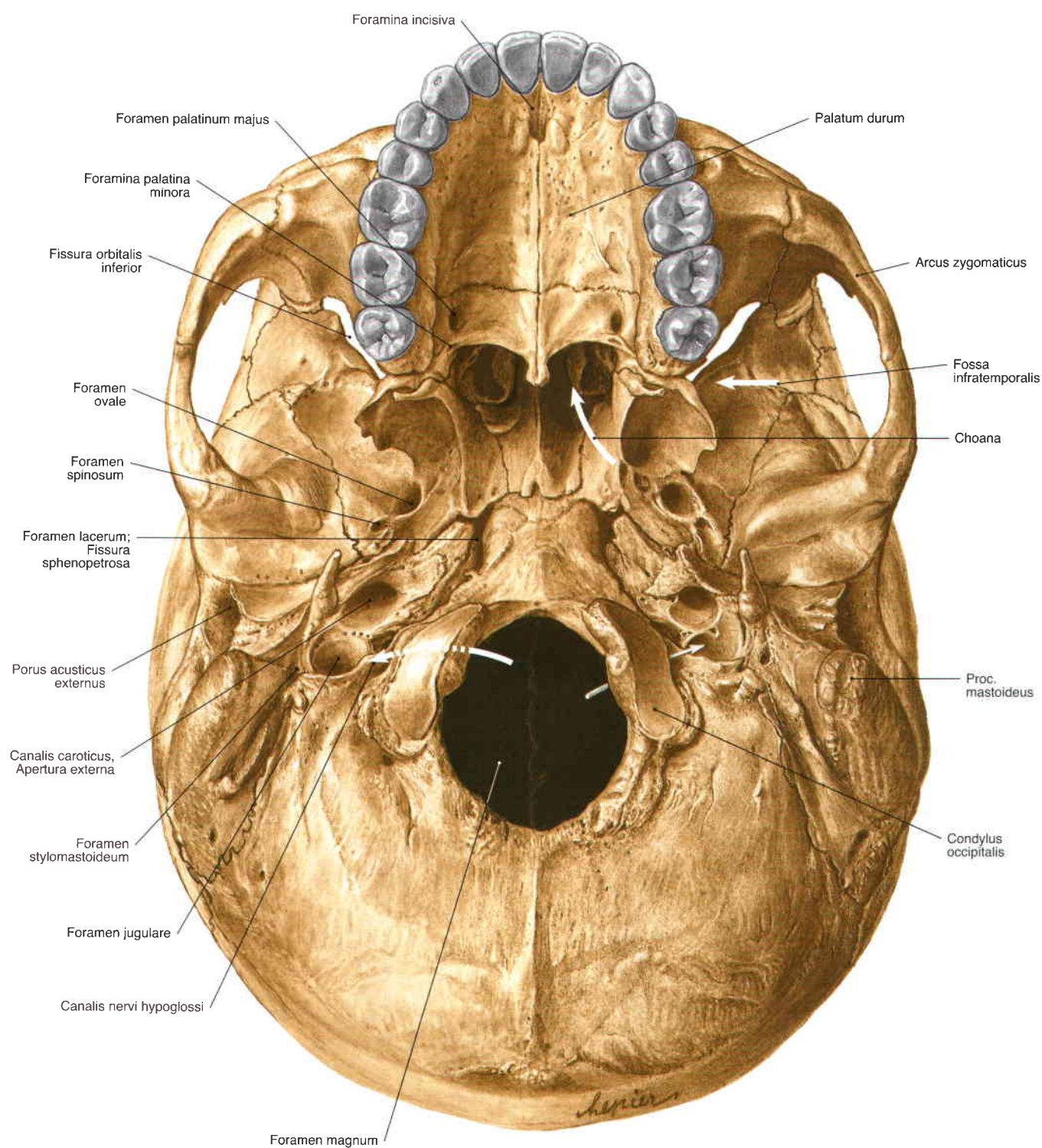


Fig. 71 External surface of the base of the skull, Basis cranii externa, and foramina, Foramina.

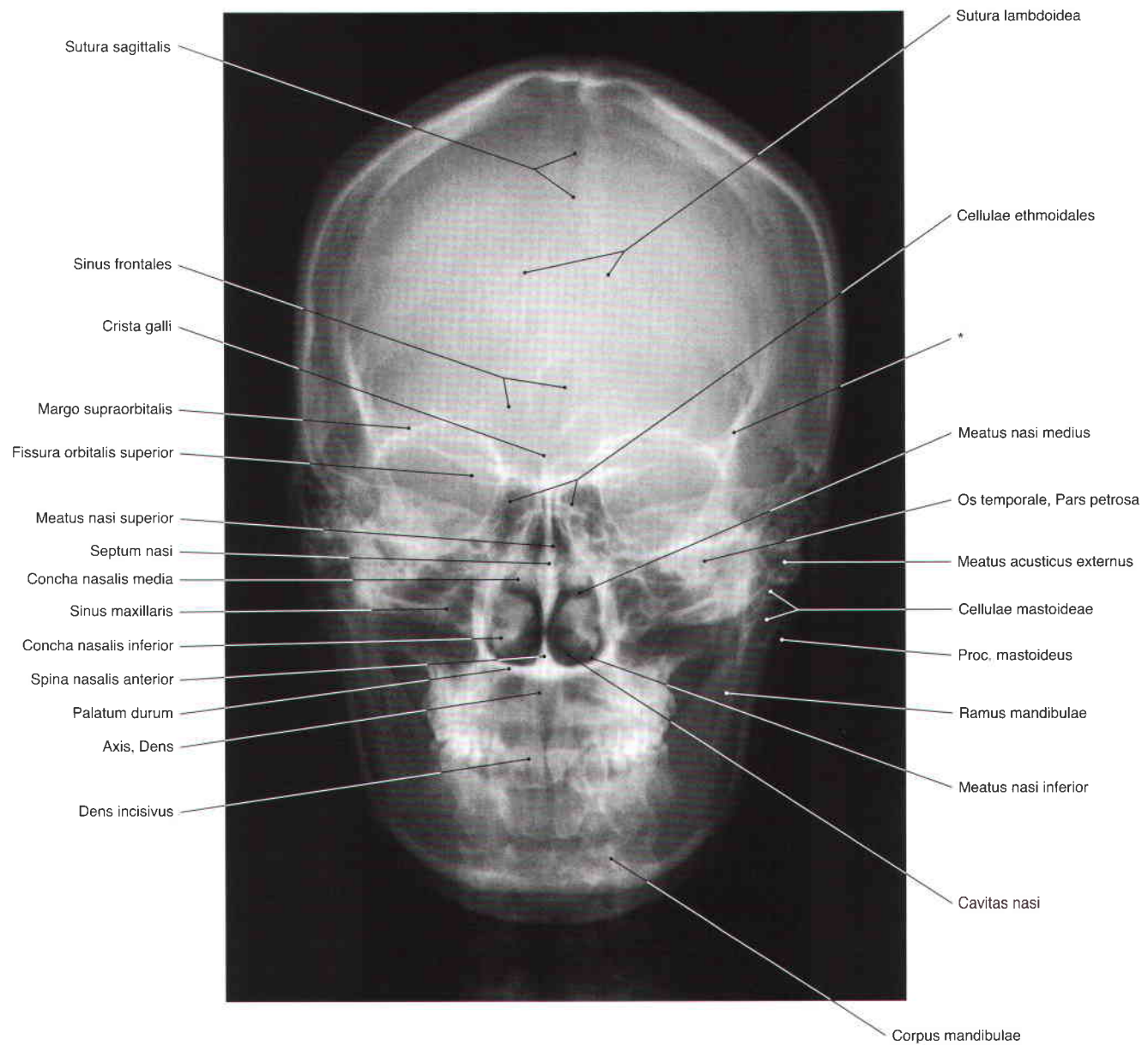
Skull, radiography

Fig. 72 Skull, Cranium;
AP-teleradiograph.

* Innominate line, Linea innominata, a projection line
without anatomical correlate

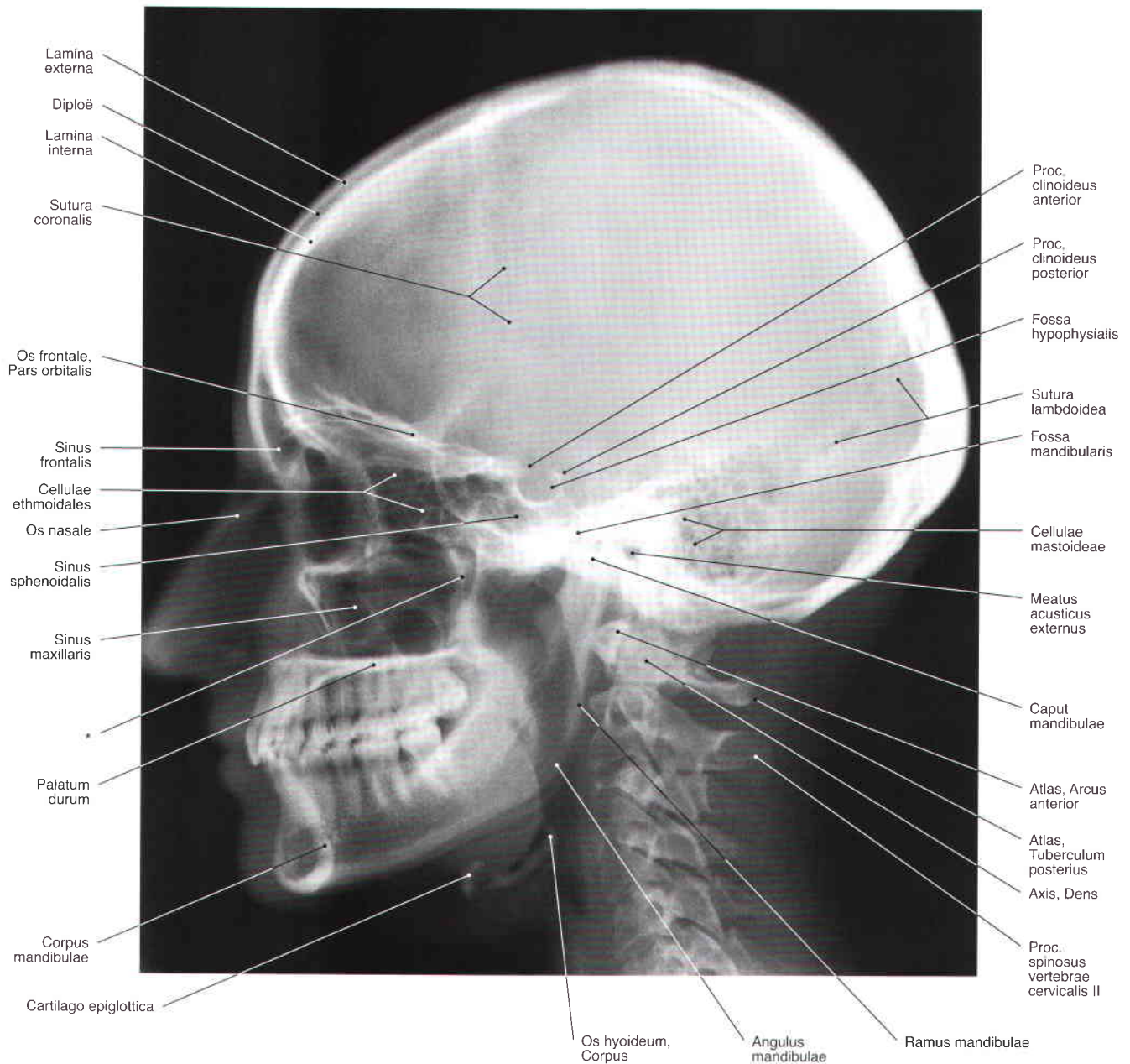
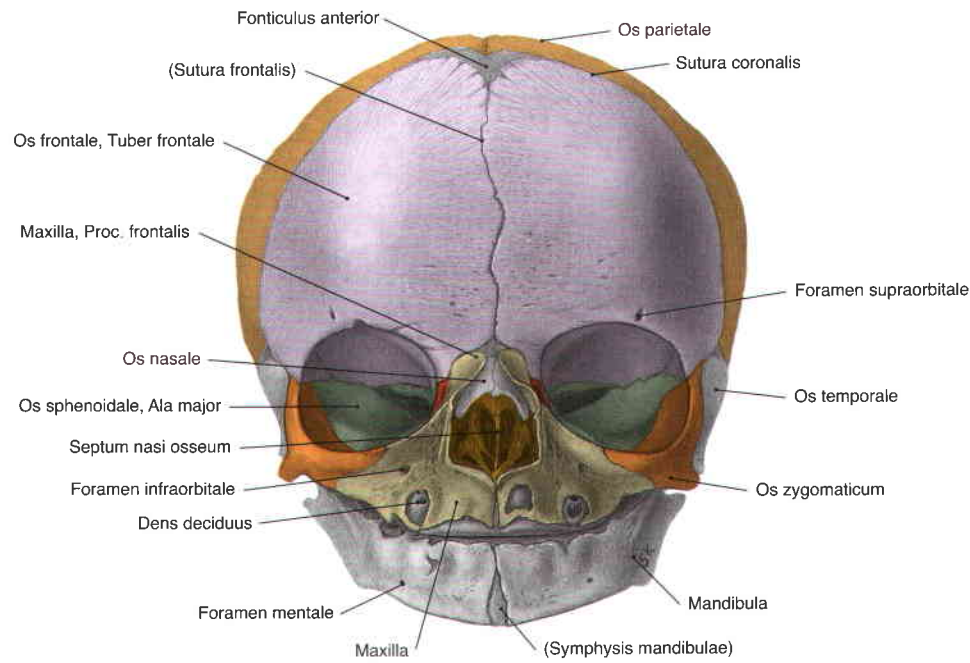
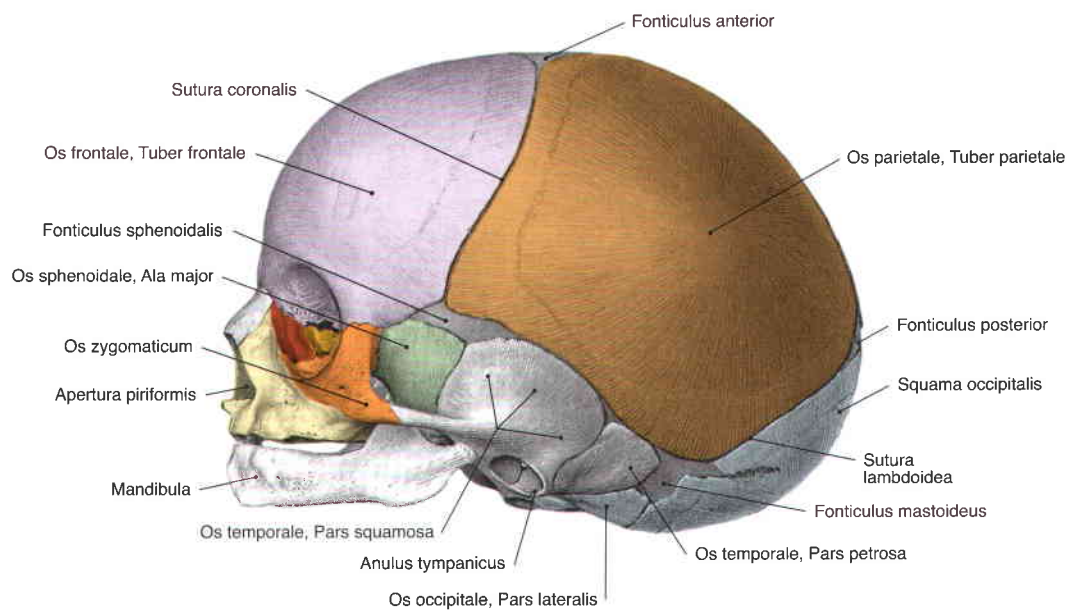
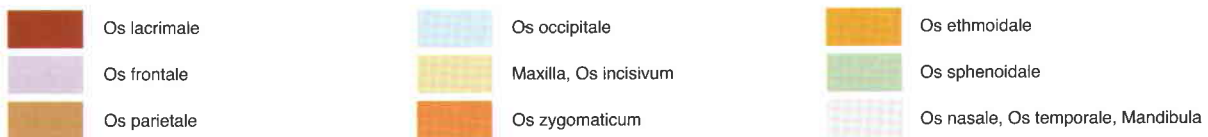


Fig. 73 Skull, Cranium;
lateral teleradiograph.

* Posterior wall of the maxillary sinus

Skull, development**Fig. 74** Skull, Cranium, of a neonate.**Fig. 75** Skull, Cranium, of a neonate.

Skull, development

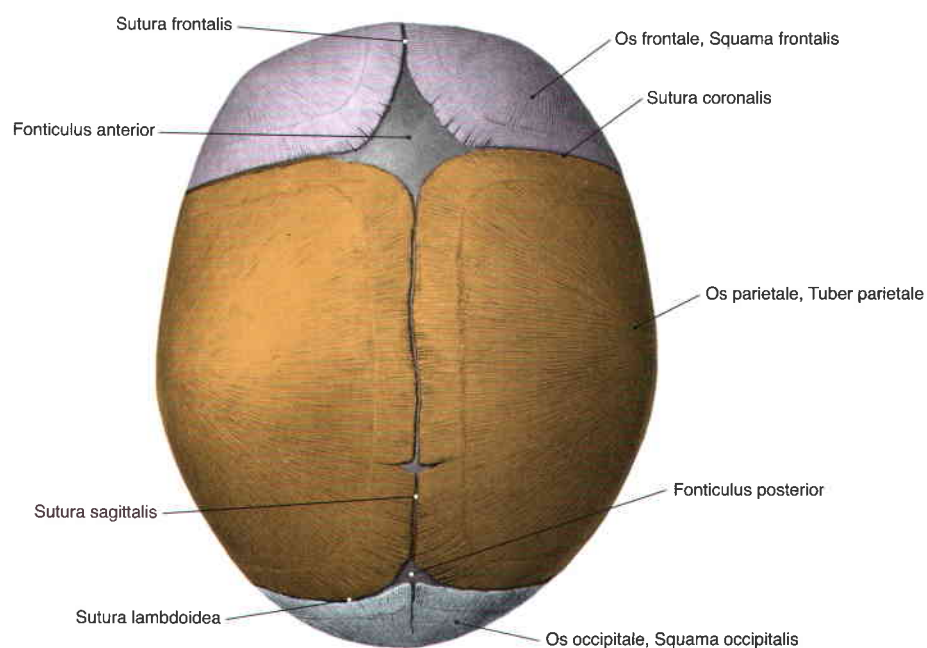


Fig. 76 Skull, Cranium, of a neonate.

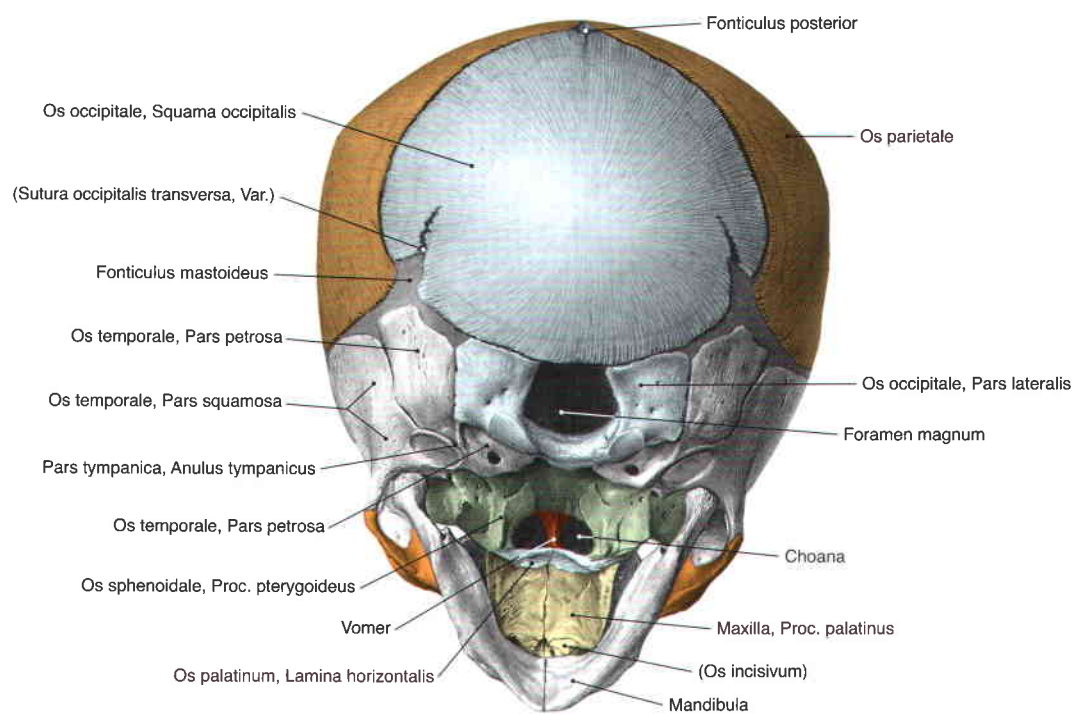
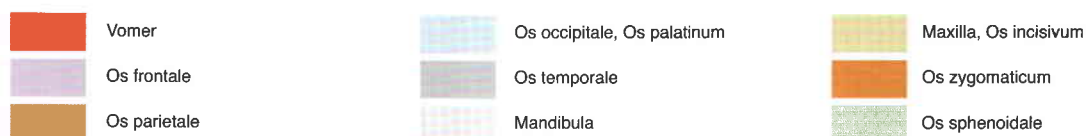
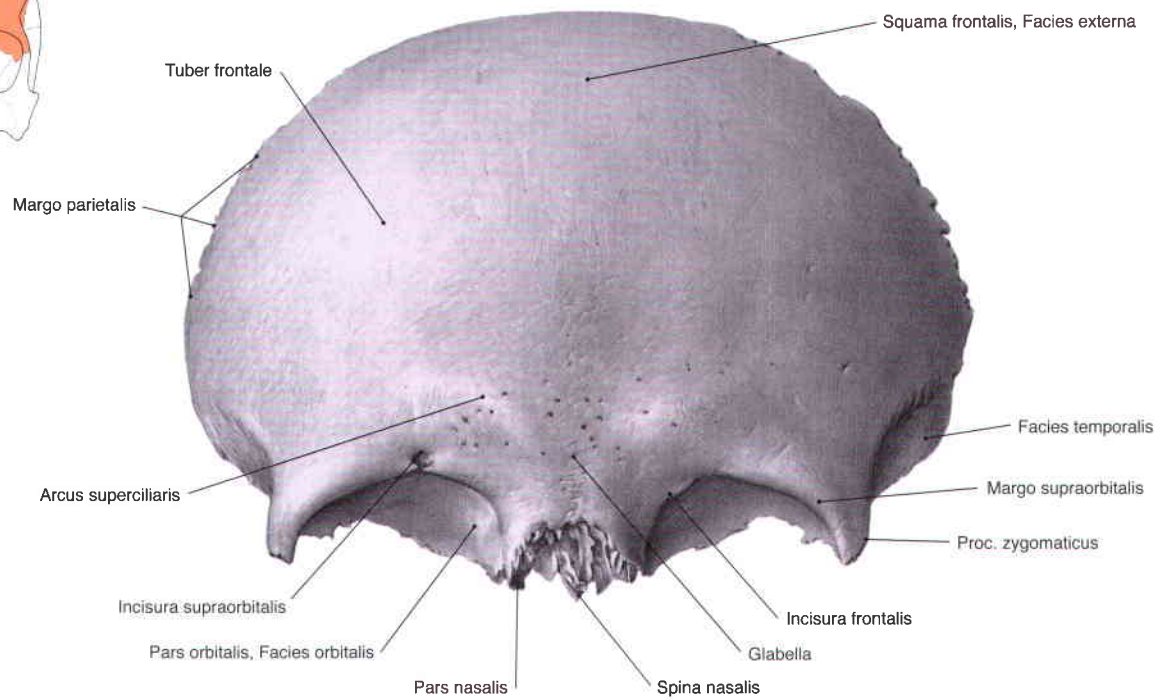
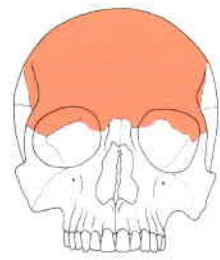
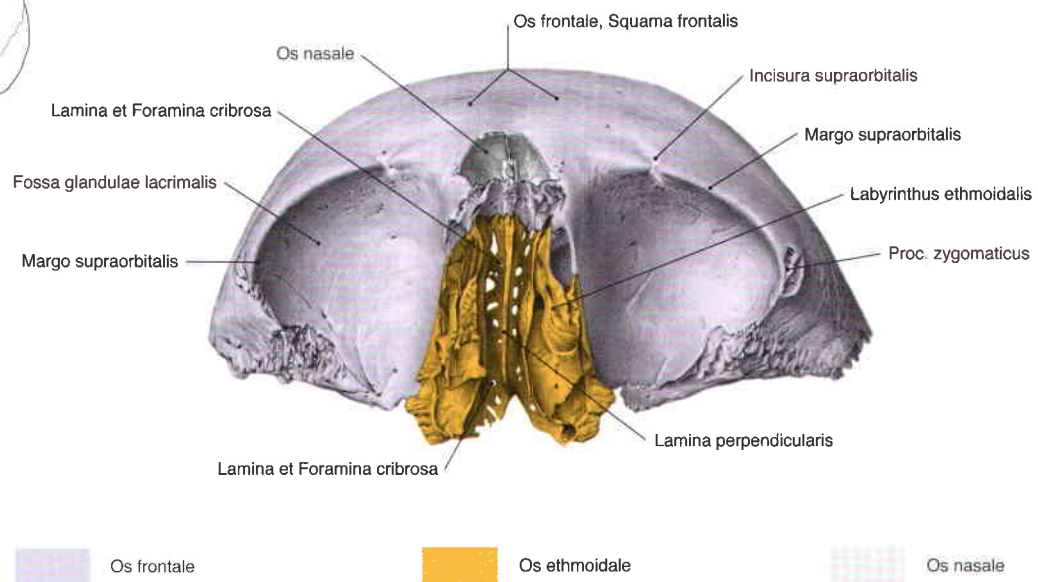
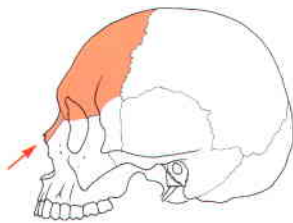


Fig. 77 Skull, Cranium, of a neonate.

Frontal and ethmoidal bone**Fig. 78** Frontal bone, Os frontale.**Fig. 79** Frontal bone, Os frontale; ethmoidal bone, Os ethmoidale, and nasal bones, Ossa nasalia.

Maxilla and palatine bone

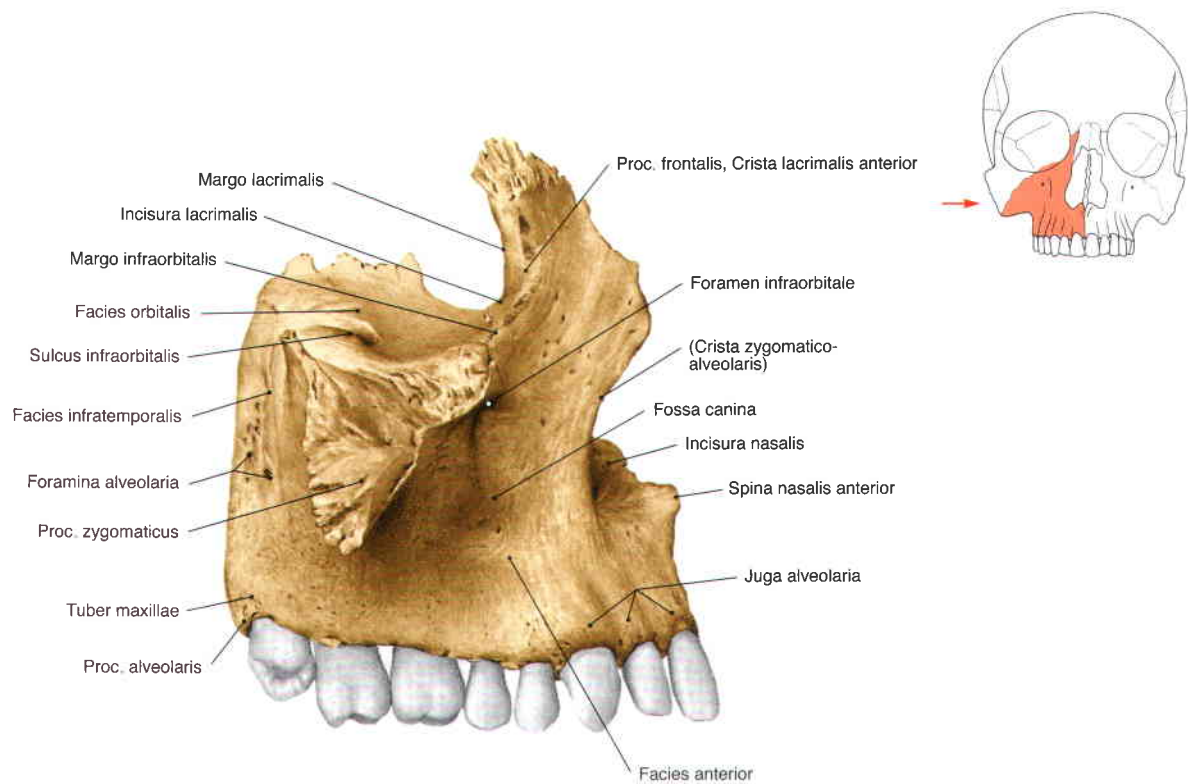


Fig. 80 Maxilla, Maxilla.

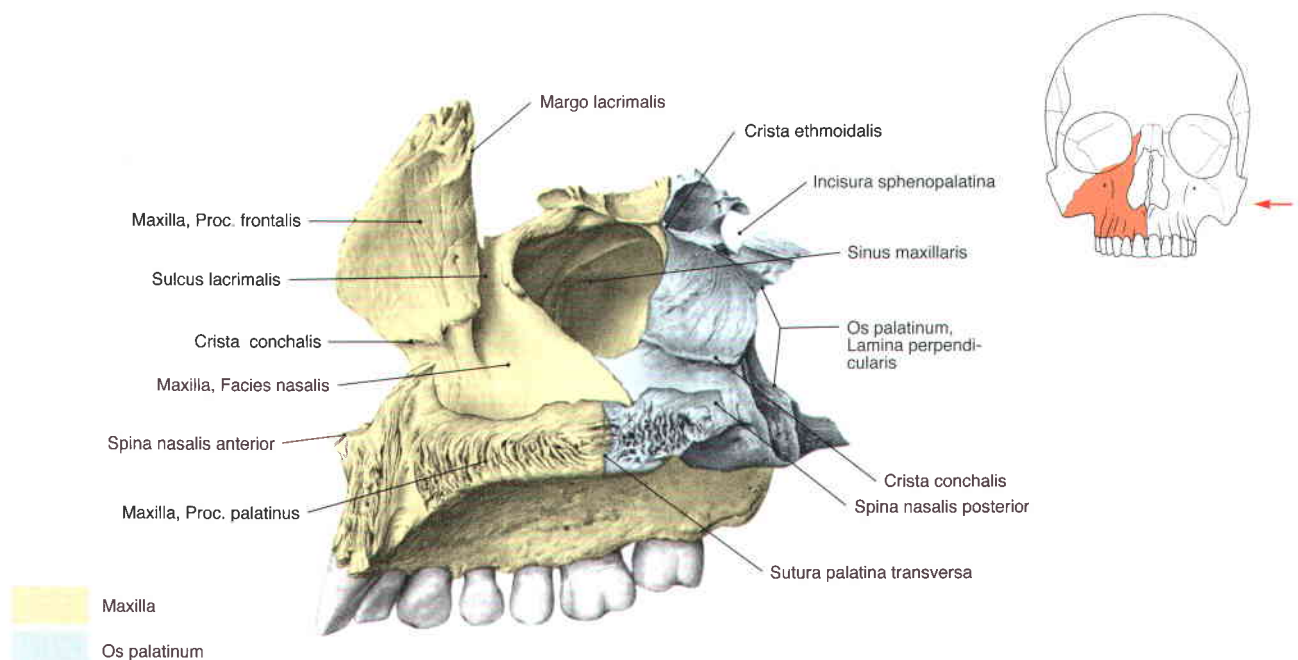


Fig. 81 Maxilla, Maxilla, and palatine bone, Os palatinum.

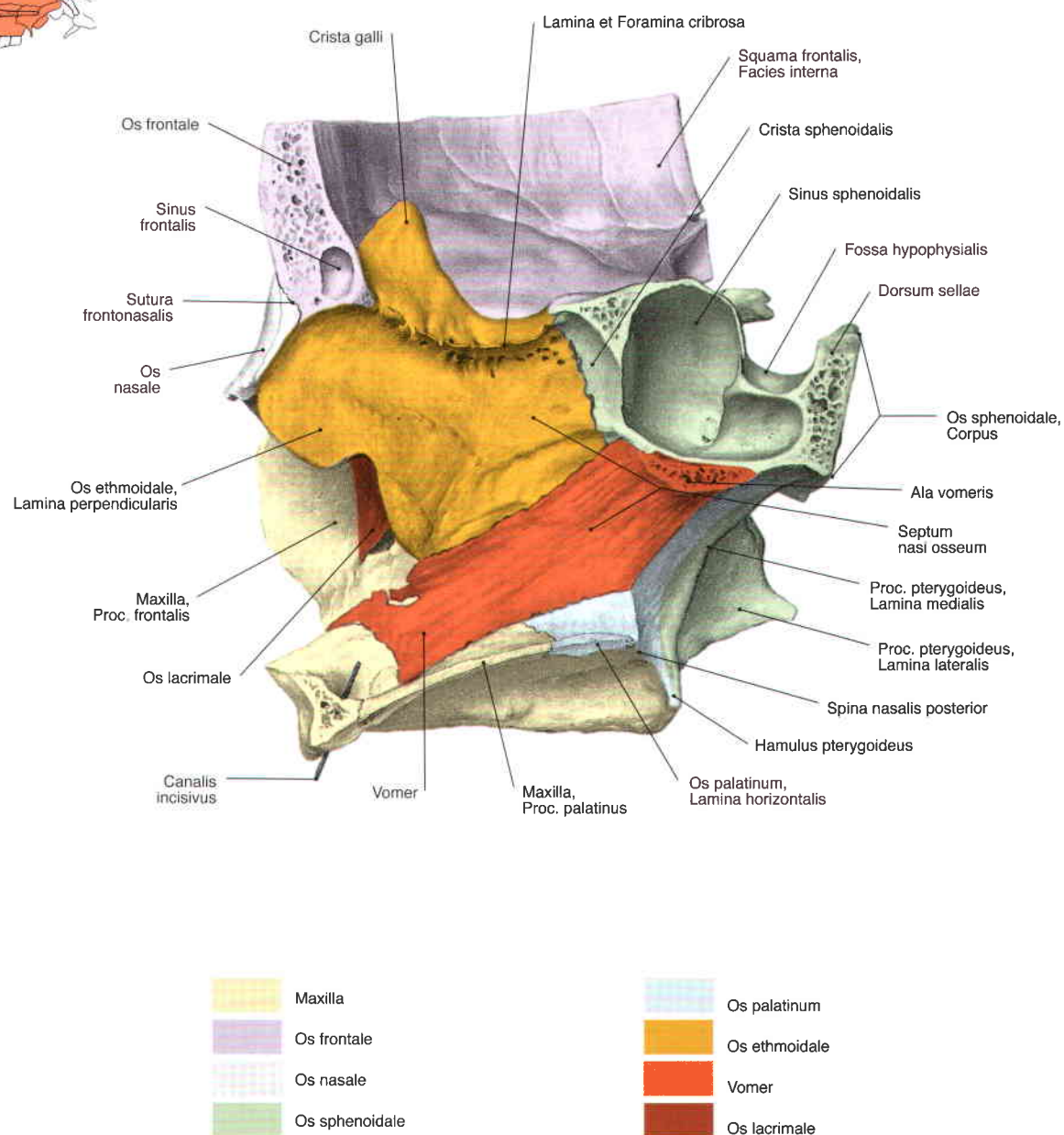
Nasal cavity

Fig. 82 Bony nasal septum, Septum nasi osseum.

Nasal cavity

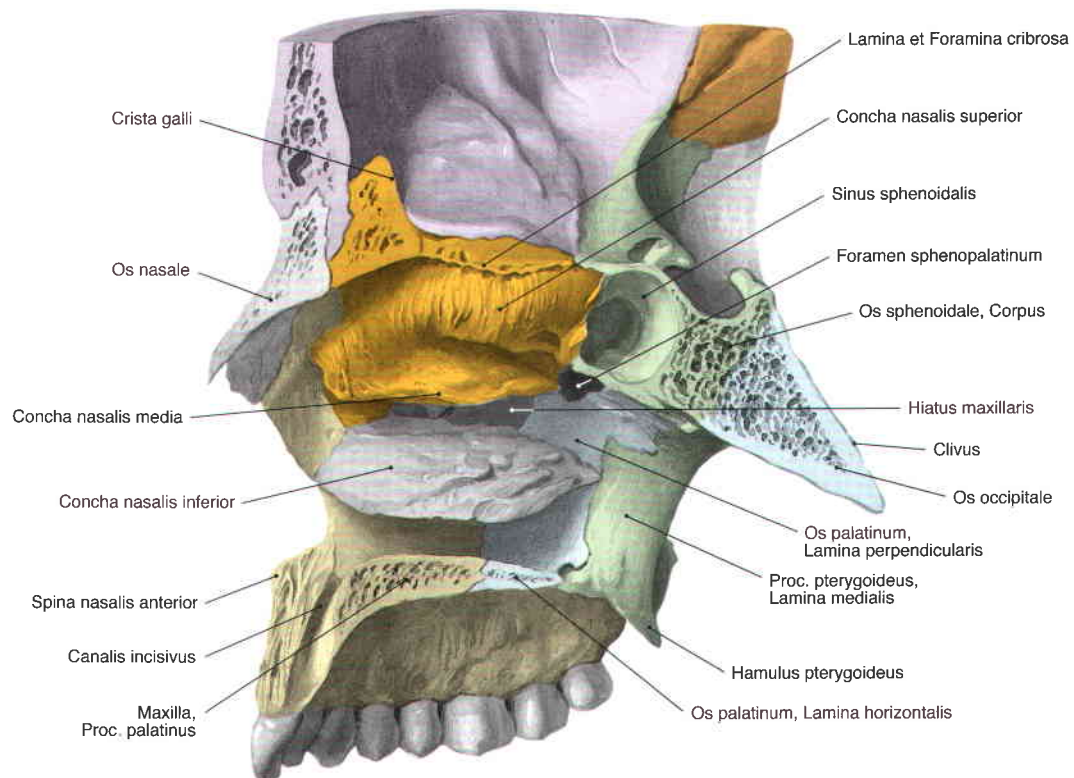


Fig. 83 Lateral wall of the nasal cavity, Cavitas nasi.

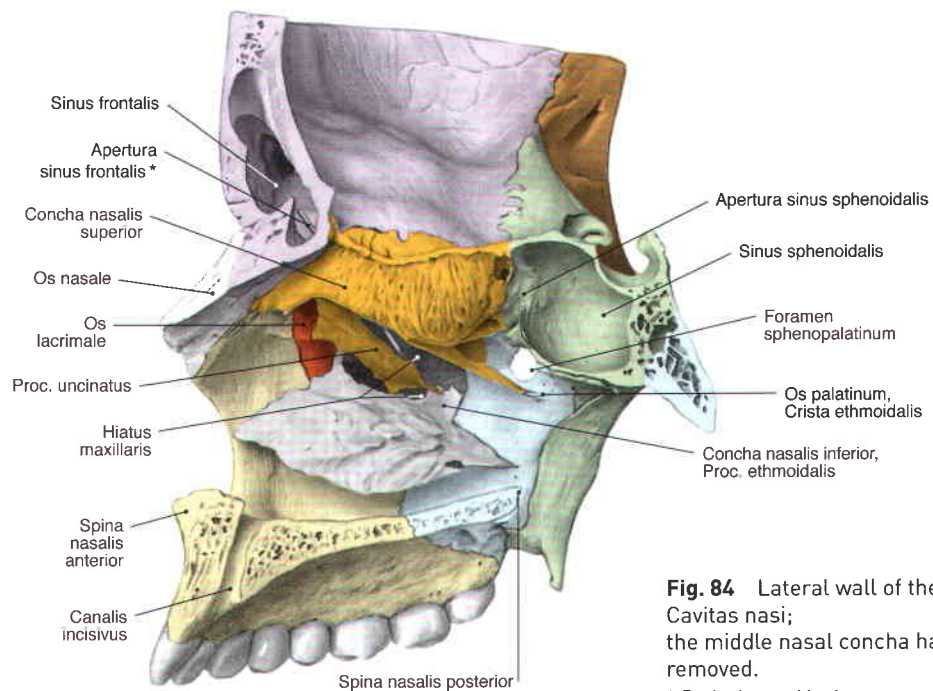
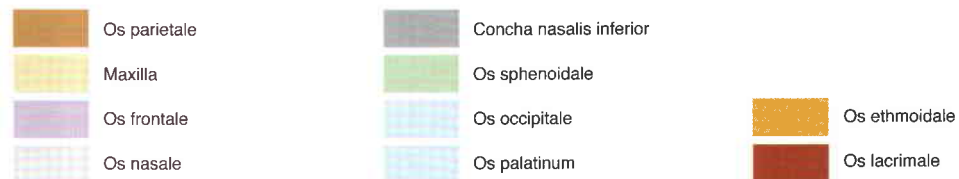
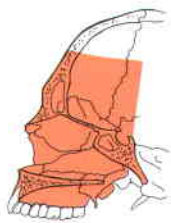


Fig. 84 Lateral wall of the nasal cavity, Cavitas nasi; the middle nasal concha has been removed.

* Probe located in the passage from the frontal sinus to the middle nasal meatus

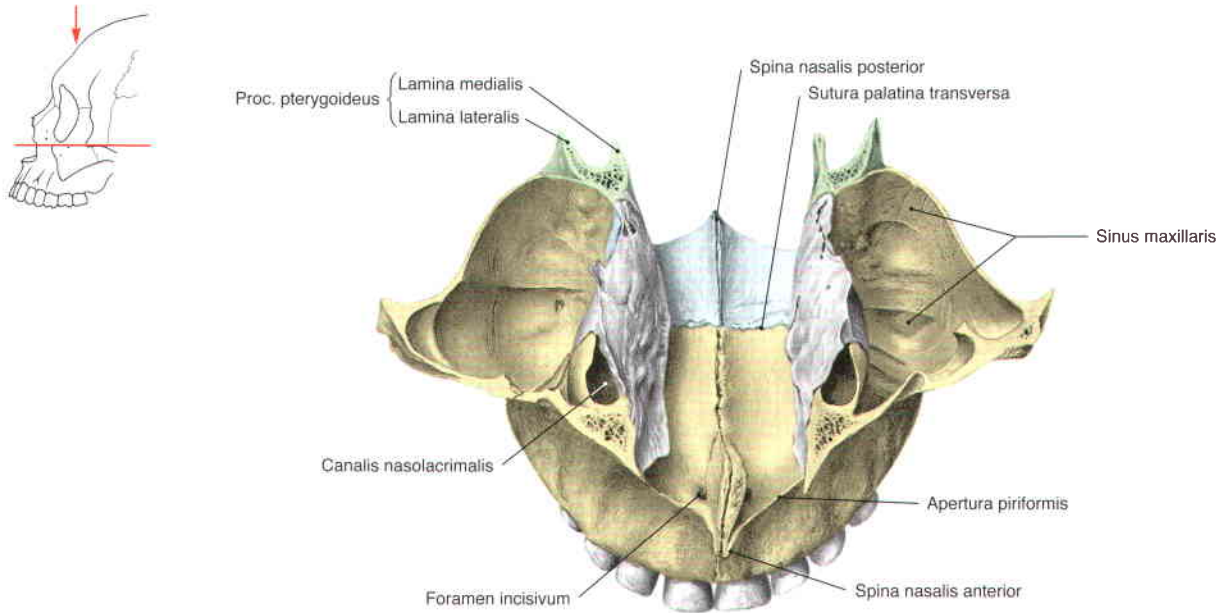
Hard palate

Fig. 85 Hard palate, Palatum durum; maxillary sinus, Sinus maxillaris, and inferior nasal concha, Concha nasalis inferior.

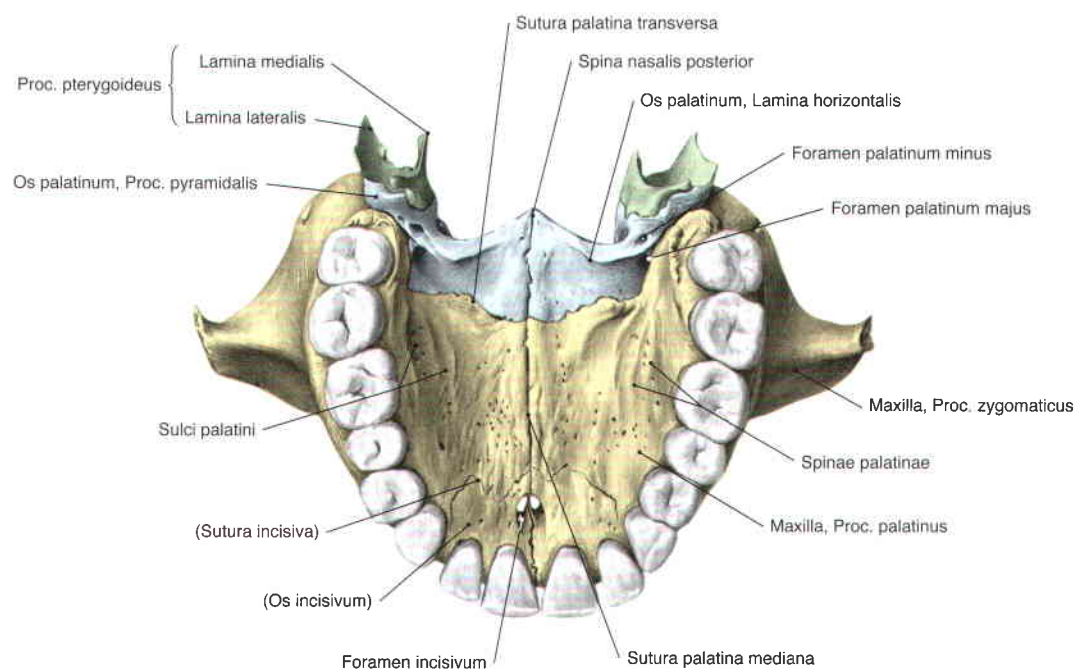
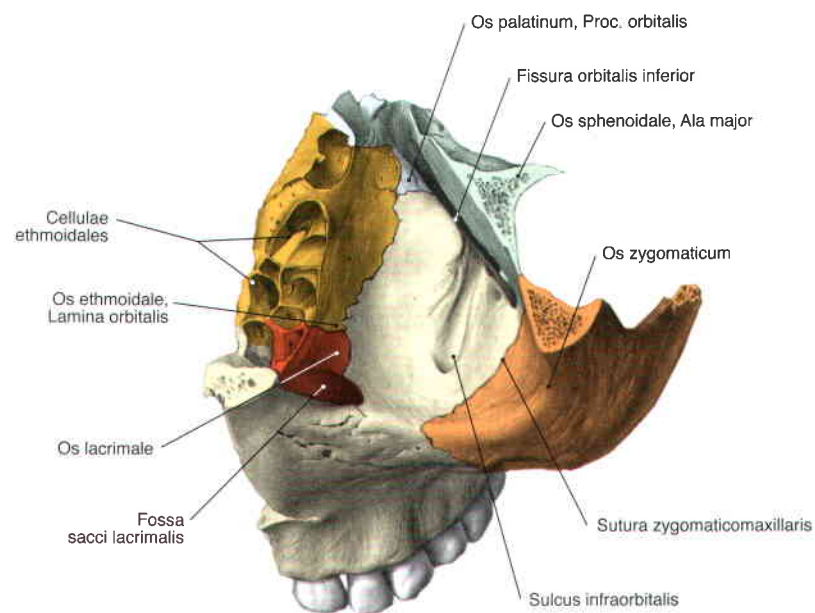
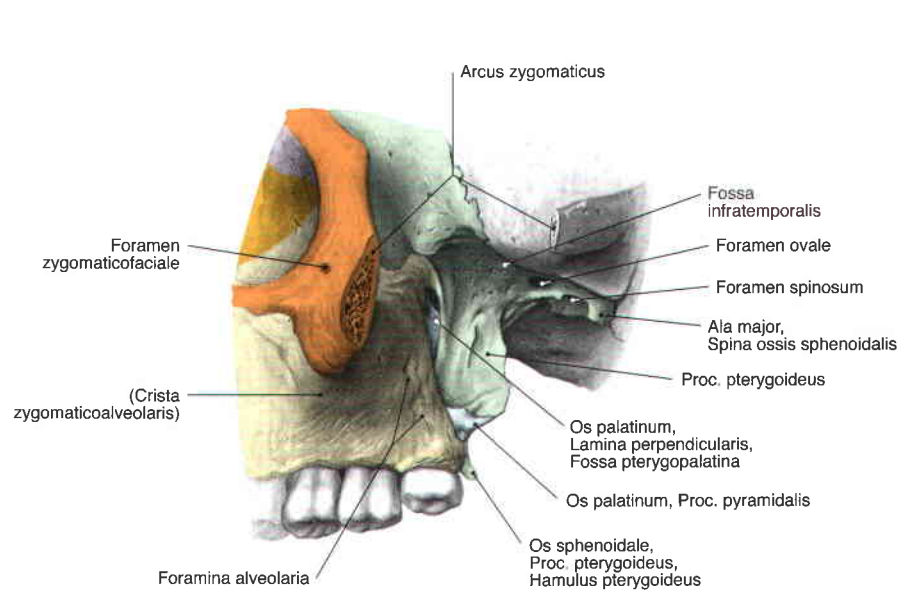
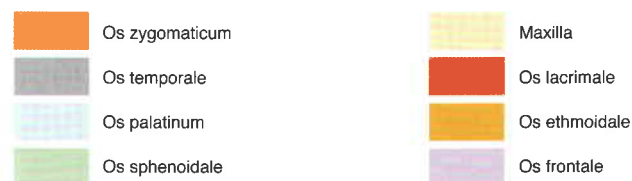


Fig. 86 Hard palate, Palatum durum.

Orbit and pterygopalatine fossa**Fig. 87** Base of the orbit, Orbita.**Fig. 88** Pterygopalatine fossa, Fossa pterygopalatina.

Orbit

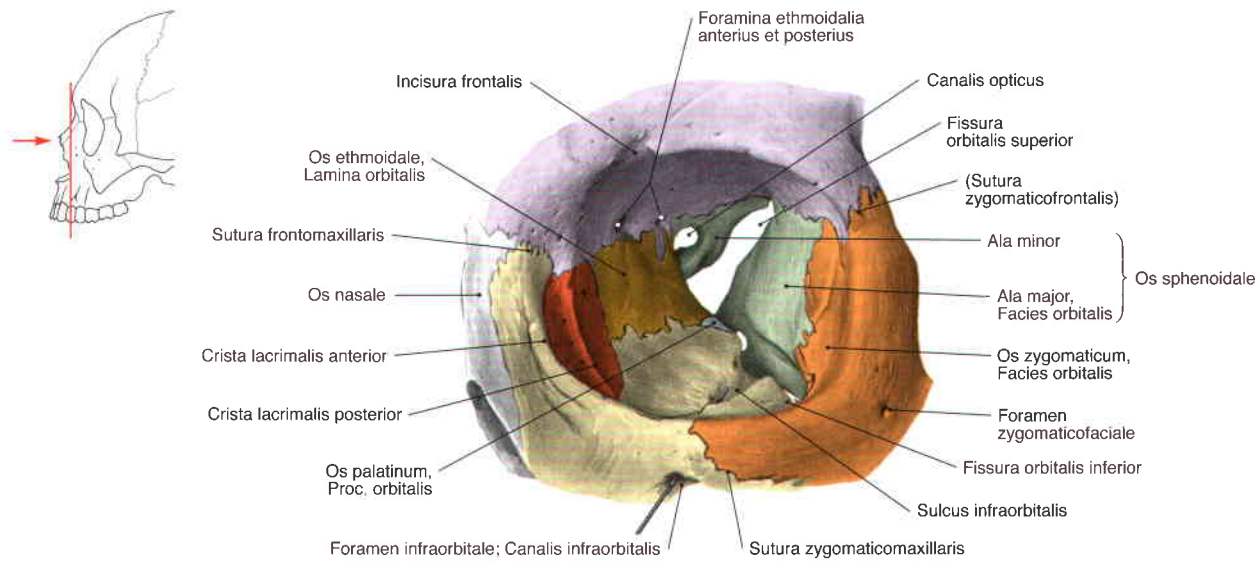


Fig. 89 Orbit, Orbita; probe located in the infra-orbital canal, Canalis infraorbitalis.

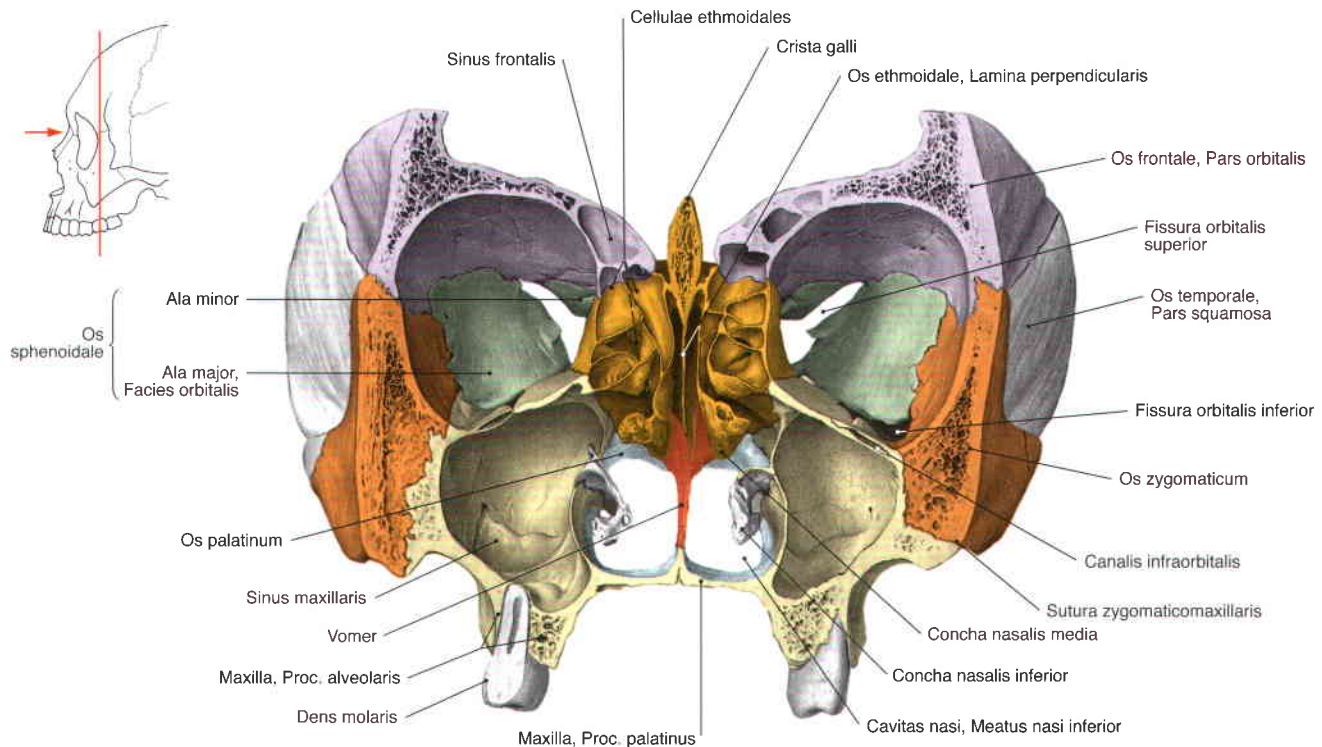
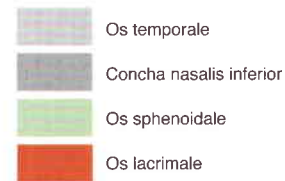
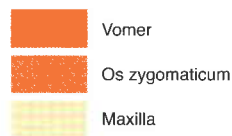


Fig. 90 Facial skeleton, Viscerocranium; frontal section.

Orbit

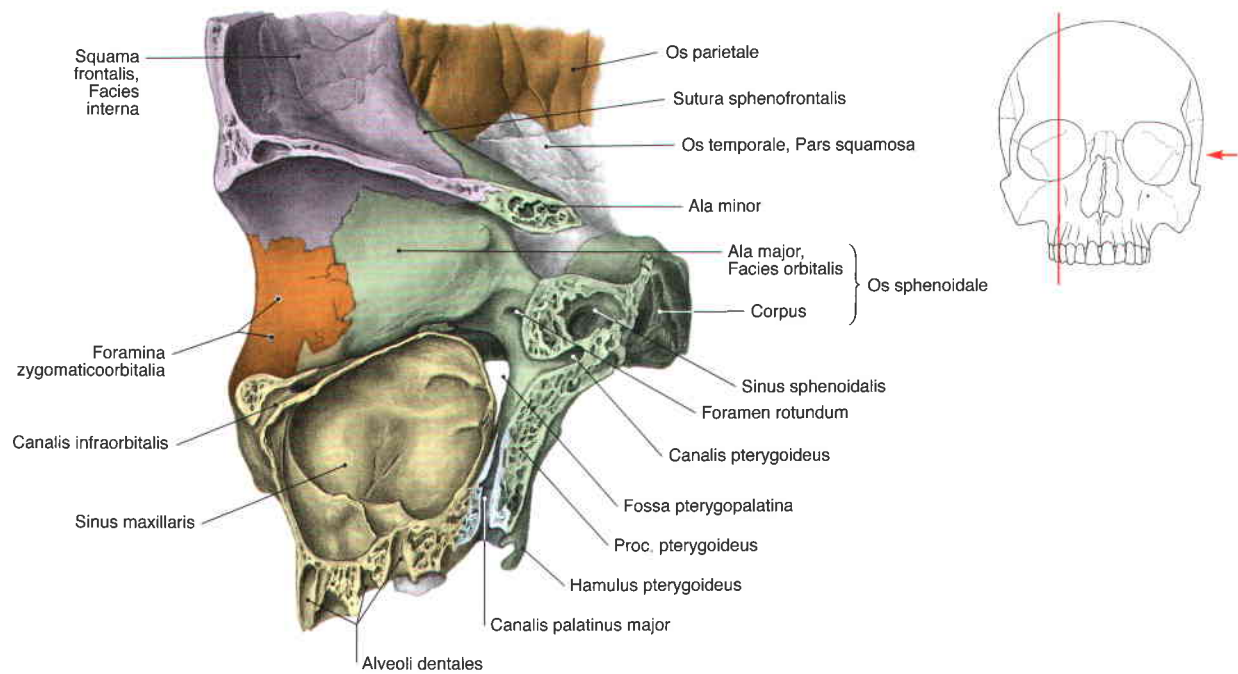


Fig. 91 Orbit, Orbita; lateral wall.

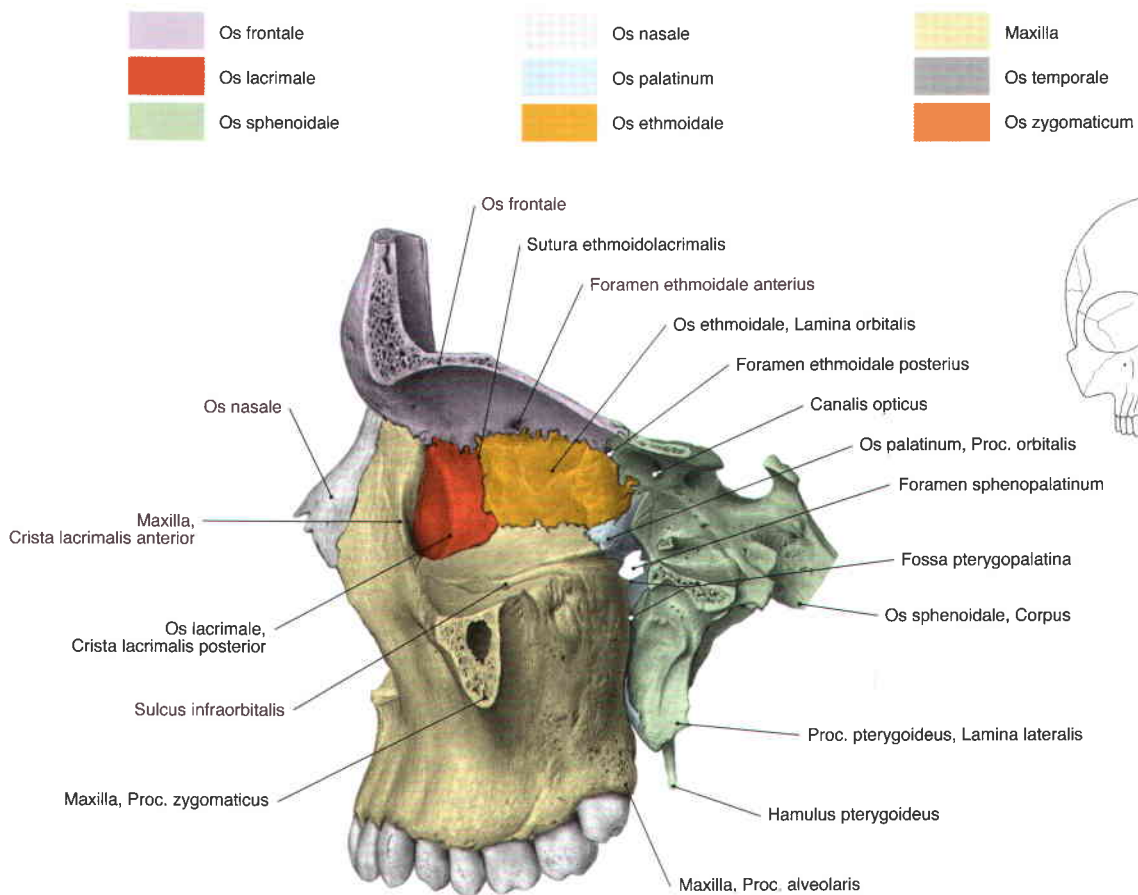


Fig. 92 Orbit, Orbita; medial wall.

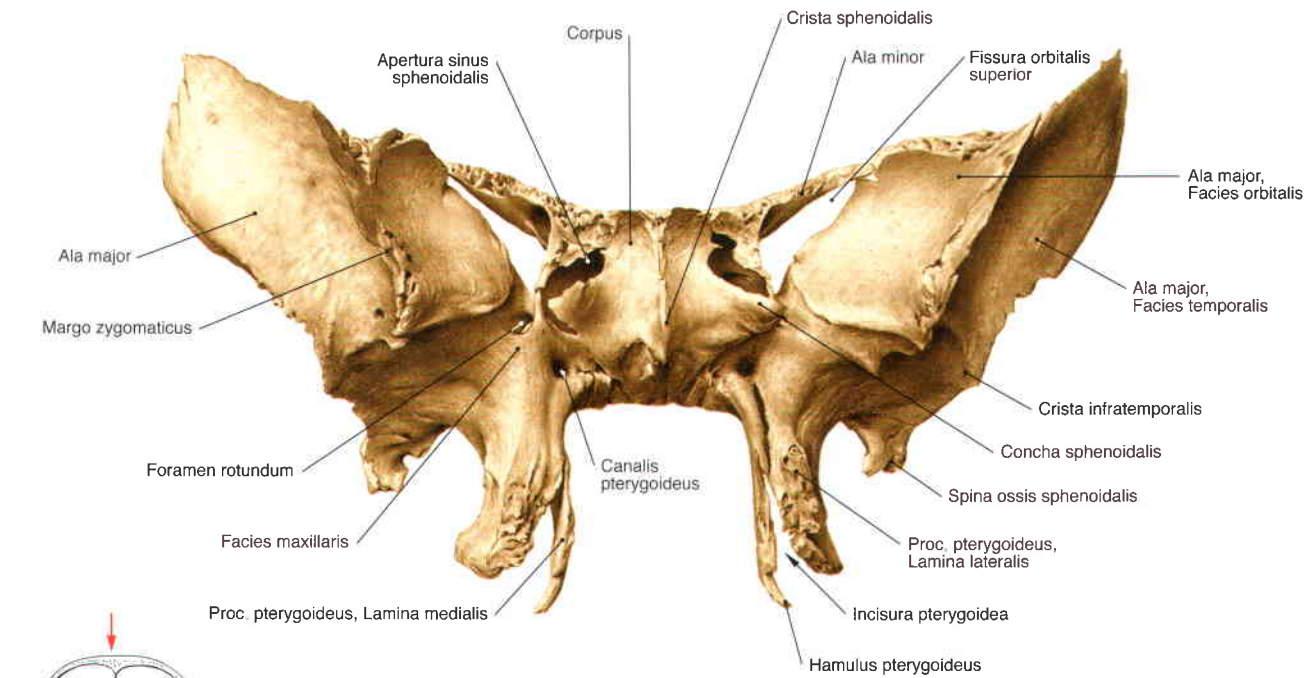
Sphenoidal bone

Fig. 93 Sphenoidal bone, Os sphenoidale; anterior view.

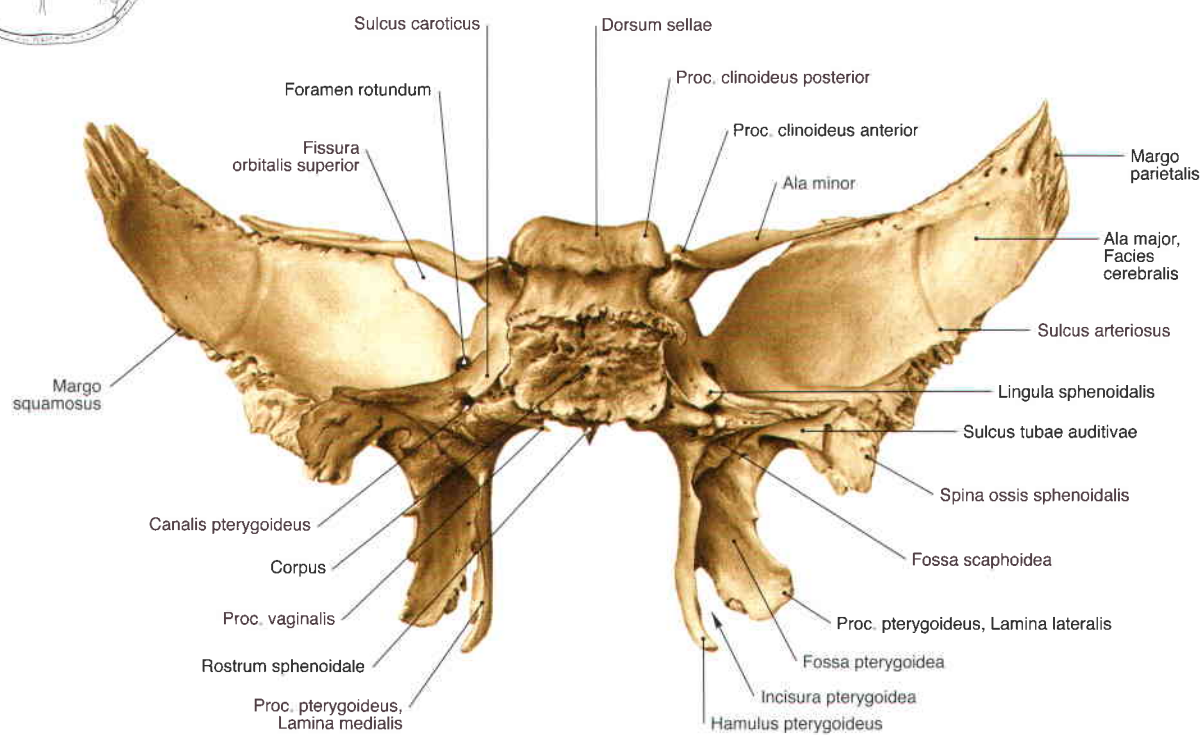


Fig. 94 Sphenoidal bone, Os sphenoidale; posterior view.

Sphenoidal and occipital bone

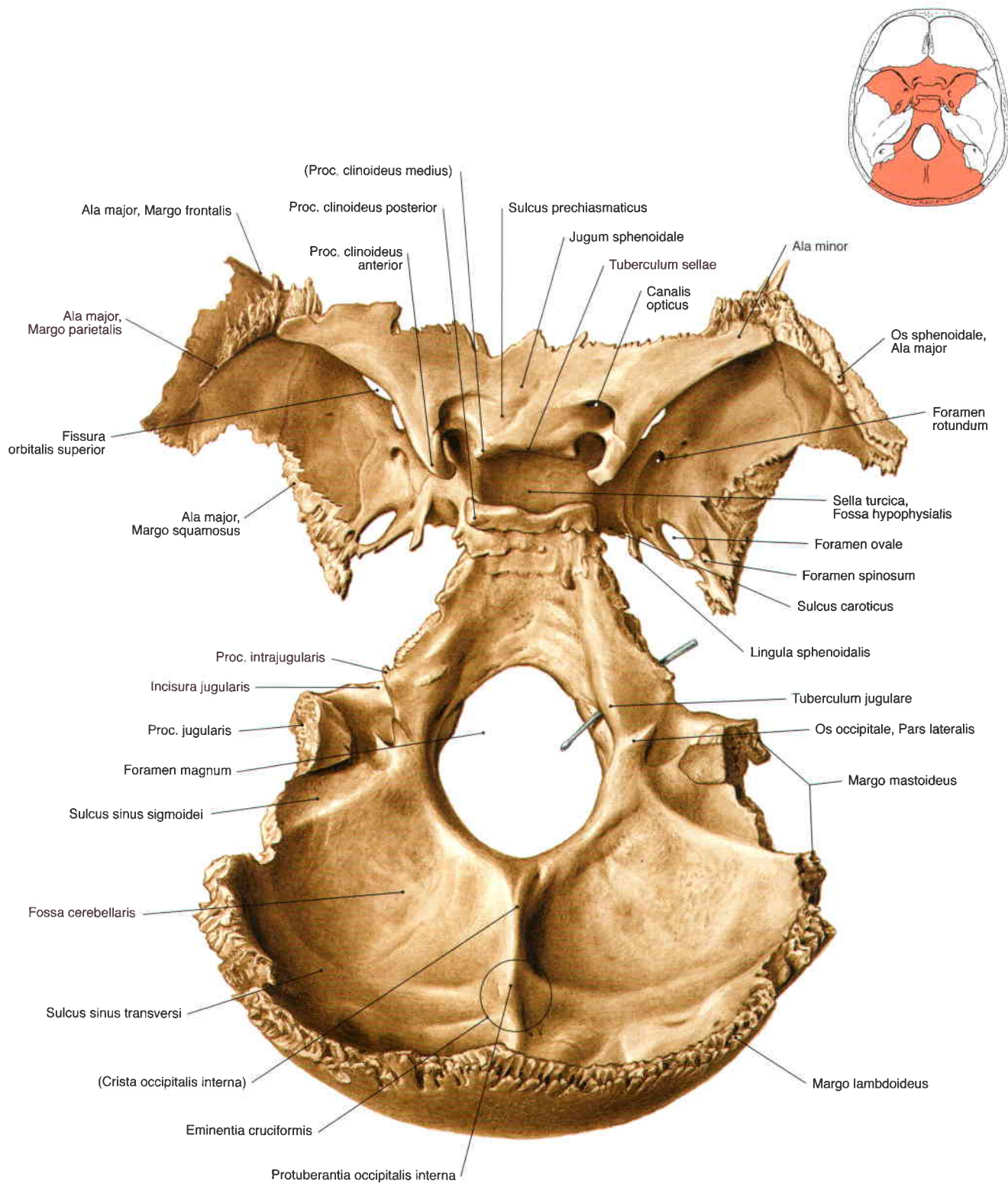
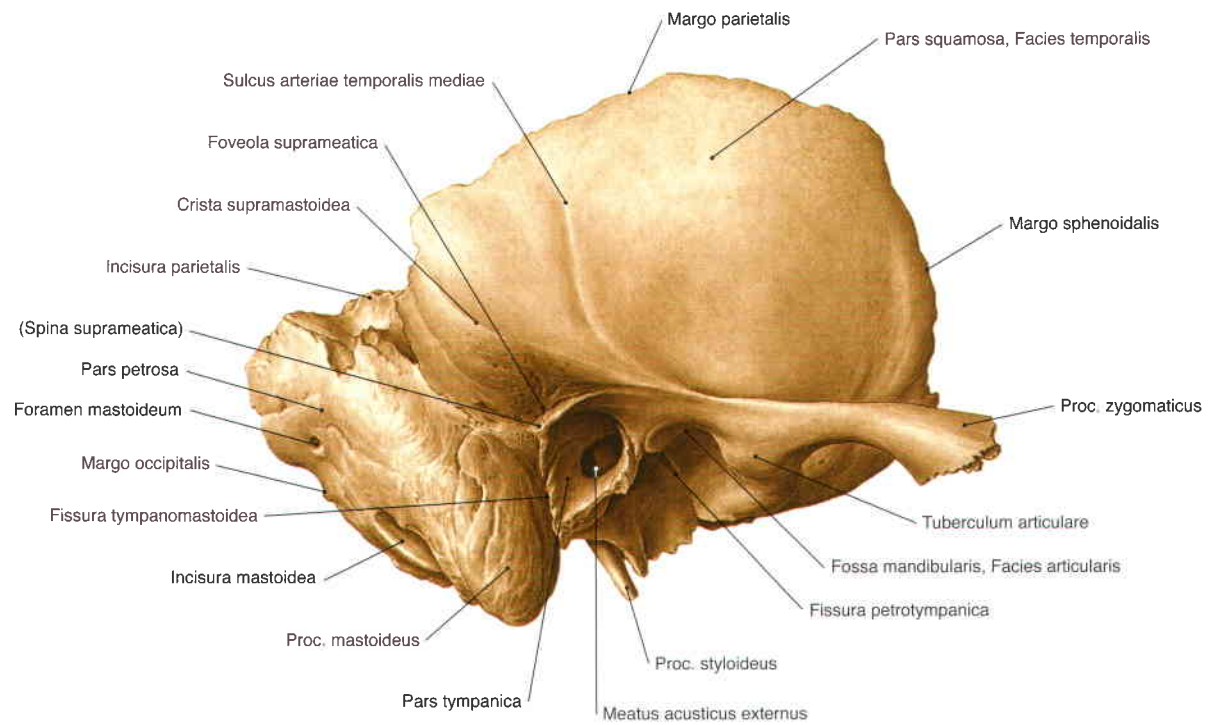
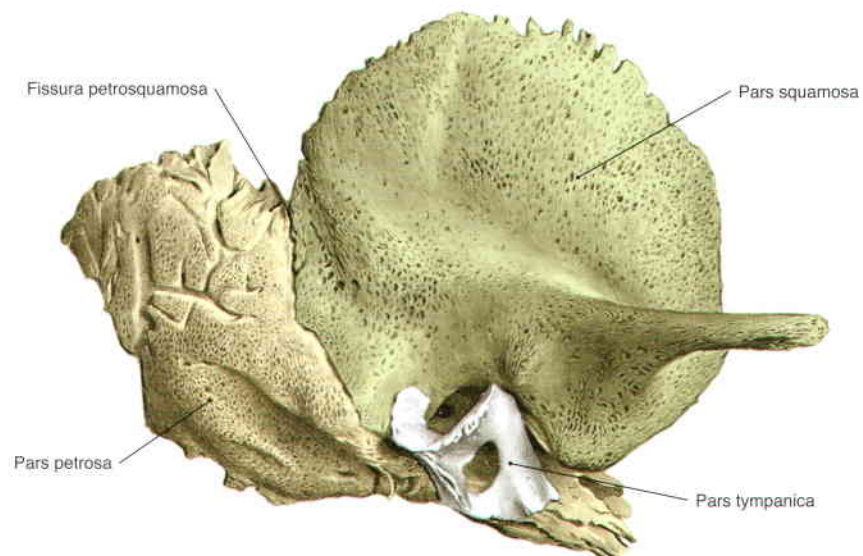
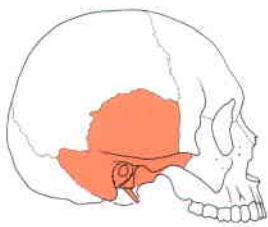


Fig. 95 Occipital bone, Os occipitale, and sphenoidal bone, Os sphenoidale.

Temporal bone**Fig. 96** Temporal bone, Os temporale.**Fig. 97** Temporal bone, Os temporale, of a neonate.

Temporal bone

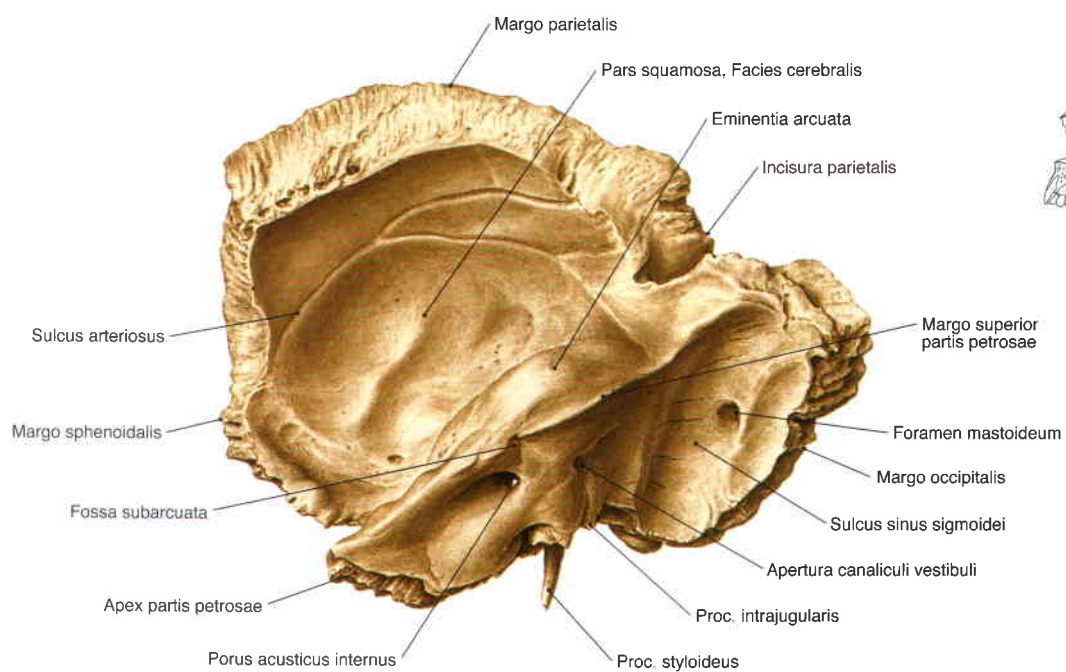


Fig. 98 Temporal bone, Os temporale.

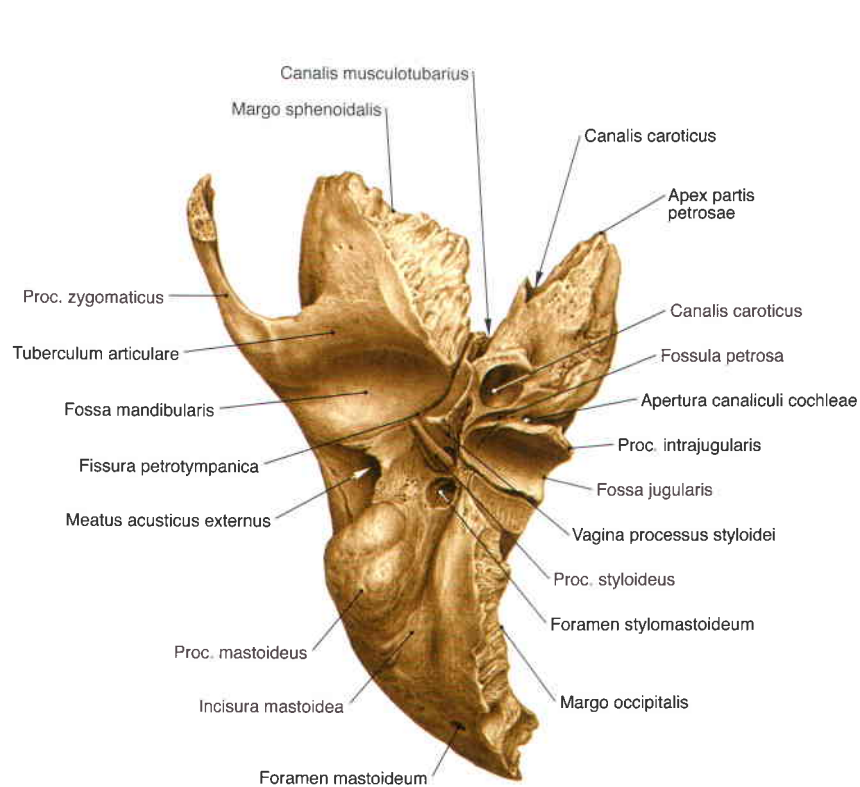
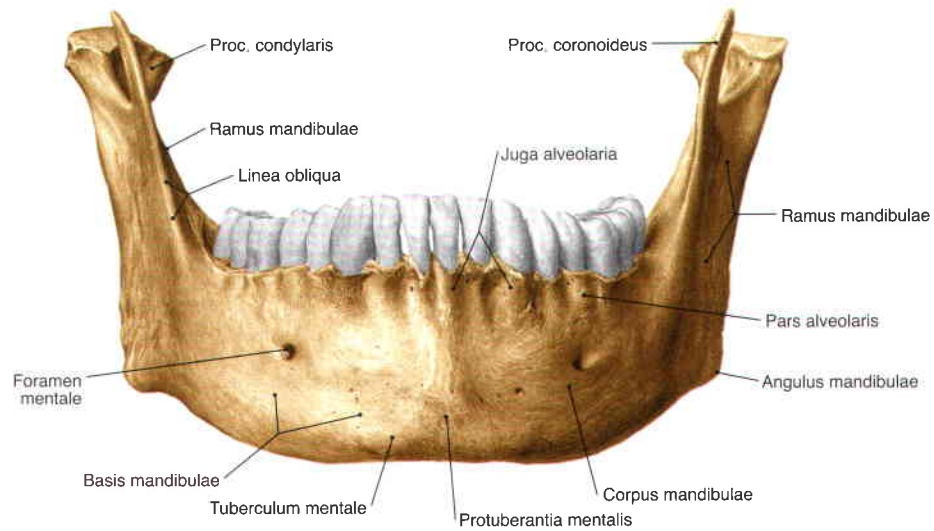
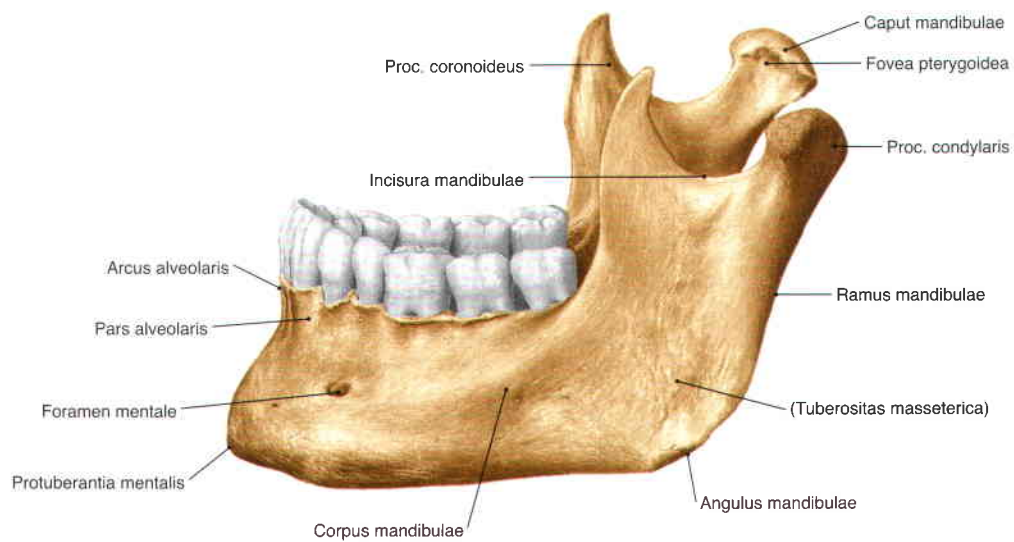
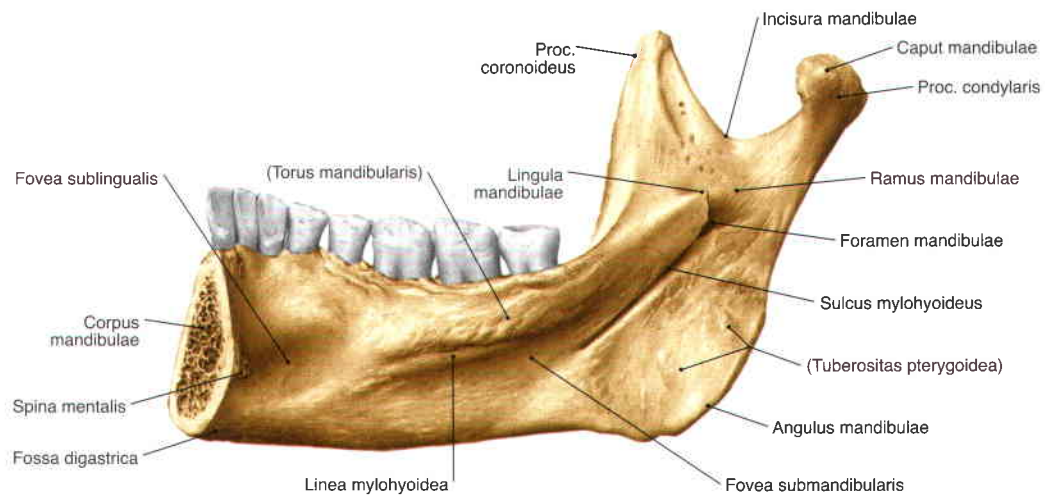


Fig. 99 Temporal bone, Os temporale.

Mandible**Fig. 100** Mandible, Mandibula.**Fig. 101** Mandible, Mandibula.**Fig. 102** Mandible, Mandibula.

Mandible

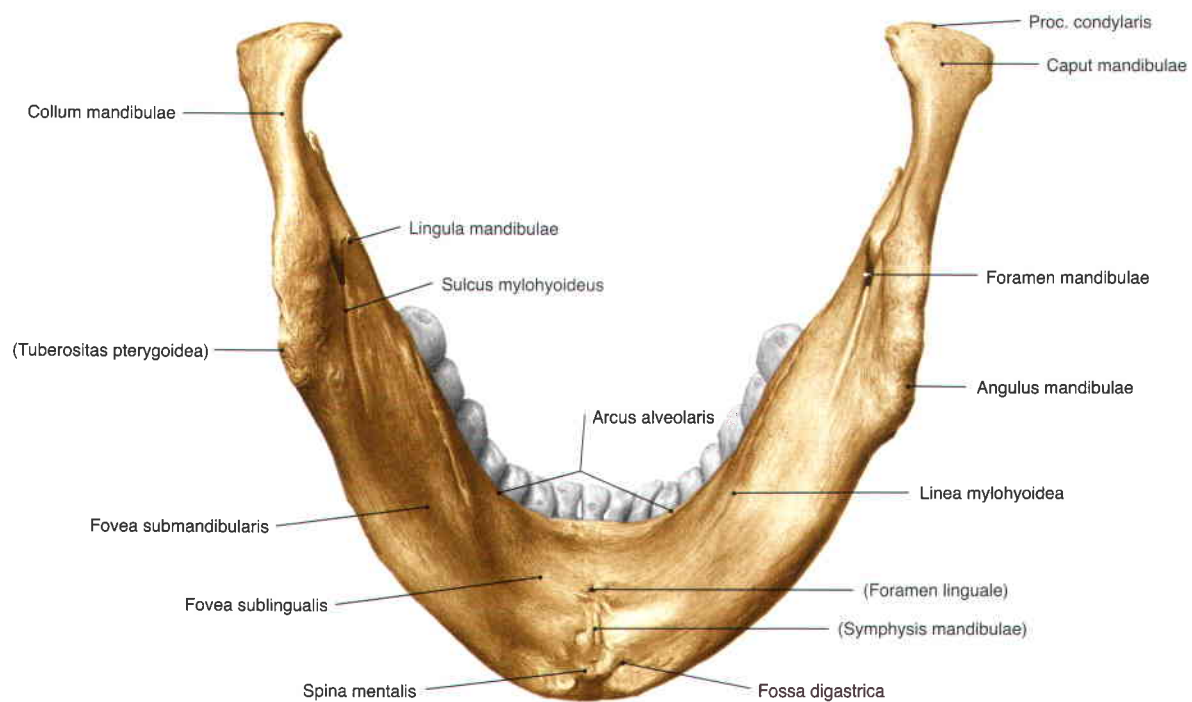


Fig. 103 Mandible, Mandibula.



Fig. 104 Mandible, Mandibula, of an elderly individual.

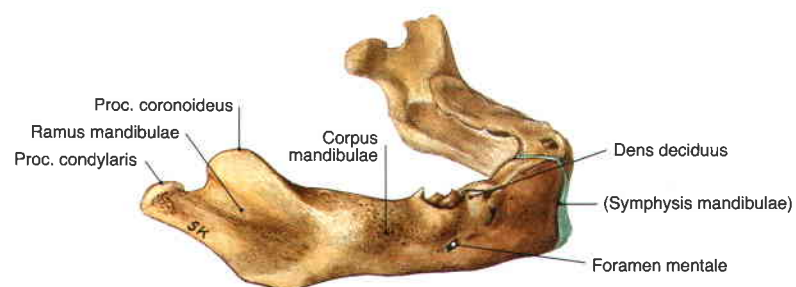


Fig. 105 Mandible, Mandibula, of a neonate.

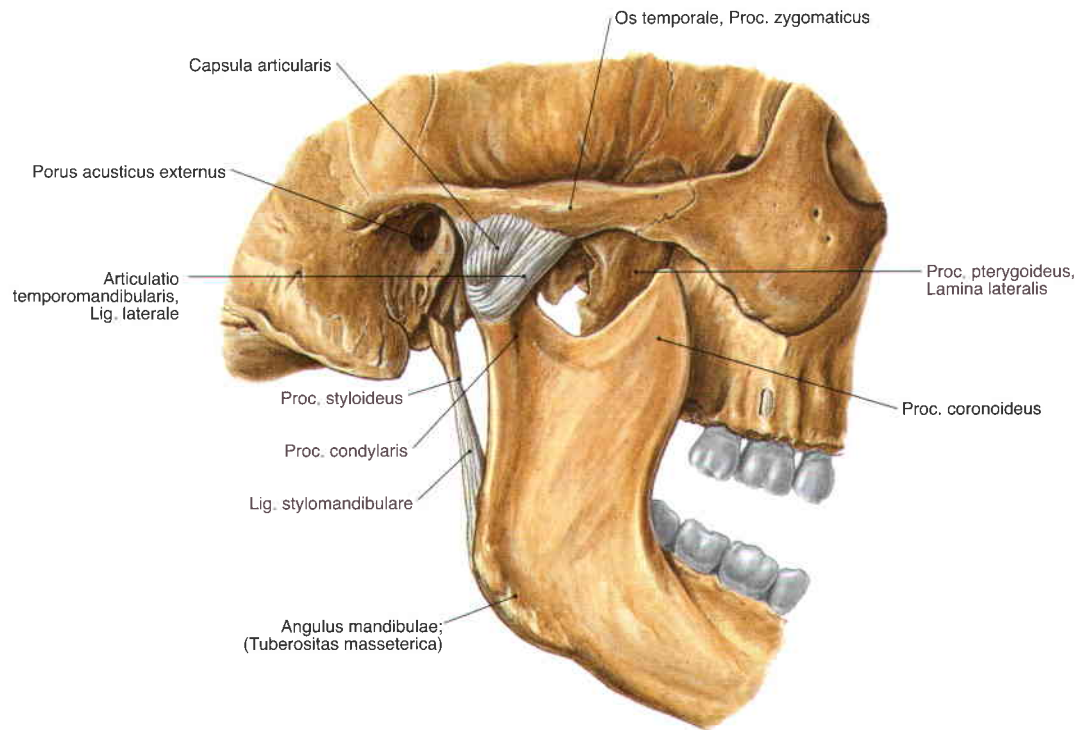
Temporomandibular joint

Fig. 106 Temporomandibular joint, Articulatio temporomandibularis.

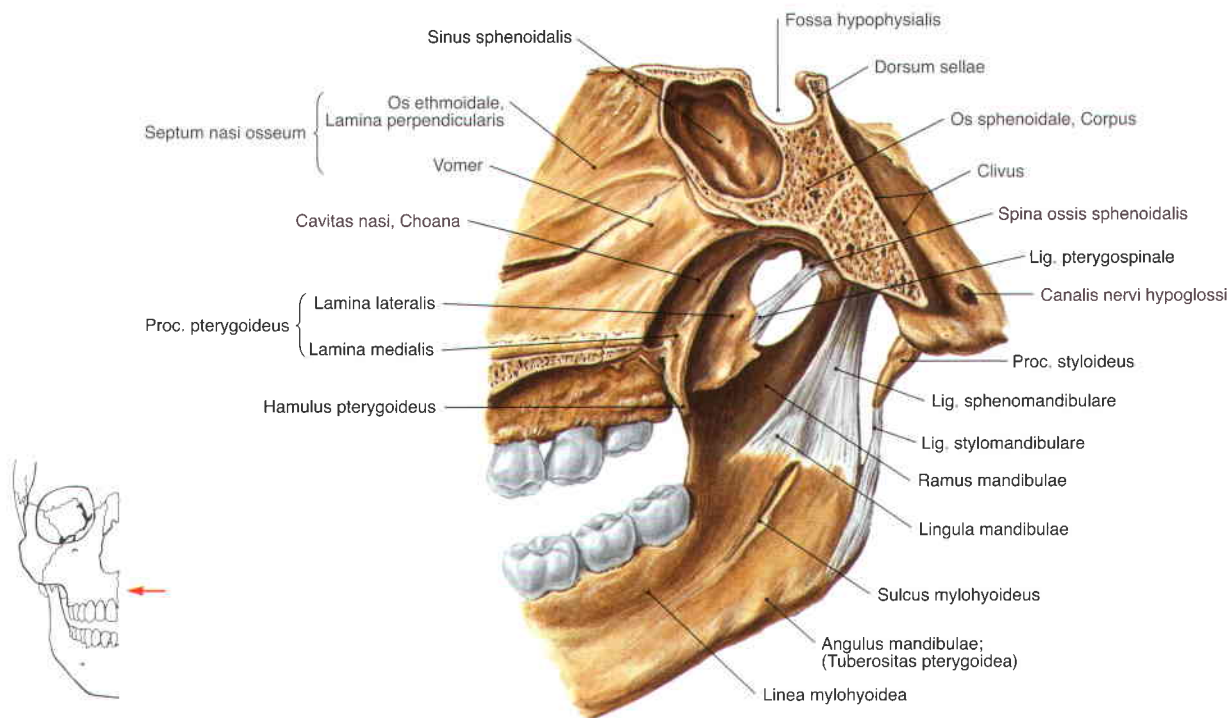


Fig. 107 Pterygospinous and sphenomandibular ligaments, Ligg. pterygospinale et sphenomandibulare.

Temporomandibular joint

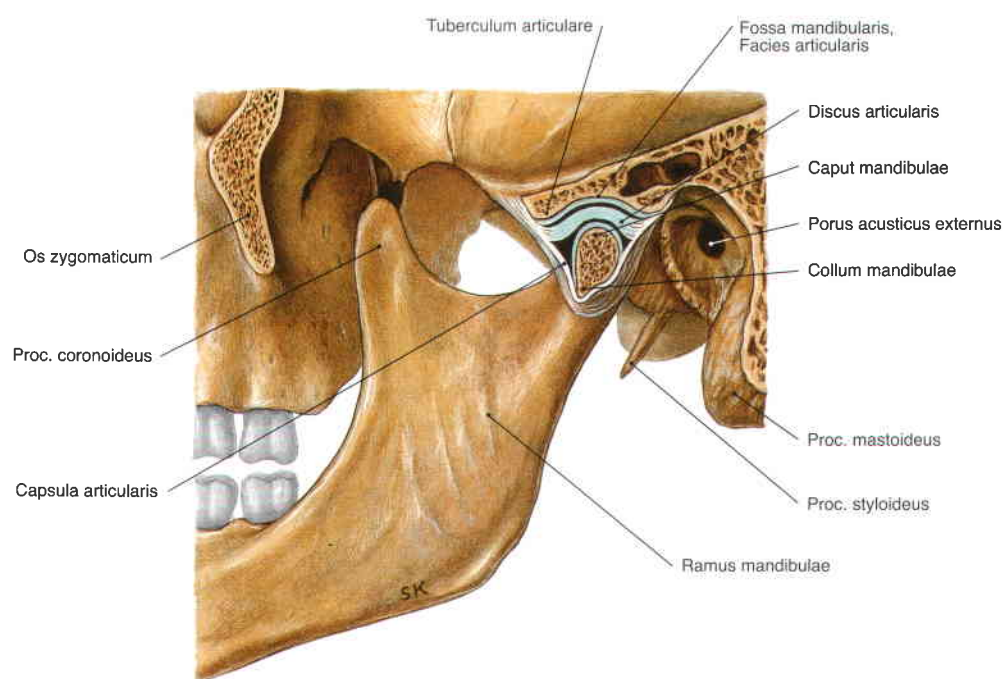


Fig. 108 Temporomandibular joint, *Articulatio temporomandibularis*; sagittal section; mouth almost closed.

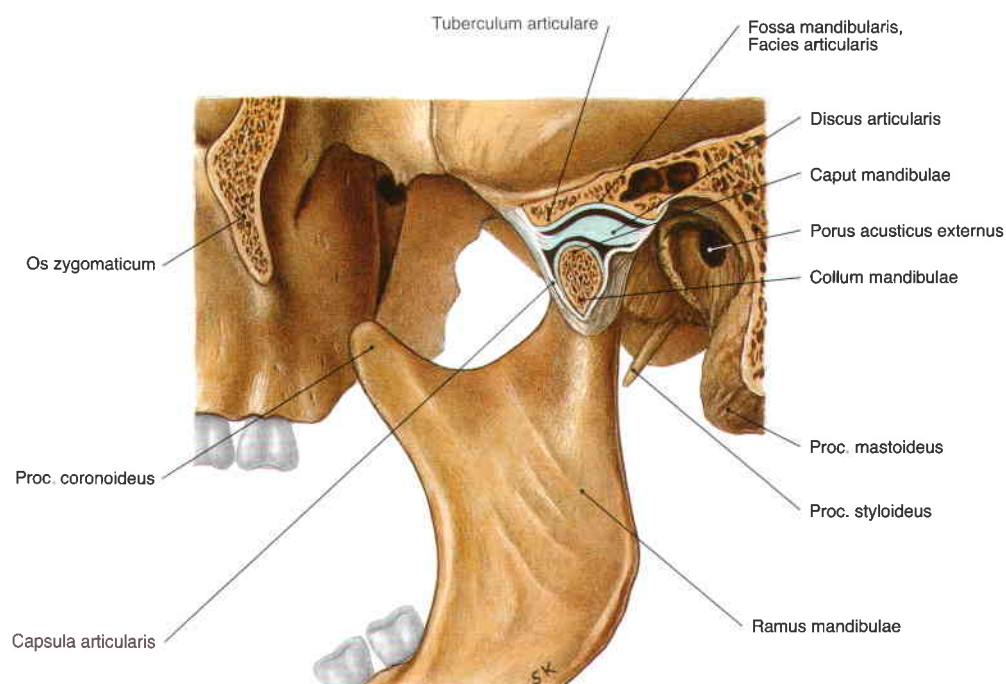
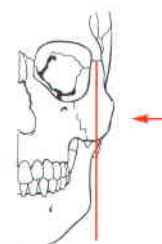


Fig. 109 Temporomandibular joint, *Articulatio temporomandibularis*; sagittal section; mouth opened.

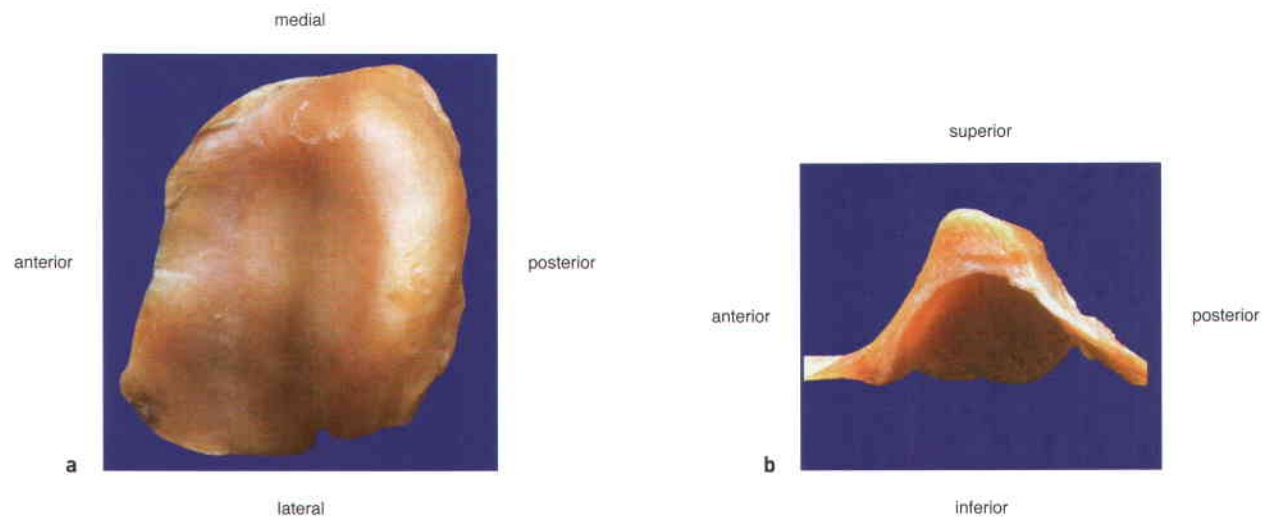
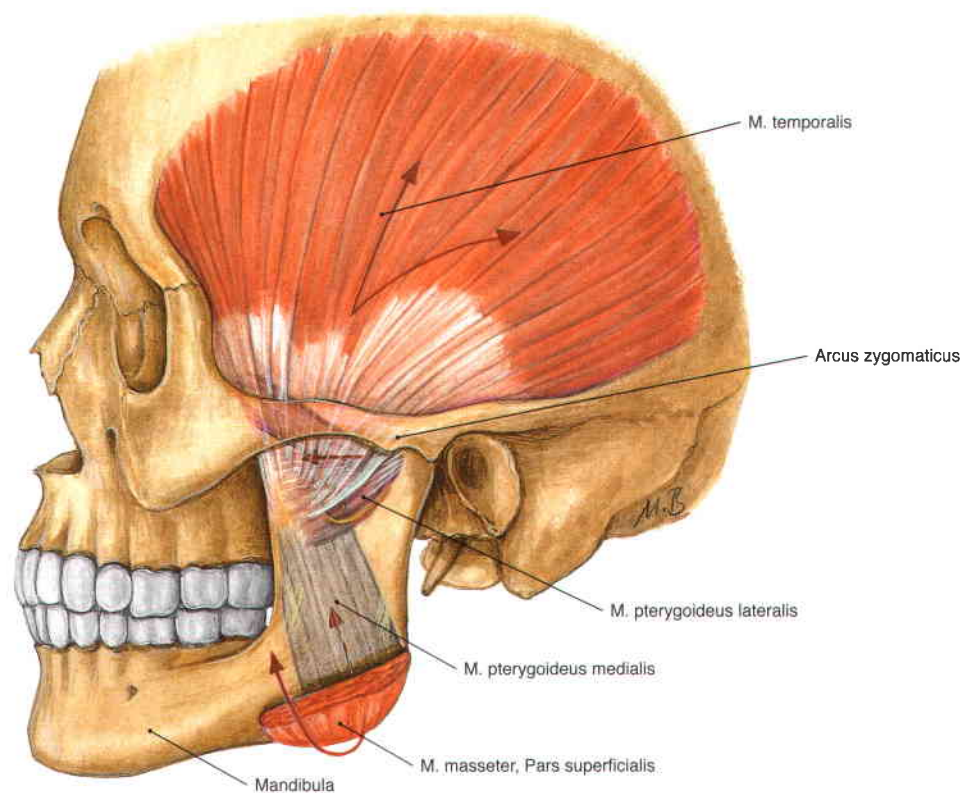
Temporomandibular joint and masticatory muscles

Fig. 110 a, b Articular disc, Discus articularis, of the temporomandibular joint, Articulatio temporomandibularis.
a Superior view
b Lateral view



→ T 4

Abb. 111 Masticatory muscles, Mm. masticatorii. Arrows indicate the direction of muscle traction when closing the mouth.

Temporomandibular joint

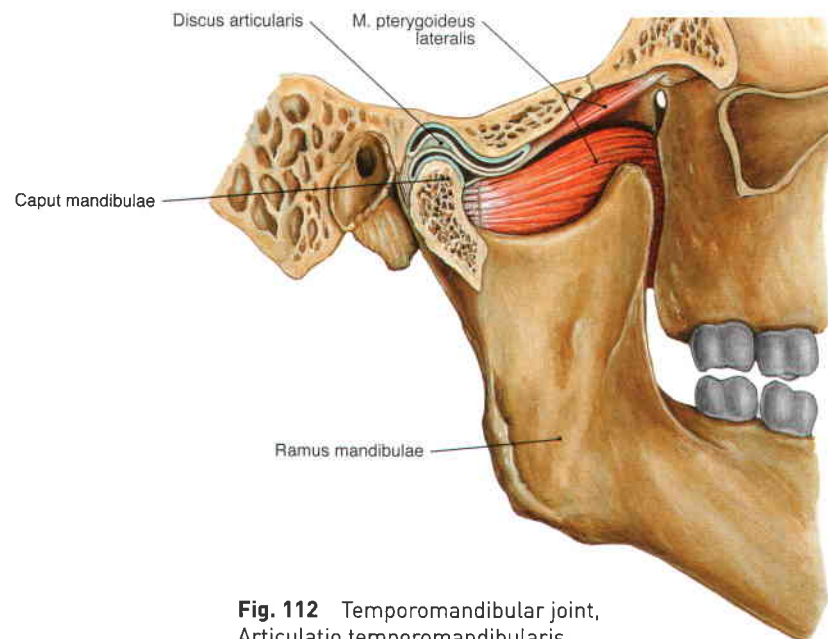
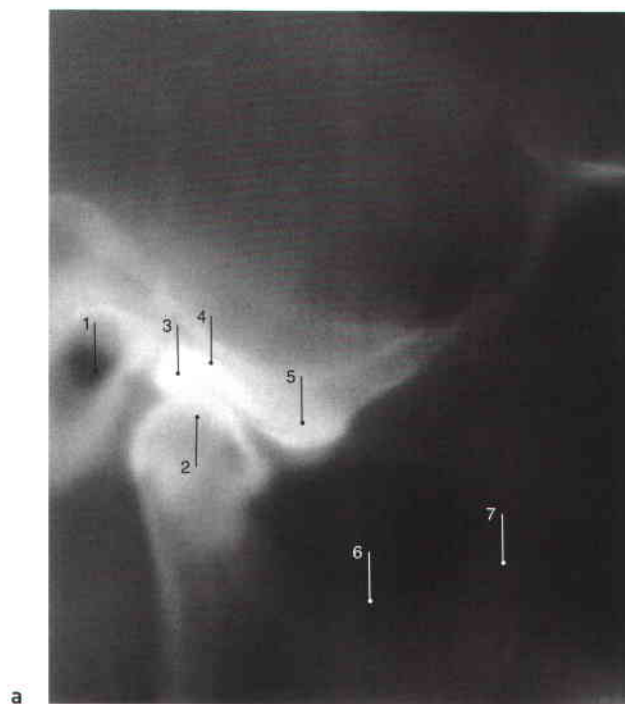
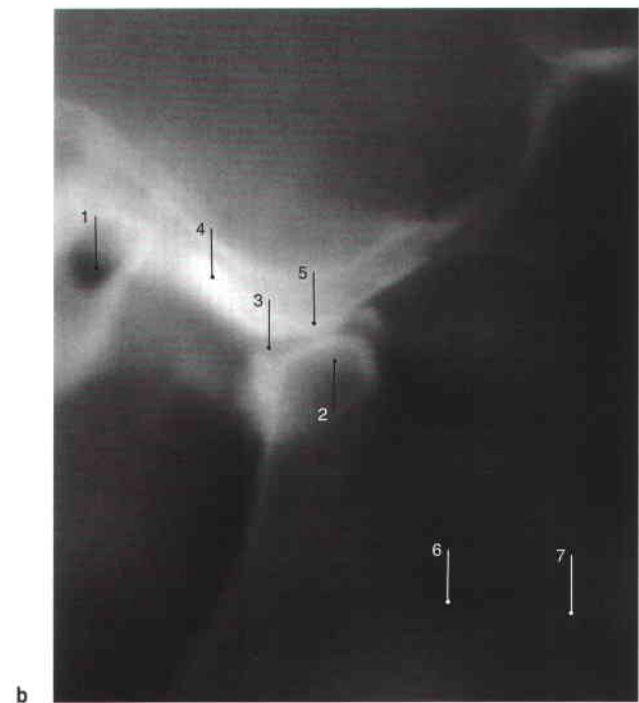


Fig. 112 Temporomandibular joint, *Articulatio temporomandibularis*.



- 1 Meatus acusticus externus
- 2 Proc. condylaris
- 3 Discus articularis
- 4 Os temporale, Fossa mandibularis



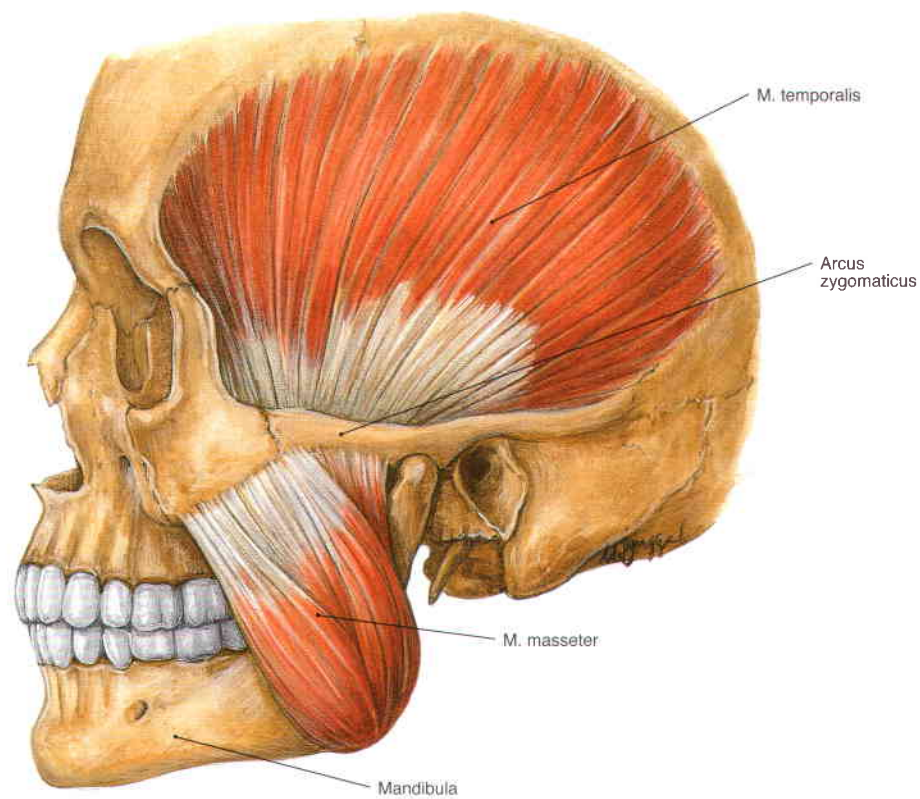
- 5 Os temporale, Tuberculum articulare
- 6 Incisura mandibulae
- 7 Proc. coronoideus

Fig. 113 a, b Temporomandibular joint, *Articulatio temporomandibularis*; tomography; lateral projection after injection of a contrast medium into the joint cavity (arthrography).

- a** Mouth closed
- b** Mouth opened

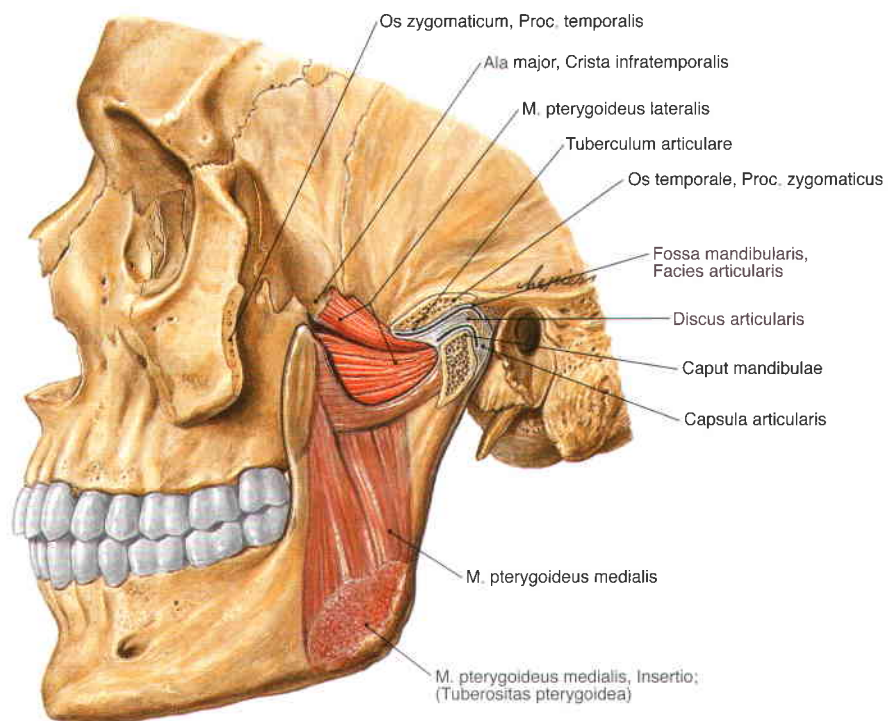
The articular disc shifts forward during opening of the mouth.

→ 108, 109

Masticatory muscles

→ T4

Fig. 114 Masseter and temporal muscle, *Mm. masseter et temporalis*.



→ T4

Fig. 115 Temporomandibular joint, *Articulatio temporomandibularis*; medial and lateral pterygoid muscles, *Mm. pterygoidei medialis et lateralis*.

Masticatory muscles

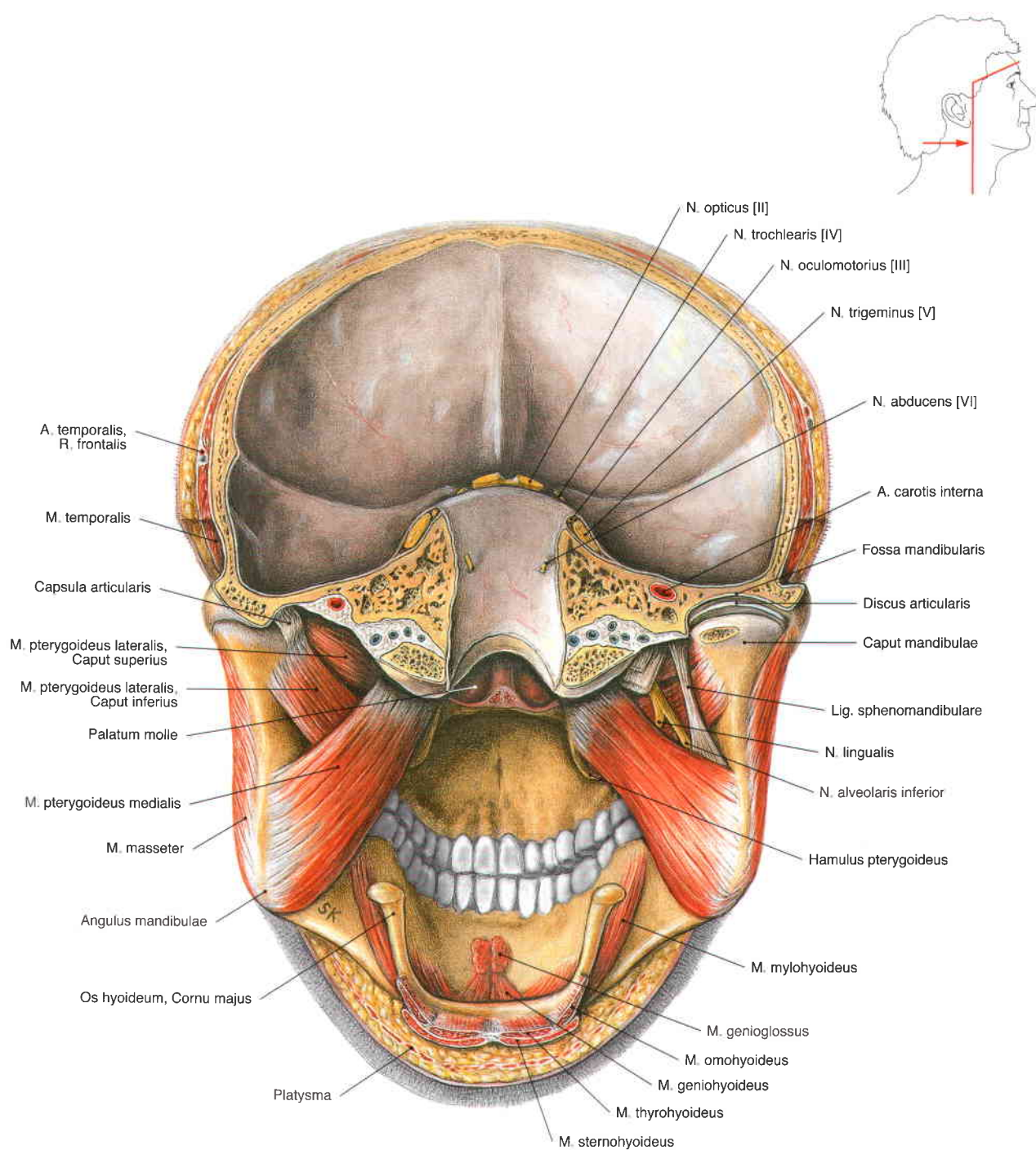
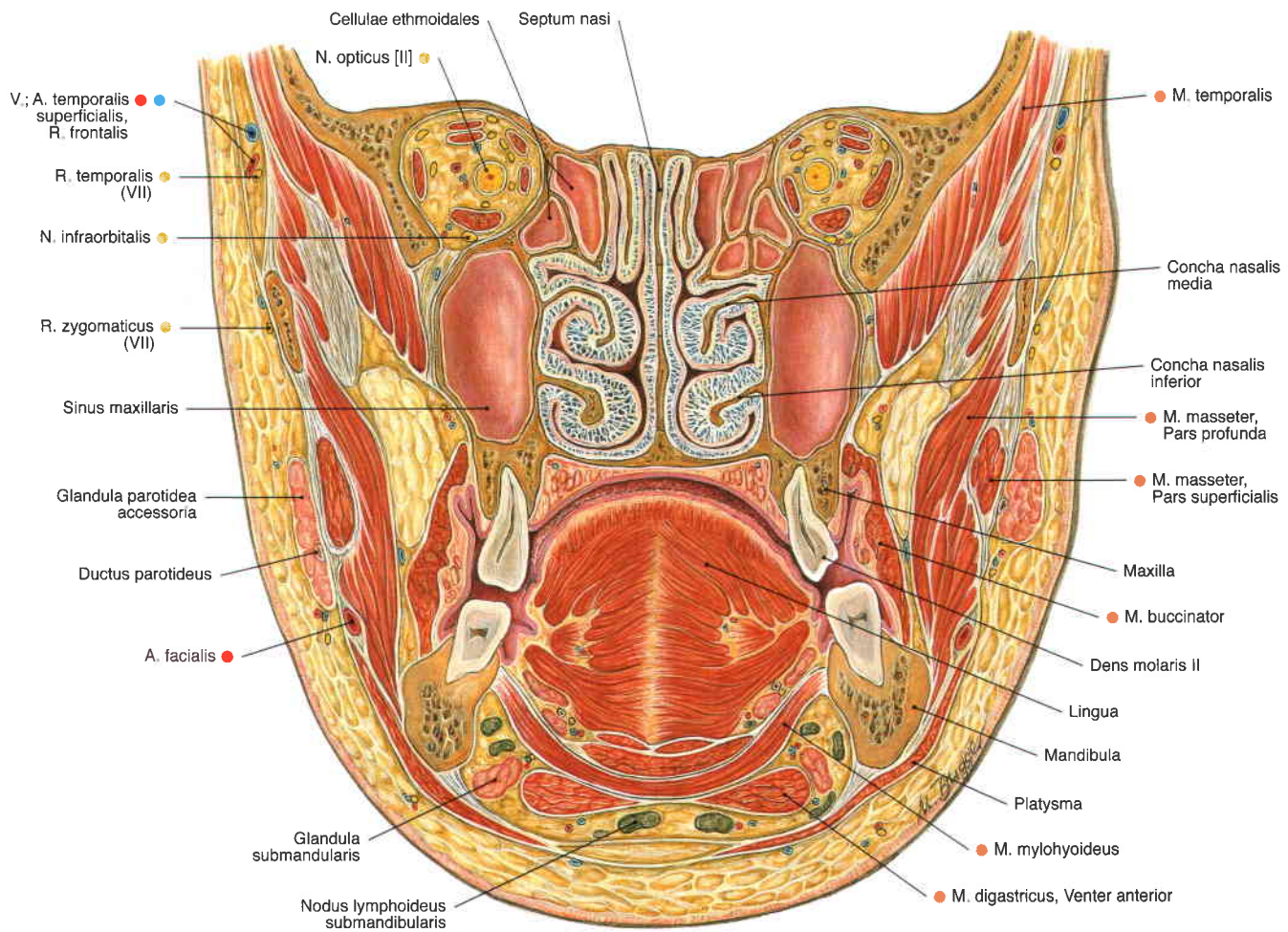
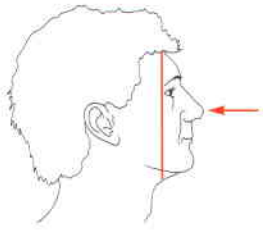


Fig. 116 Masticatory muscles, Mm. masticatorii; frontal section through the temporomandibular joint and horizontal section through the calvaria; posterior view.

→ T4

Masticatory muscles

→ T4

Fig. 117 Masticatory muscles, Mm. masticatorii;
frontal section;
anterior view.

Masticatory muscles

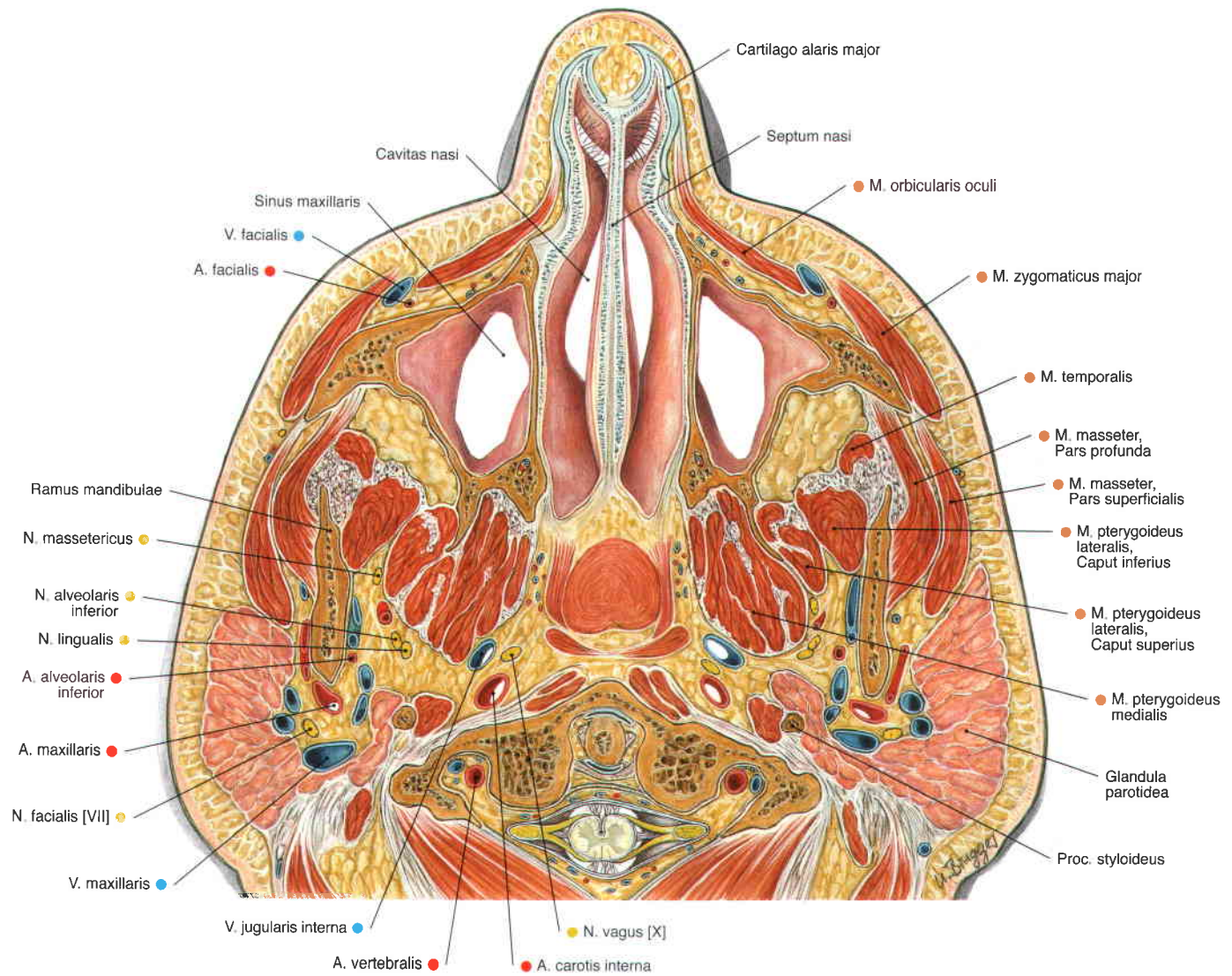
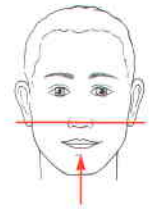
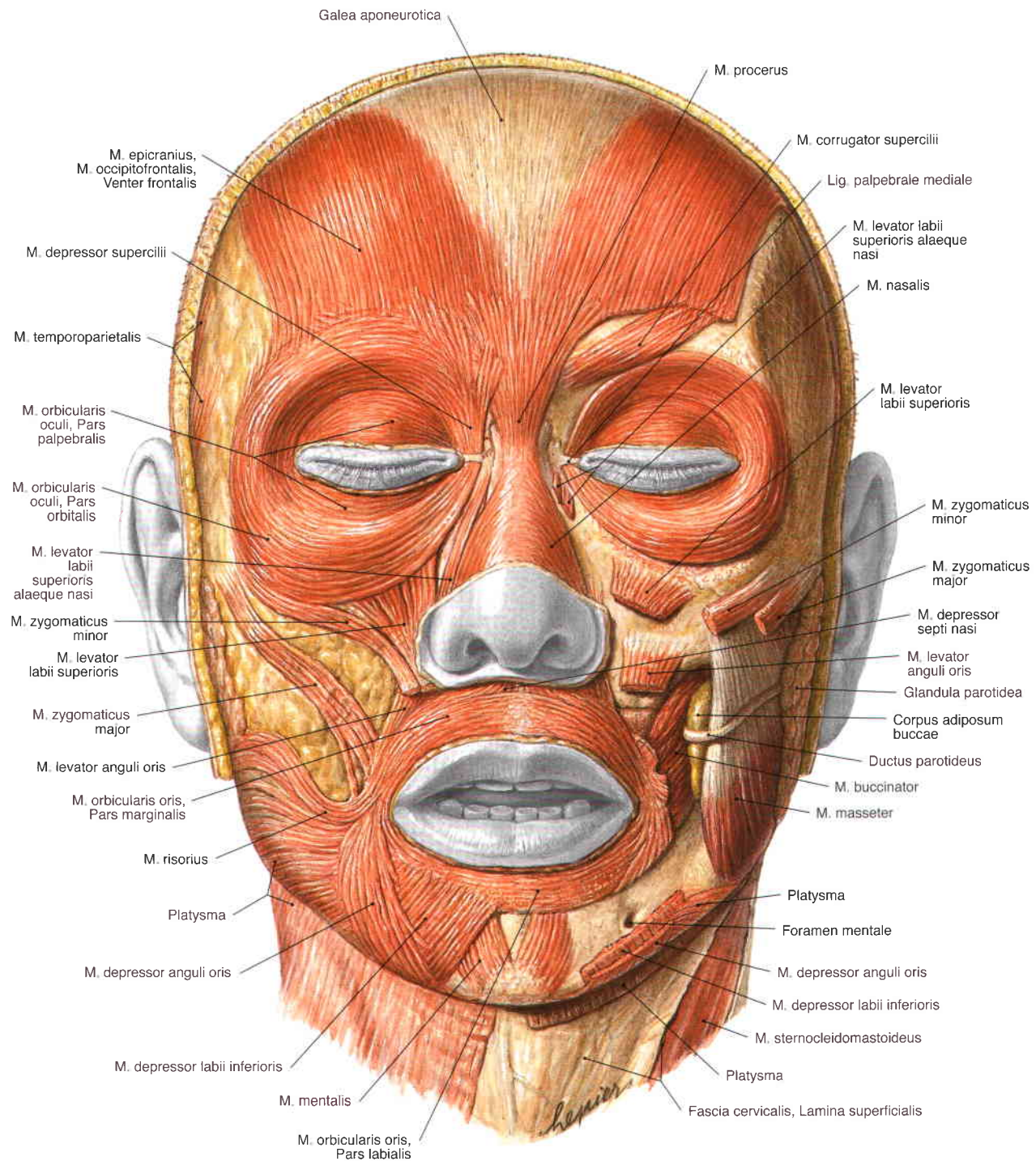


Fig. 118 Masticatory muscles, Mm. masticatorii; horizontal section.

→ T 4

Facial and masticatory muscles

→ T1 a, c-f, T4

Fig. 119 Facial muscles, Mm. faciei, and masticatory muscles, Mm. masticatorii.

Facial muscles

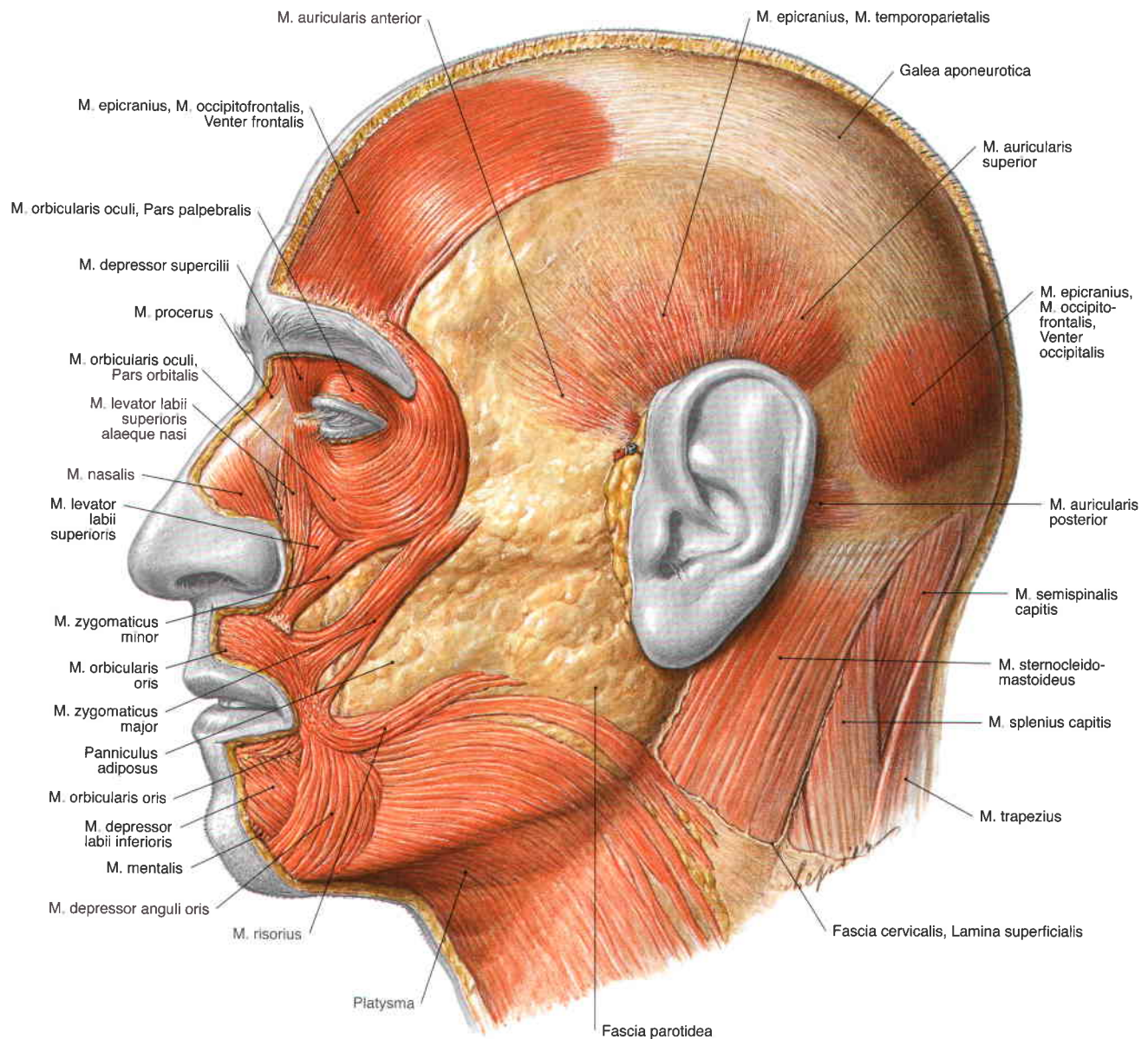
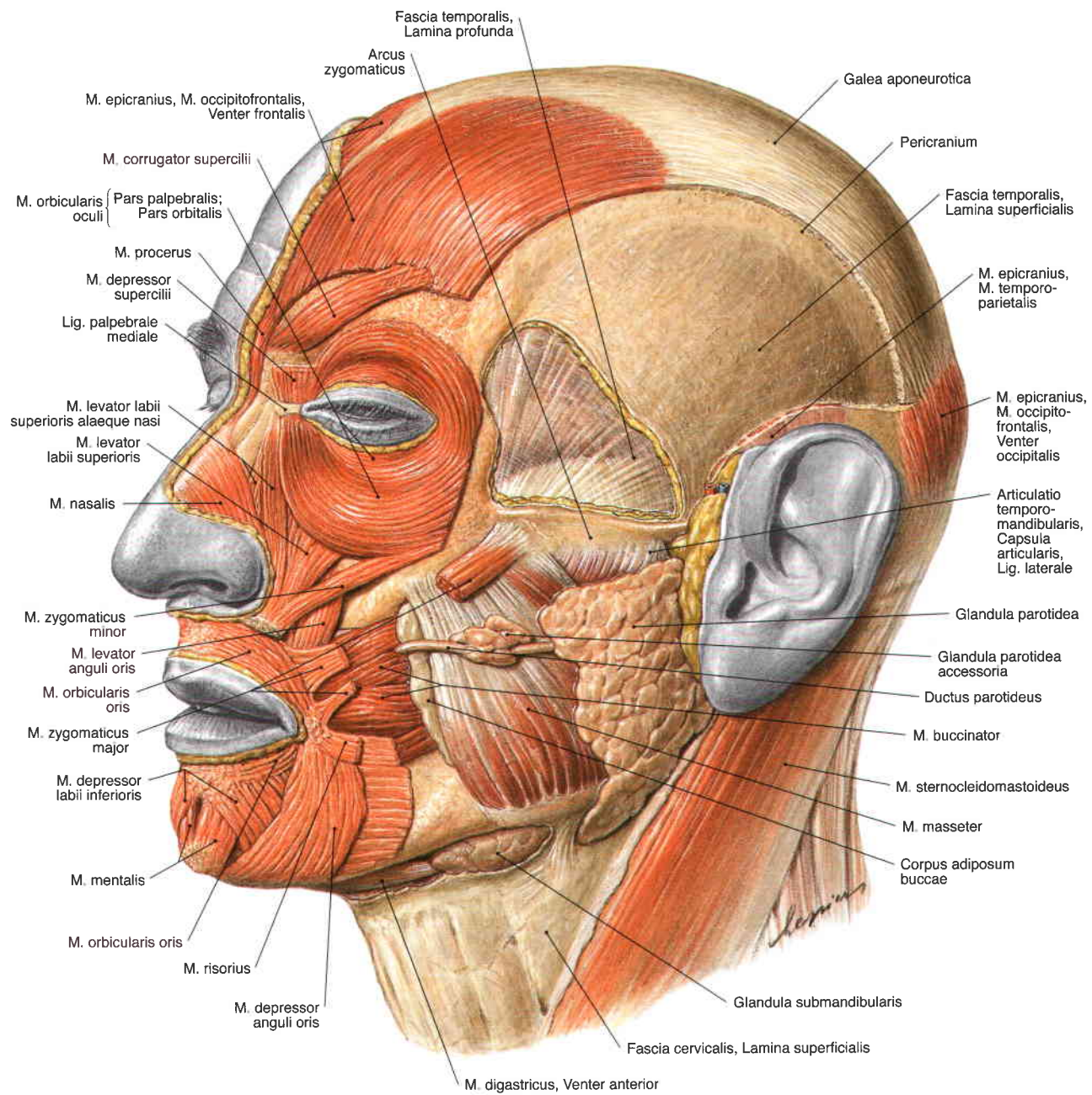


Fig. 120 Facial muscles, Mm. faciei.

→ T 1



Facial and masticatory muscles

→ T1, T4

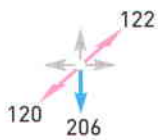
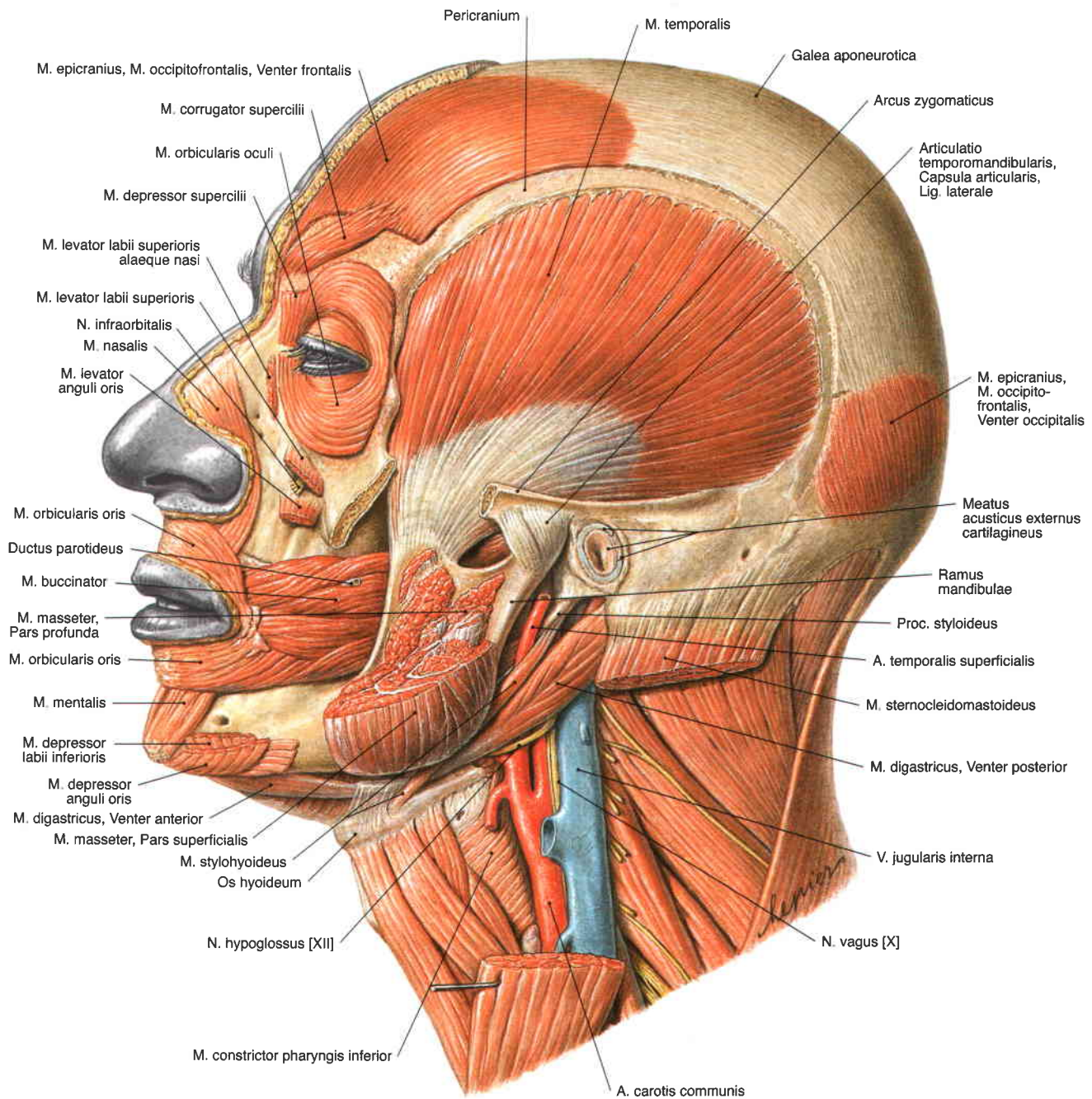


Fig. 121 Facial muscles, Mm. faciei, and masticatory muscles, Mm. masticatorii.

Facial and masticatory muscles



→ T1, T4

Fig. 122 Facial muscles, *Mm. faciei*, and masticatory muscles, *Mm. masticatorii*.

121

256

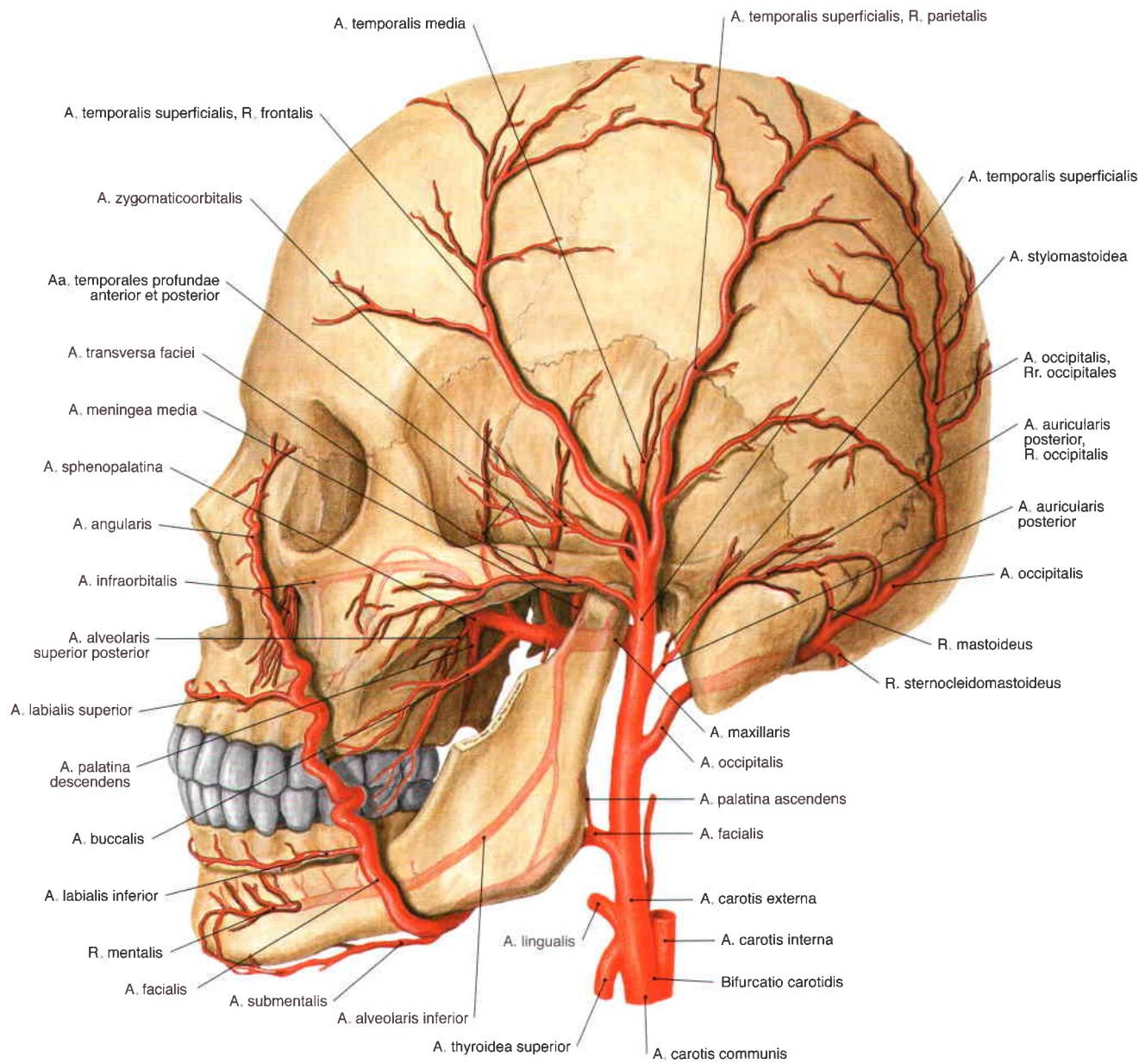
Arteries of the head

Fig. 123 External carotid artery,
A. carotis externa.

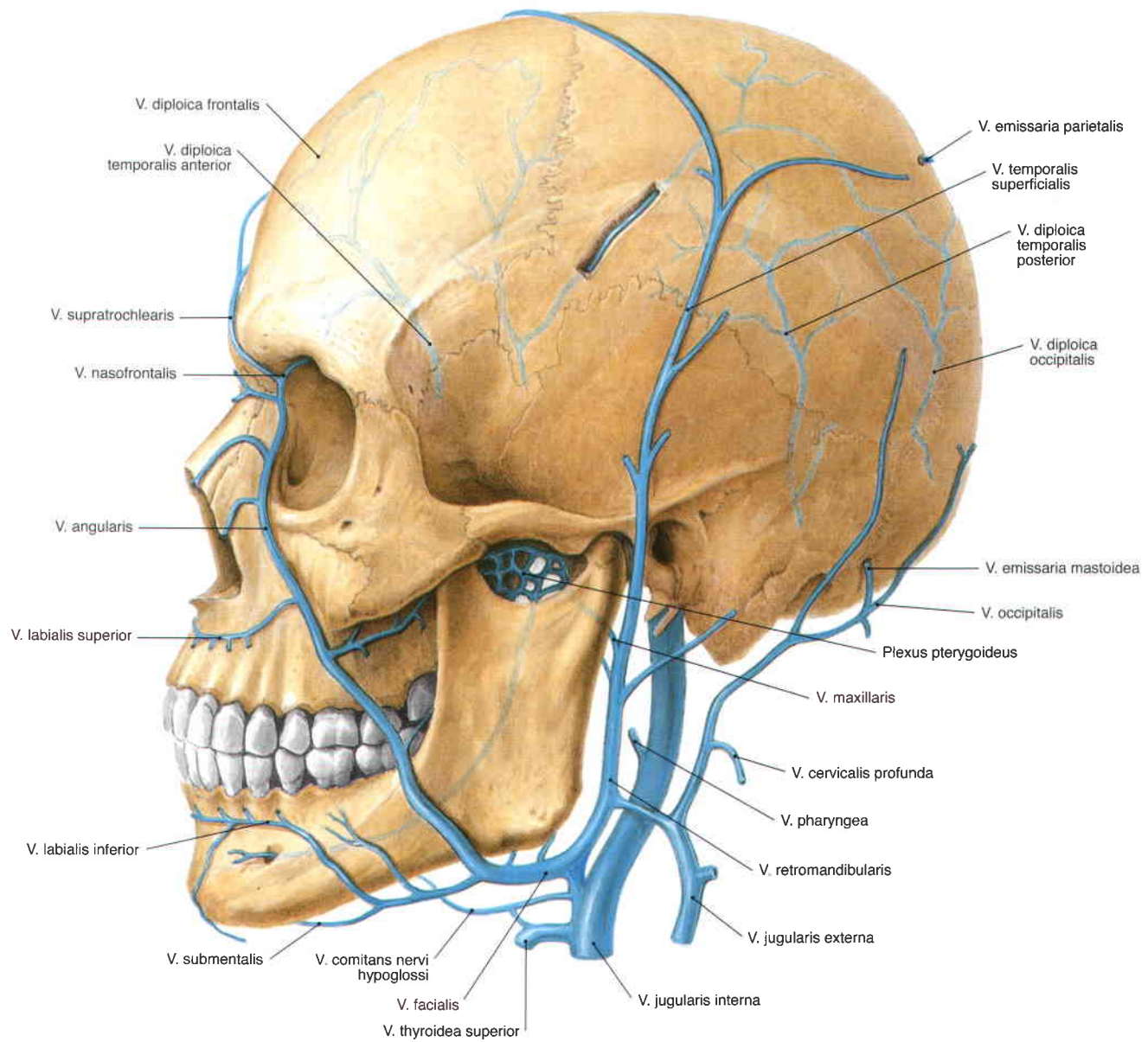
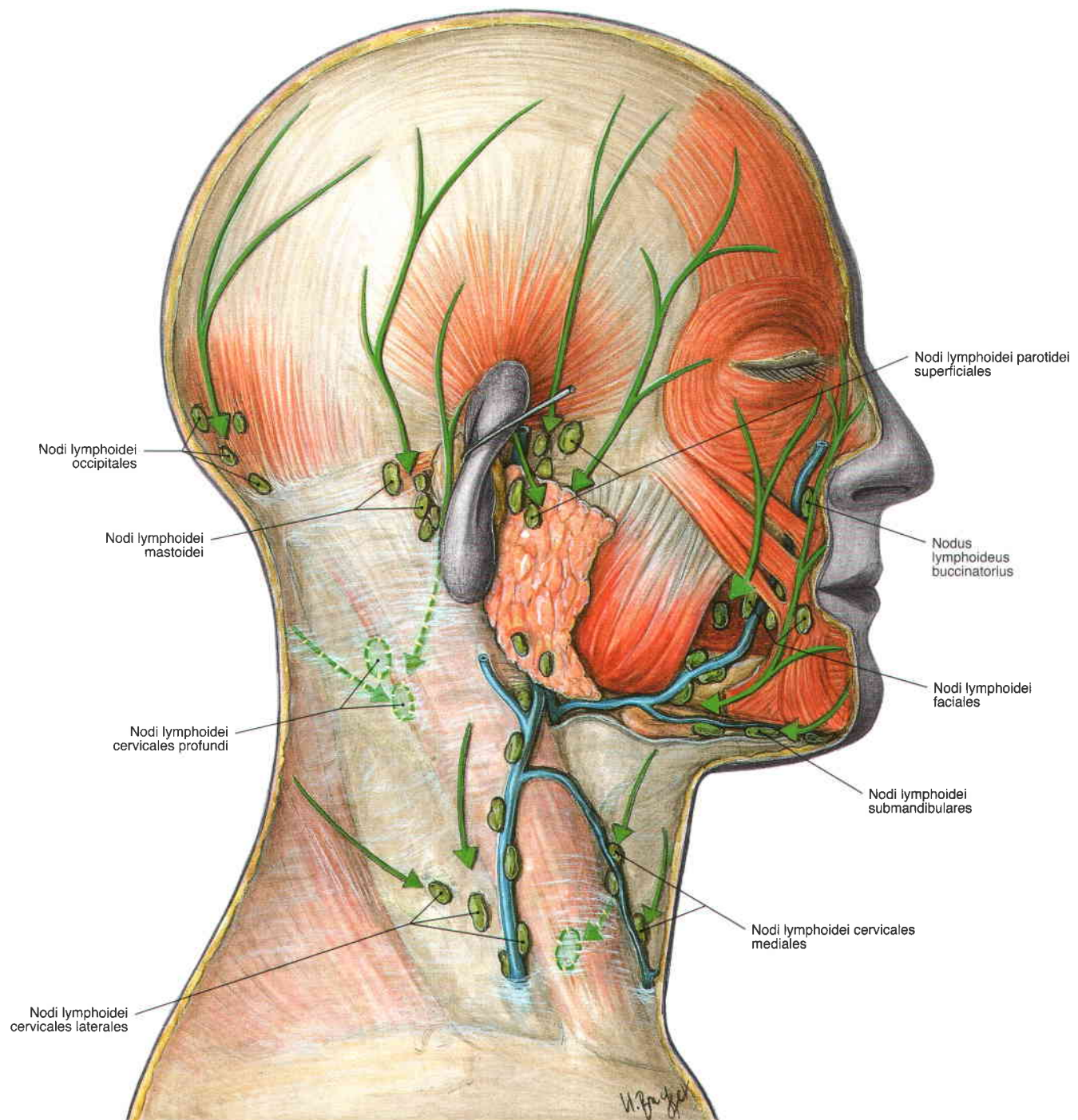


Fig. 124 Internal jugular vein,
V. jugularis interna.

Lymphatics of the head and the neck

→ 261, 414

Fig. 125 Lymph nodes and lymphatics of the head and the neck, Nodi lymphoidei capitis et cervicis; arrows indicate drainage areas.

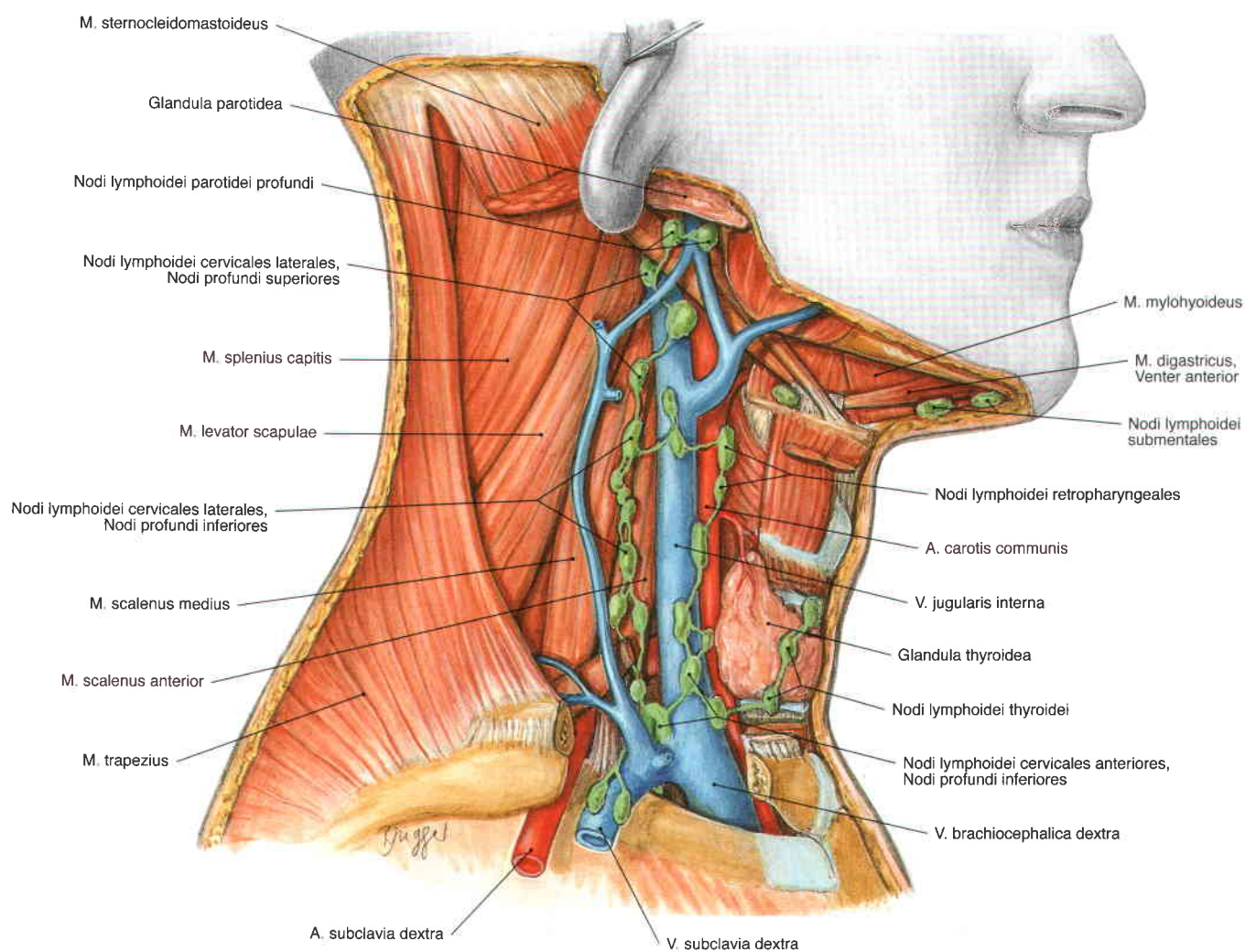
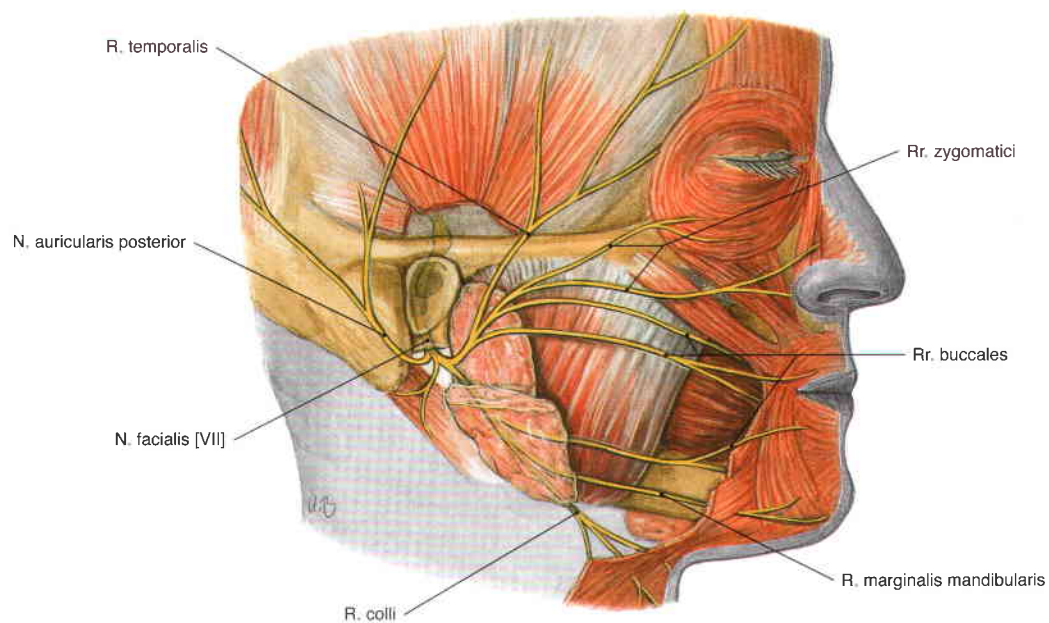


Fig. 126 Deep lymph nodes of the neck, Nodi lymphoidei cervicales profundi.

Facial nerve**Fig. 127** Facial nerve, N. facialis [VII].**a****b**

→ 477

Fig. 128 a, b Palsy of the left facial nerve, N. facialis [VII].**a** The concerned eye cannot be closed upon request (lagophthalmus).**b** The teeth of the concerned side cannot be shown upon request.

Cutaneous innervation

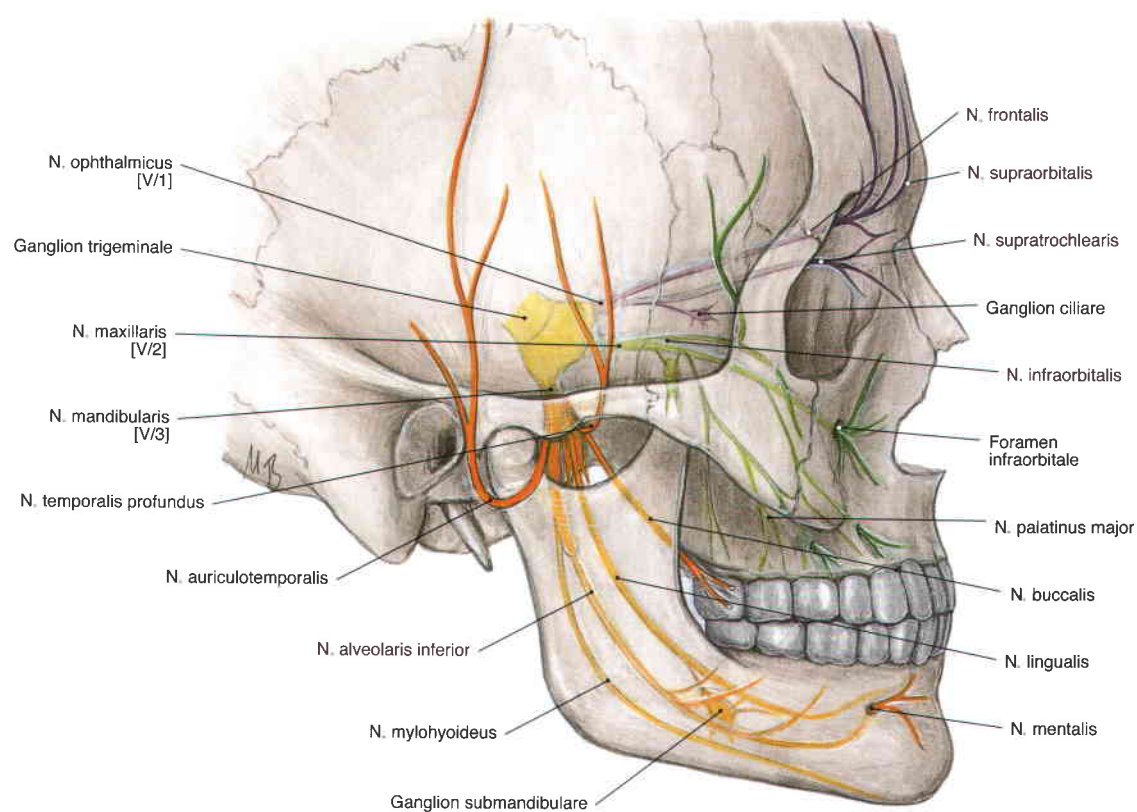


Fig. 129 Trigeminal nerve, N. trigeminus [V].

→ 472–475

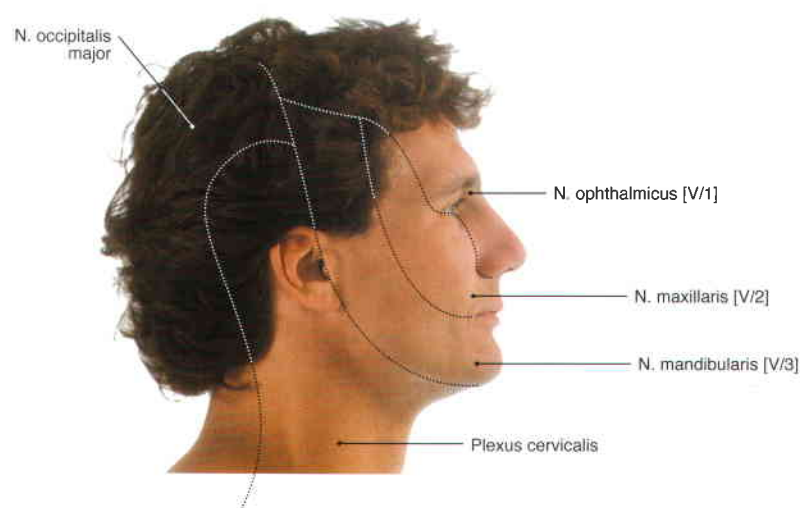


Fig. 130 Cutaneous innervation of the head and the neck.

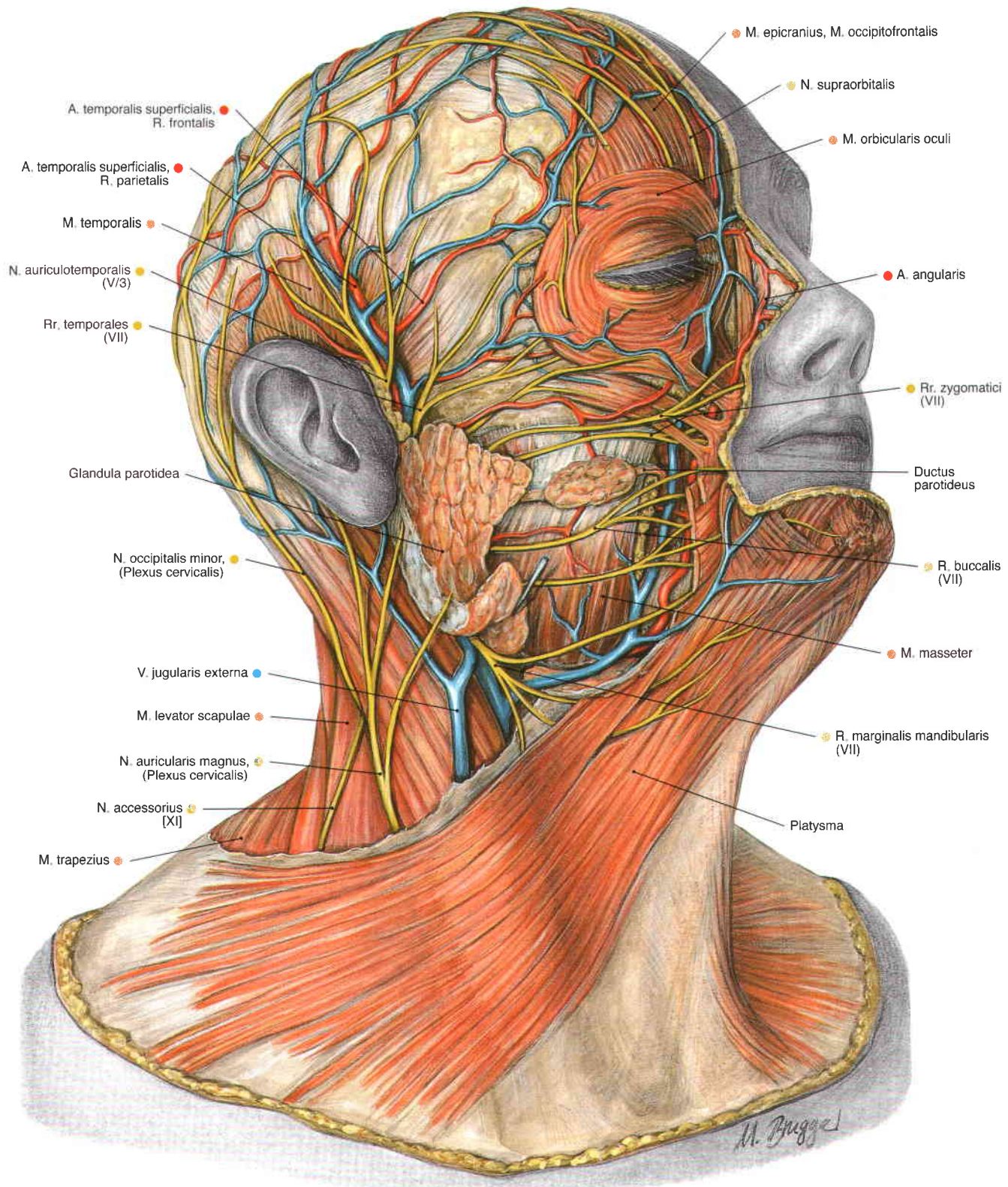
Vessels and nerves of the head and the neck

Fig. 131 Vessels and nerves of the head and the neck; superficial lateral regions.

Vessels and nerves of the head and the neck

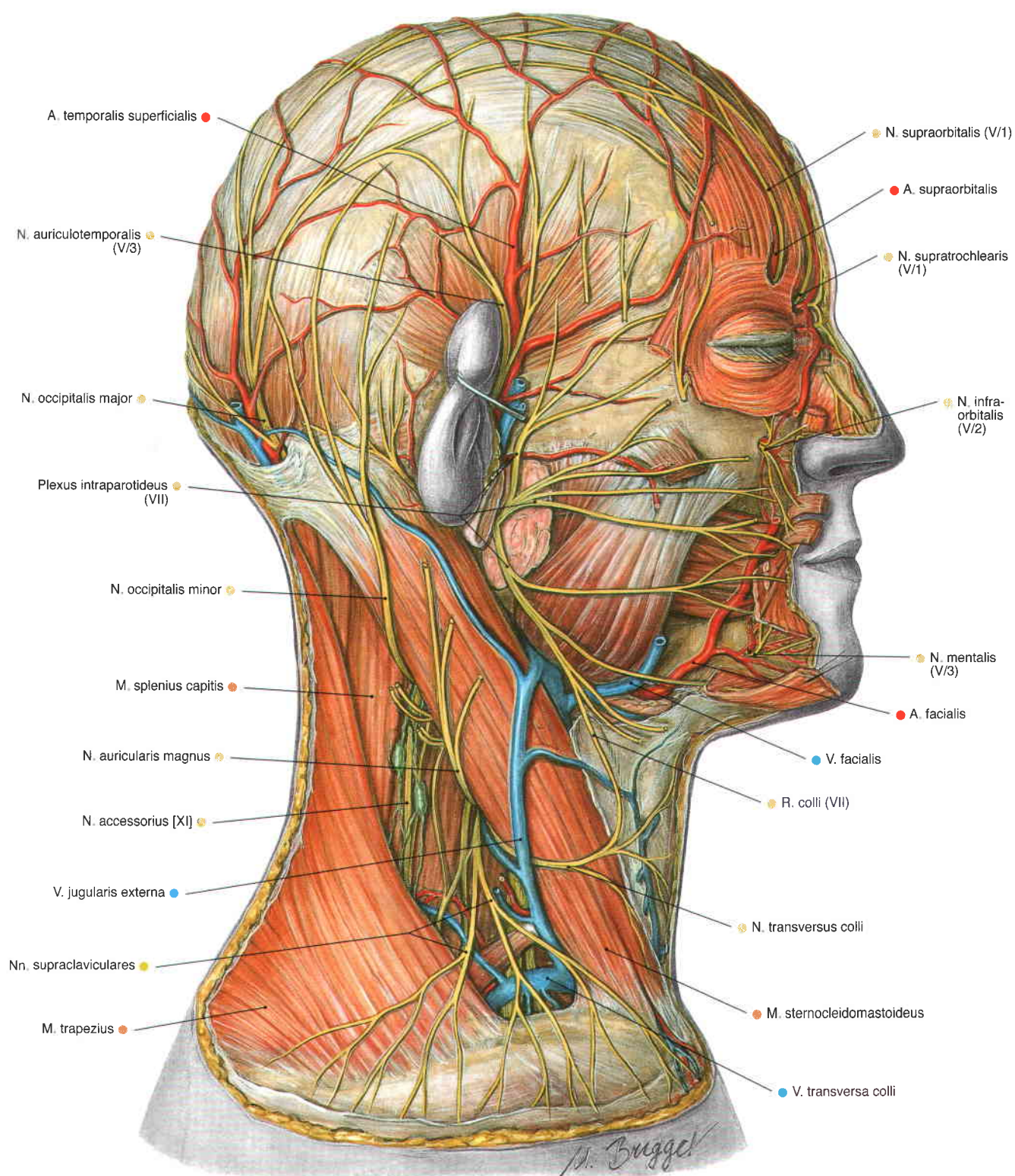


Fig. 132 Vessels and nerves of the head and the neck; deep lateral regions.

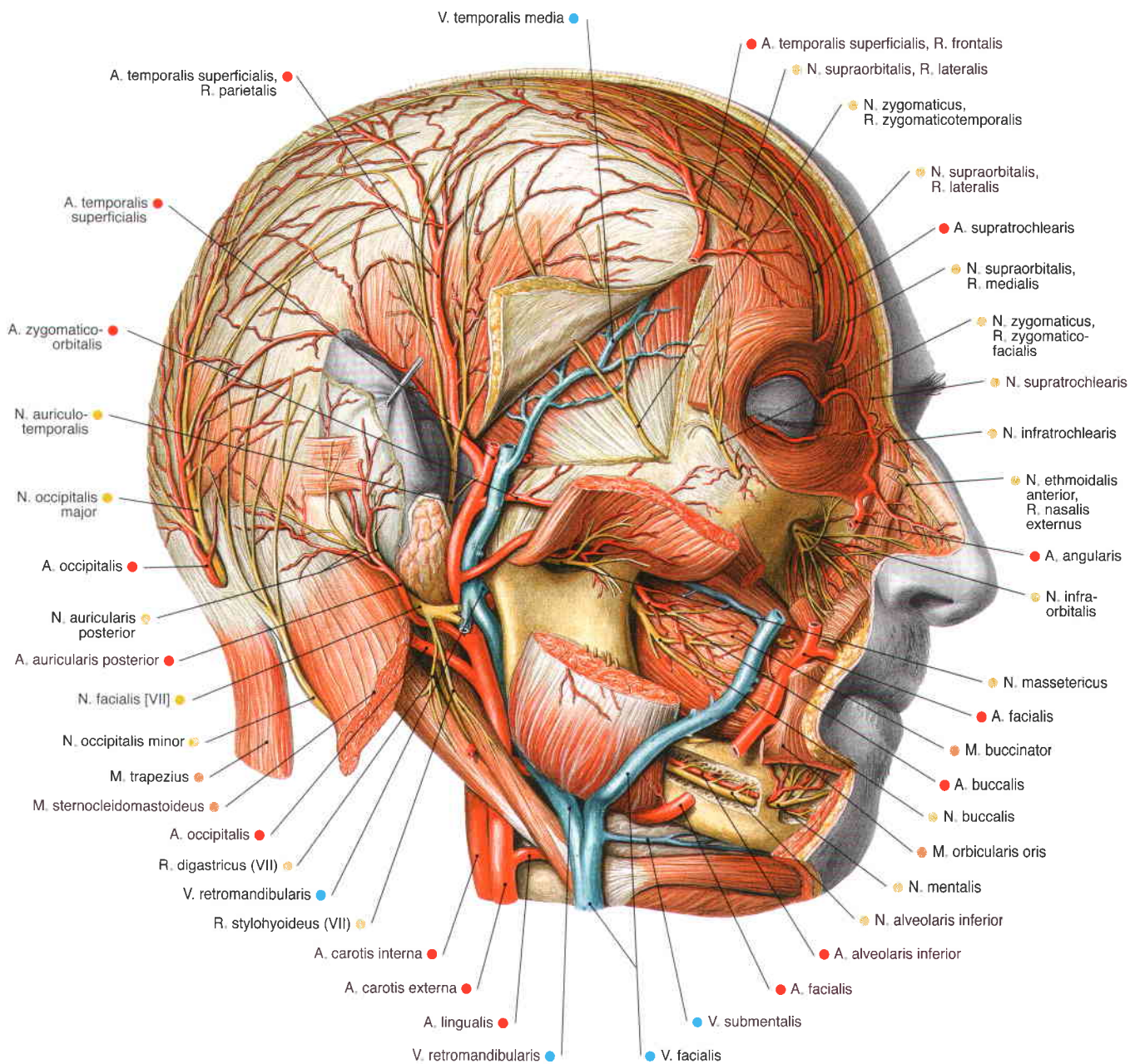
Lateral region of the face

Fig. 133 Vessels and nerves of the head; deep lateral regions.

Maxillary artery

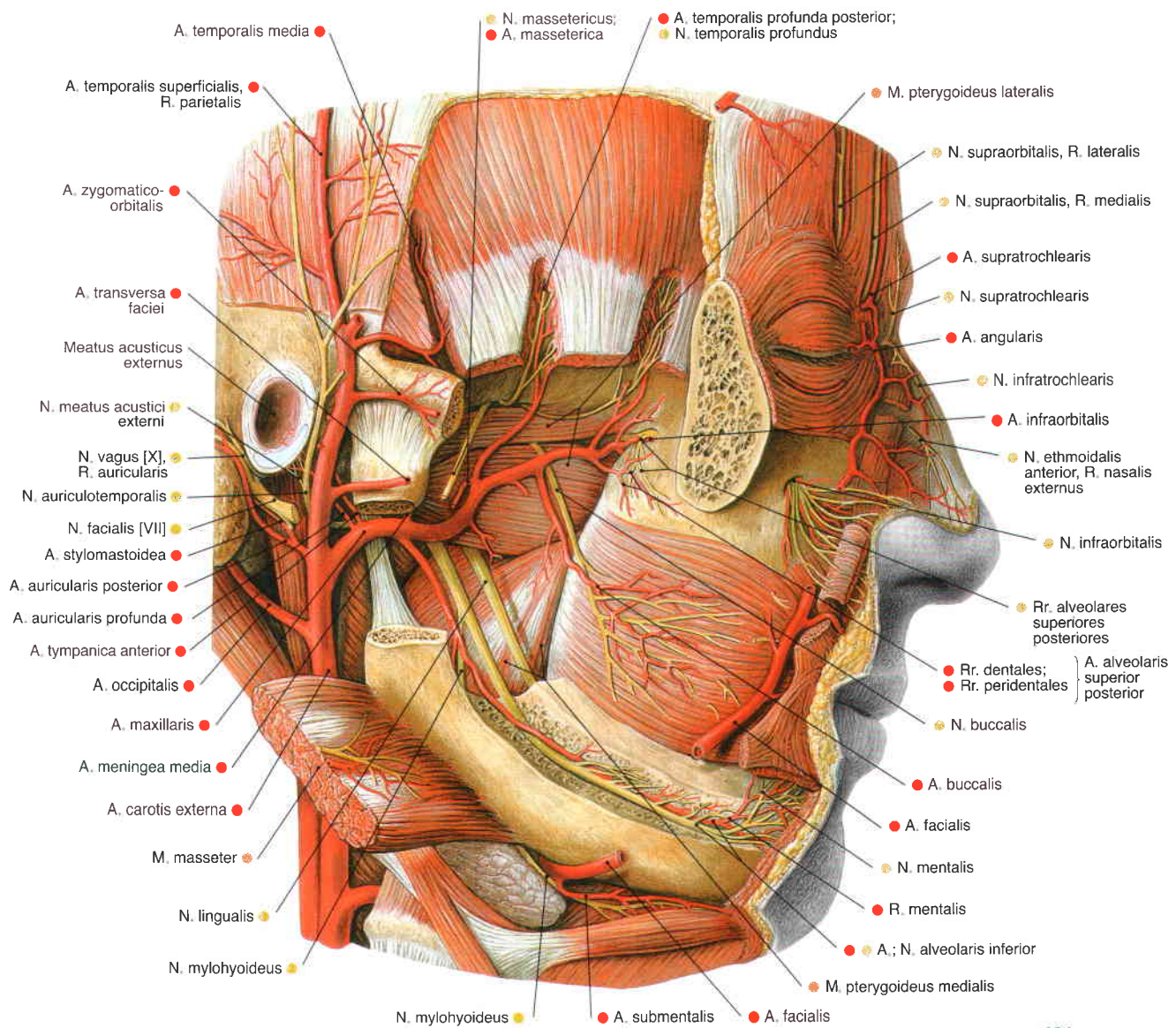


Fig. 134 Arteries and nerves of the head; deeper lateral regions.

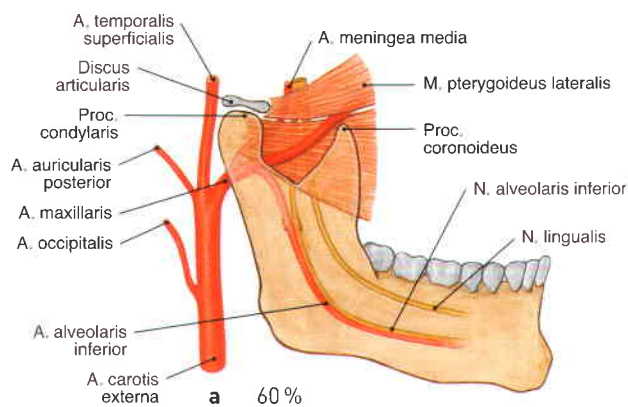
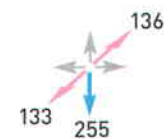


Fig. 135 a–c Variations of the middle meningeal artery, A. meningea media.

- a** The middle meningeal artery, A. meningea media, branches off proximal to the inferior alveolar artery, A. alveolaris inferior.
- b** The middle meningeal artery, A. meningea media, branches off across from the inferior alveolar artery, A. alveolaris inferior.
- c** The middle meningeal artery, A. meningea media, branches off distal to the inferior alveolar artery, A. alveolaris inferior.

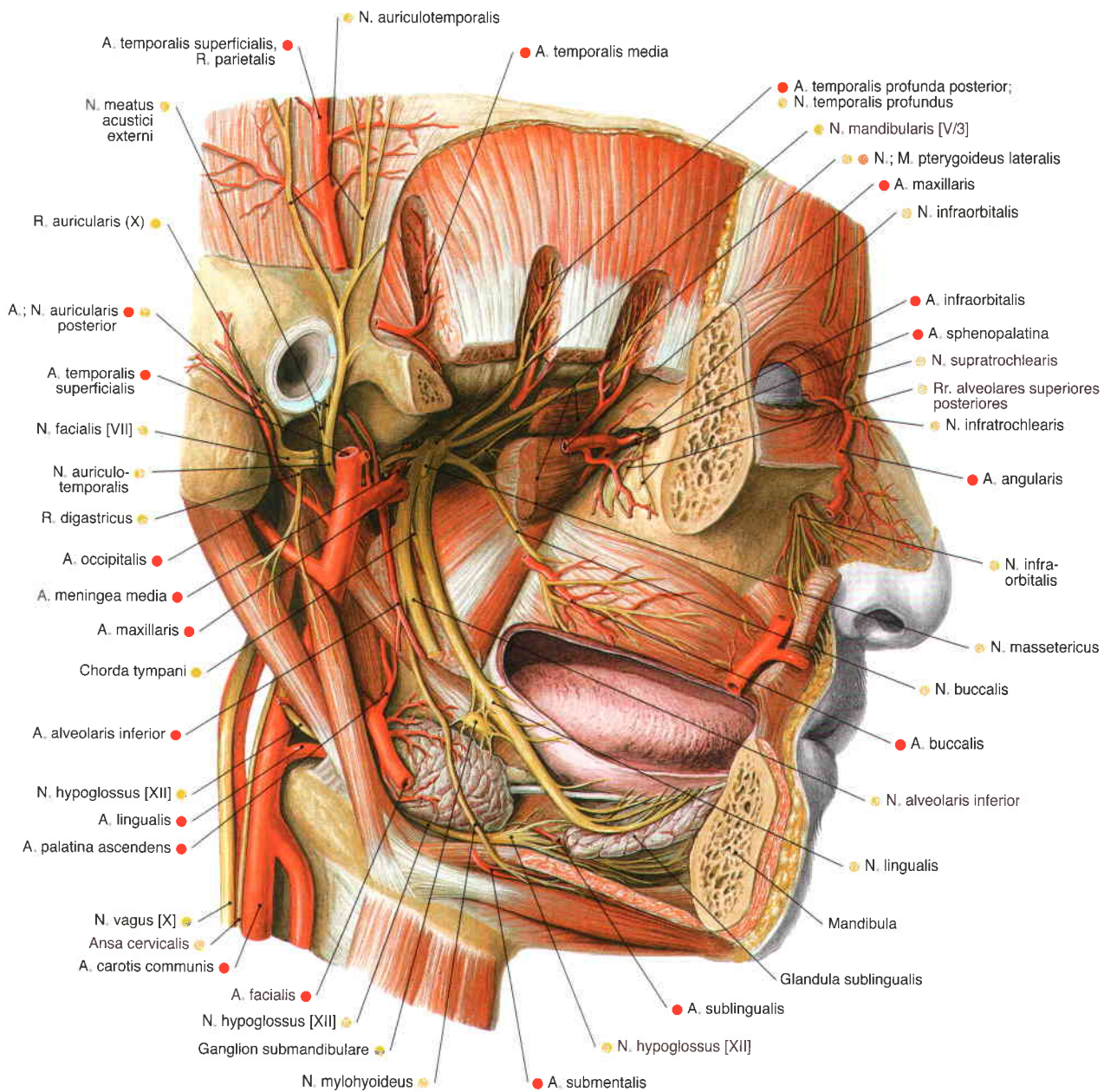
Lateral region of the face

Fig. 136 Arteries and nerves of the head, deepest lateral regions.

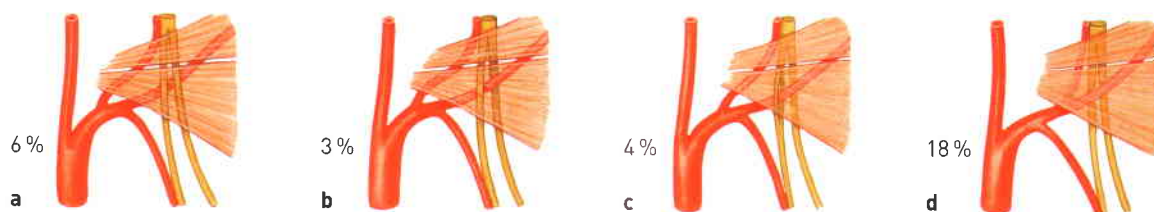
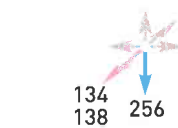


Fig. 137 a–d Variations in the course of the maxillary artery, A. maxillaris.

- a** The maxillary artery, A. maxillaris, passes medially to the lateral pterygoid muscle, M. pterygoideus lateralis, the lingual nerve, N. lingualis, and the inferior alveolar nerve, N. alveolaris inferior.
- b** The maxillary artery, A. maxillaris, passes between the lingual nerve, N. lingualis, and the inferior alveolar nerve, N. alveolaris inferior.
- c** The maxillary artery, A. maxillaris, passes through a loop formed by the inferior alveolar nerve, N. alveolaris inferior.
- d** The middle meningeal artery, A. meningea media, branches off distal to the inferior alveolar artery, A. alveolaris inferior.

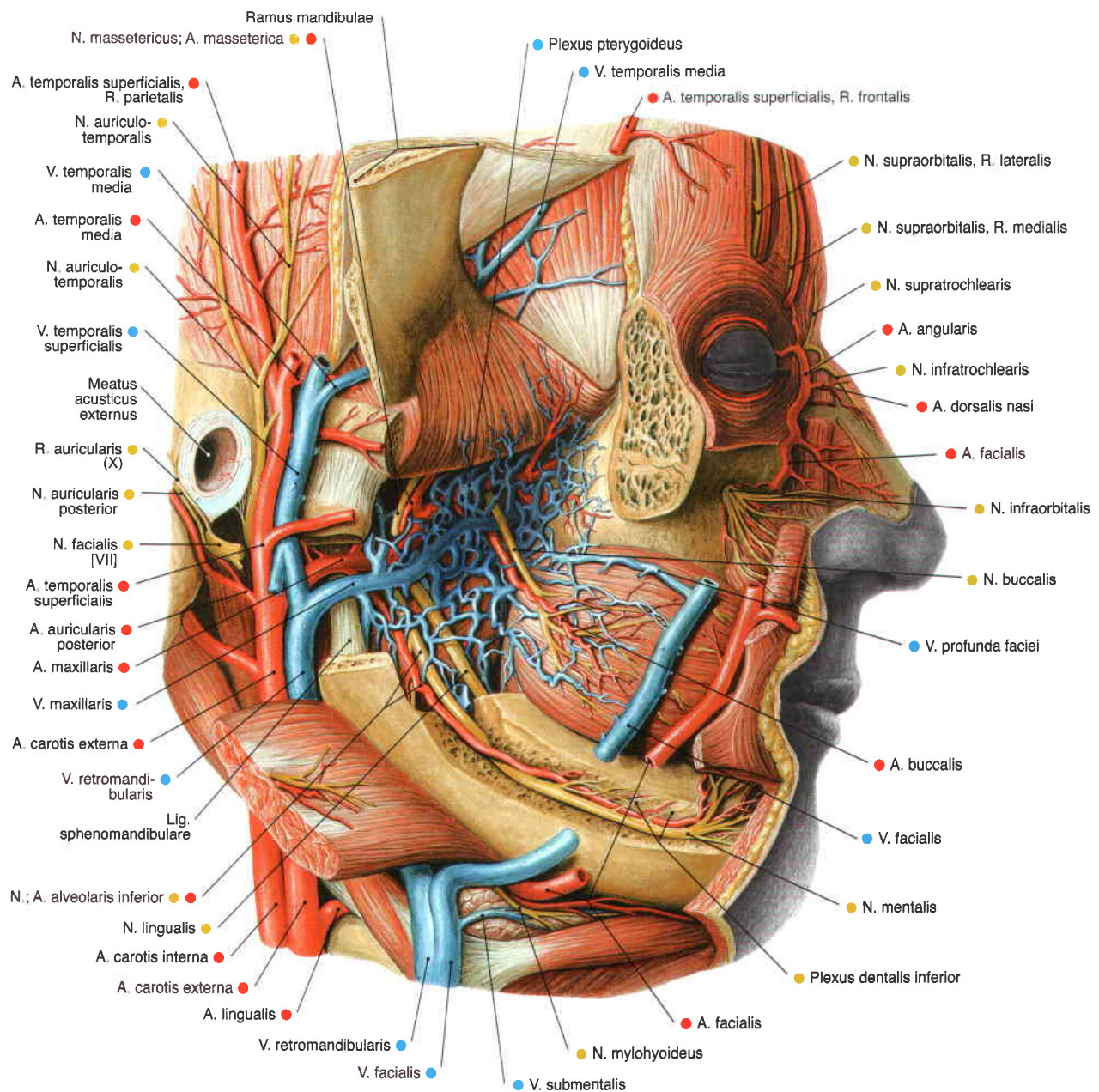
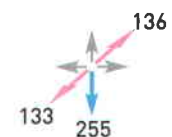
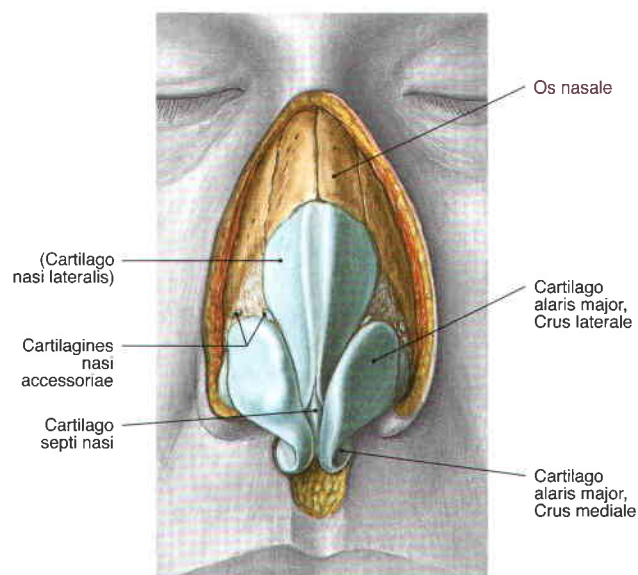
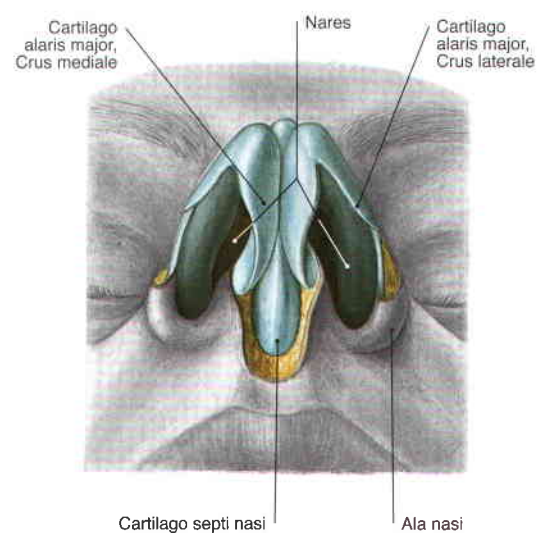
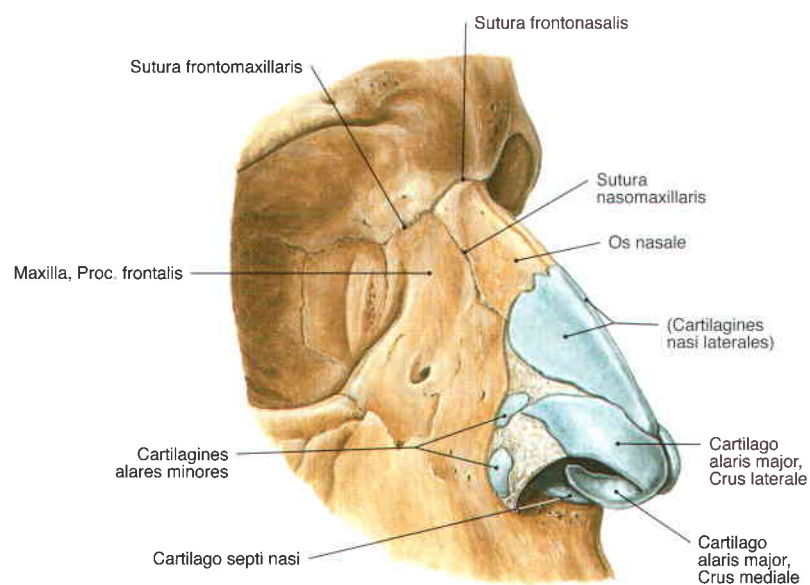


Fig. 138 Vessels and nerves of the head; deeper lateral regions.



Skeleton of the nose**Fig. 139** Skeleton of the nose.**Fig. 140** Nasal cartilages, Cartilagine nasales.**Fig. 141** Skeleton of the nose.

Nasal septum

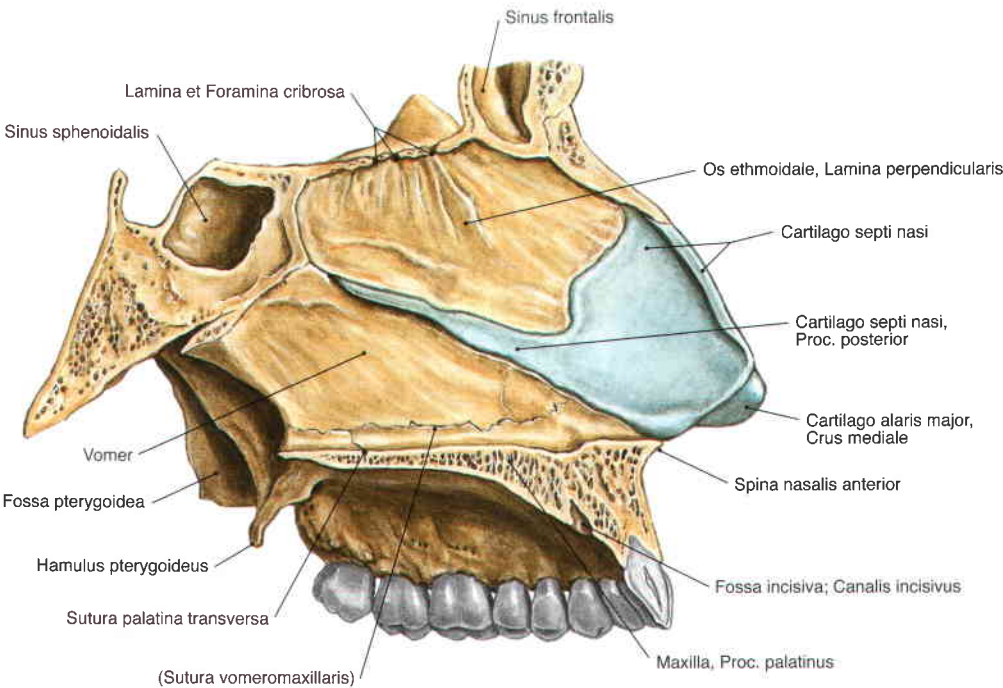


Fig. 142 Nasal septum, Septum nasi.

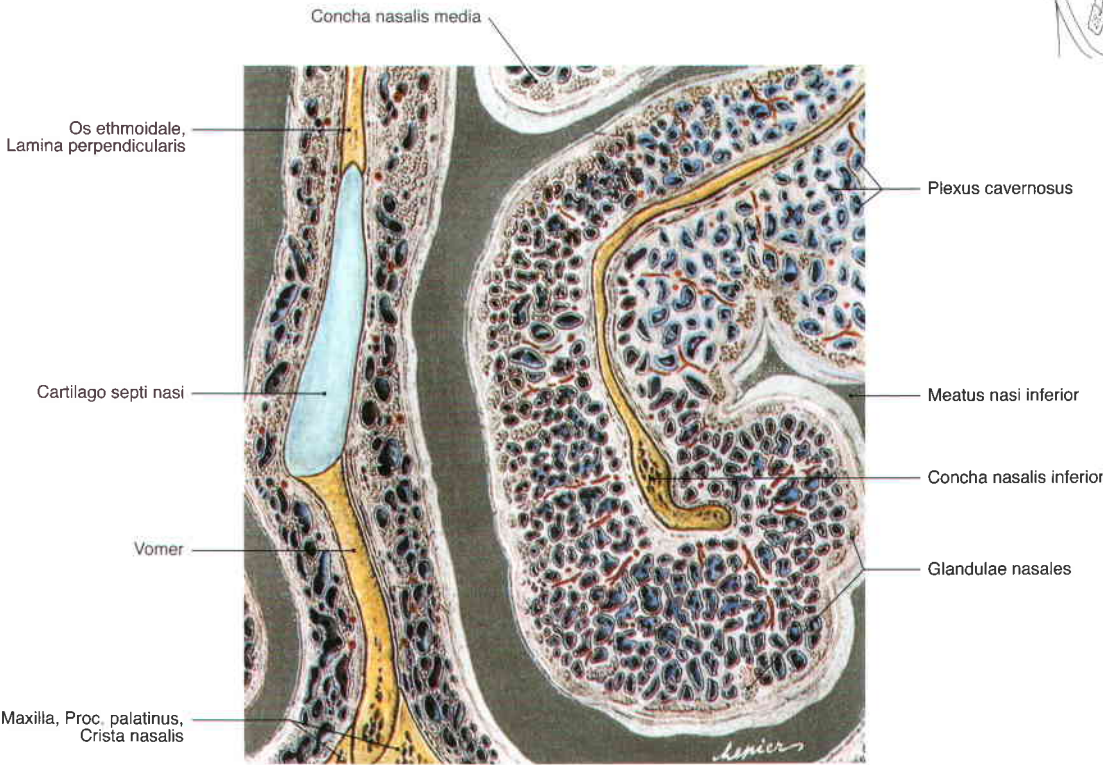
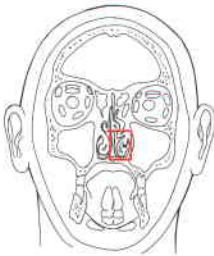


Fig. 143 Inferior nasal concha, Concha nasalis inferior.

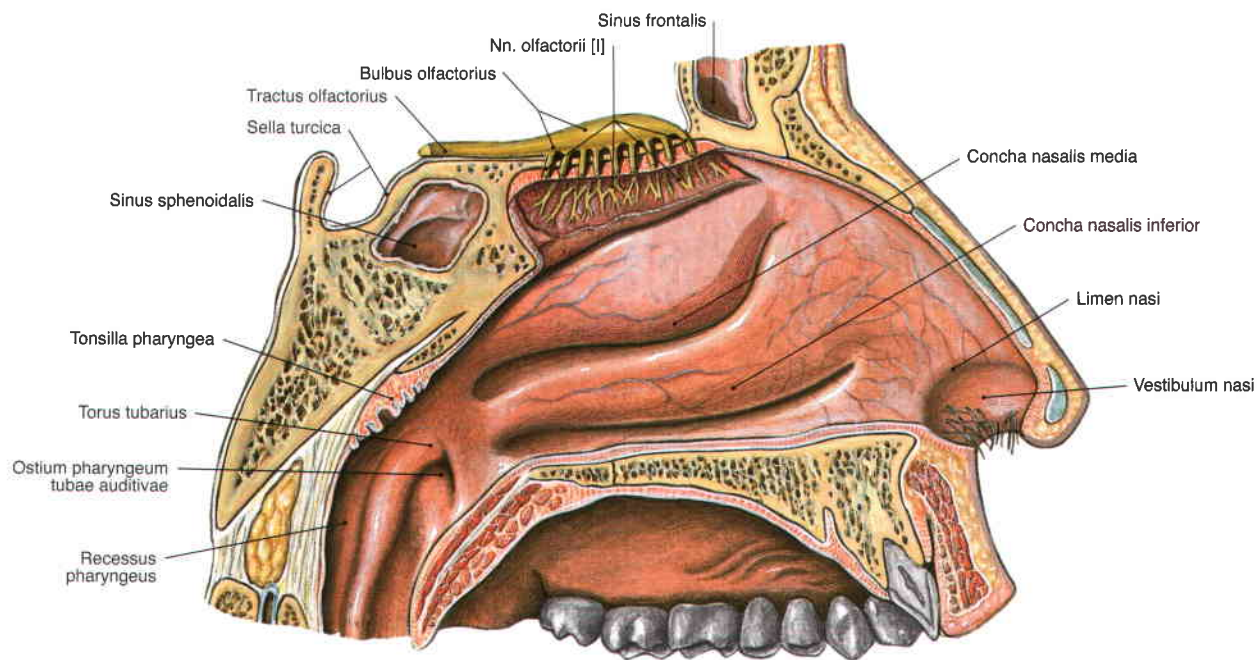
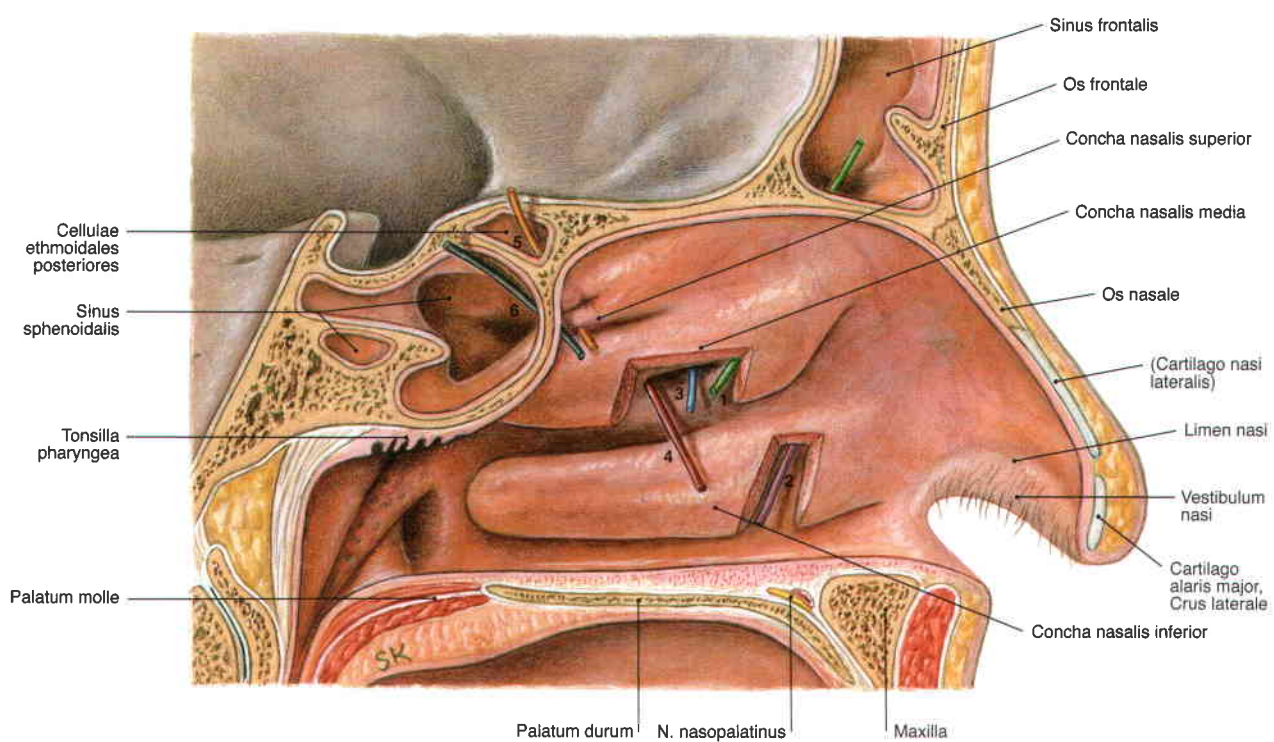


Fig. 144 Lateral wall of the nasal cavity, Cavitas nasi.



- Openings of:
- 1 Sinus frontalis
 - 2 Ductus nasolacrimalis
 - 3 Cellulae ethmoidales anteriores
 - 4 Sinus maxillaris
 - 5 Cellulae ethmoidales posteriores
 - 6 Sinus sphenoidalis

Fig. 145 Nasal cavity, Cavitas nasi, and openings of the paranasal sinuses, Sinus paranasales.

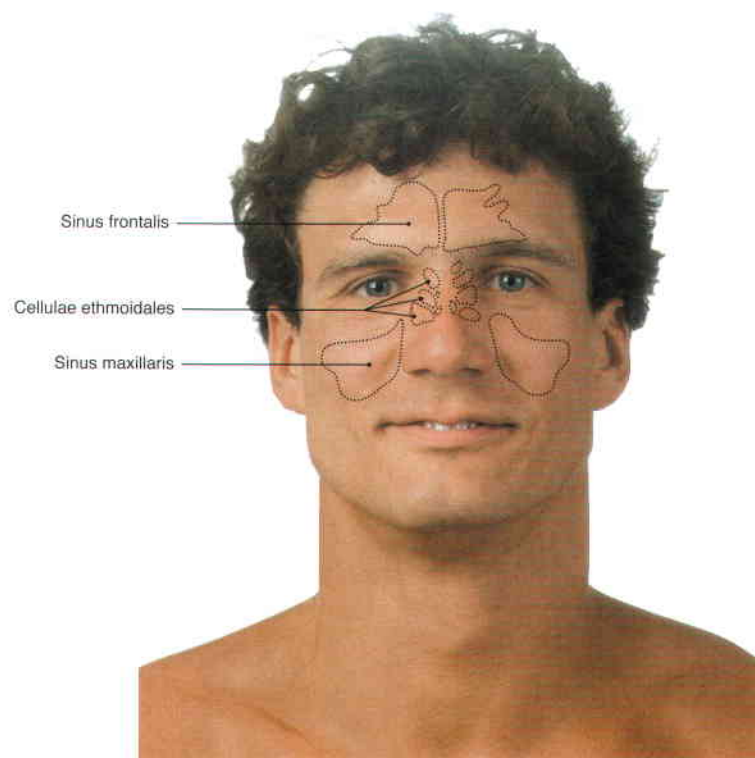
Paranasal sinuses

Fig. 146 Projection of the paranasal sinuses, Sinus paranasales.

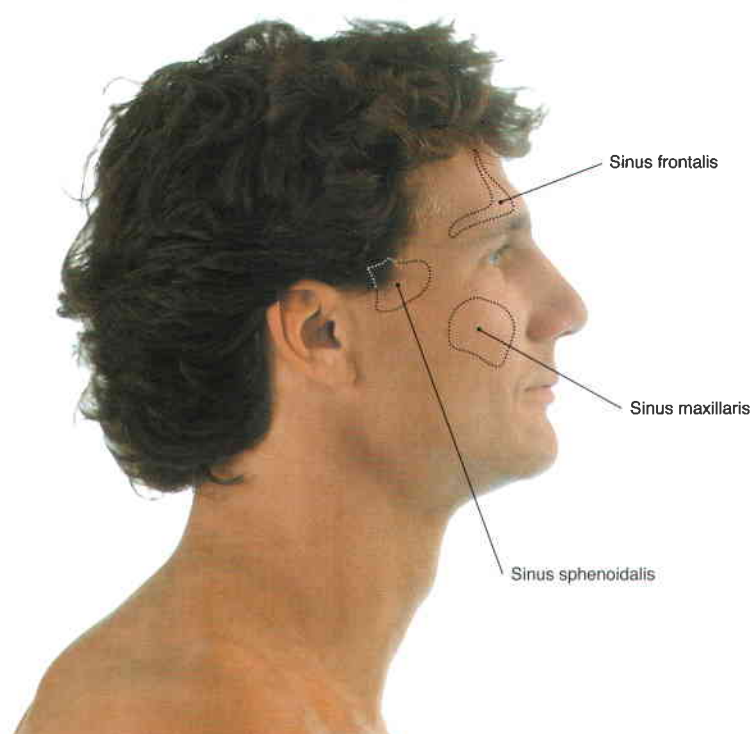
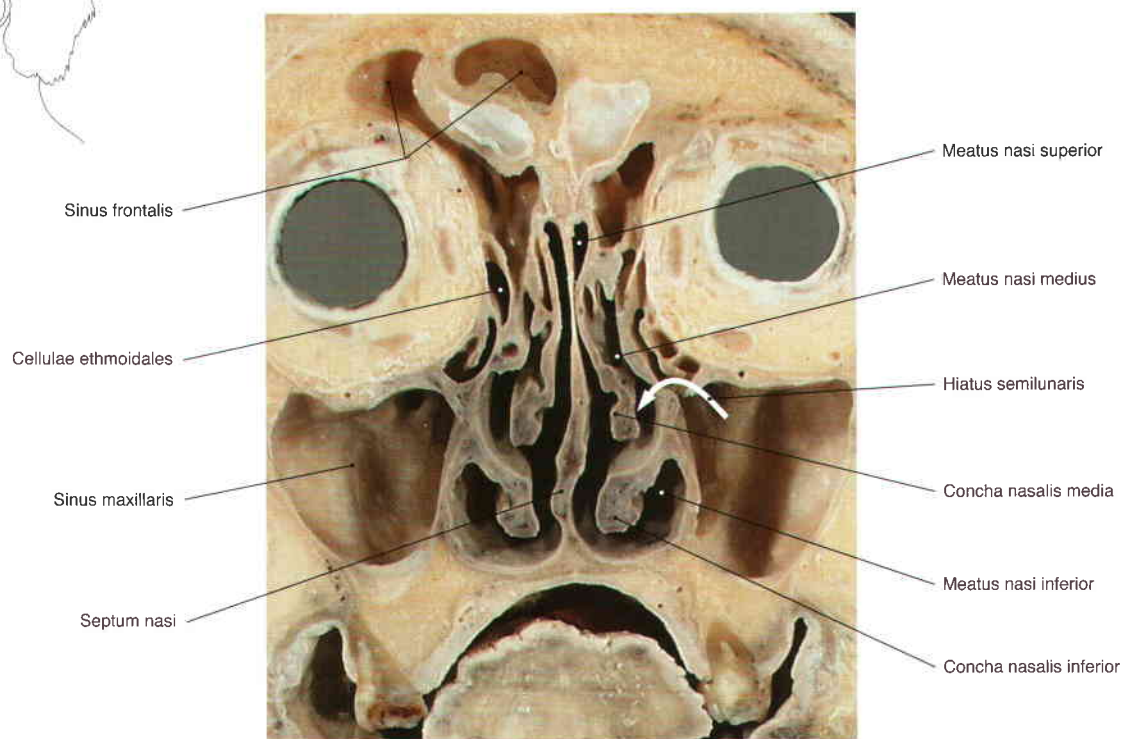
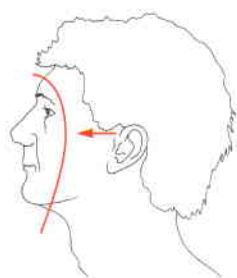
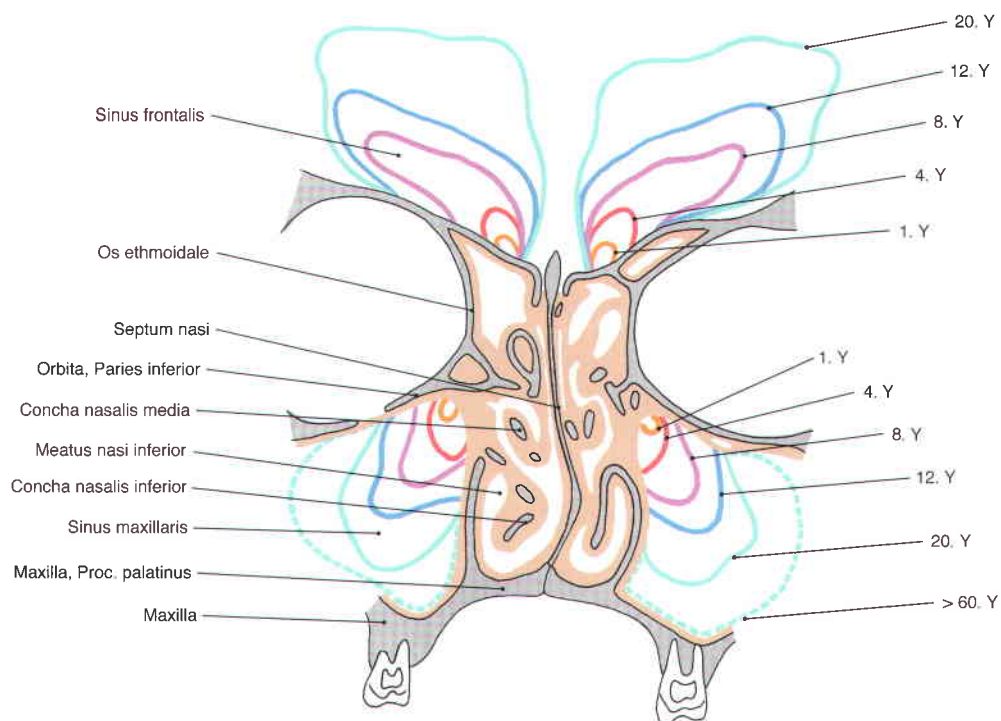


Fig. 147 Projection of the paranasal sinuses, Sinus paranasales.

Paranasal sinuses**Fig. 148** Paranasal sinuses, Sinus paranasales.**Fig. 149** Development of the maxillary and frontal sinuses.
Y – year of life

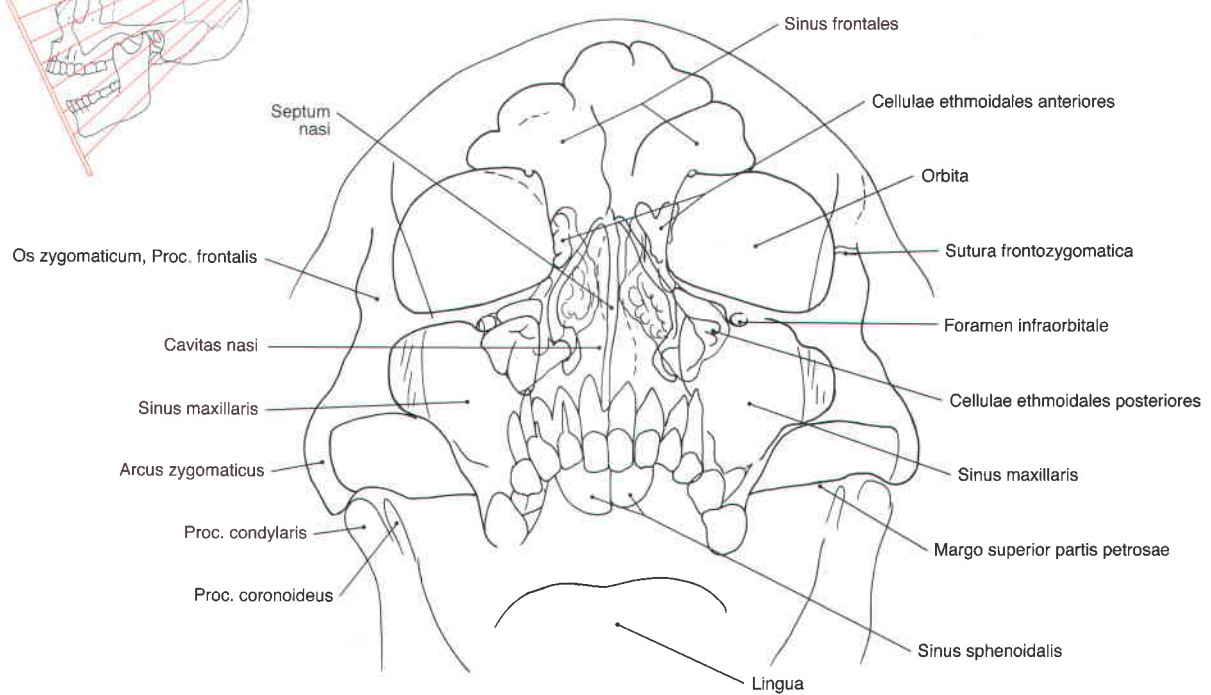
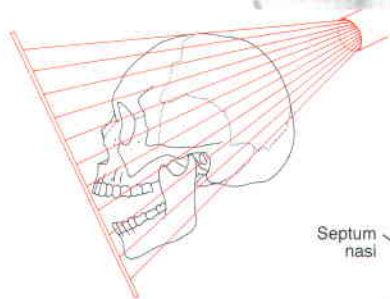


Fig. 150 Paranasal sinuses, Sinus paranasales; PA-radiograph.

Oral cavity

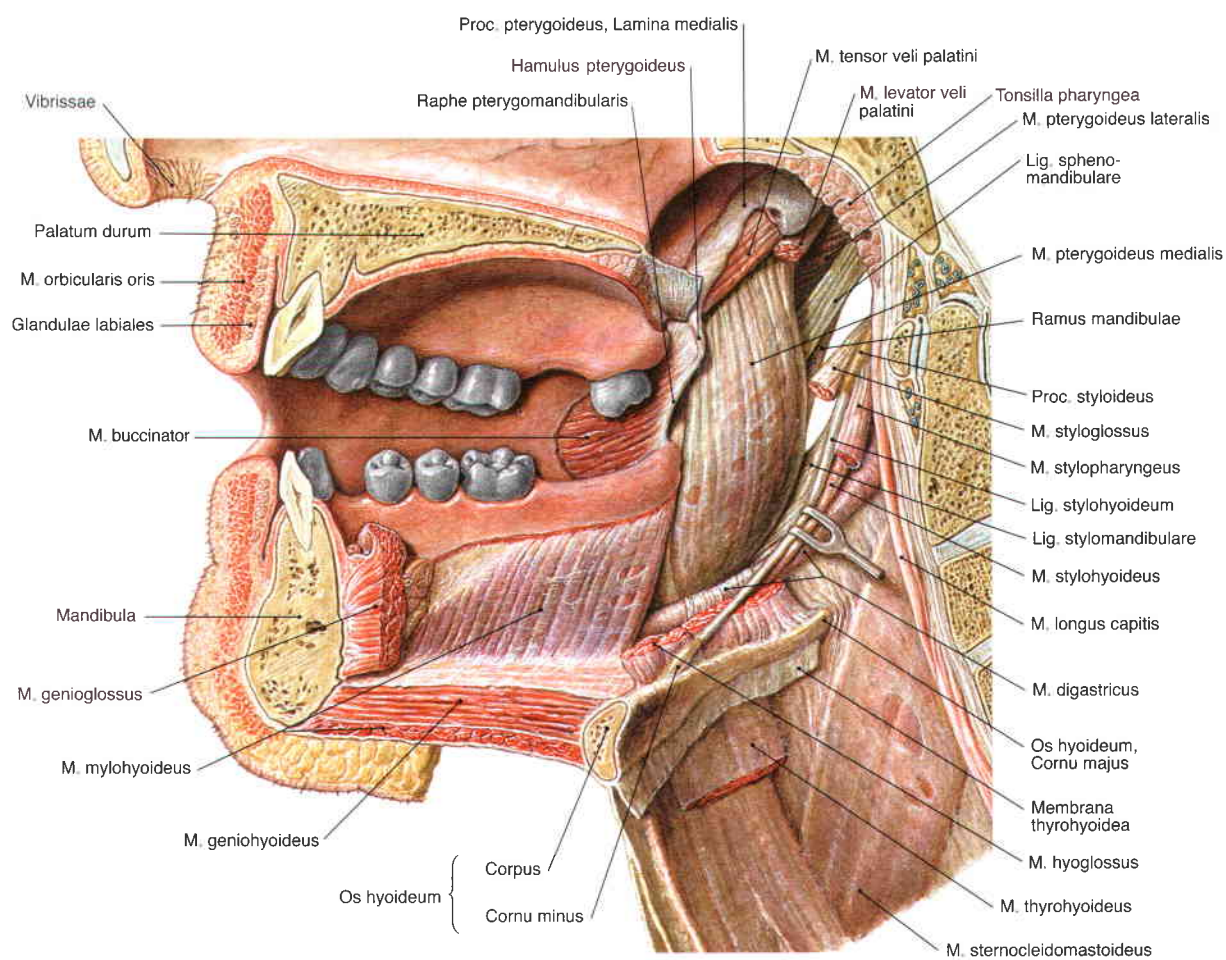


Fig. 151 Oral cavity, Cavitas oris.

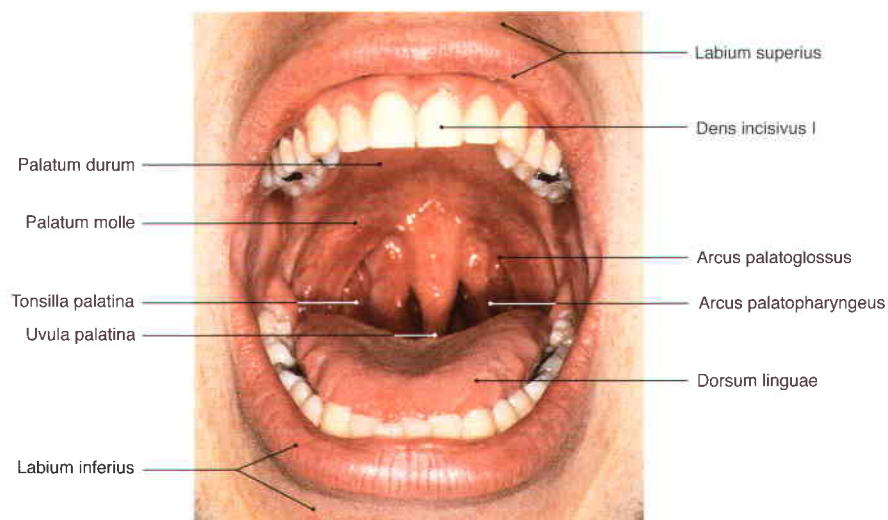


Fig. 152 Oral cavity, Cavitas oris.

Dental arcade

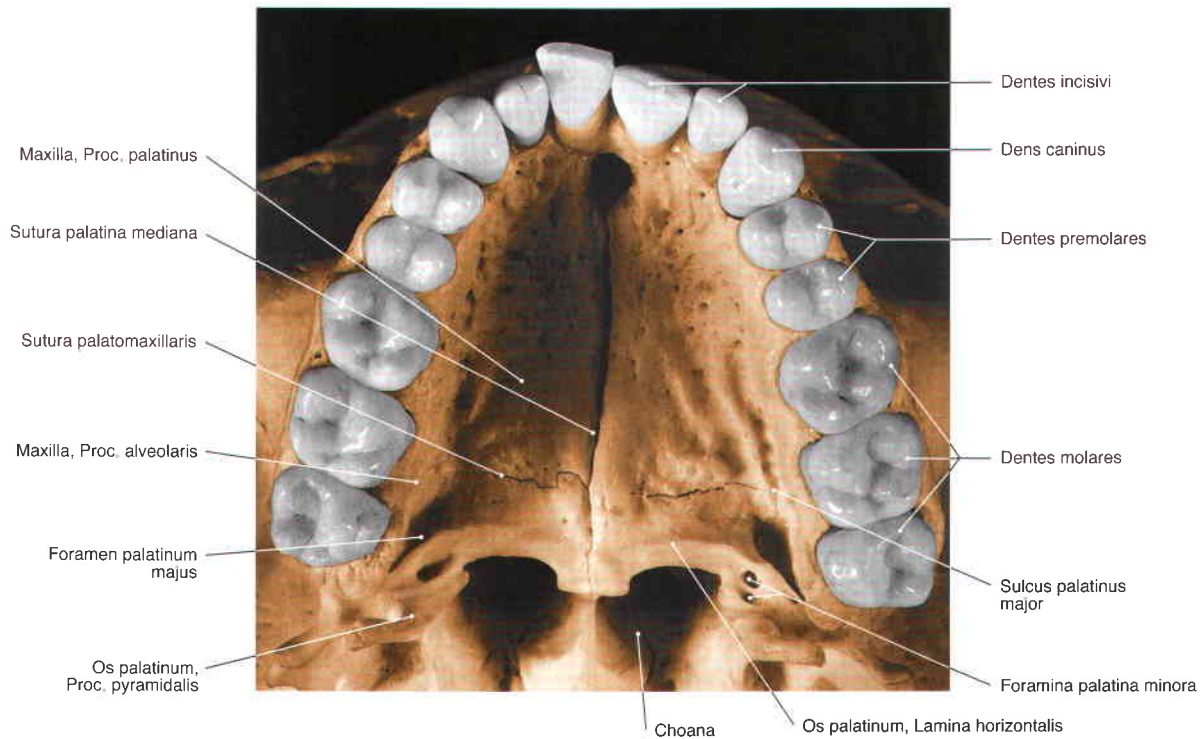


Fig. 153 Upper dental arcade, Arcus dentalis superior, and bony palate, Palatum osseum.

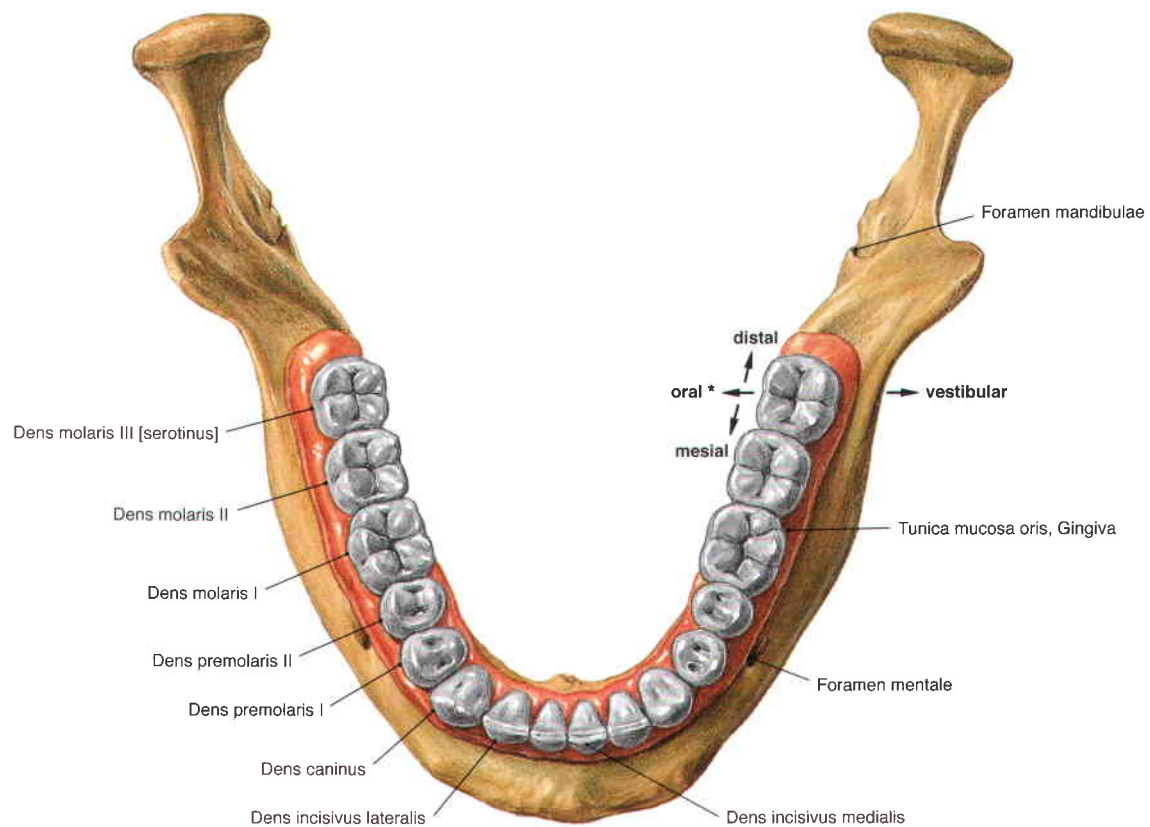


Fig. 154 Lower dental arcade, Arcus dentalis inferior,

* In the mandible oral is synonymous with lingual, and in the maxilla it is synonymous with palatal.

Teeth, structure

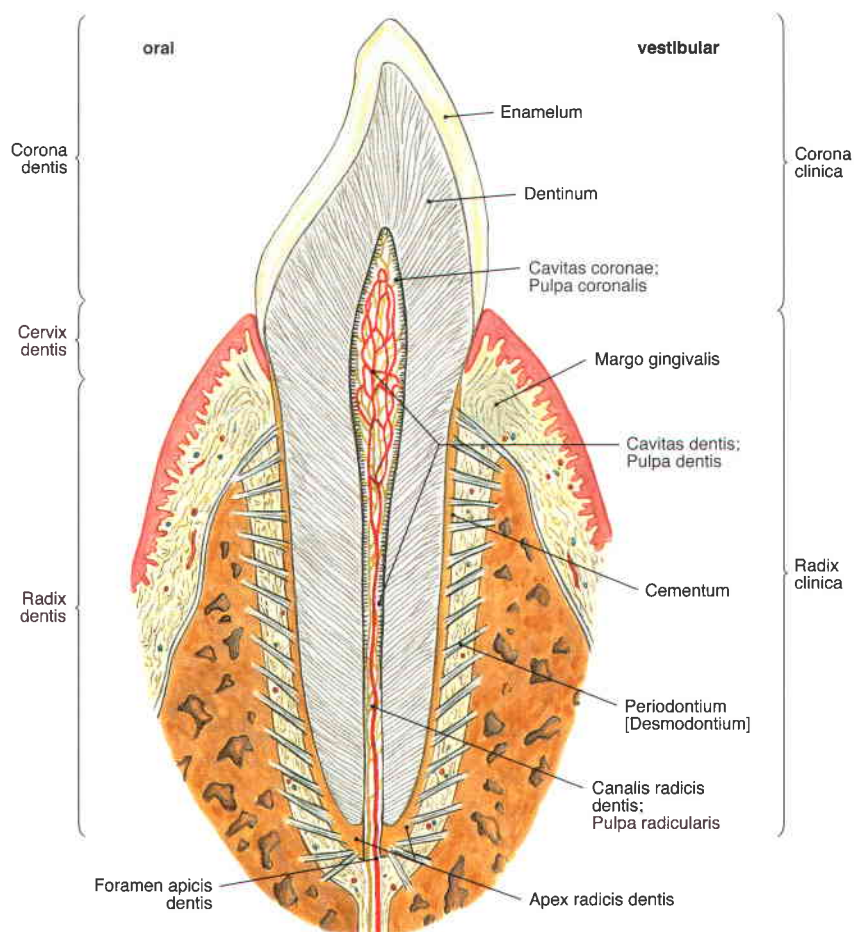


Fig. 155 Incisor tooth, Dens incisivus.

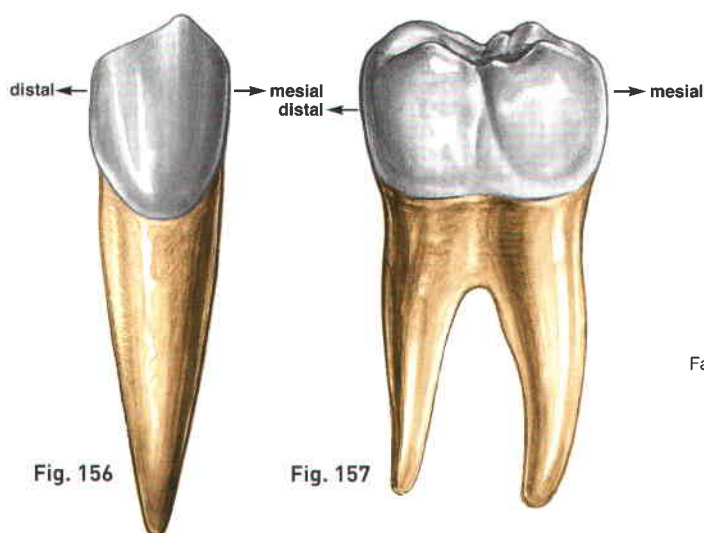


Fig. 156 Permanent lower canine tooth, Dens caninus permanens.

Fig. 157 Deciduous second molar tooth, Dens molaris deciduus.

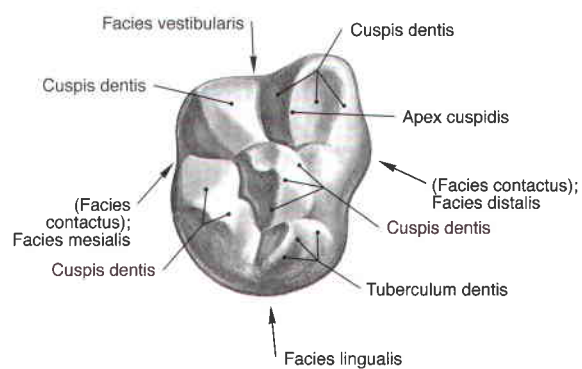


Fig. 158 Permanent upper first molar tooth, Dens molaris primus.

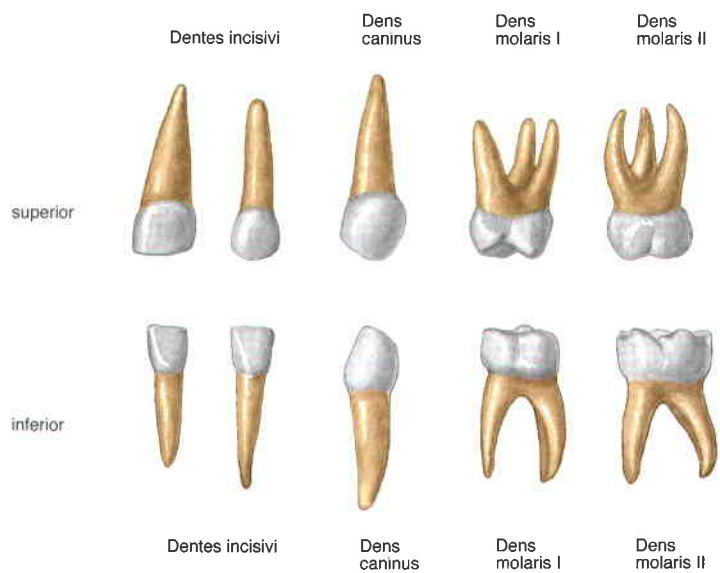


Fig. 159 Deciduous teeth, Dentes decidui, of a 3-year-old child; vestibular view.

Maxilla											
right	55	54	53	52	51	61	62	63	64	65	left
	85	84	83	82	81	71	72	73	74	75	
Mandible											



Fig. 160 Deciduous teeth, Dentes decidui, of a 2-year-old child; top row viewed from vestibular; bottom row viewed obliquely from inferior.

Teeth

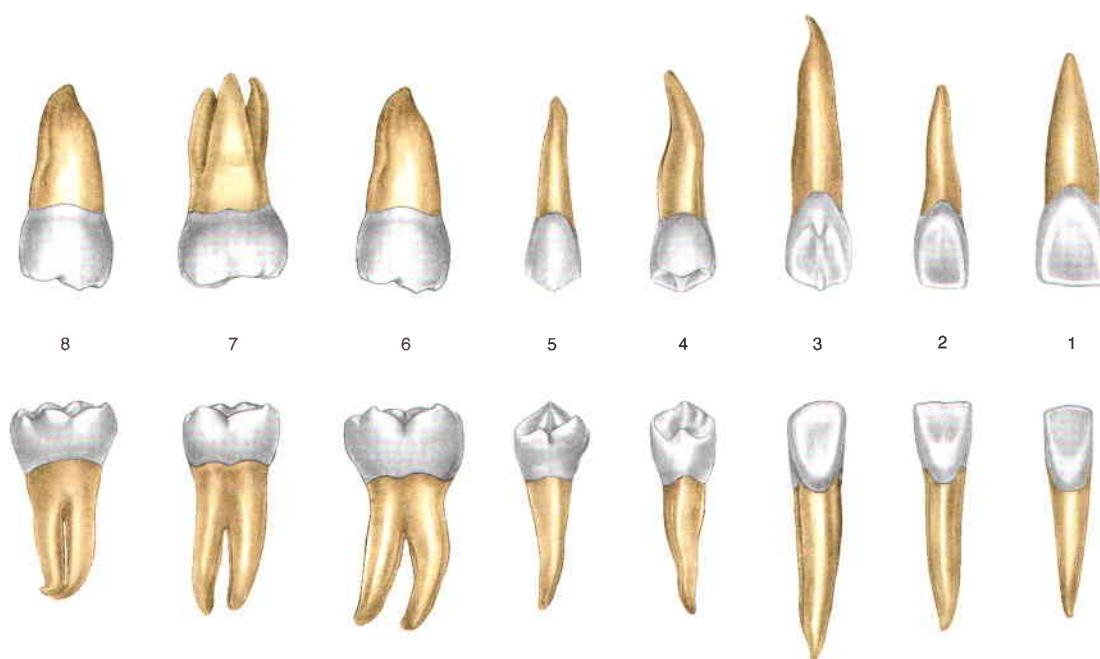


Fig. 161 Permanent teeth, Dentes permanentes; oral view.
[See p. 97 for identification of the numbers.]

																		Maxilla																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
right	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												

Adult dentition

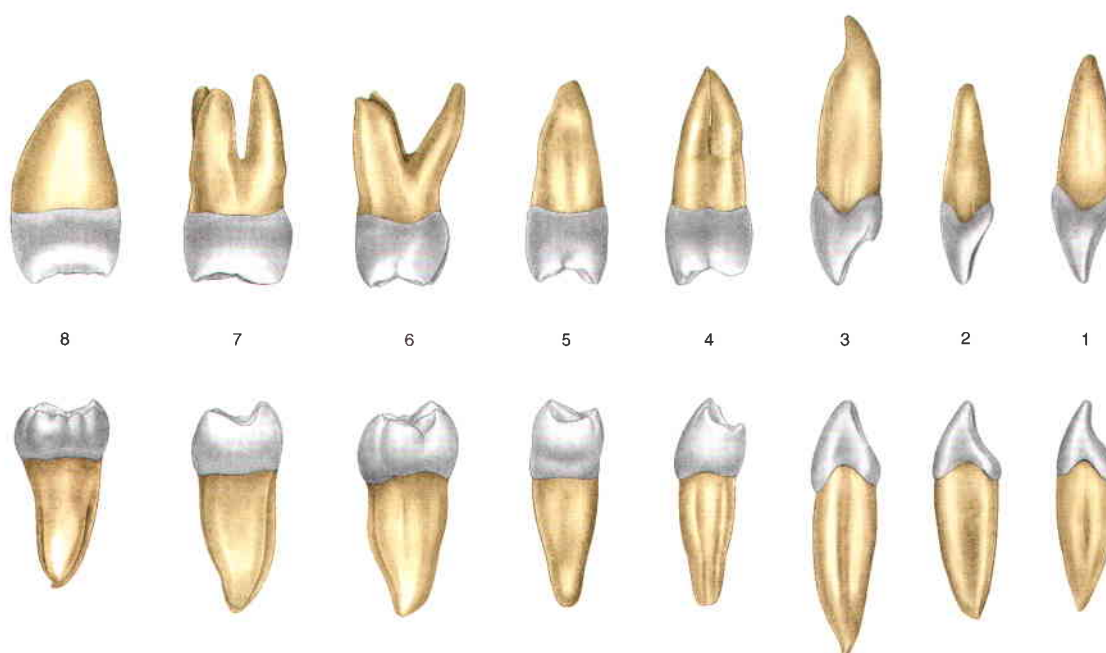


Fig. 162 Permanent teeth, Dentes permanentes; distal view.
[See p. 97 for identification of the numbers.]

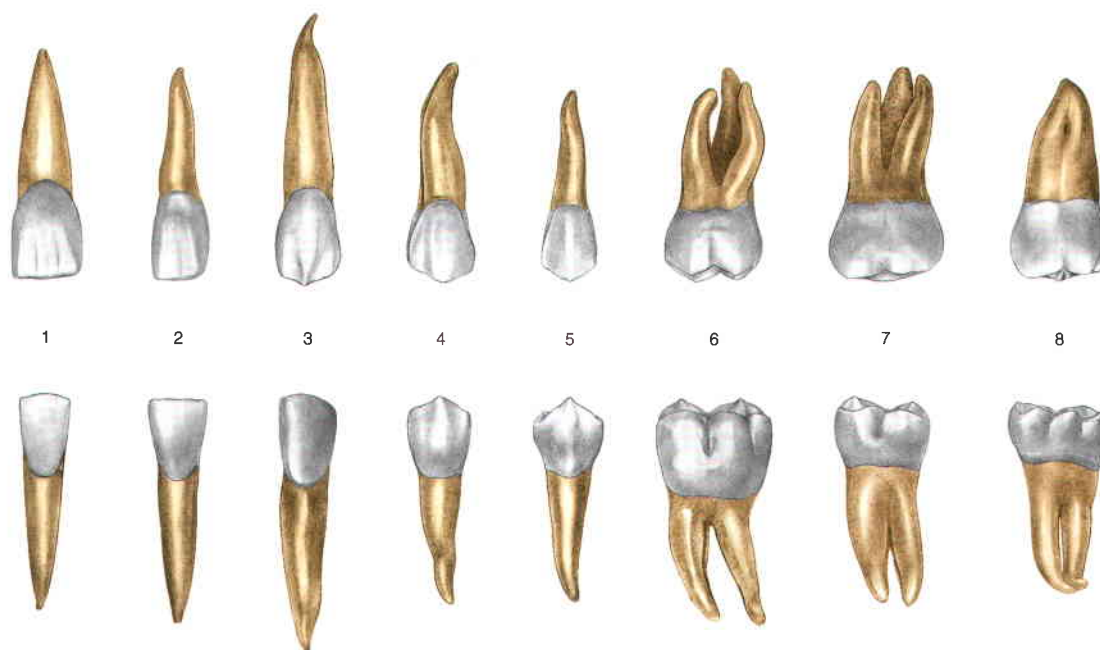


Fig. 163 Permanent teeth, Dentes permanentes; vestibular view.

1 Dens incisivus I
2 Dens incisivus II
3 Dens caninus
4 Dens premolaris I

5 Dens premolaris II
6 Dens molaris I
7 Dens molaris II
8 Dens molaris III
[serotinus]

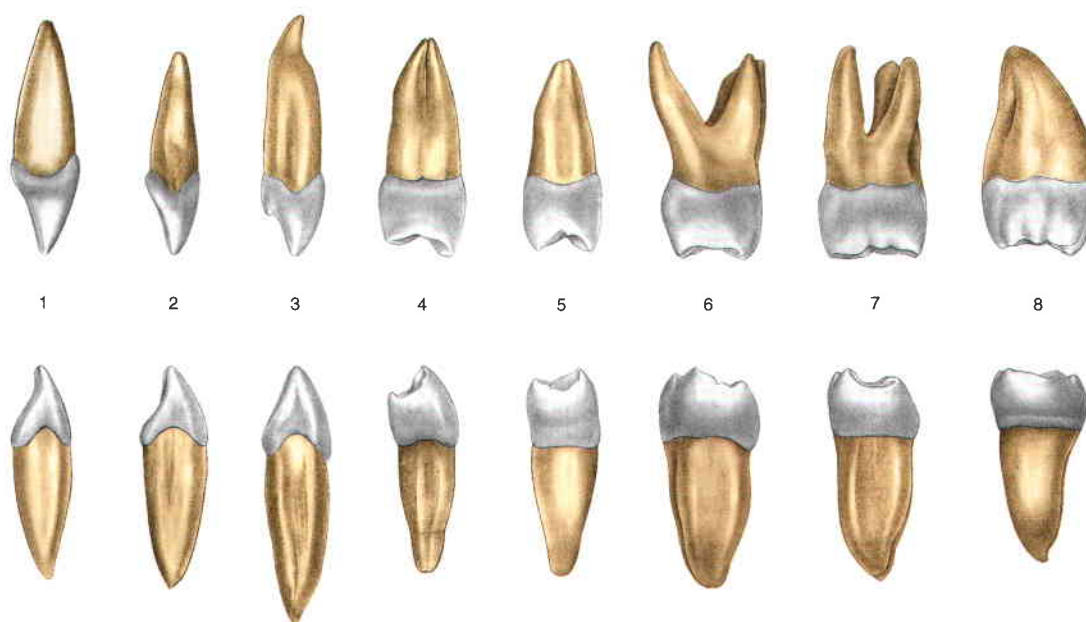


Fig. 164 Permanent teeth, Dentes permanentes; mesial view.

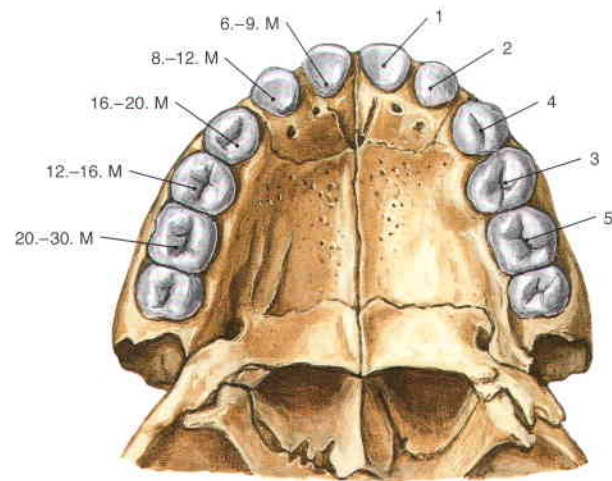


Fig. 165 Maxilla, Maxilla, with deciduous teeth, Dentes decidui, and the first permanent tooth; left: median time of eruption in months (M); right: order of eruption.

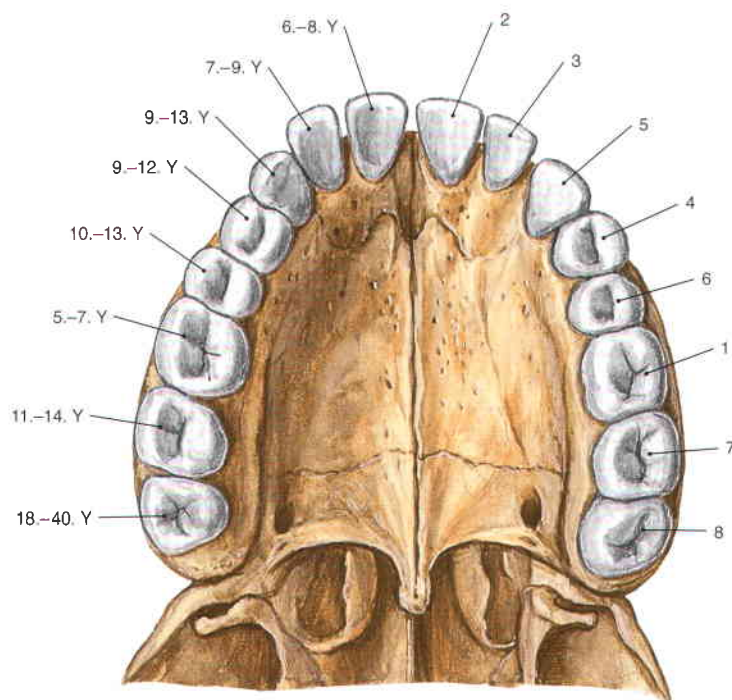


Fig. 166 Maxilla, Maxilla, with permanent teeth, Dentes permanentes; left: median time of eruption in years (Y); right: order of eruption.

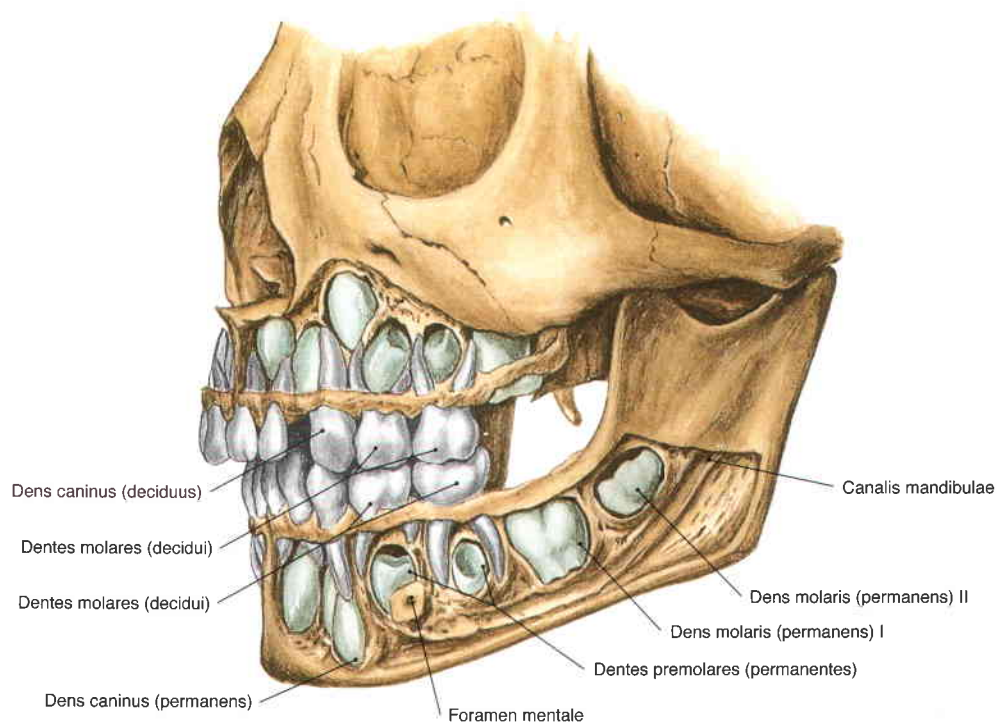


Fig. 167 Maxilla, Maxilla, and mandible, Mandibula, of a 5-year-old child; deciduous teeth and anlage of permanent teeth.

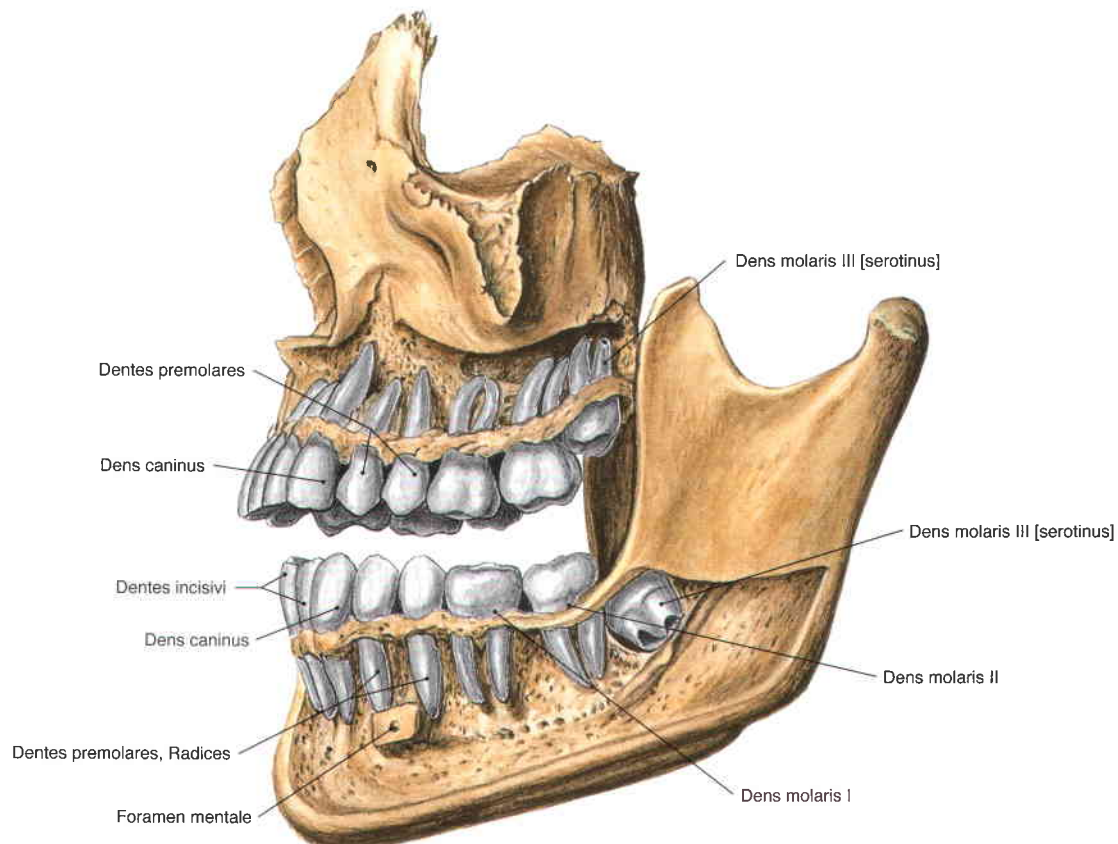


Fig. 168 Maxilla, Maxilla, and mandible, Mandibula, of a 20-year-old male.

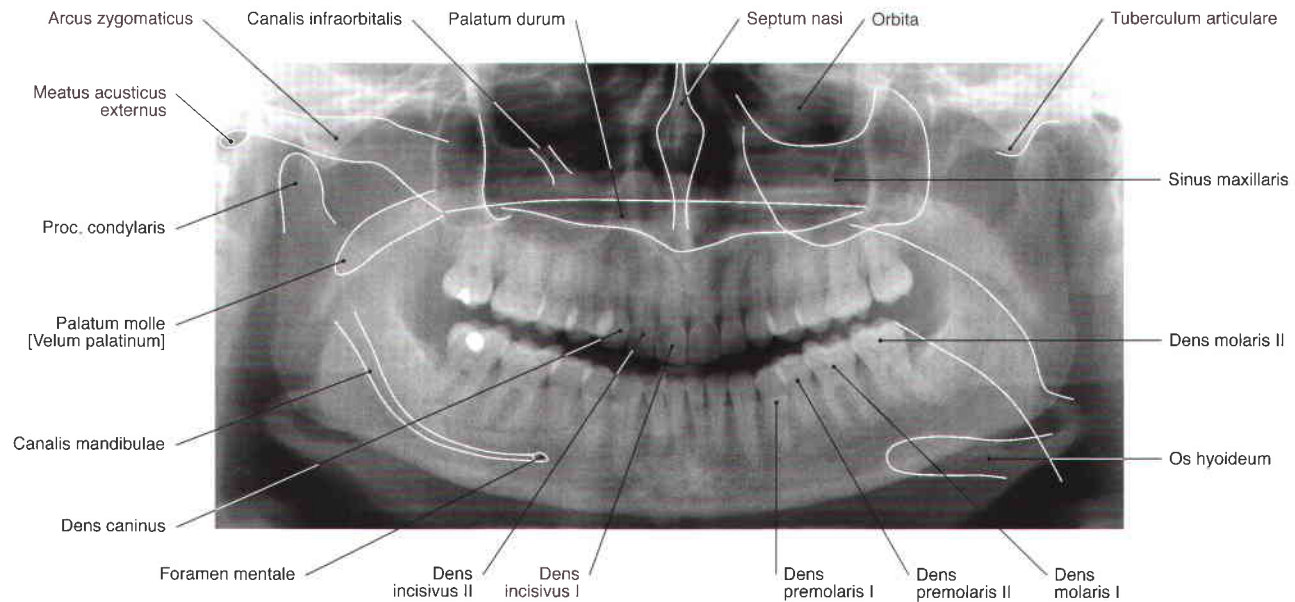
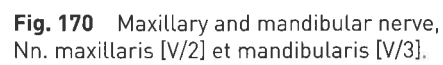
Teeth, radiography

Fig. 169 Maxilla, Maxilla, and mandible, Mandibula;
panoramic radiograph;
without wisdom teeth.



→ 473, 474



Palate

Fig. 172 Hard and soft palate, Palatum durum et molle; inferior view.

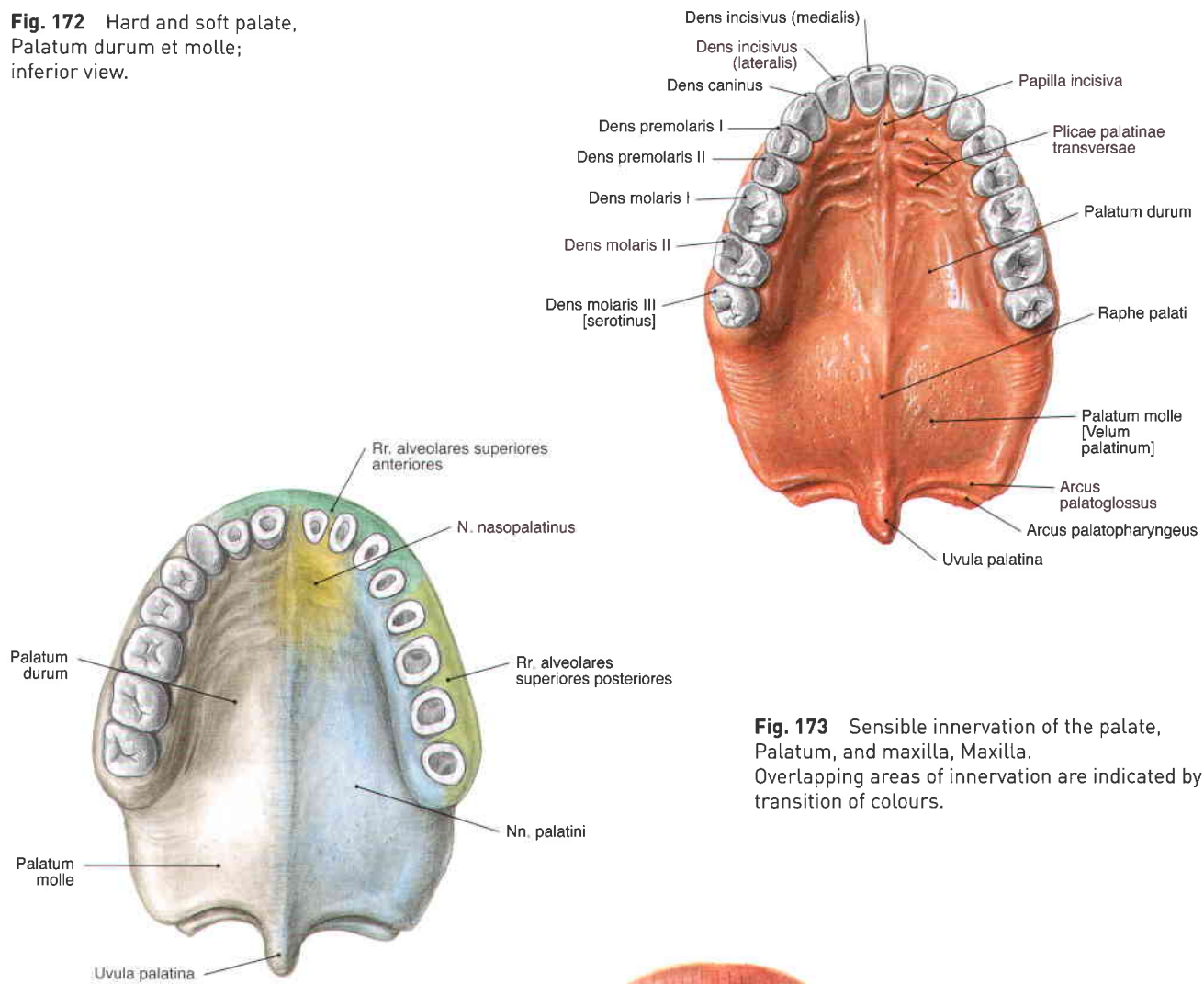
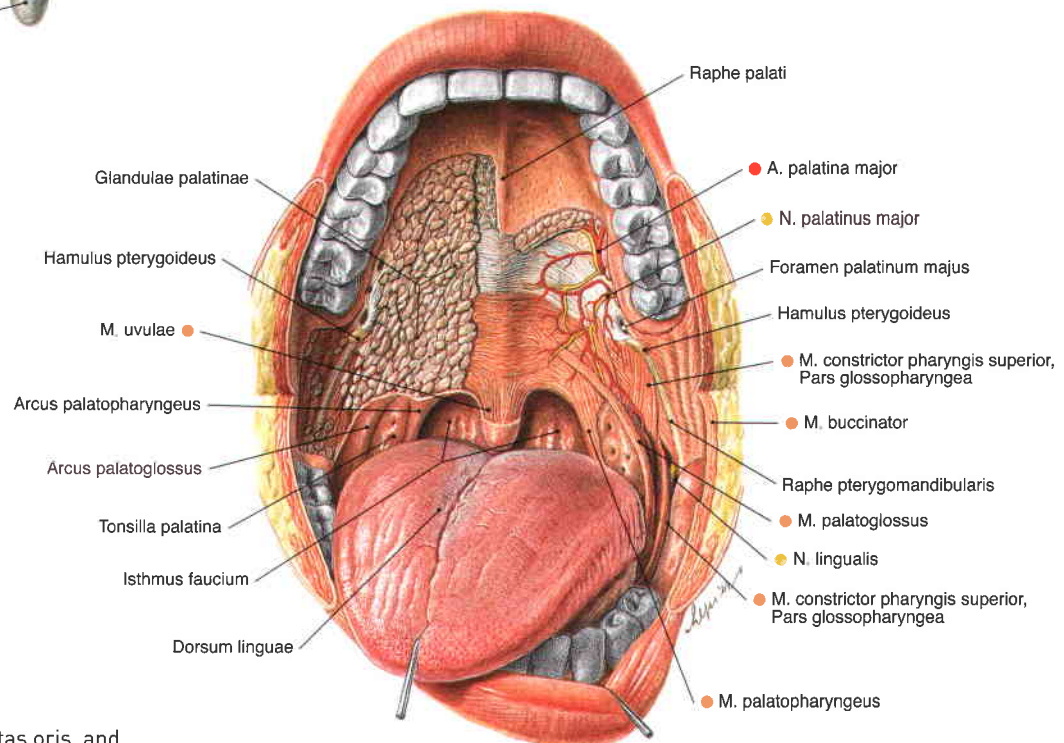


Fig. 173 Sensible innervation of the palate, Palatum, and maxilla, Maxilla. Overlapping areas of innervation are indicated by transition of colours.



→ T 3

Fig. 174 Oral cavity, Cavitas oris, and muscles of the palate, Mm. palati.

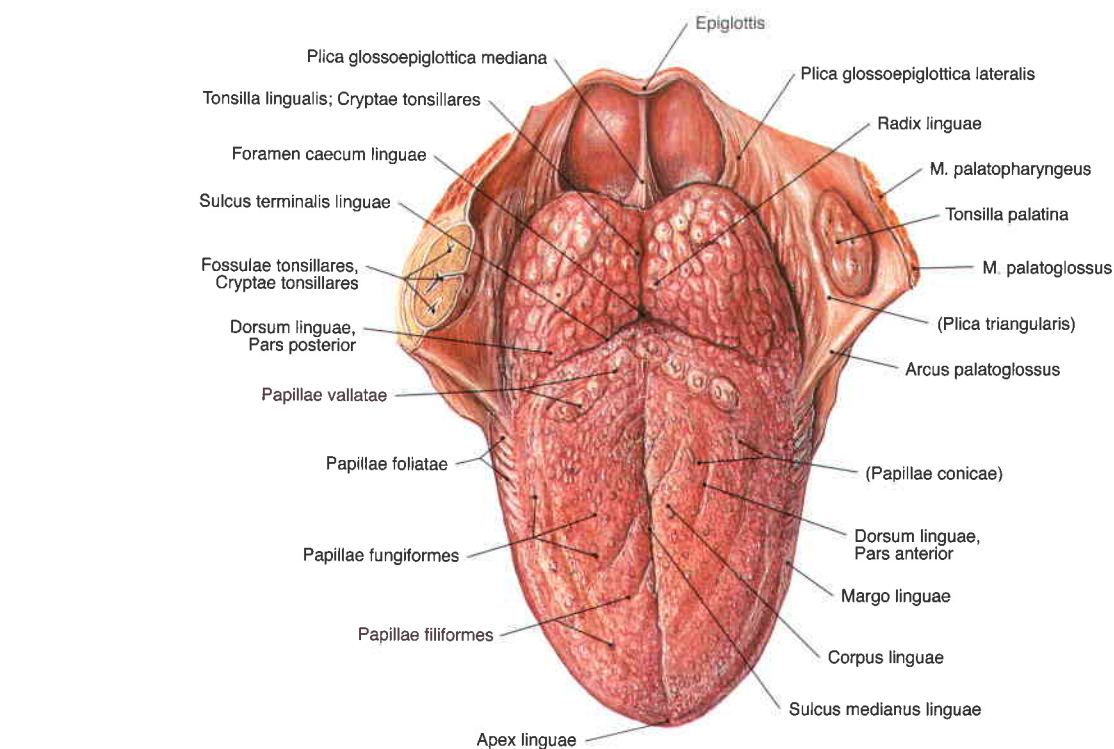


Fig. 175 Tongue, Lingua.

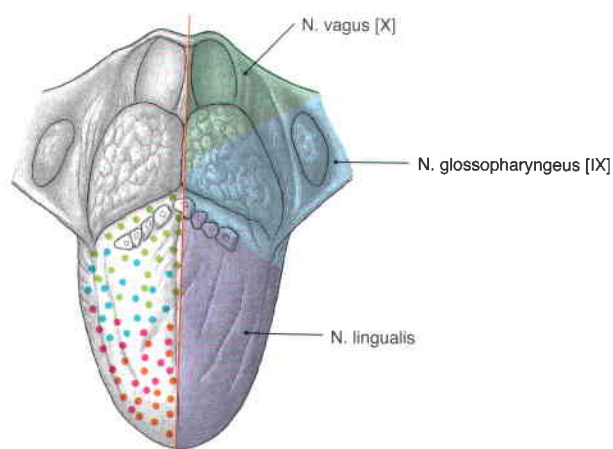


Fig. 176 Innervation and taste categories at the dorsum of the tongue.

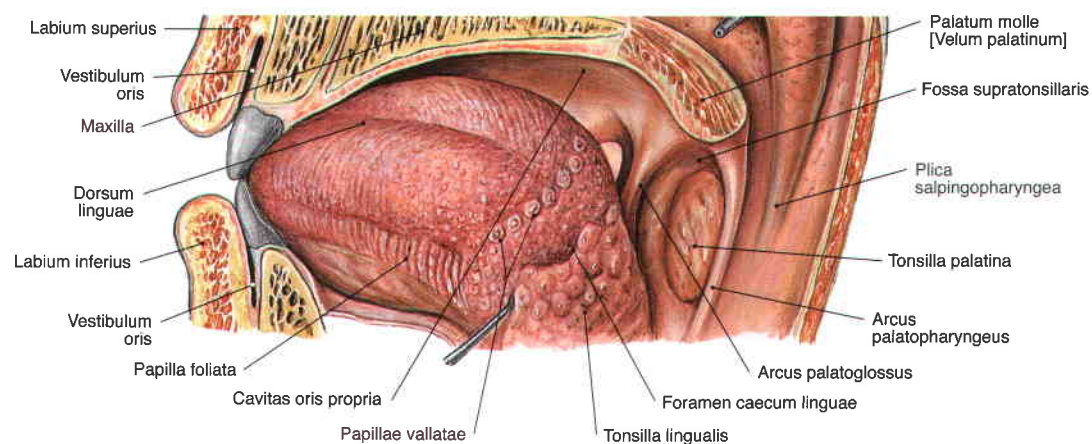
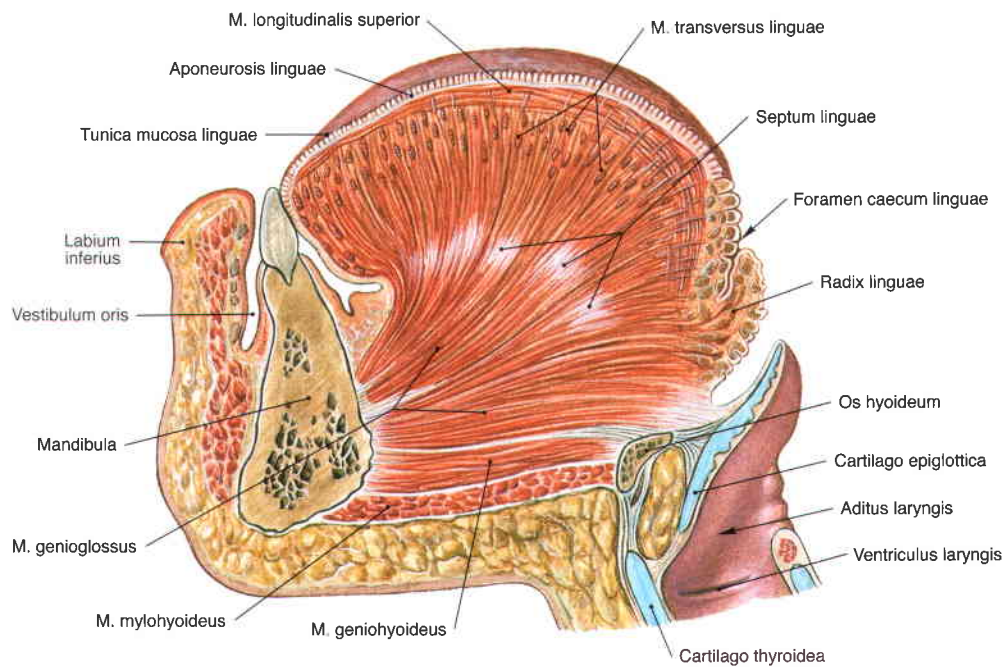
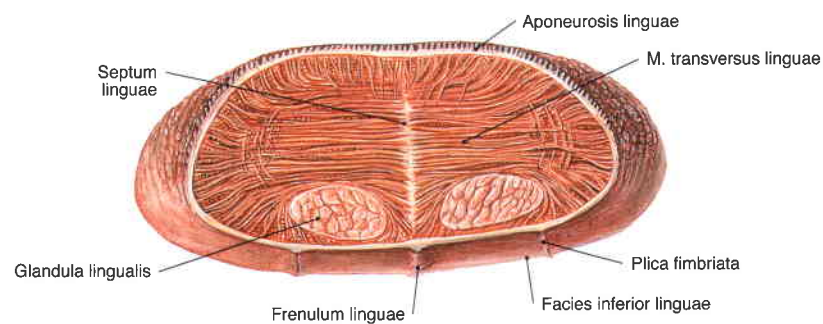


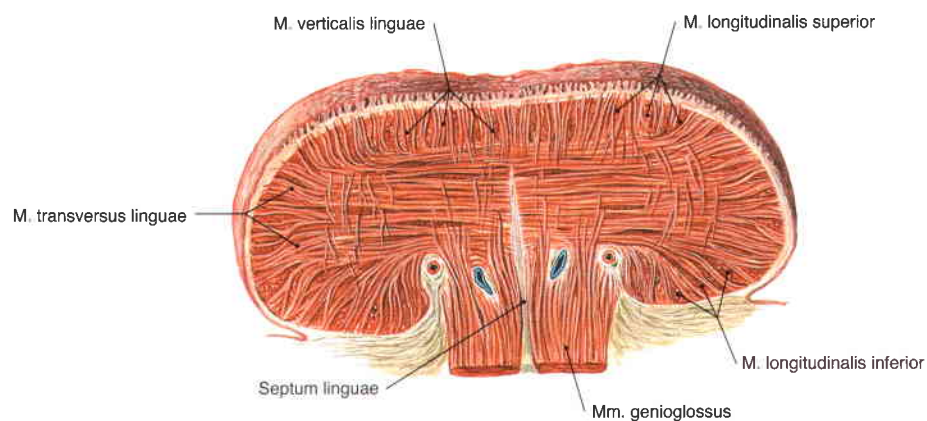
Fig. 177 Oral cavity, Cavitas oris.

Muscles of the tongue

→ T 2 a

Fig. 178 Tongue, Lingua, and muscles of the tongue, Mm. linguae; median section.

→ T 2 a

Fig. 179 Tongue, Lingua, and muscles of the tongue, Mm. linguae; cross-section through the tip of the tongue.

→ T 2 a

Fig. 180 Tongue, Lingua, and muscles of the tongue, Mm. linguae; cross-section at the level of the middle of the tongue.

Hyoid bone and infra- and suprahyoid muscles

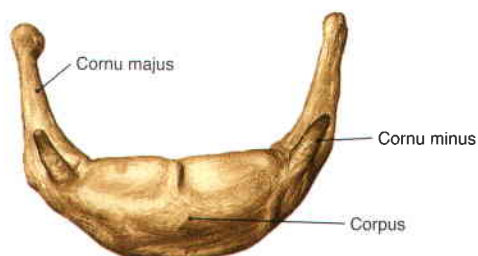


Fig. 181 Hyoid bone, Os hyoideum.



Fig. 182 Hyoid bone, Os hyoideum.

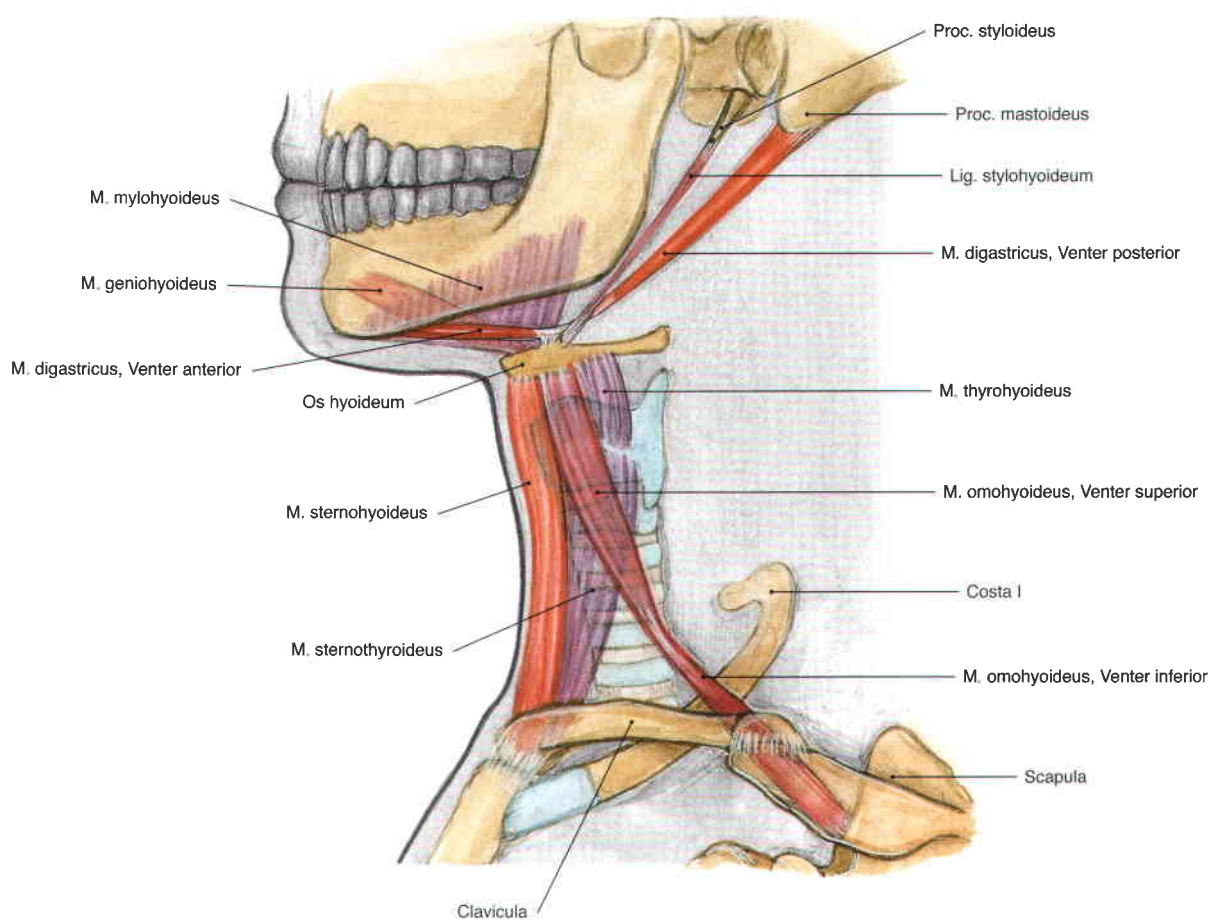
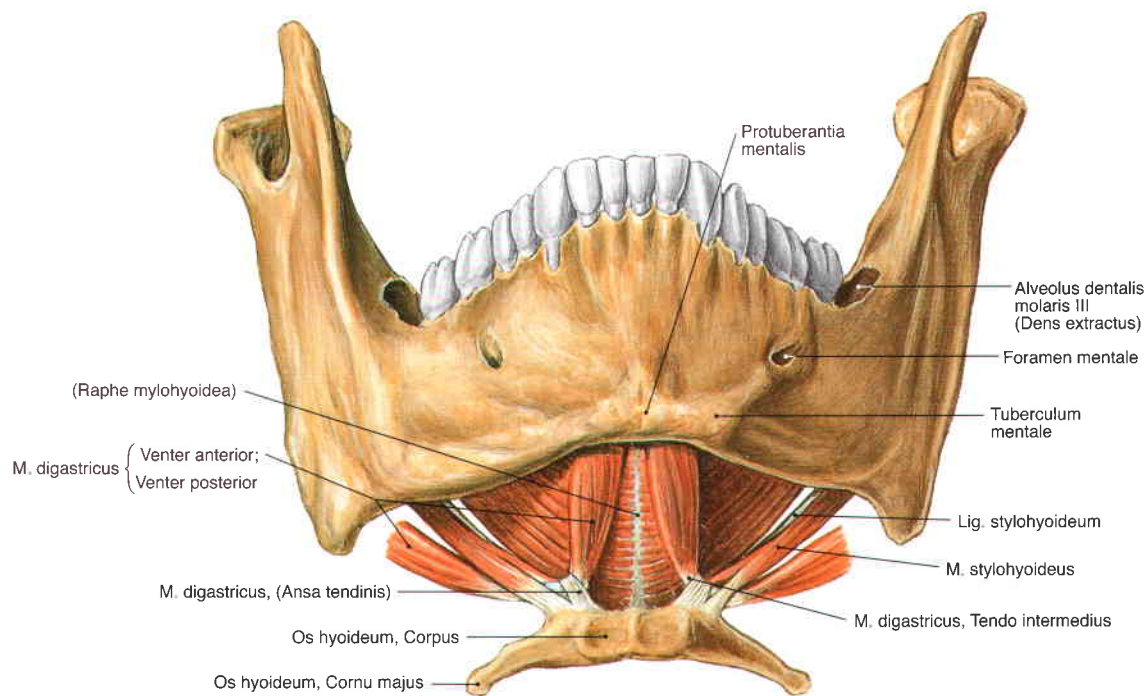
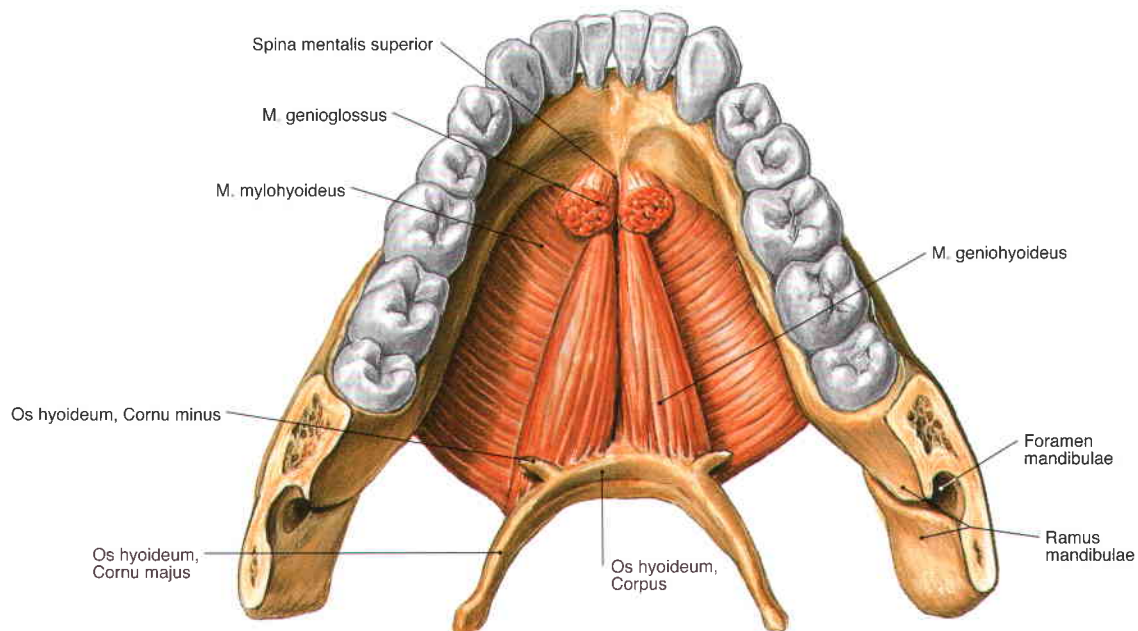


Fig. 183 Muscular suspension of the hyoid bone.

→ T9, T10

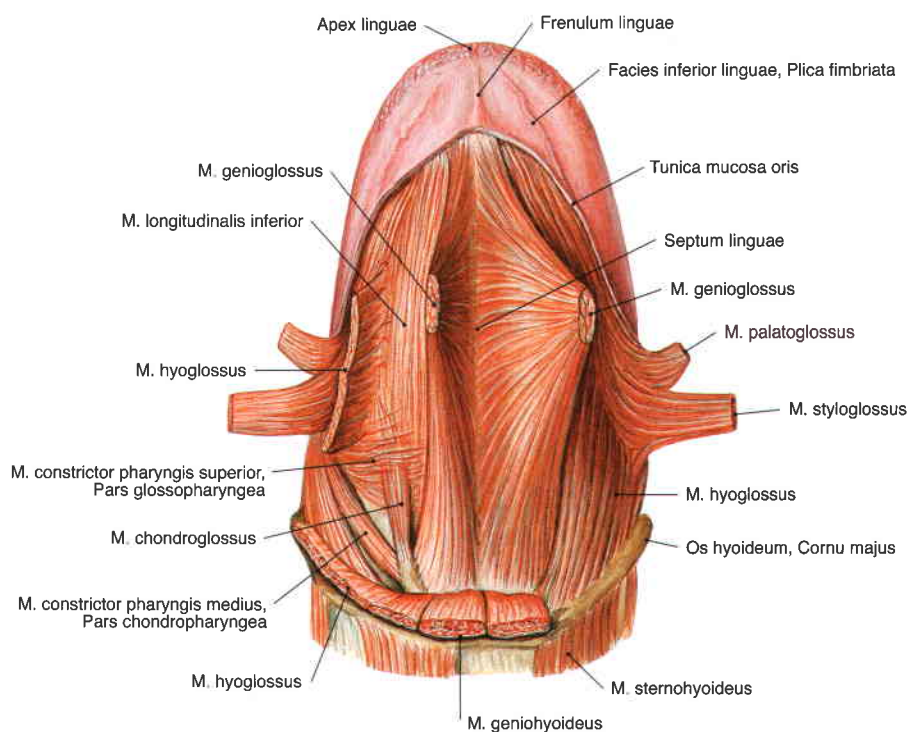
Suprahyoid muscles

→ T9

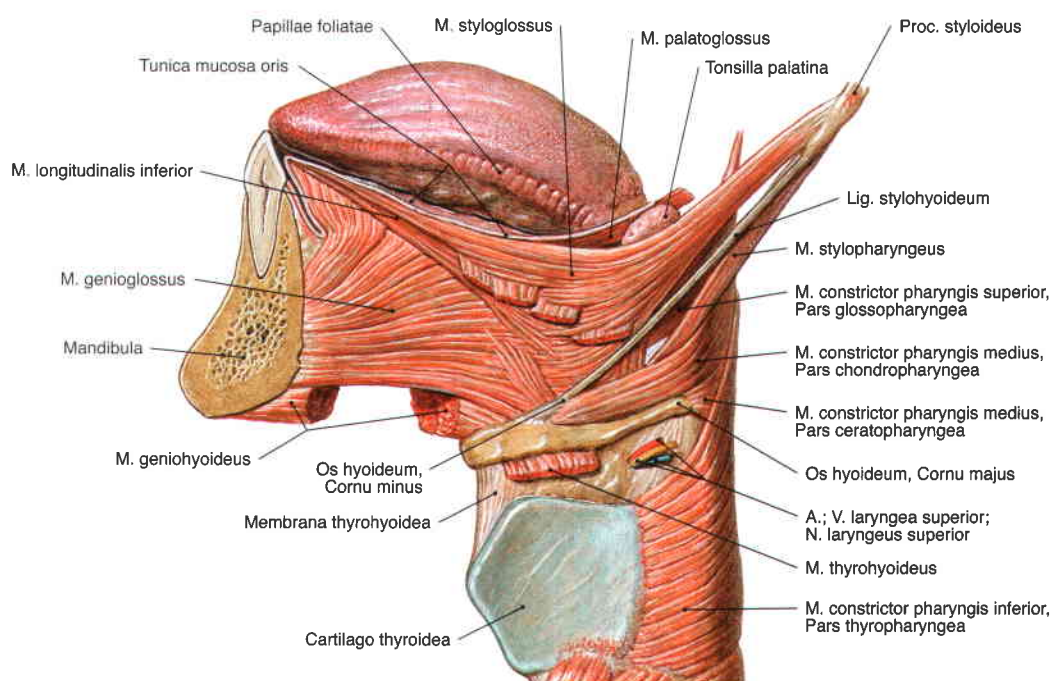
Fig. 184 Mandible, Mandibula, and suprahyoid muscles, Mm. suprahyoidei.

→ T9

Fig. 185 Mandible, Mandibula; suprahyoid muscles, Mm. suprahyoidei, and hyoid bone, Os hyoideum.

Muscles of the tongue and the pharynx

→ T 2b

Fig. 188 Muscles of the tongue, Mm. linguae.

→ T 2b, T 5

Fig. 189 Muscles of the tongue, Mm. linguae, and muscles of the pharynx, Tunica muscularis pharyngis.

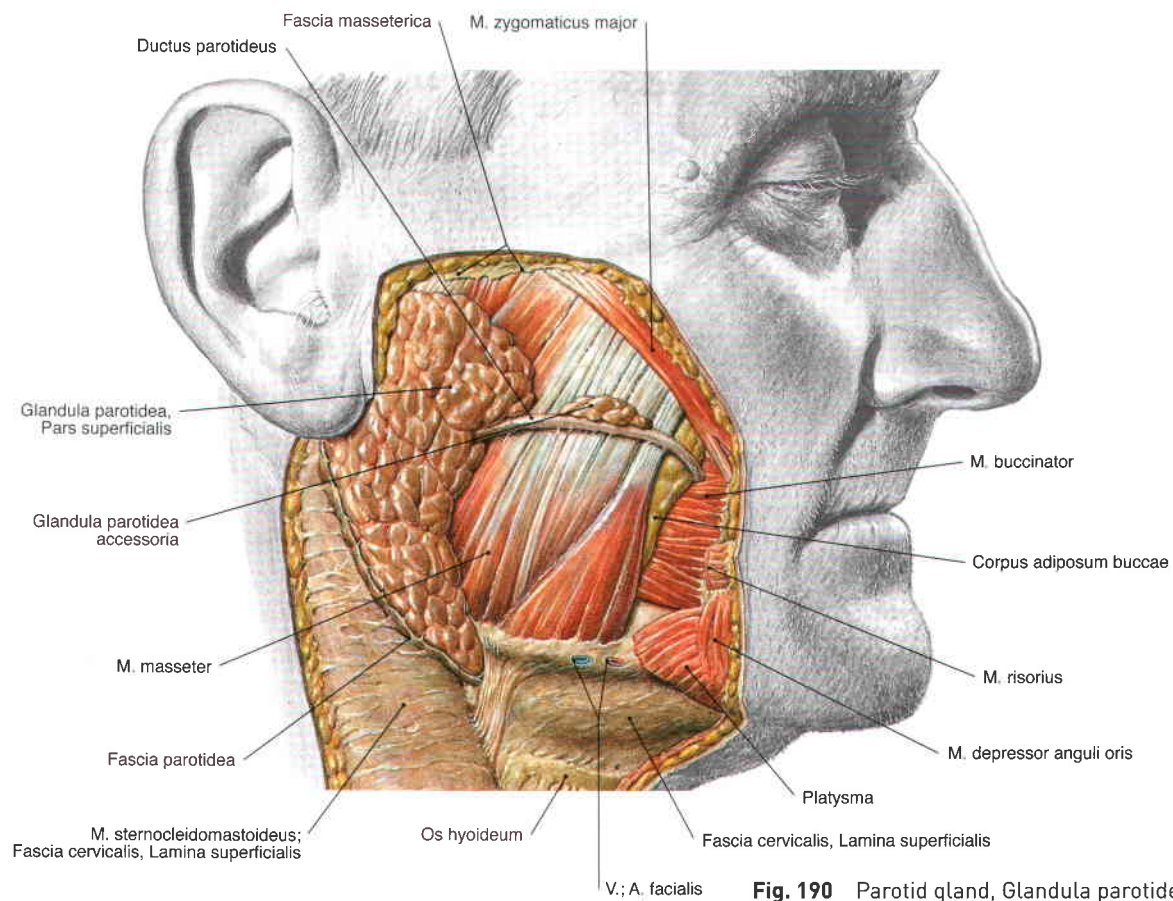


Fig. 190 Parotid gland, Glandula parotidea.

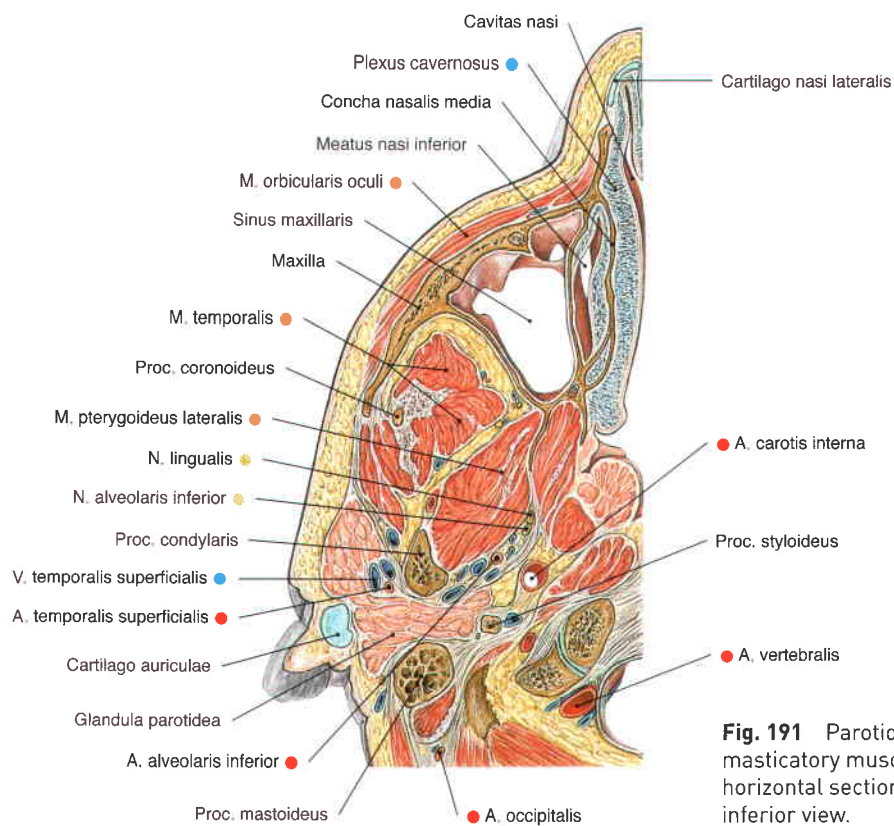
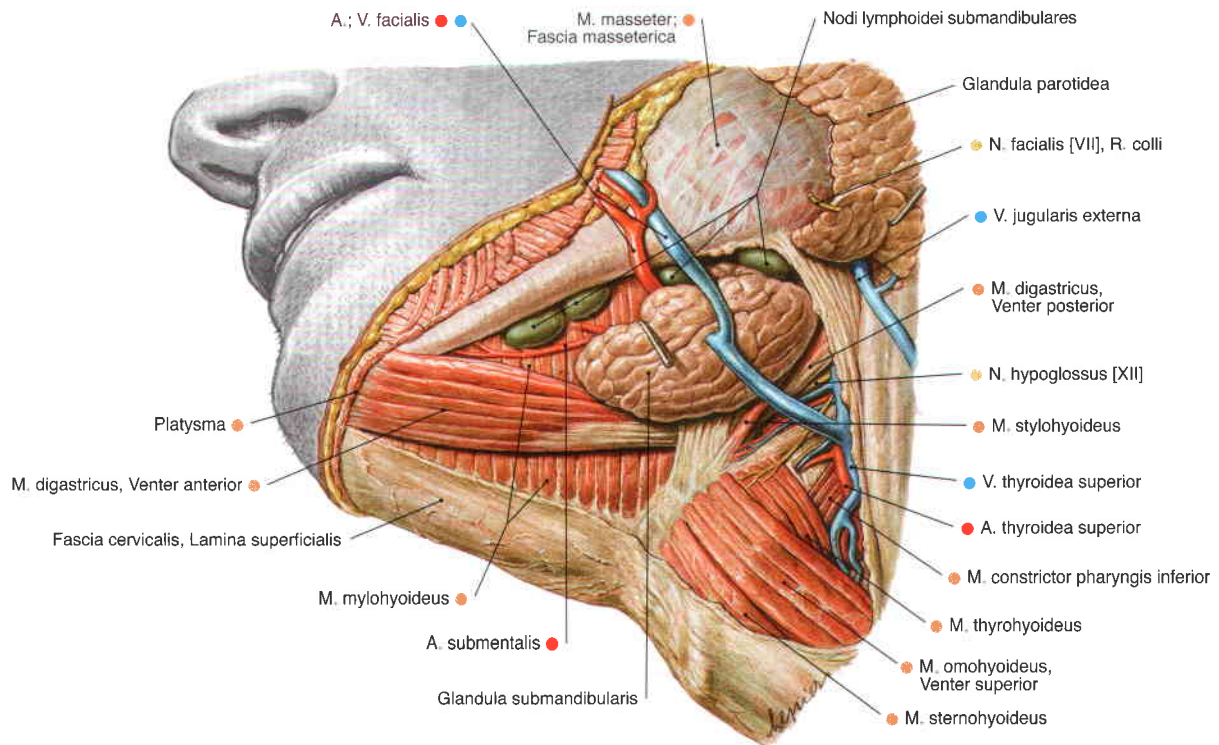
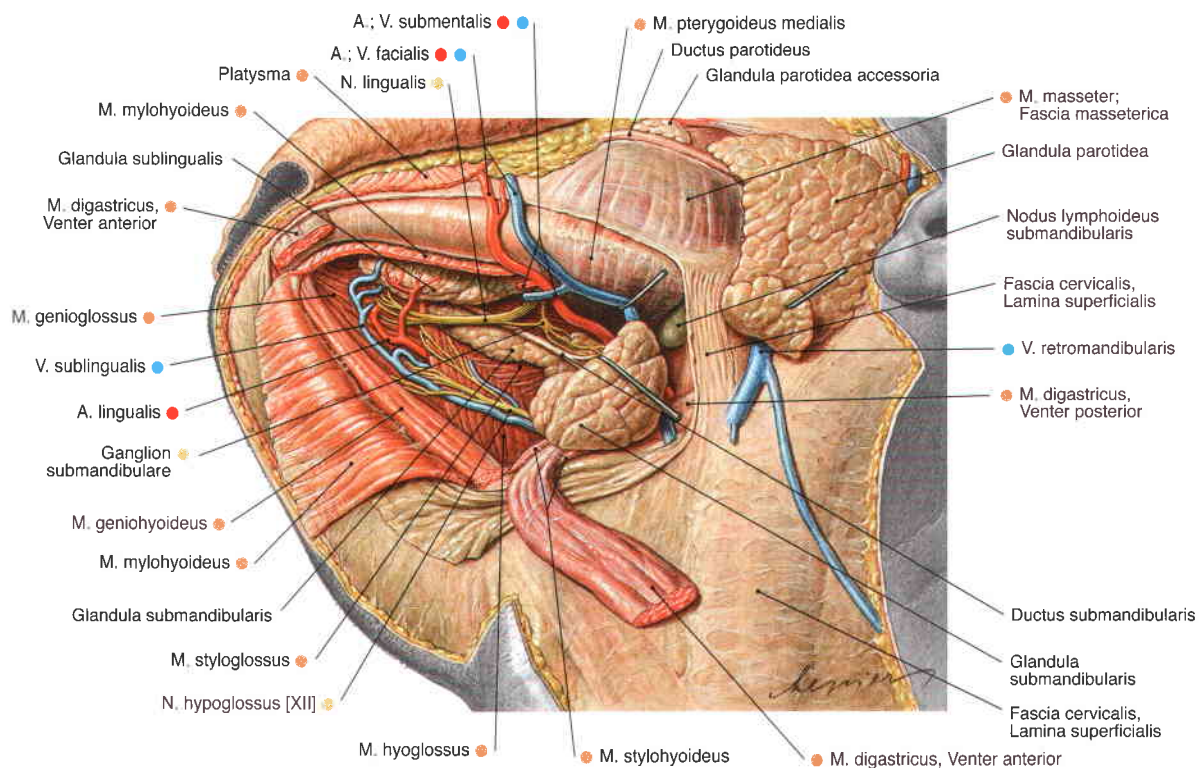


Fig. 191 Parotid gland, Glandula parotidea, and masticatory muscles, Mm. masticatorii; horizontal section; inferior view.

Submandibular gland**Fig. 192** Submandibular gland, Glandula submandibularis.**Fig. 193** Major salivary glands, Glandulae salivariae majores; inferolateral view.

Submandibular and sublingual gland

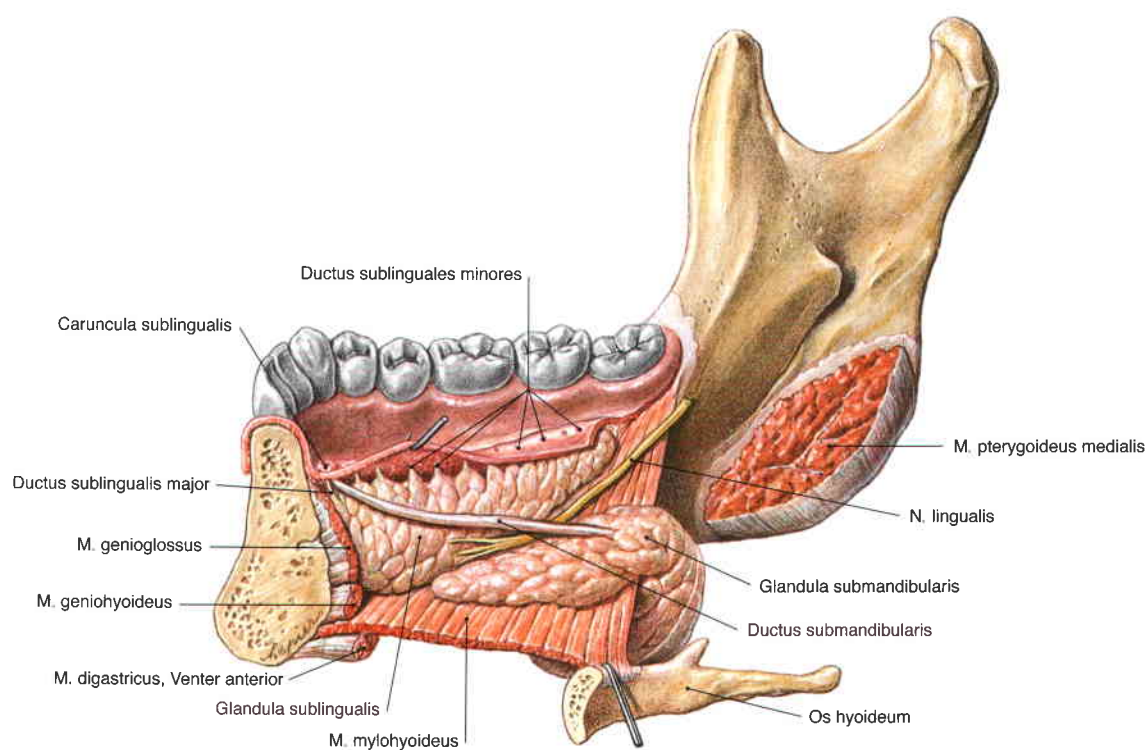


Fig. 194 Submandibular gland, Glandula submandibularis, and sublingual gland, Glandula sublingualis.

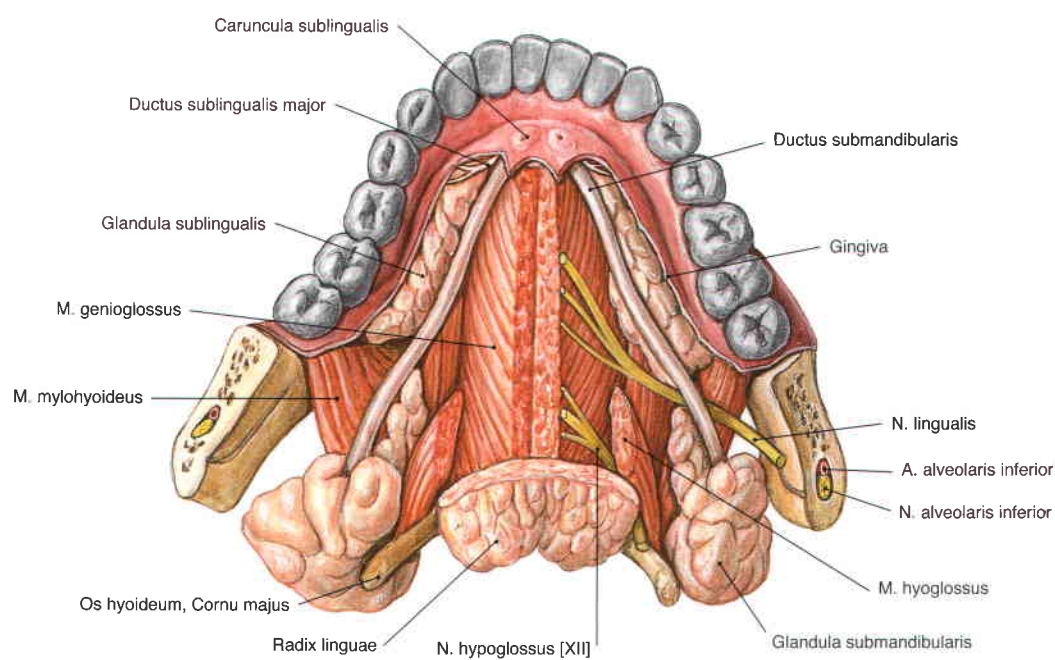


Fig. 195 Sublingual gland, Glandula sublingualis, and submandibular gland, Glandula submandibularis; superior view.

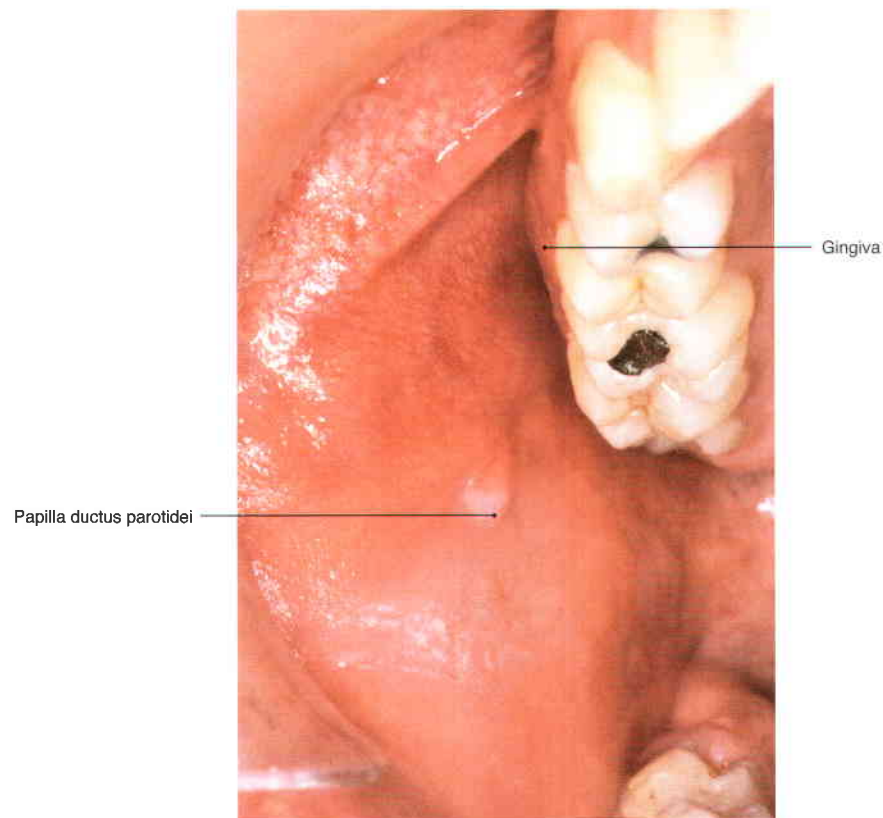
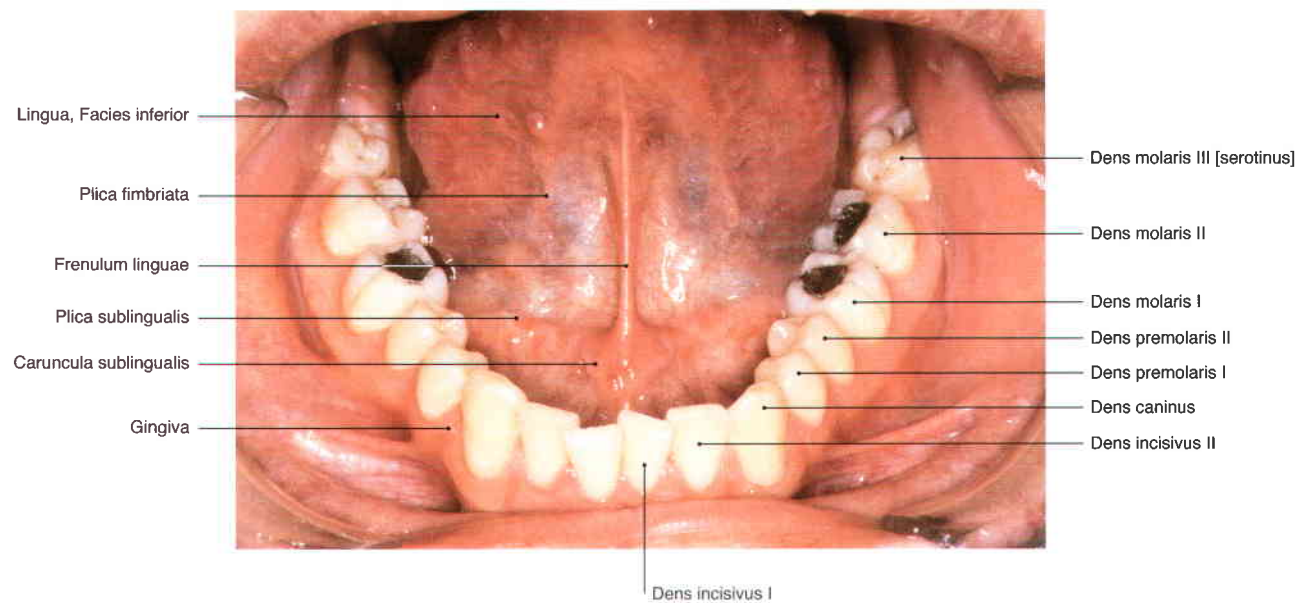
Openings of the salivary glands

Fig. 196 Opening of the excretory duct of the parotid gland, Papilla ductus parotidei.



→ 154

Fig. 197 Opening of the excretory duct of the submandibular gland, Caruncula sublingualis.

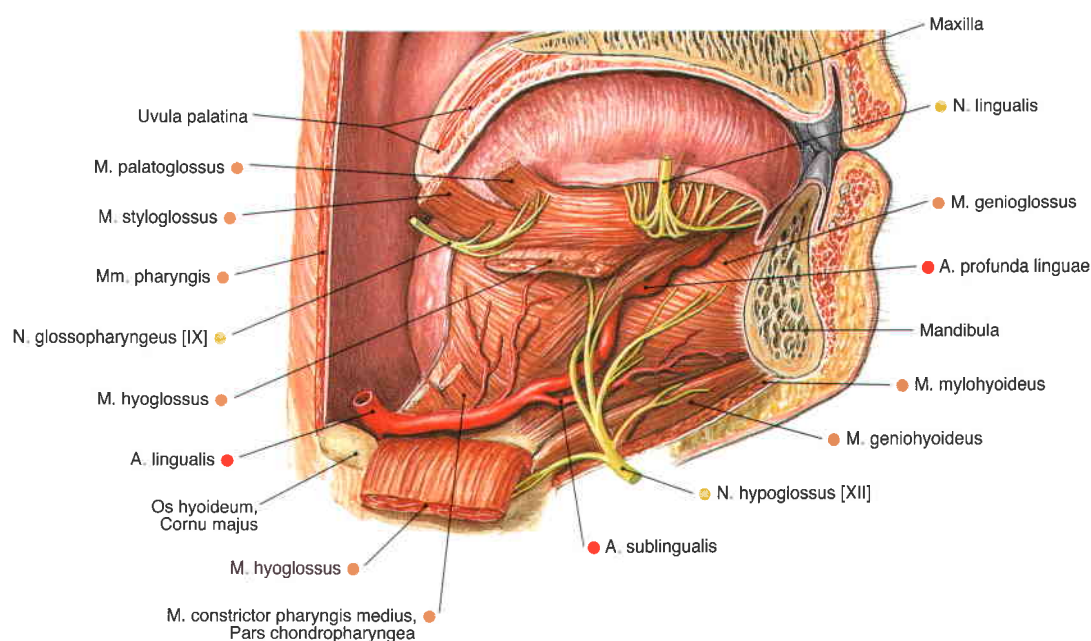


Fig. 198 Arteries and nerves of the tongue, Lingua; medial view.

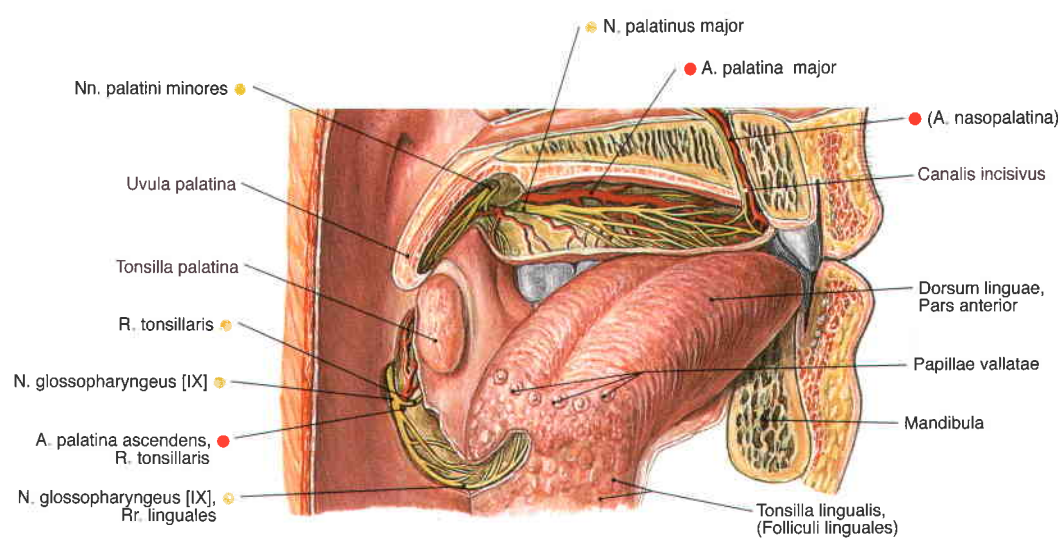
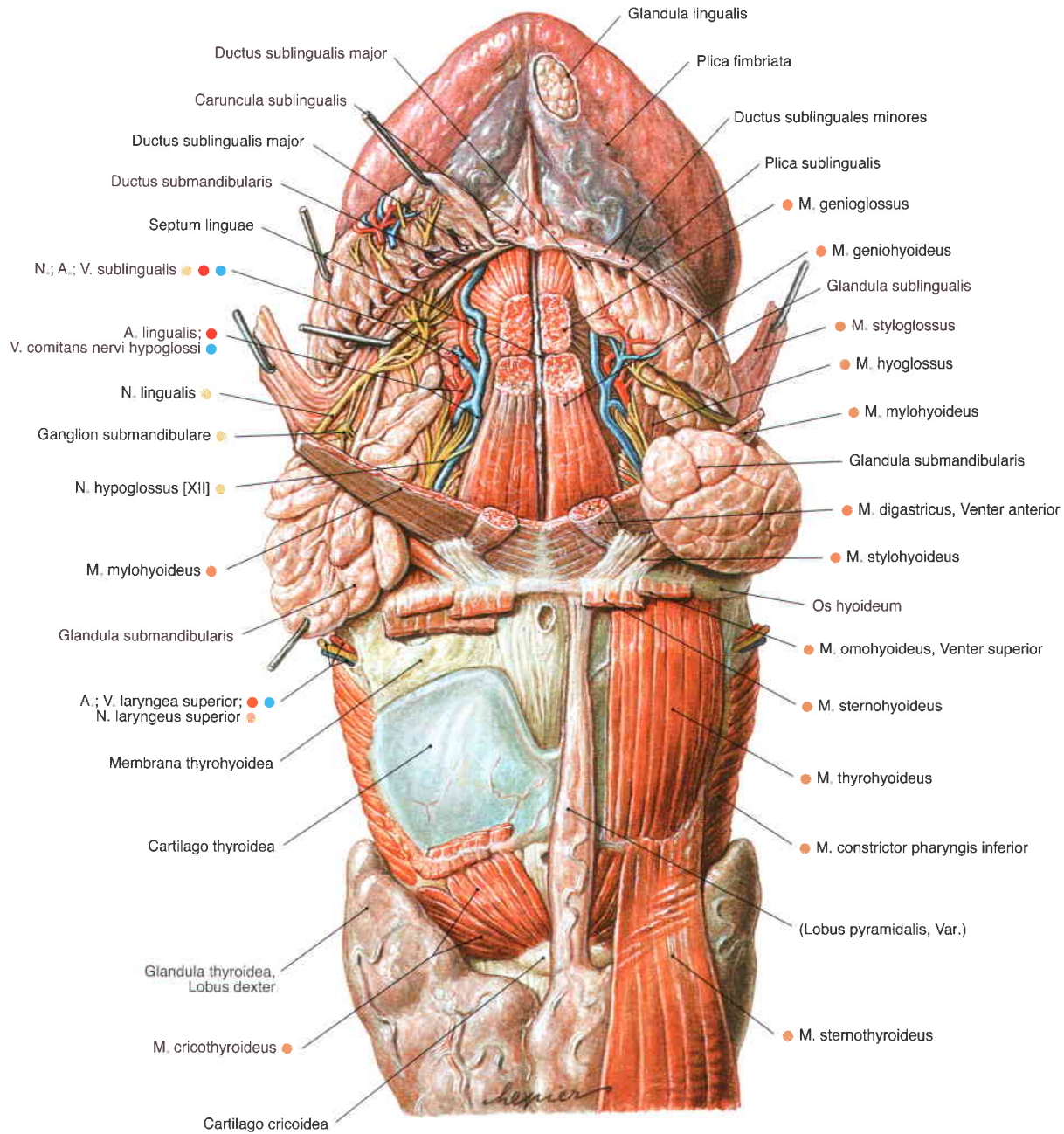


Fig. 199 Arteries and nerves of the palate, Palatum, and the root of the tongue, Radix linguae; medial view.

Vessels and nerves of the tongue and the larynx

→ 204, 218, 234, 237

Fig. 200 Vessels and nerves of the tongue, Lingua; major salivary glands, Glandulae salivariae majores, and larynx, Larynx; anterior-inferior view.

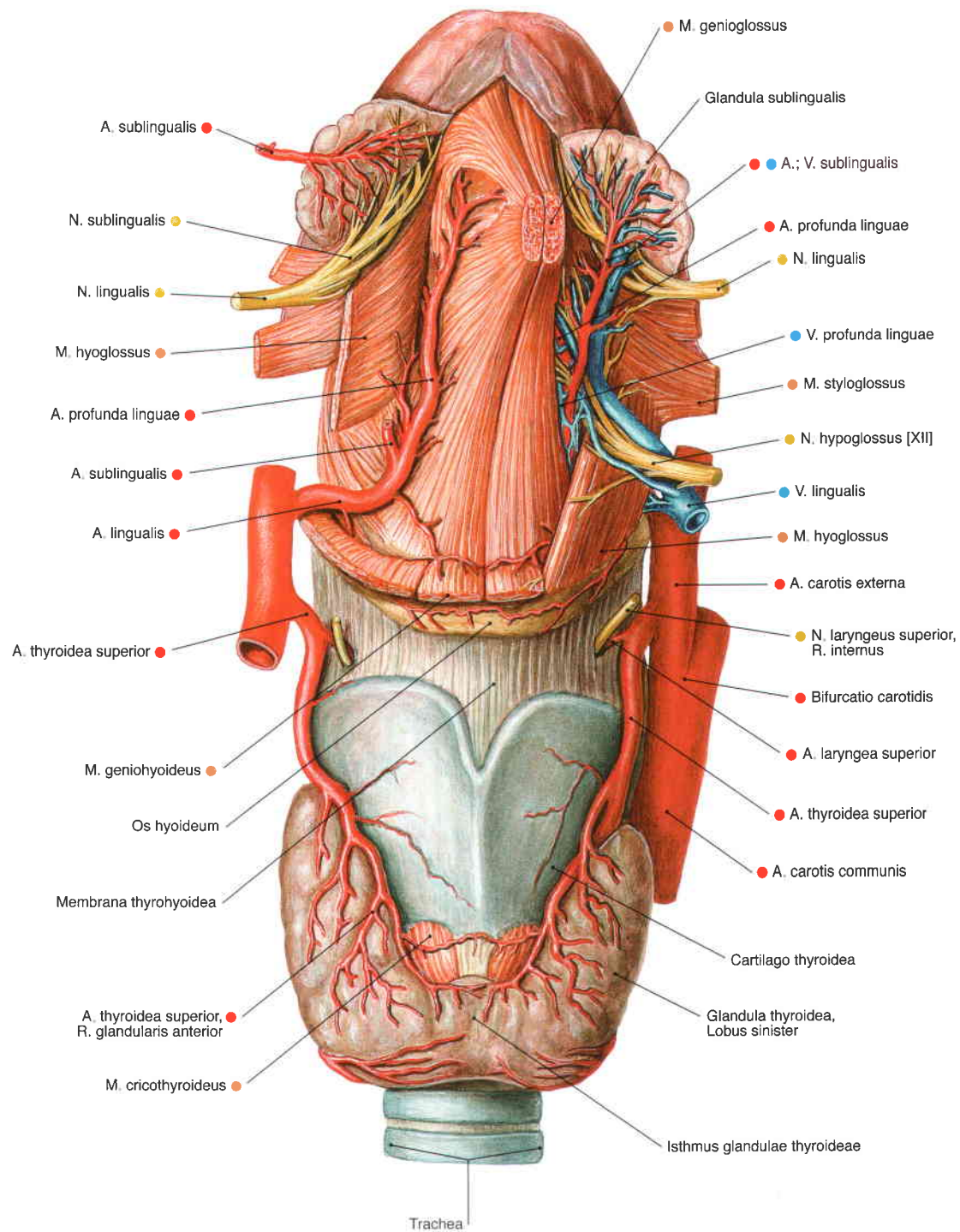
Vessels and nerves of the tongue and the thyroid gland

Fig. 201 Vessels and nerves of the tongue, Lingua, and the thyroid gland, Glandula thyroidea; anterior-inferior view.

→ 238, 264

Head, frontal section

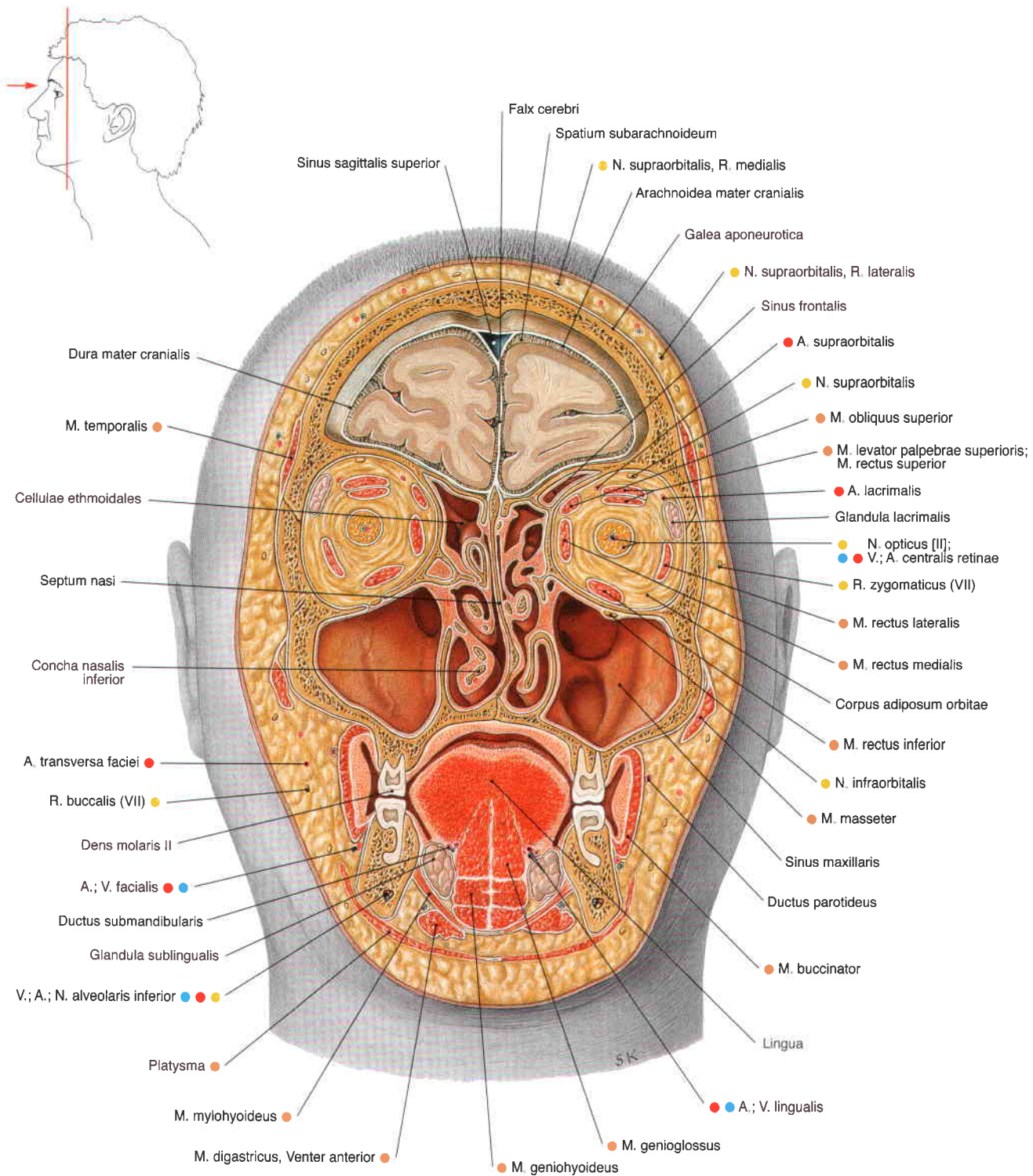


Fig. 202 Frontal section through the head of a 48-year-old male at the level of the second upper molar tooth; anterior view.

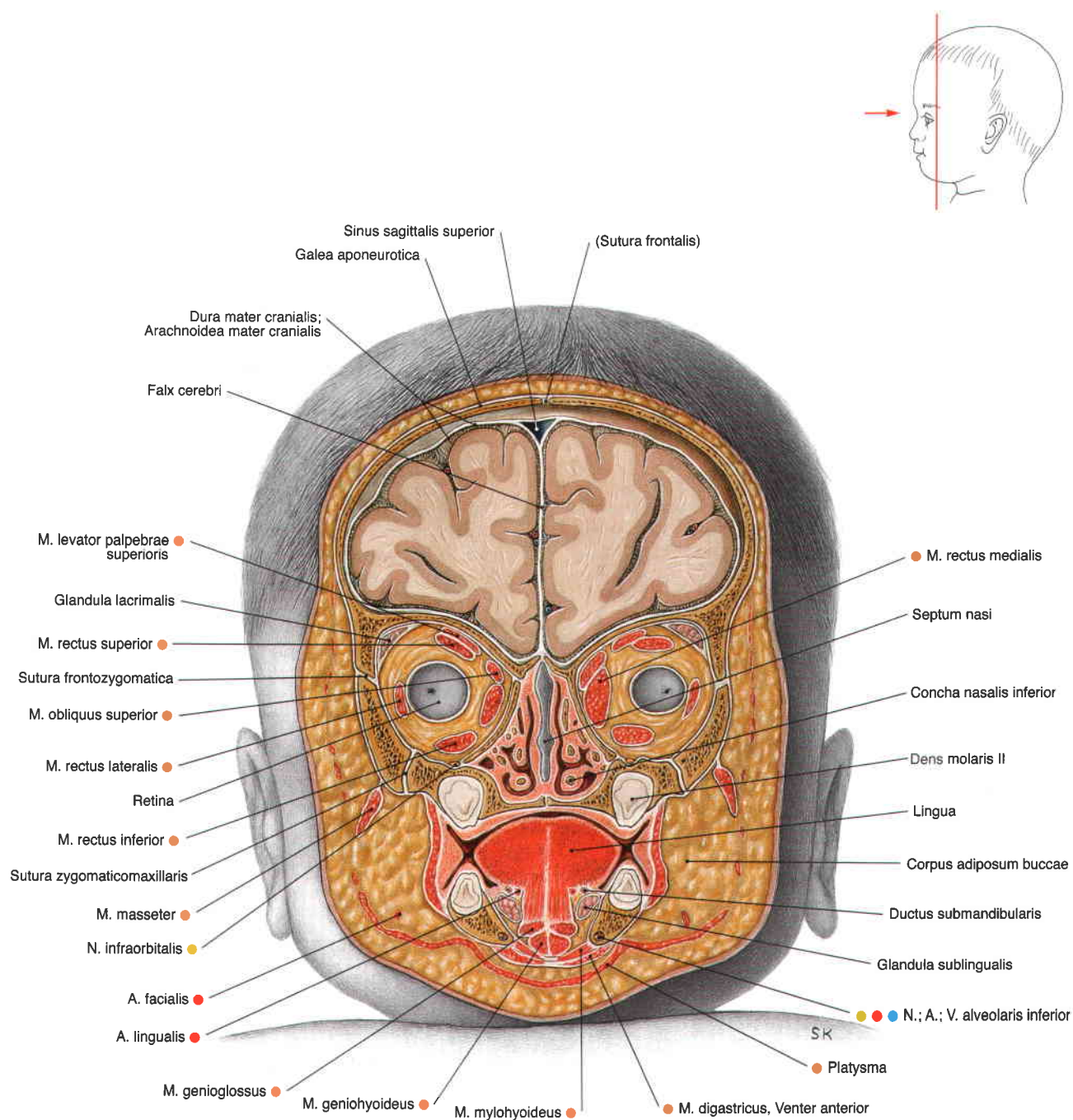
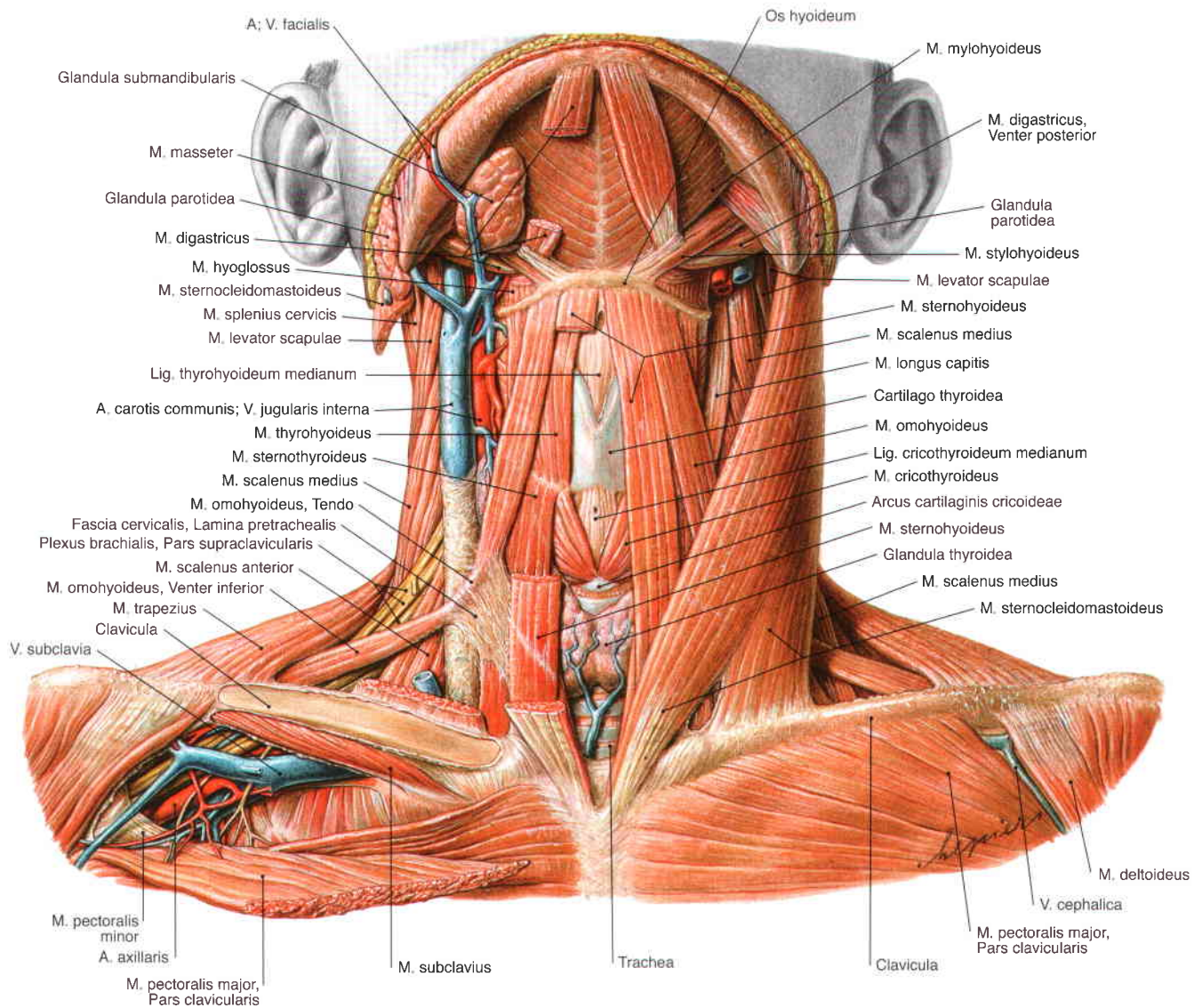
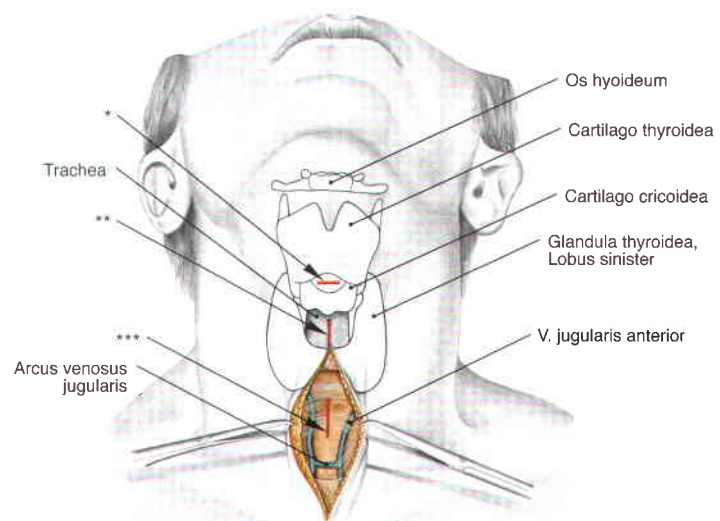


Fig. 203 Frontal section through the head of a neonate at the level of the second upper molar tooth; anterior view.

Note the absence of the maxillary sinus and the close proximity of the tooth anlage to the orbit.

Muscles of the neck and tracheotomy

→ T8, T9, T10, T11

Fig. 204 Muscles of the neck, Mm. colli.**Fig. 205** Surgical access to the trachea with the neck hyperextended.

* Coniotomy

** Upper tracheotomy (above the isthmus of the thyroid gland)

*** Lower tracheotomy (below the isthmus of the thyroid gland)

Cervical fascia

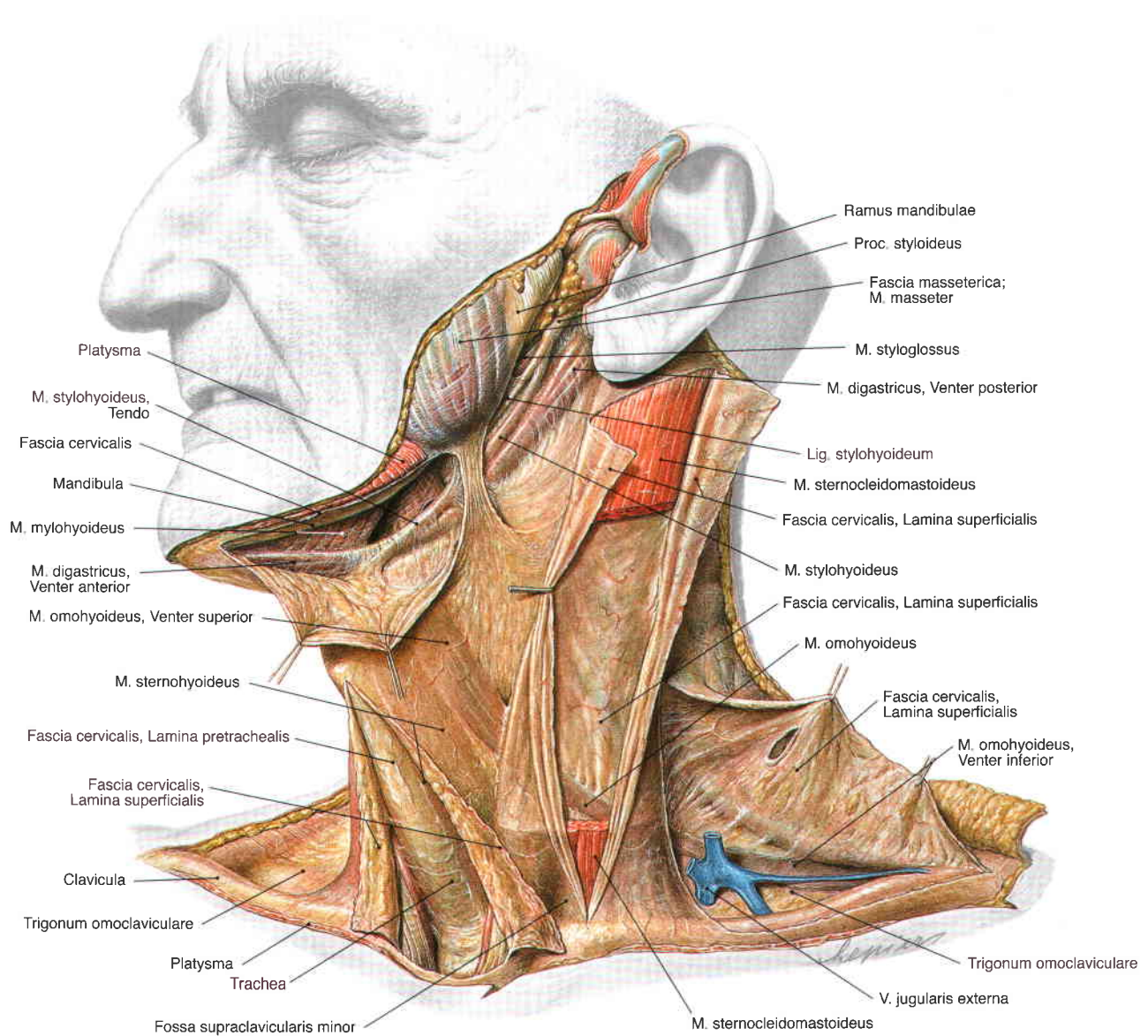
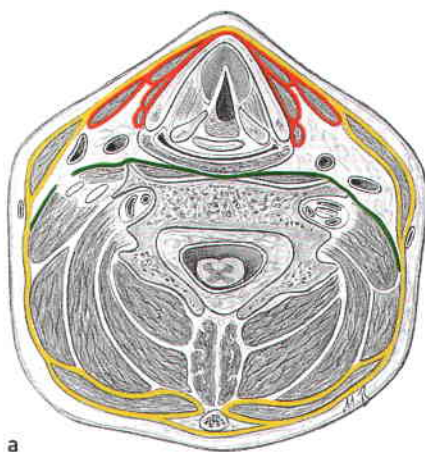


Fig. 206 Cervical fascia, Fascia cervicalis.



a

Fascia cervicalis

Yellow: Lamina superficialis

Red: Lamina pretrachealis

Green: Lamina prevertebralis

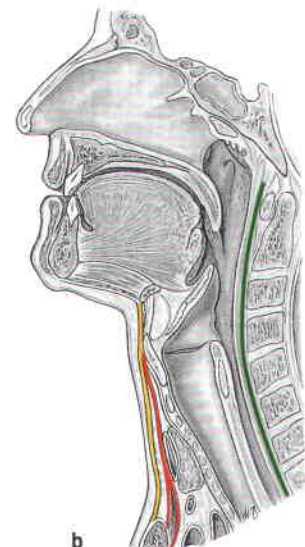
Fig. 207 a, b Schema of the cervical fascia.

a Transverse section

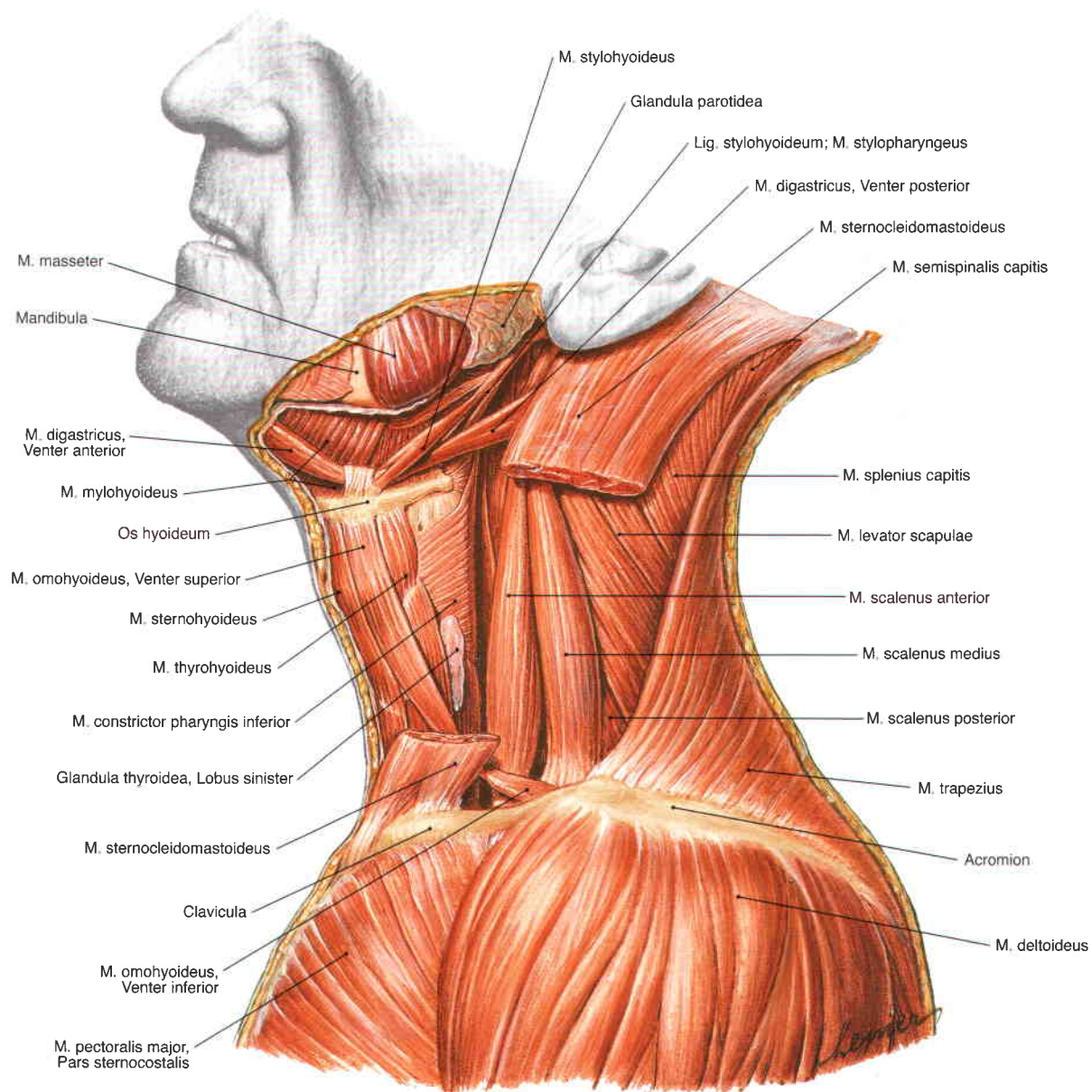
→ 269

b Median section

→ 246



b

Muscles of the neck

→ T8, T9, T10, T11

**Fig. 208** Muscles of the neck, Mm. colli.

Muscles of the neck

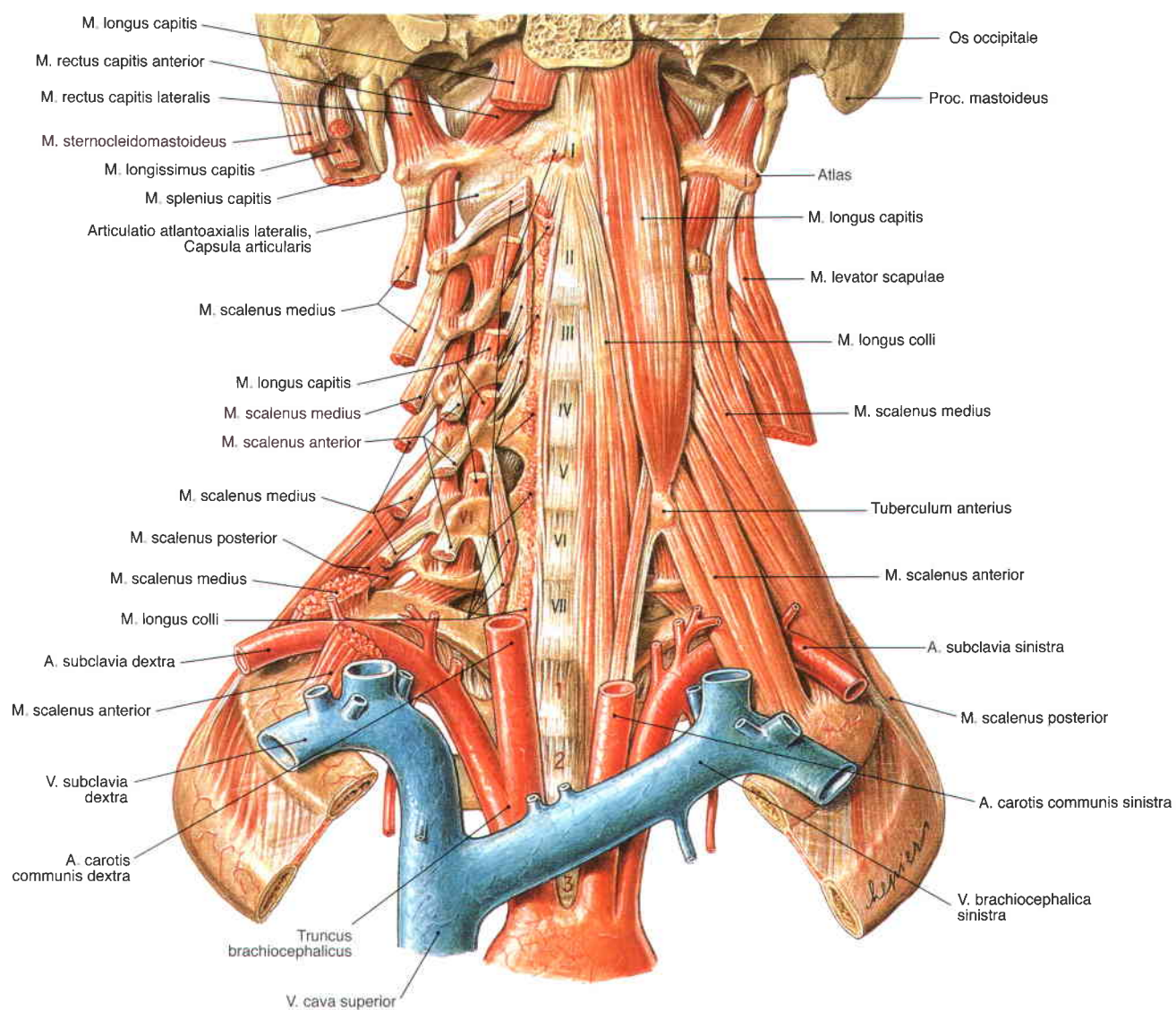


Fig. 209 Prevertebral muscles and scalenus muscles, Mm. scaleni.

I - VII = First to seventh cervical vertebra

1 - 3 = First to third thoracic vertebra

→ T11, T12

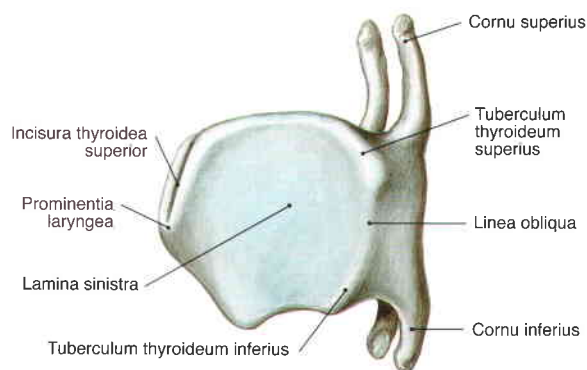
Skeleton of the larynx

Fig. 210 Thyroid cartilage, Cartilago thyroidea; viewed from the left.

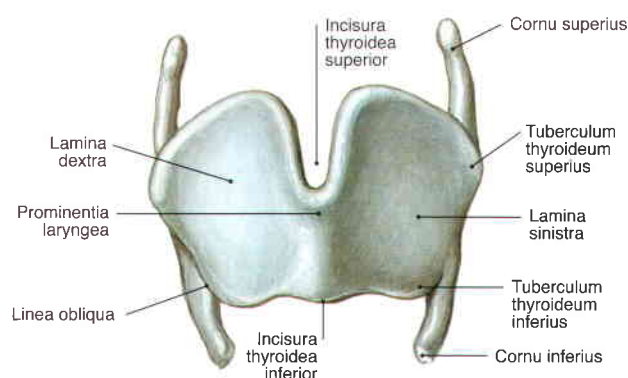


Fig. 211 Thyroid cartilage, Cartilago thyroidea; ventral view.

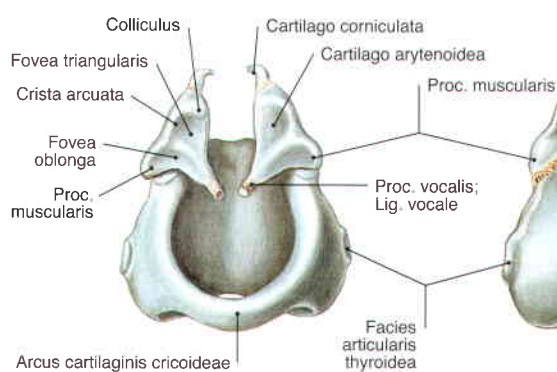


Fig. 212 Cartilages of the larynx, Cartilagine laryngis; ventrosuperior view.

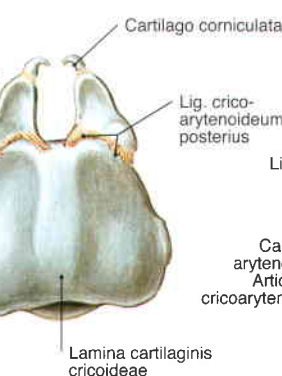


Fig. 213 Cartilages of the larynx, Cartilagine laryngis; dorsal view.

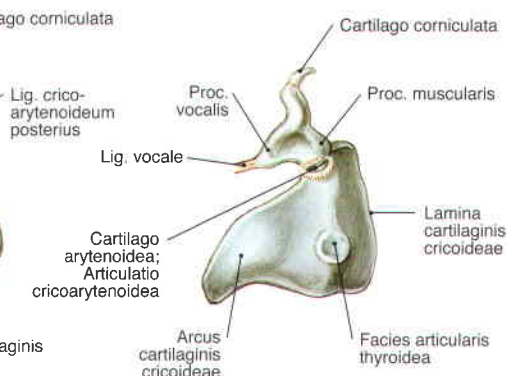


Fig. 214 Cartilages of the larynx, Cartilagine laryngis; viewed from the left.

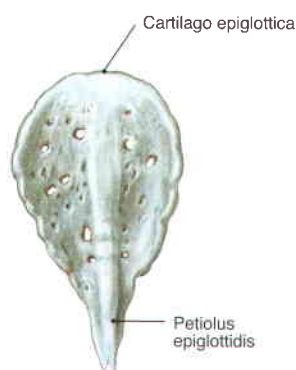


Fig. 215 Epiglottic cartilage, Cartilago epiglottica; dorsal view.

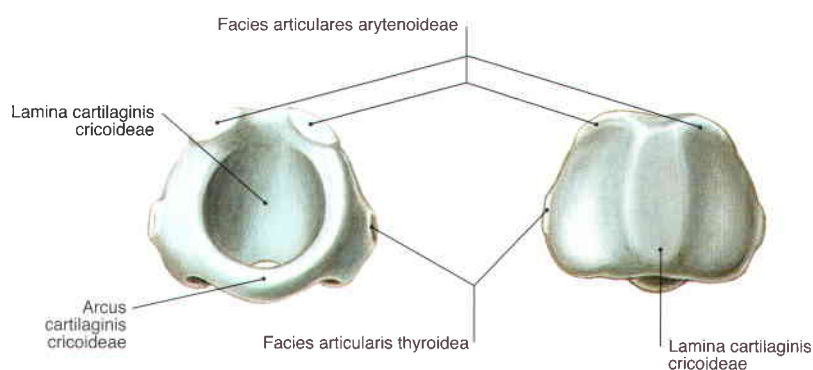


Fig. 216 Cricoid cartilage, Cartilago cricoidea; ventrosuperior view.

Fig. 217 Cricoid cartilage, Cartilago cricoidea; dorsal view.

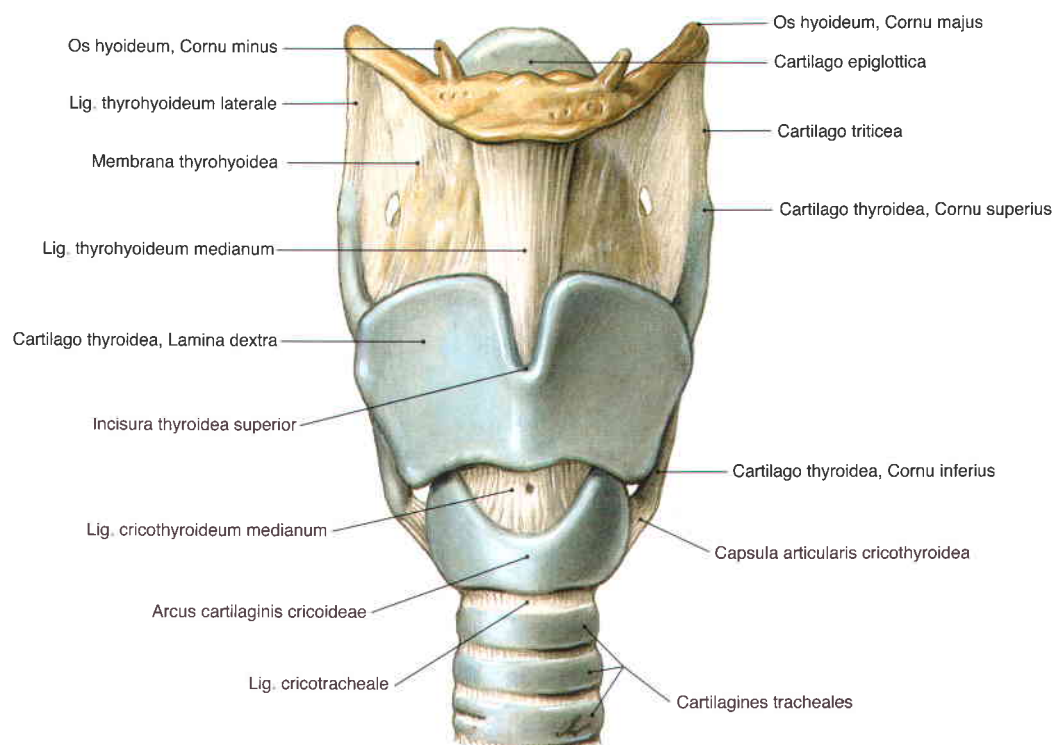
Hyoid bone and skeleton of the larynx

Fig. 218 Larynx, Larynx,
and hyoid bone, Os hyoideum;
ventral view.

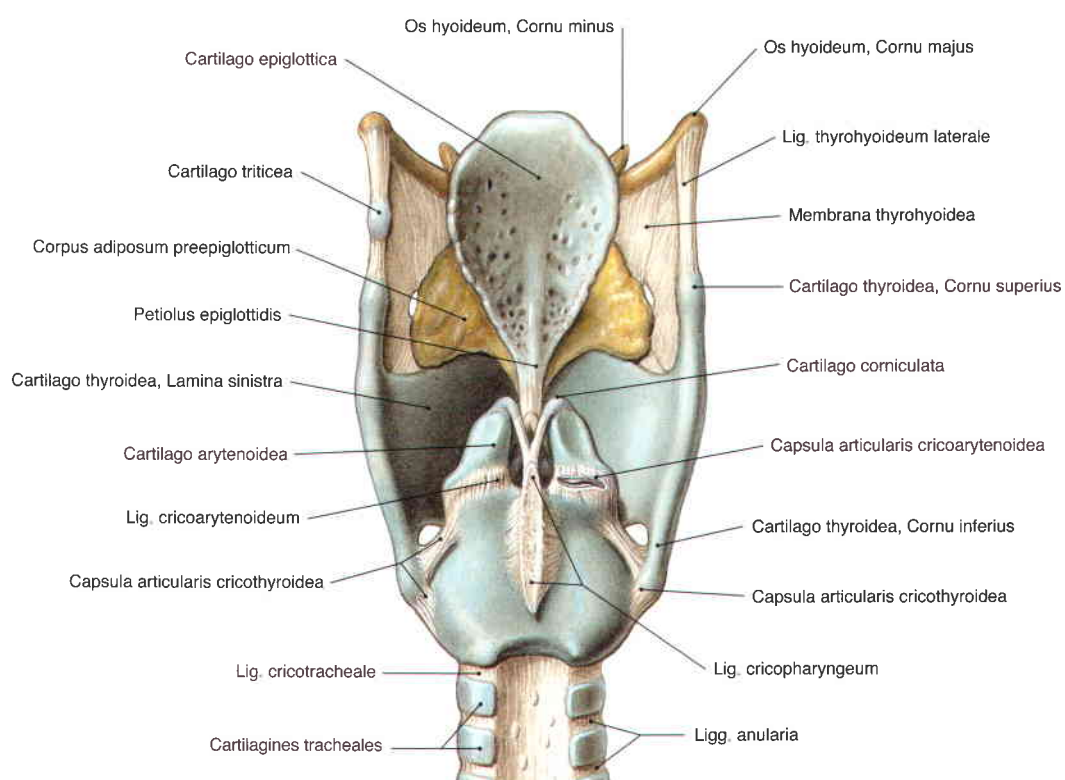


Fig. 219 Cartilages of the larynx, Cartilagines laryngis,
and hyoid bone, Os hyoideum;
dorsal view.

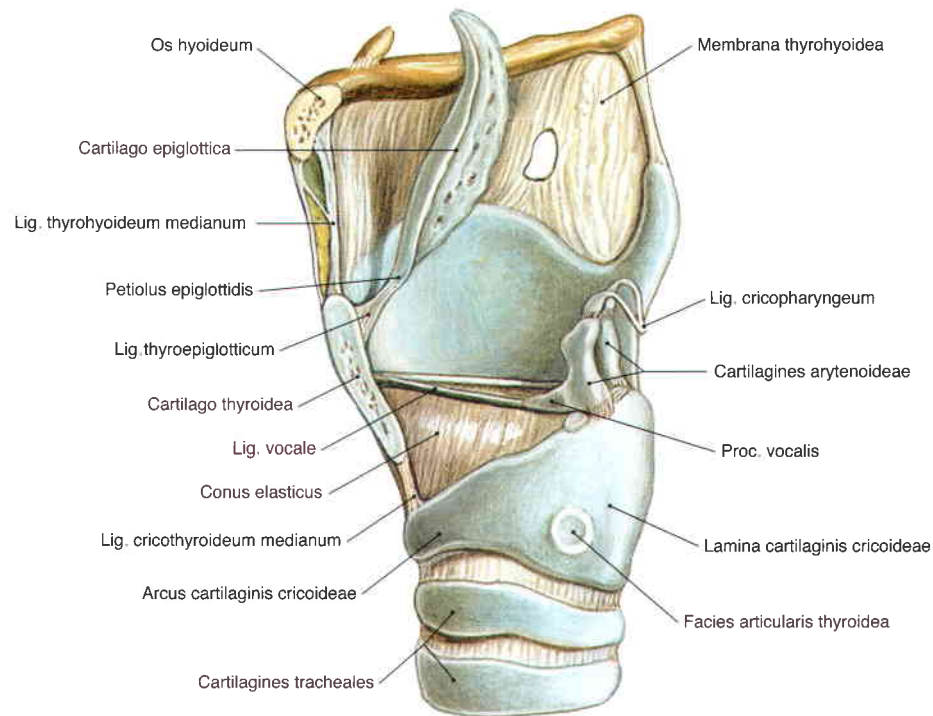
Hyoid bone and skeleton of the larynx

Fig. 220 Larynx, Larynx, and hyoid bone, Os hyoideum; viewed from the left.

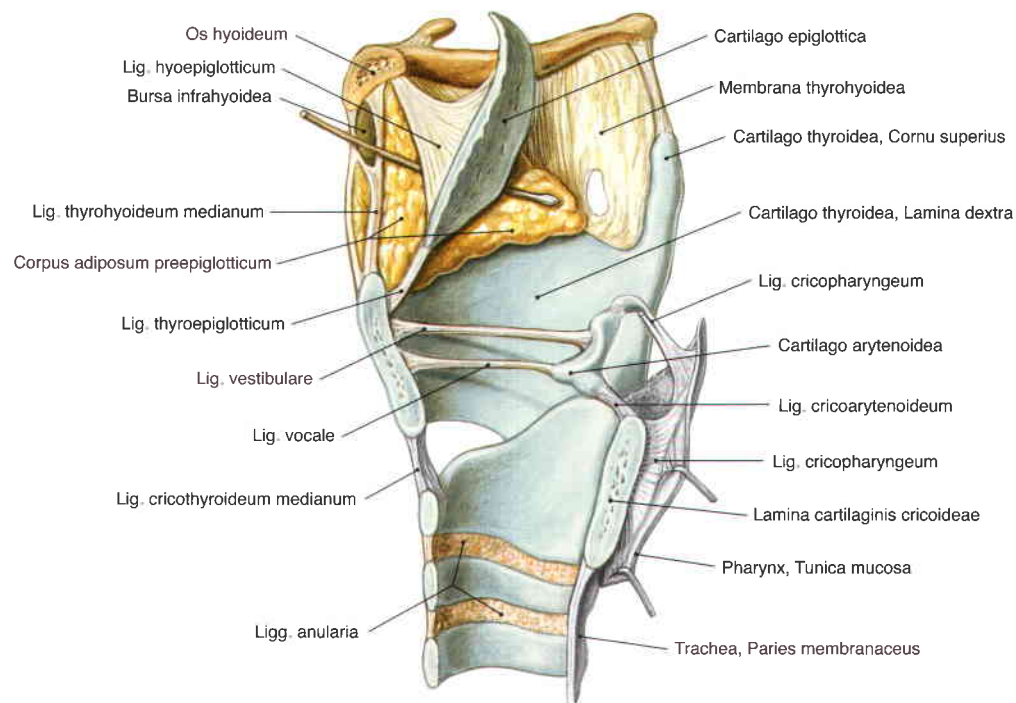


Fig. 221 Larynx, Larynx, and hyoid bone, Os hyoideum; median section; medial view.

Laryngeal muscles

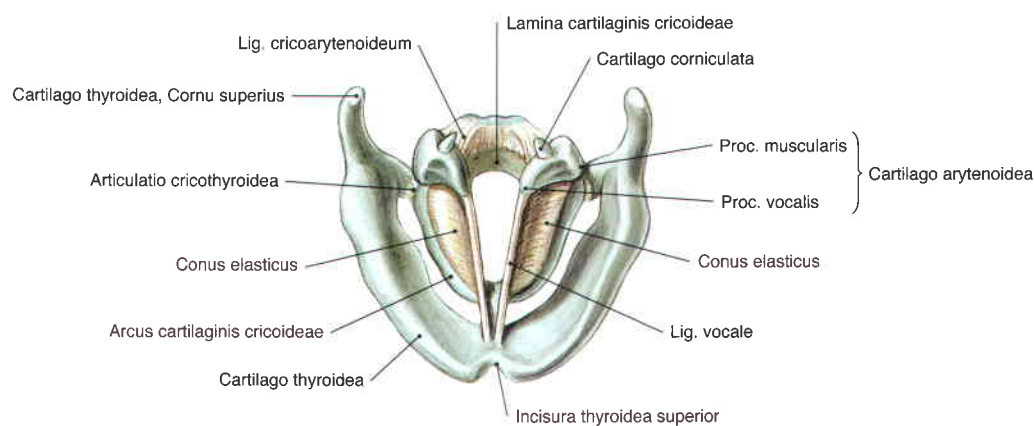


Fig. 222 Cartilages of the larynx, Cartilages laryngis, and vocal ligament, Lig. vocale; ventrosuperior view.

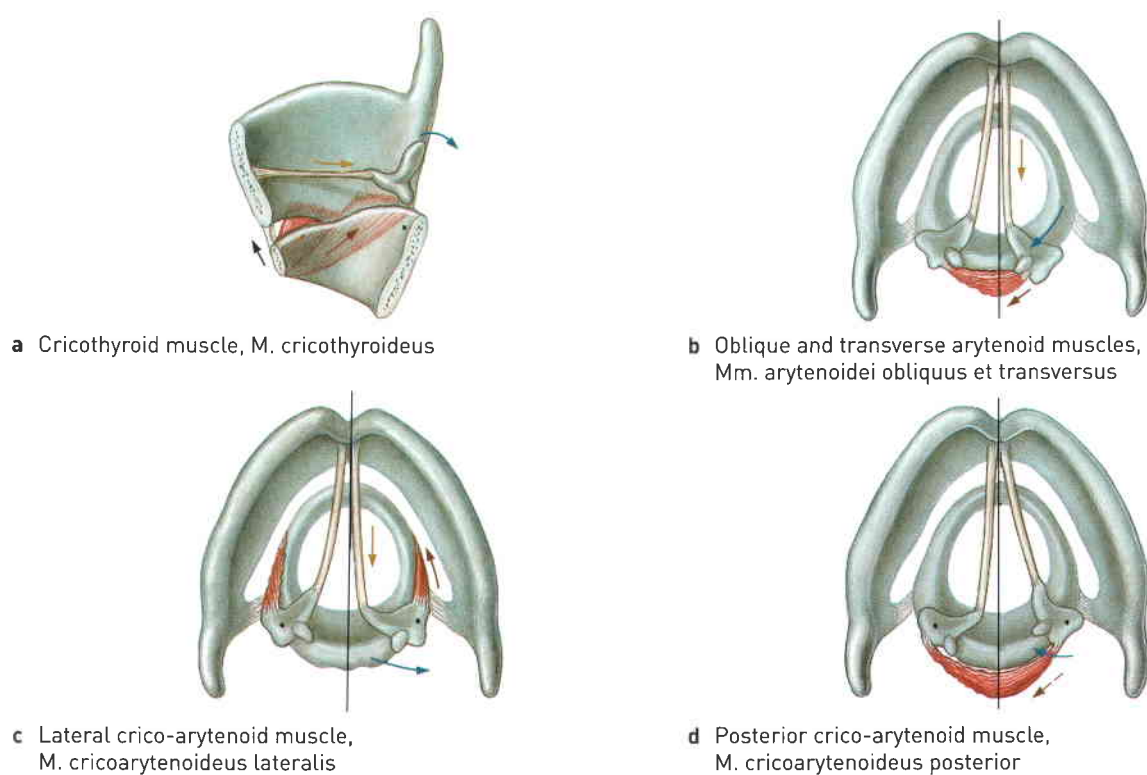
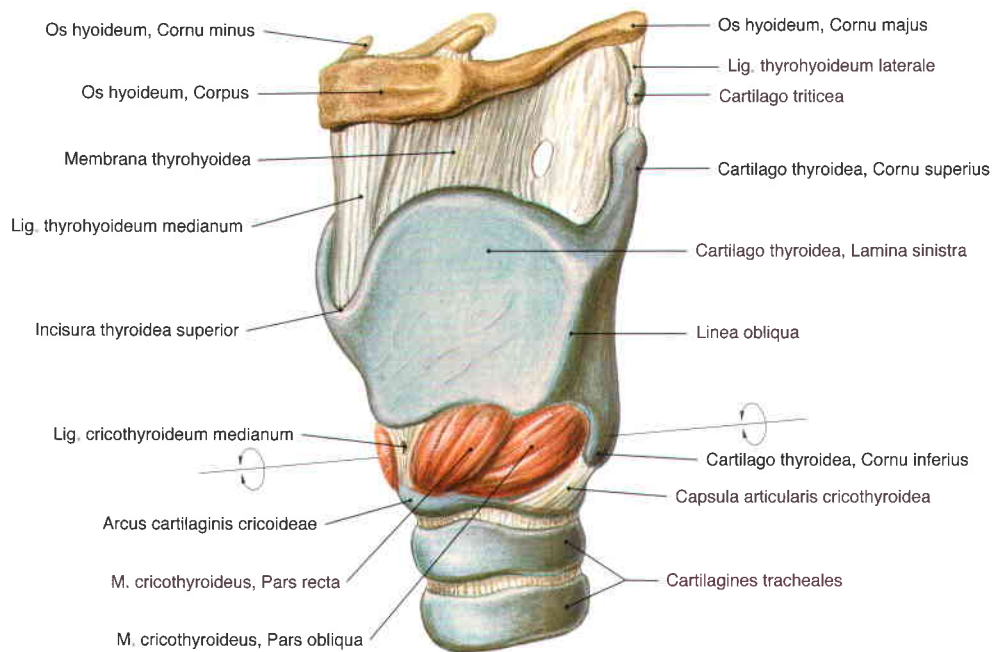


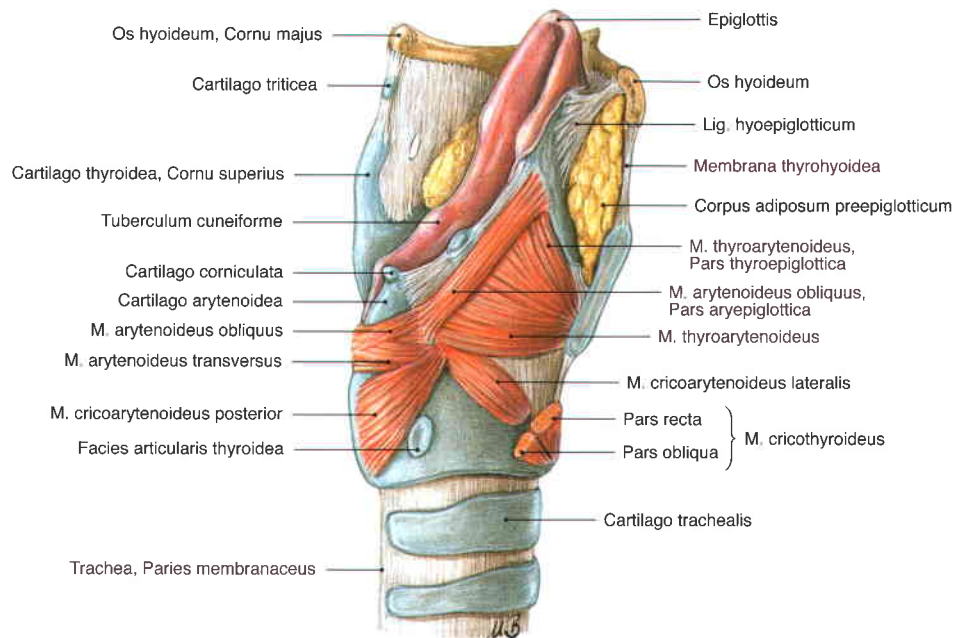
Fig. 223 a–d Schema showing the functions of the laryngeal muscles, Mm. laryngis; yellow arrows: tension of the vocal ligament; red arrows: muscle contraction; blue arrows: direction of rotation;

the muscles on the left are relaxed; those on the right are contracted; superior view.

Laryngeal muscles

→ T 6

Fig. 224 Cricothyroid muscle, M. cricothyroideus; ventral view from the left.



→ T 6

Fig. 225 Laryngeal muscles, Mm. laryngis; dorsal view from the right.

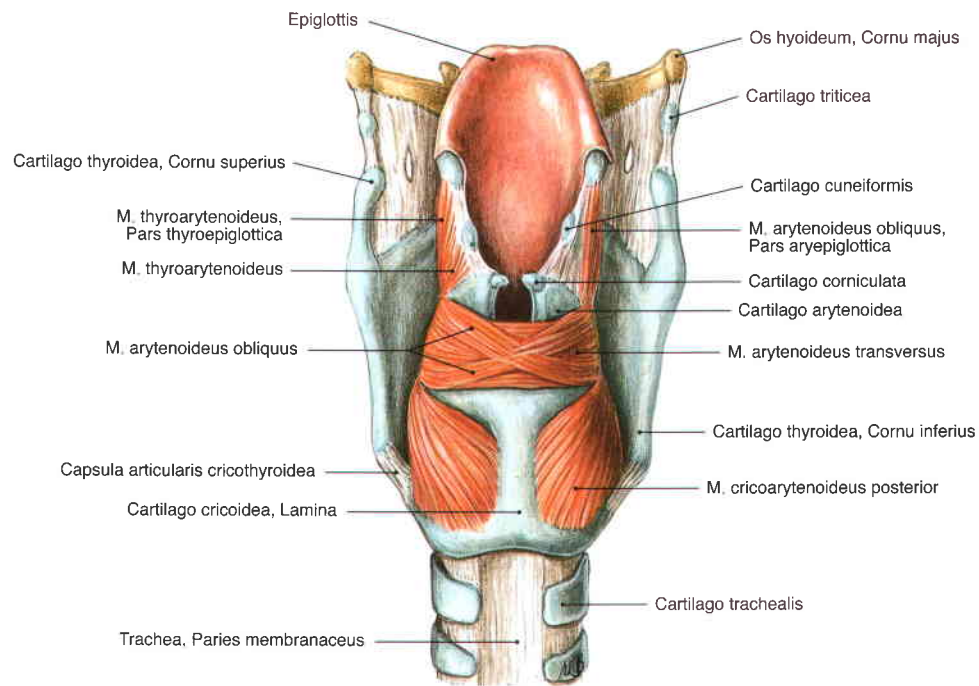
Laryngeal muscles

Fig. 226 Laryngeal muscles, Mm. laryngis; dorsal view.

→ T 6

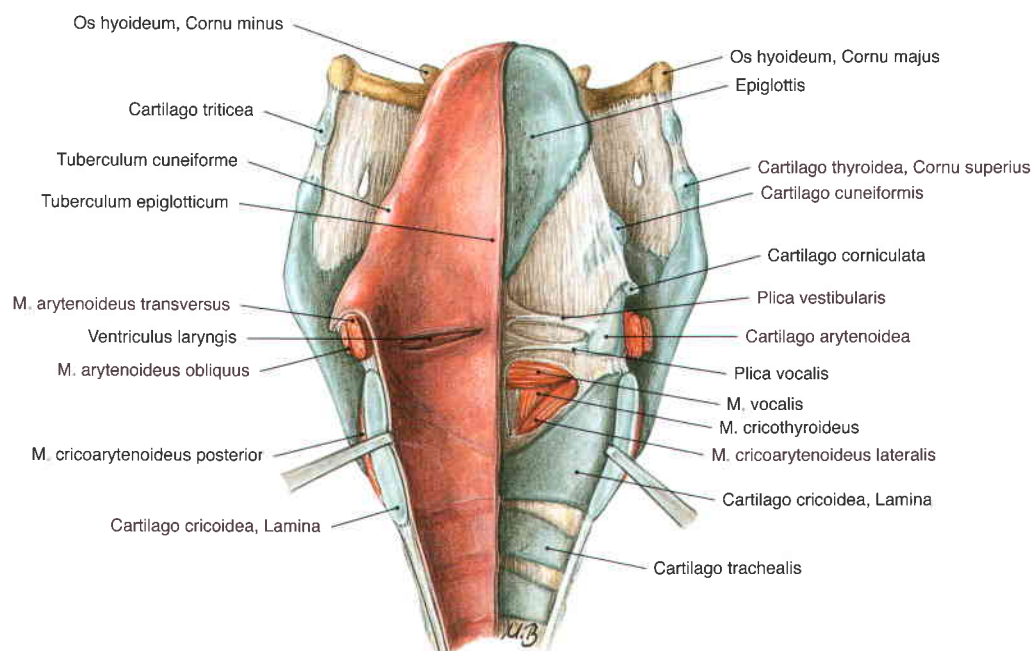
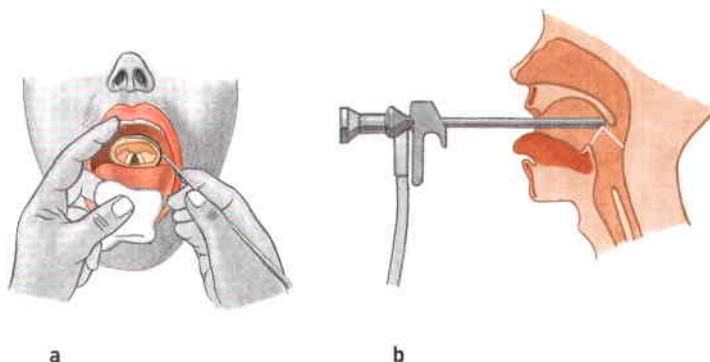
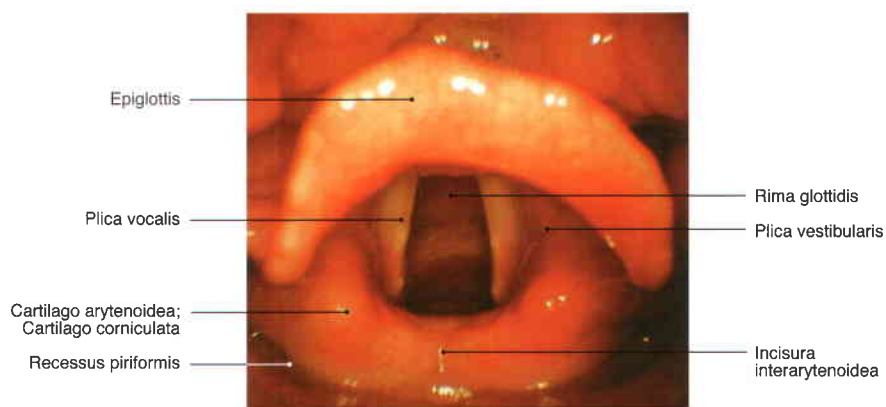
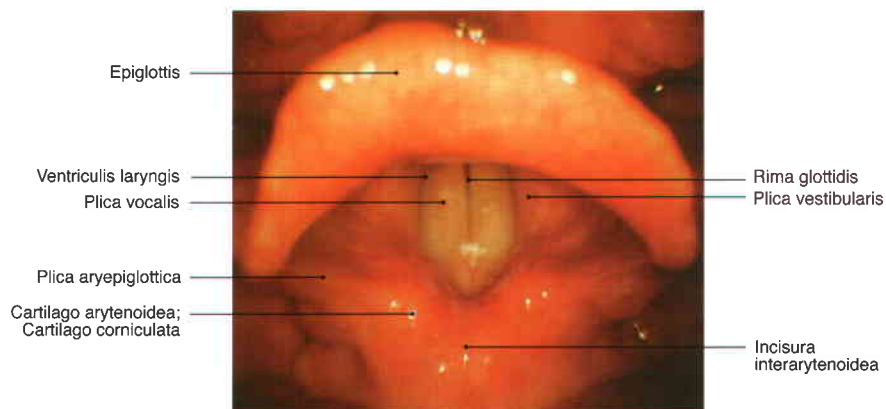
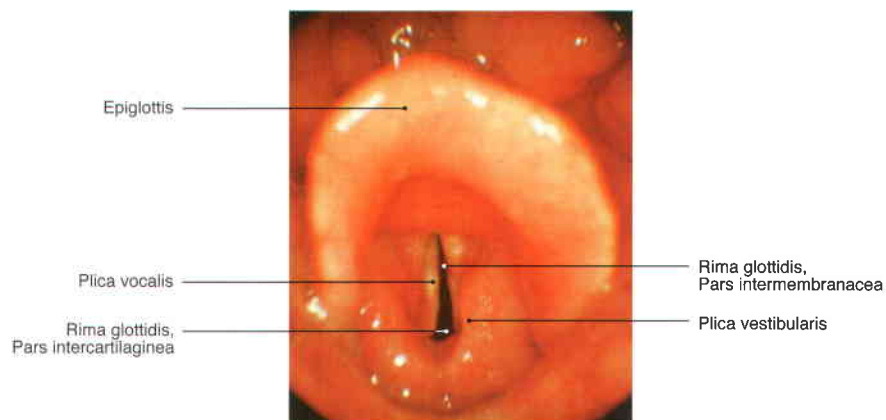
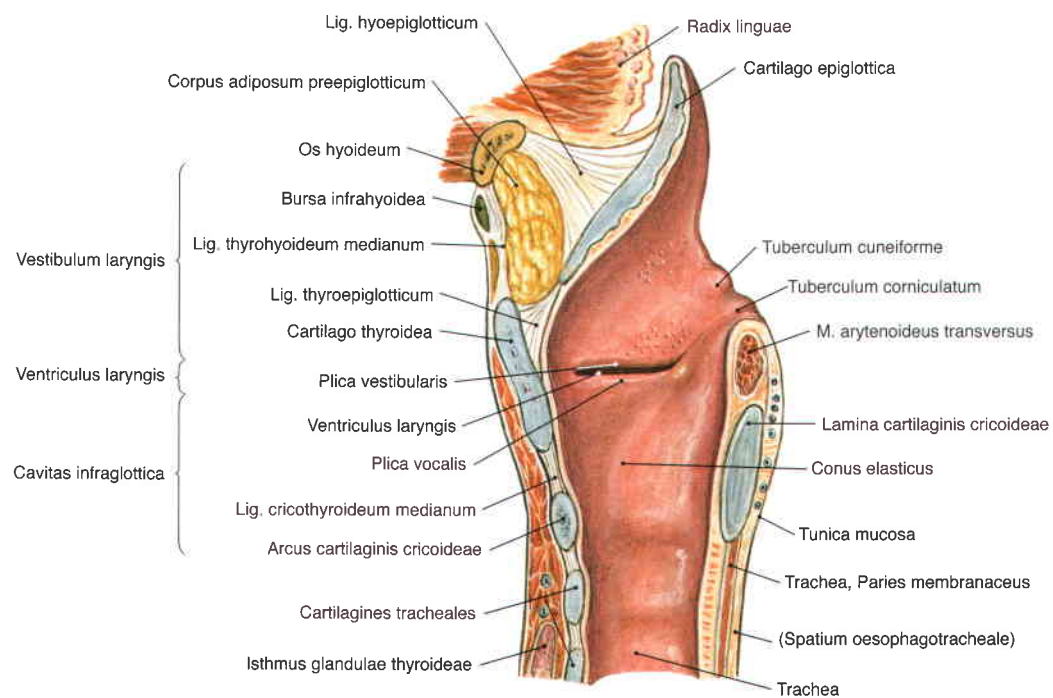
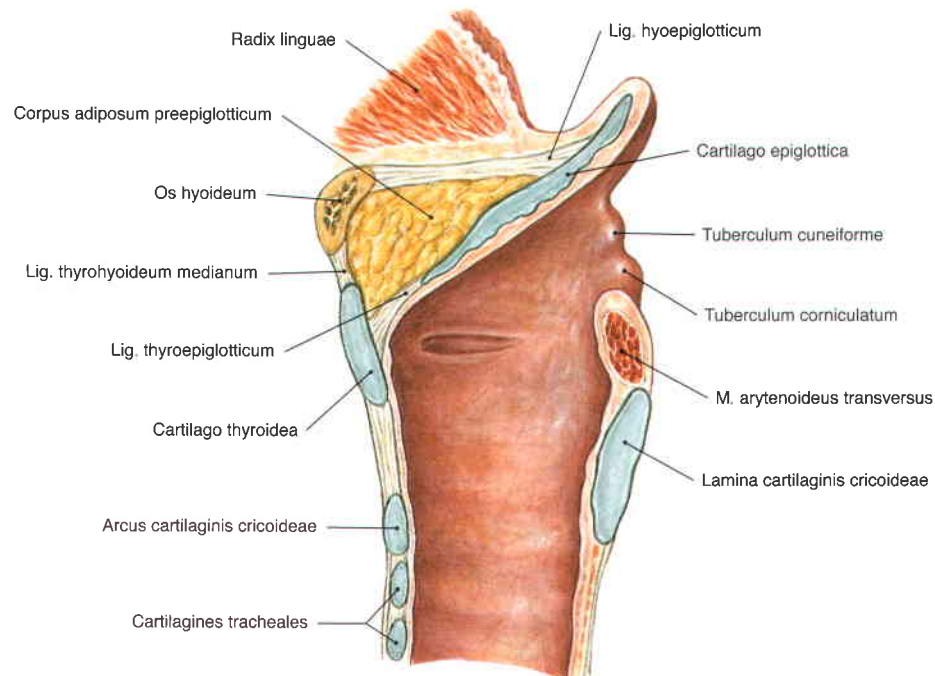
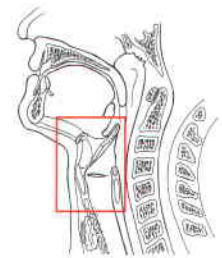
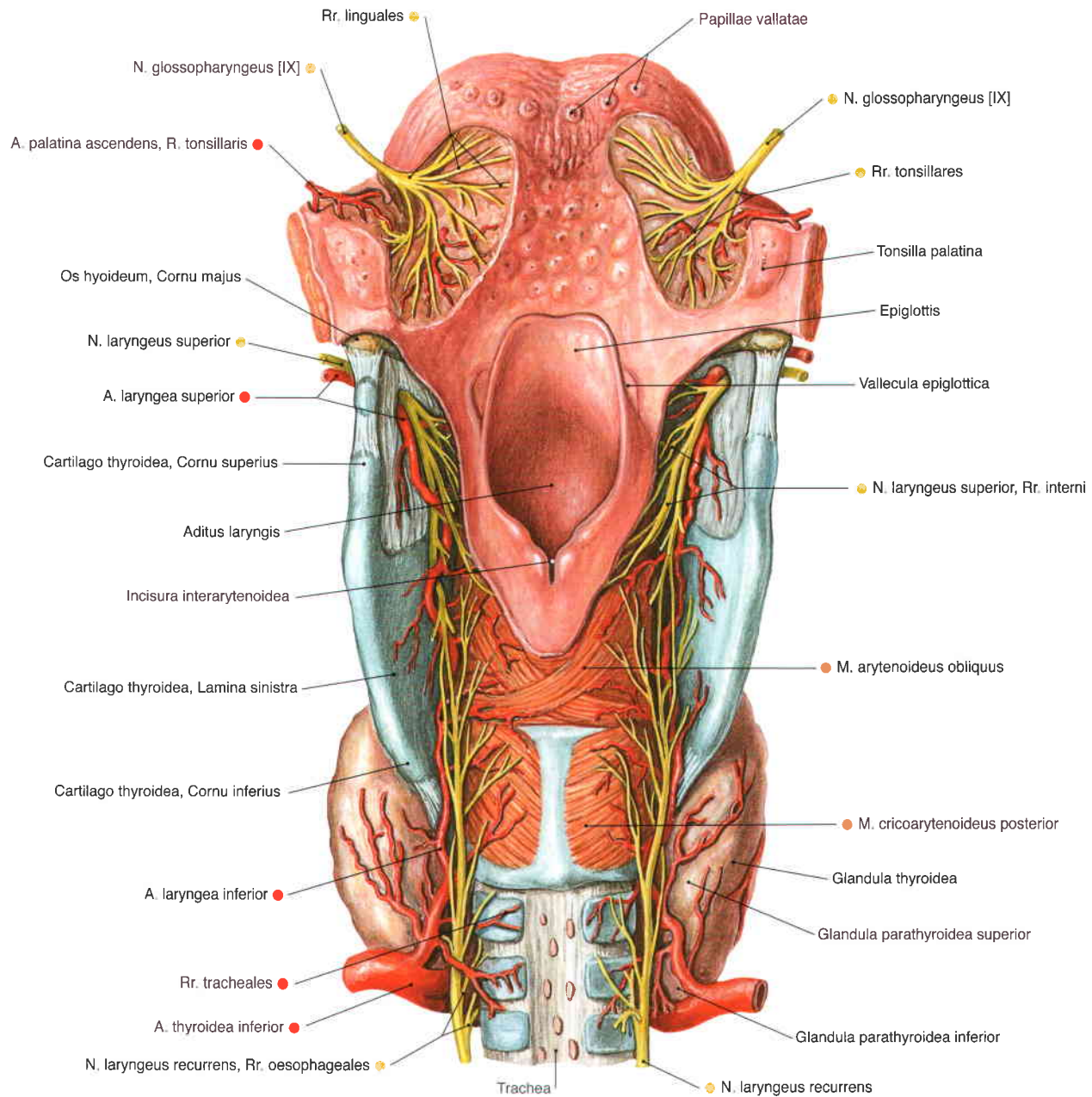


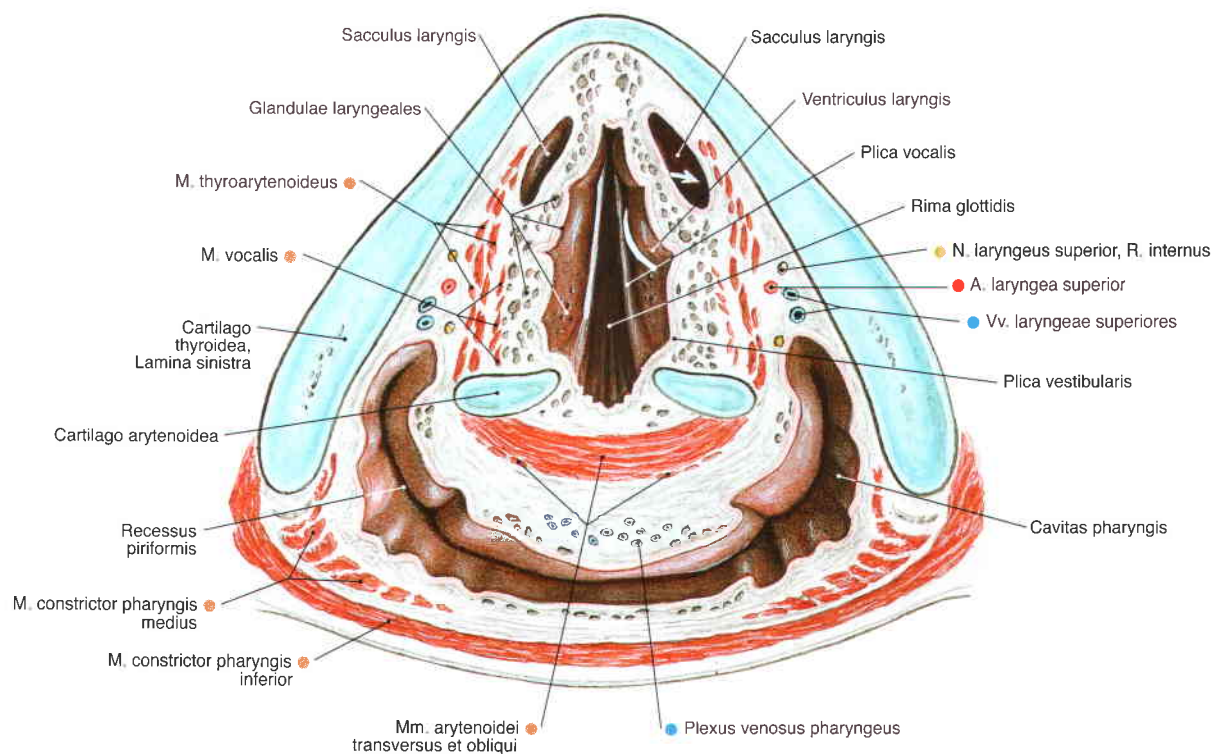
Fig. 227 Larynx, Larynx; sectioned from dorsal in the median plane and separated with hooks; dorsal view.

→ T 6

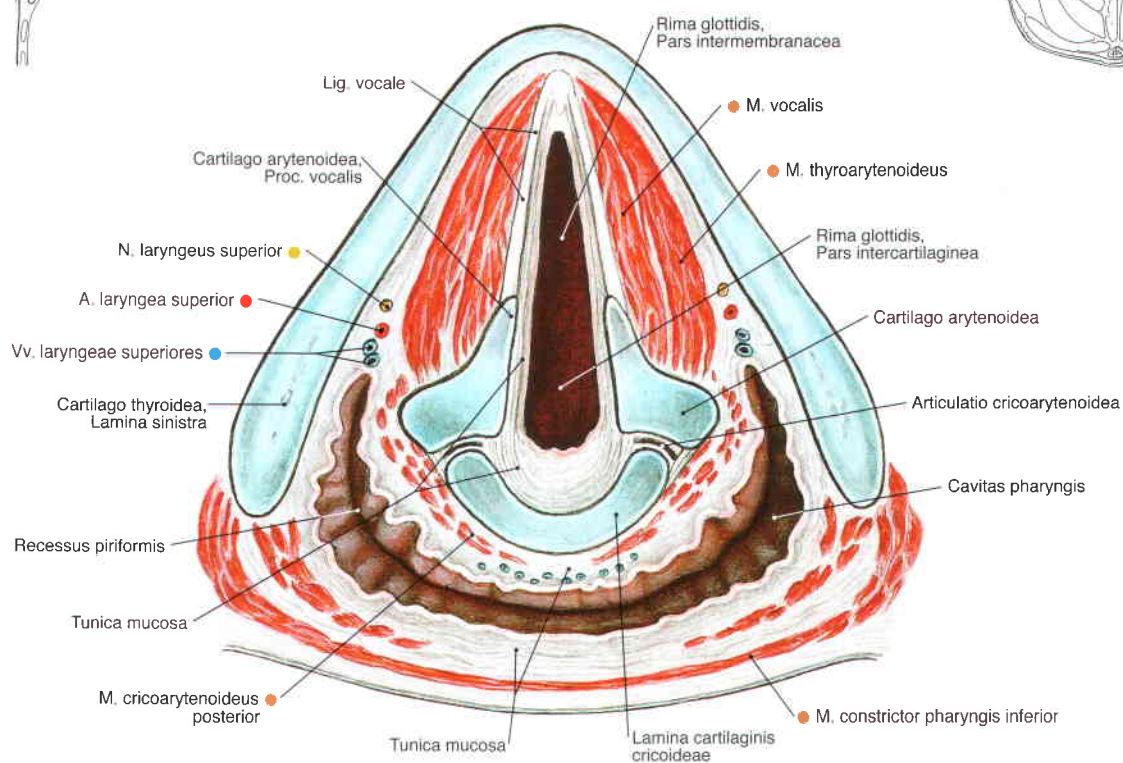
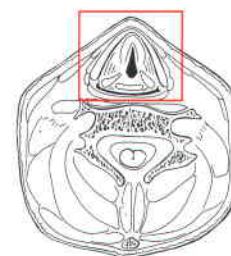
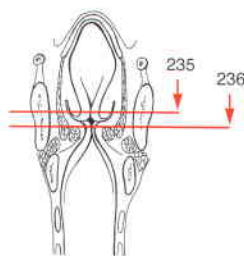
*Laryngoscopy***Fig. 228 a, b** Laryngoscopy.**a** Indirect laryngoscopy**b** Direct, endoscopic laryngoscopy**Fig. 229** Direct laryngoscopy; respiratory position.**Fig. 230** Direct laryngoscopy; phonation position.**Fig. 231** Direct laryngoscopy; whispering position.

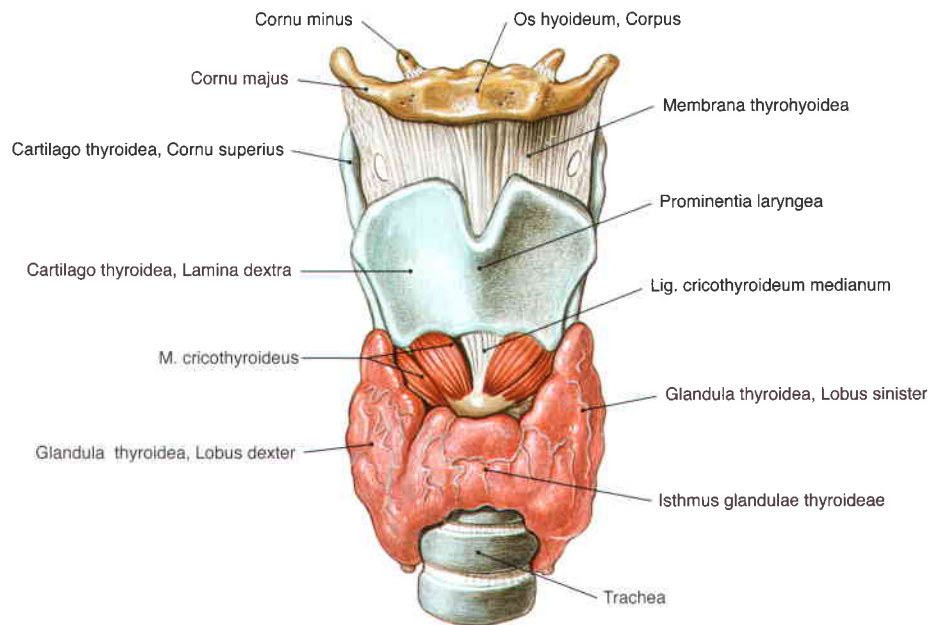
Inner contour of the larynx**Fig. 232** Larynx, Larynx.**Fig. 233** Larynx, Larynx;
position of the epiglottis during swallowing.

Arteries and nerves of the larynx

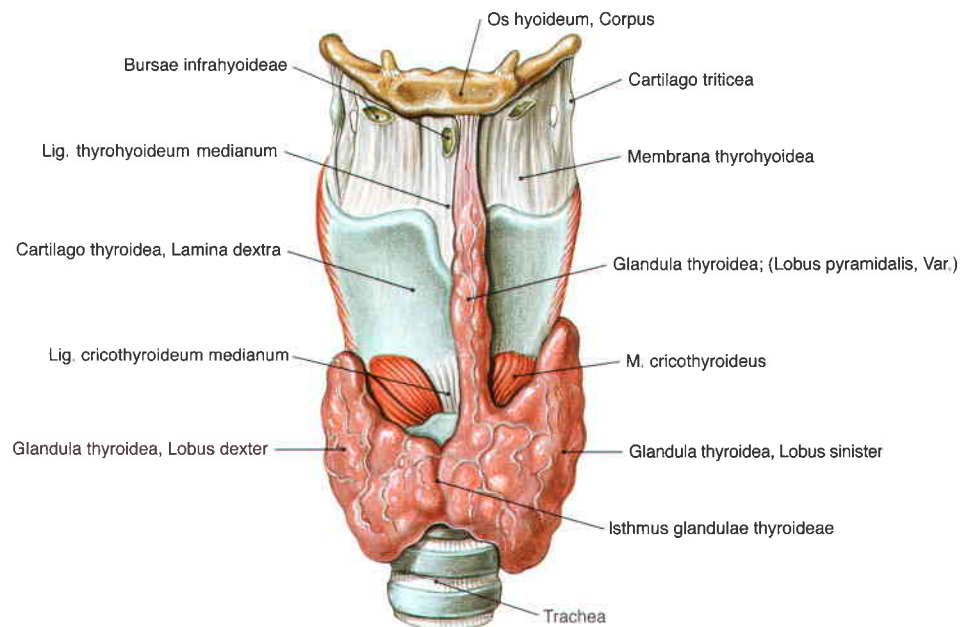
Larynx, transverse sections**Fig. 235** Larynx, Larynx.

The white arrow indicates the connection between the laryngeal ventricle and the laryngeal saccule.

**Fig. 236** Larynx, Larynx.

Thyroid gland

→ 205

Fig. 237 Thyroid gland, Glandula thyroidea, and larynx, Larynx.**Fig. 238** Thyroid gland, Glandula thyroidea, and larynx, Larynx.

Thyroid gland, sections

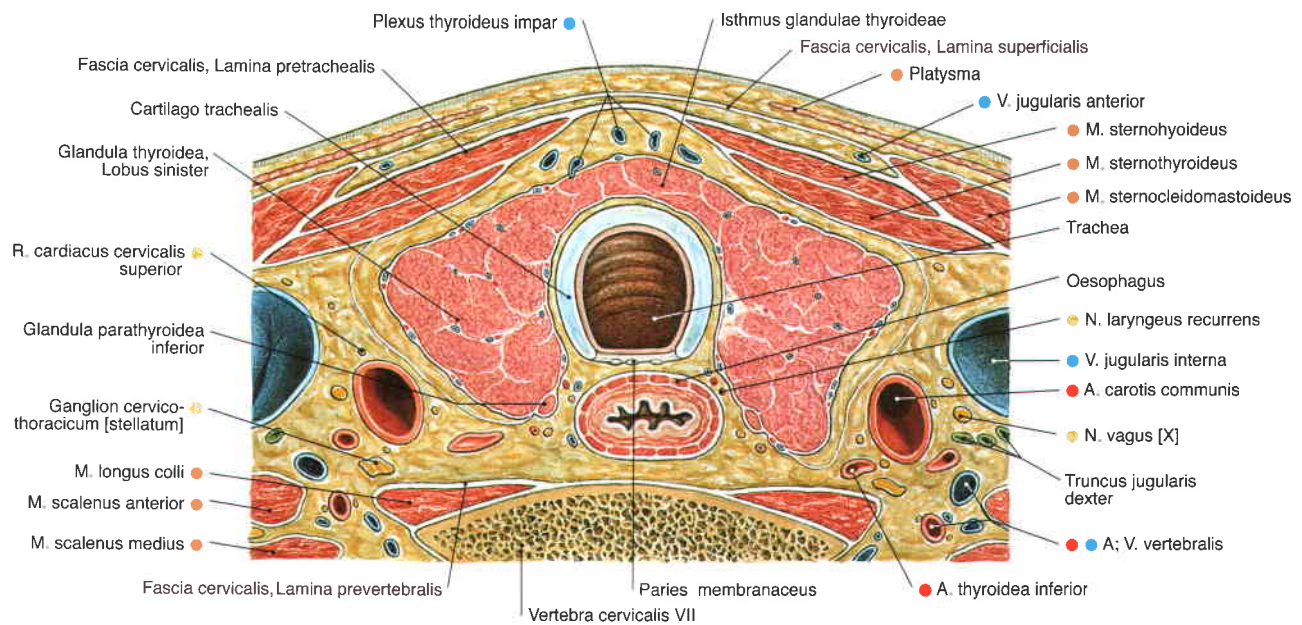


Fig. 239 Thyroid gland, Glandula thyroidea; horizontal section.

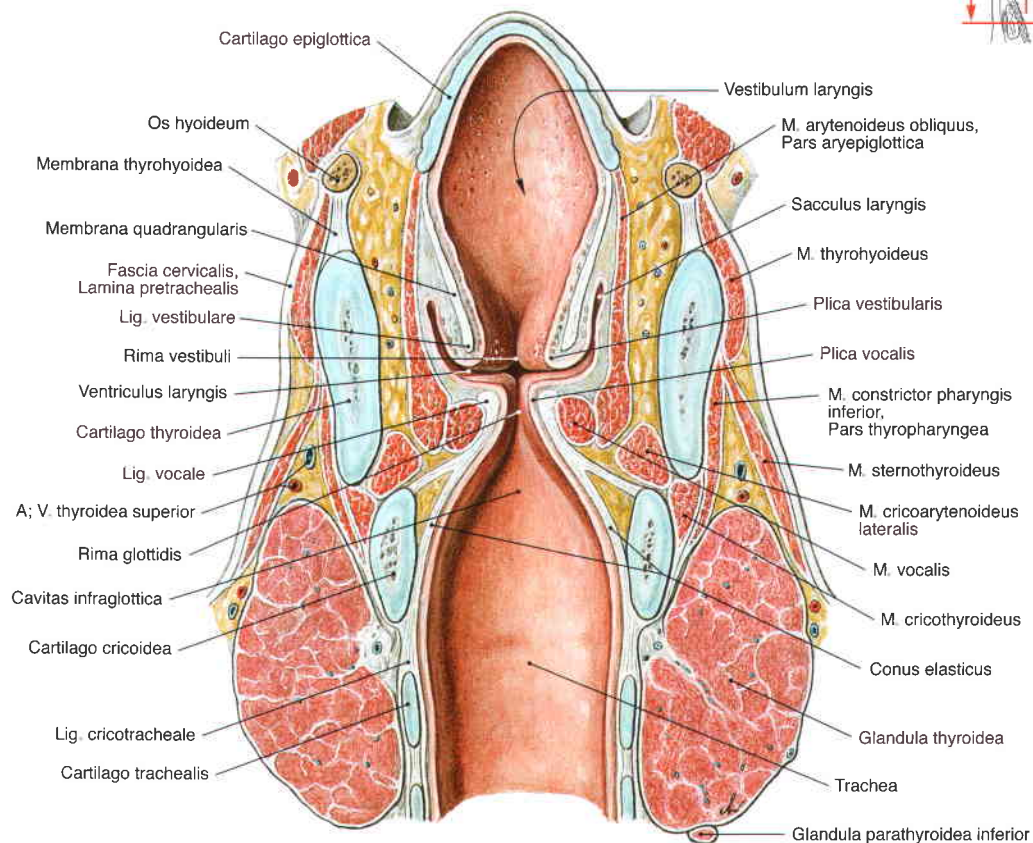
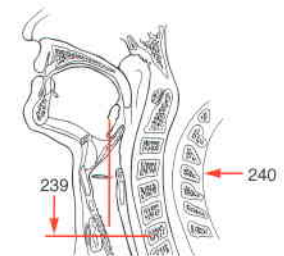


Fig. 240 Thyroid gland, Glandula thyroidea; frontal section.

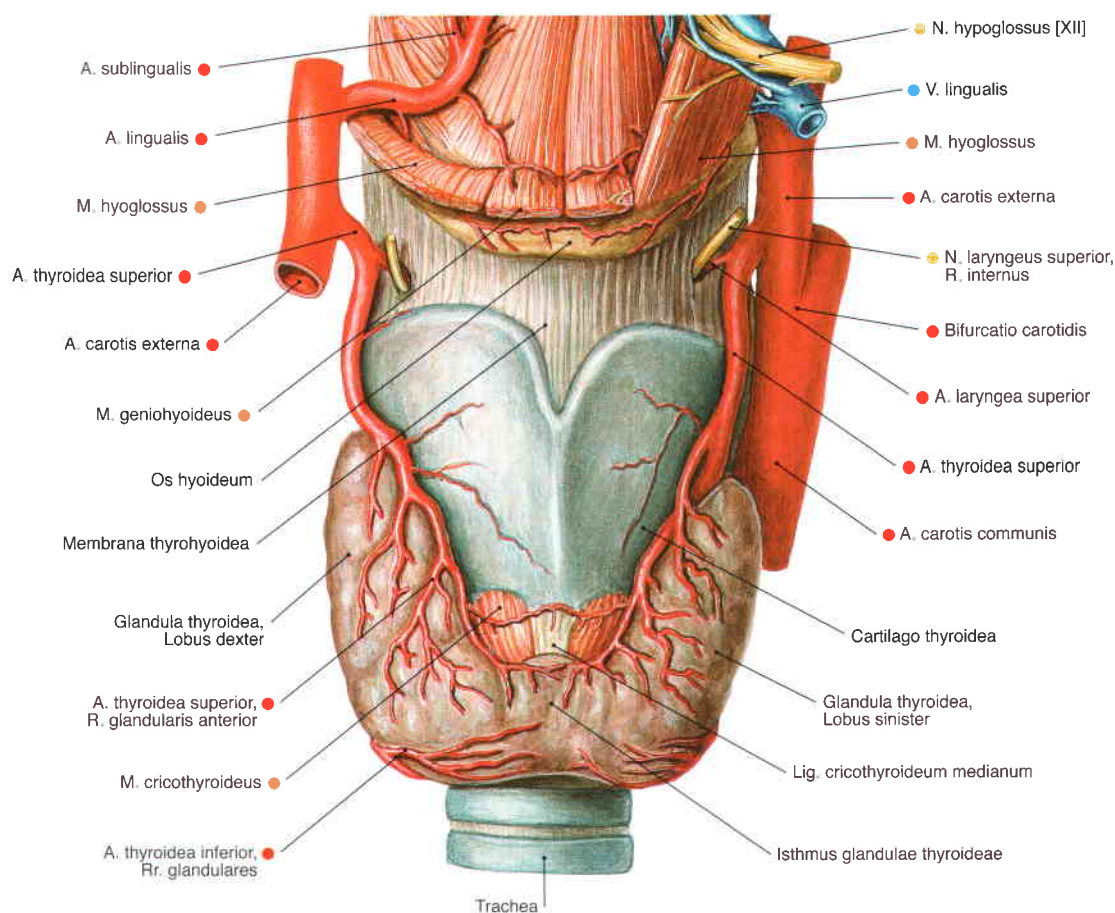
Arterial supply of the thyroid gland

Fig. 241 Vessels and nerves of the thyroid gland, Glandula thyroidea, and the larynx, Larynx.

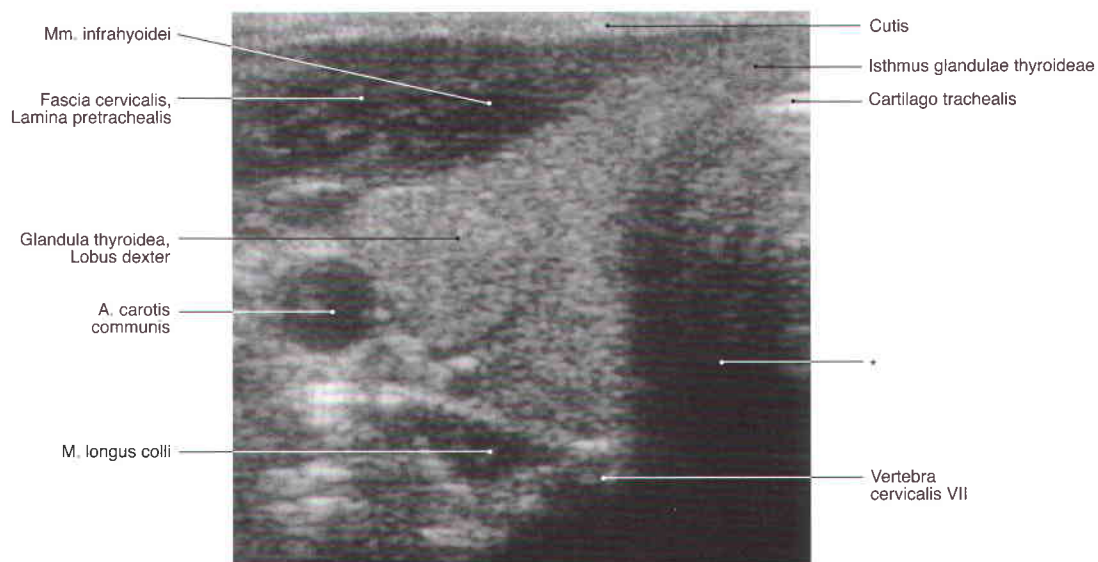


Fig. 242 Thyroid gland, Glandula thyroidea; oblique ultrasound image in ventrodorsal direction; inferior view (right, 200%).
* Ultrasound shadow of the trachea

Pathological enlargement of the thyroid gland

Fig. 243 Thyroid gland, Glandula thyroidea;
enlargement of the thyroid gland with three obvious nodes, Struma nodosa.

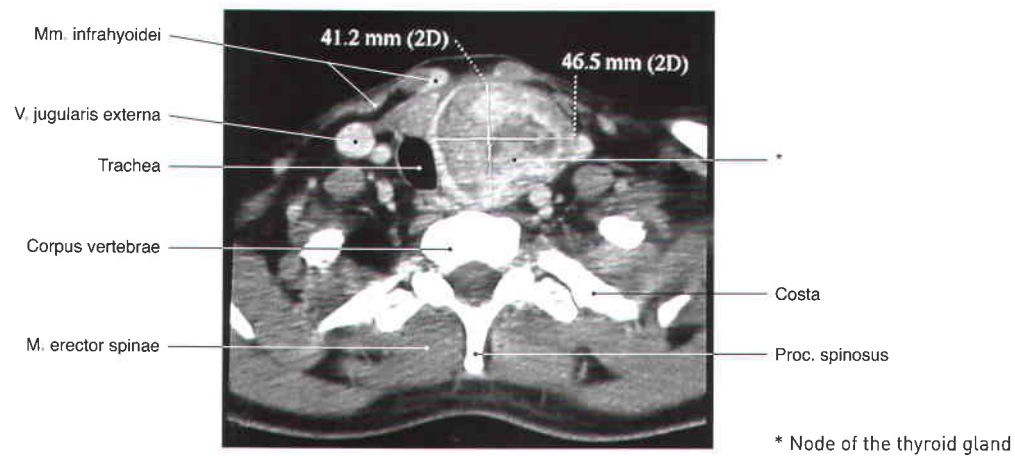


Fig. 244 Neck, Collum;
computed tomographic (CT) section;
inferior view.
The trachea is displaced towards the right by a pathologically enlarged
node of the thyroid gland.

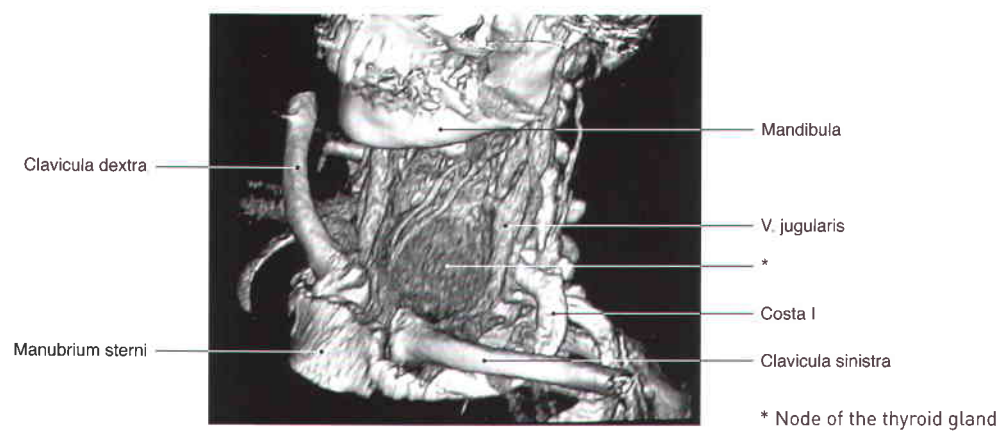
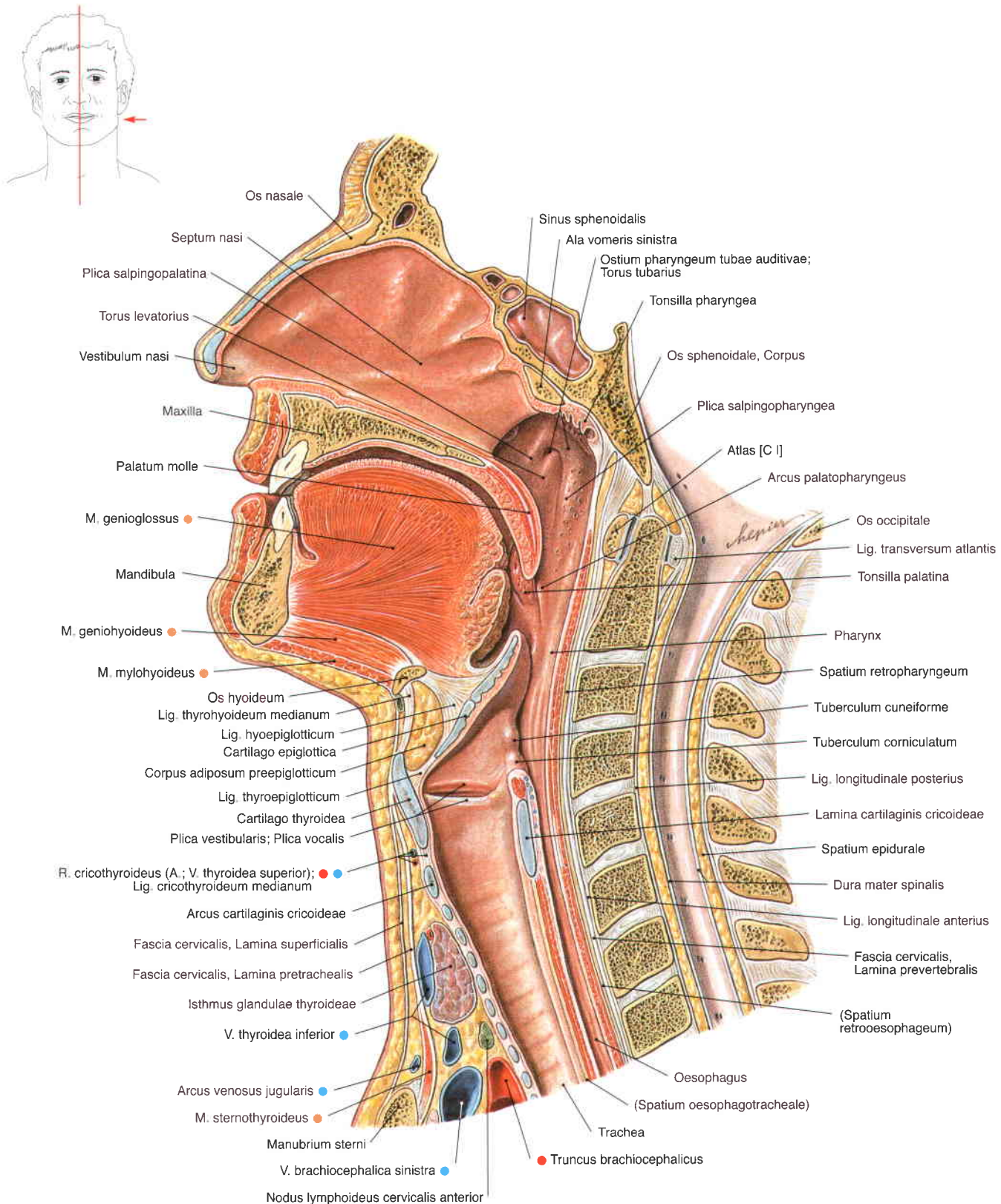


Fig. 245 Neck, Collum;
3-dimensional reconstruction from computed tomographic (CT) sections
showing a heavily enlarged left lobe of the thyroid gland;
same patient as in Fig. 244.

Nasal and pharyngeal cavity, paramedian section

→ 271

Fig. 246 Nasal cavity, Cavitas nasi; oral cavity, Cavitas oris; pharynx, Pharynx, and larynx, Larynx; paramedian section.

Pharyngeal muscles

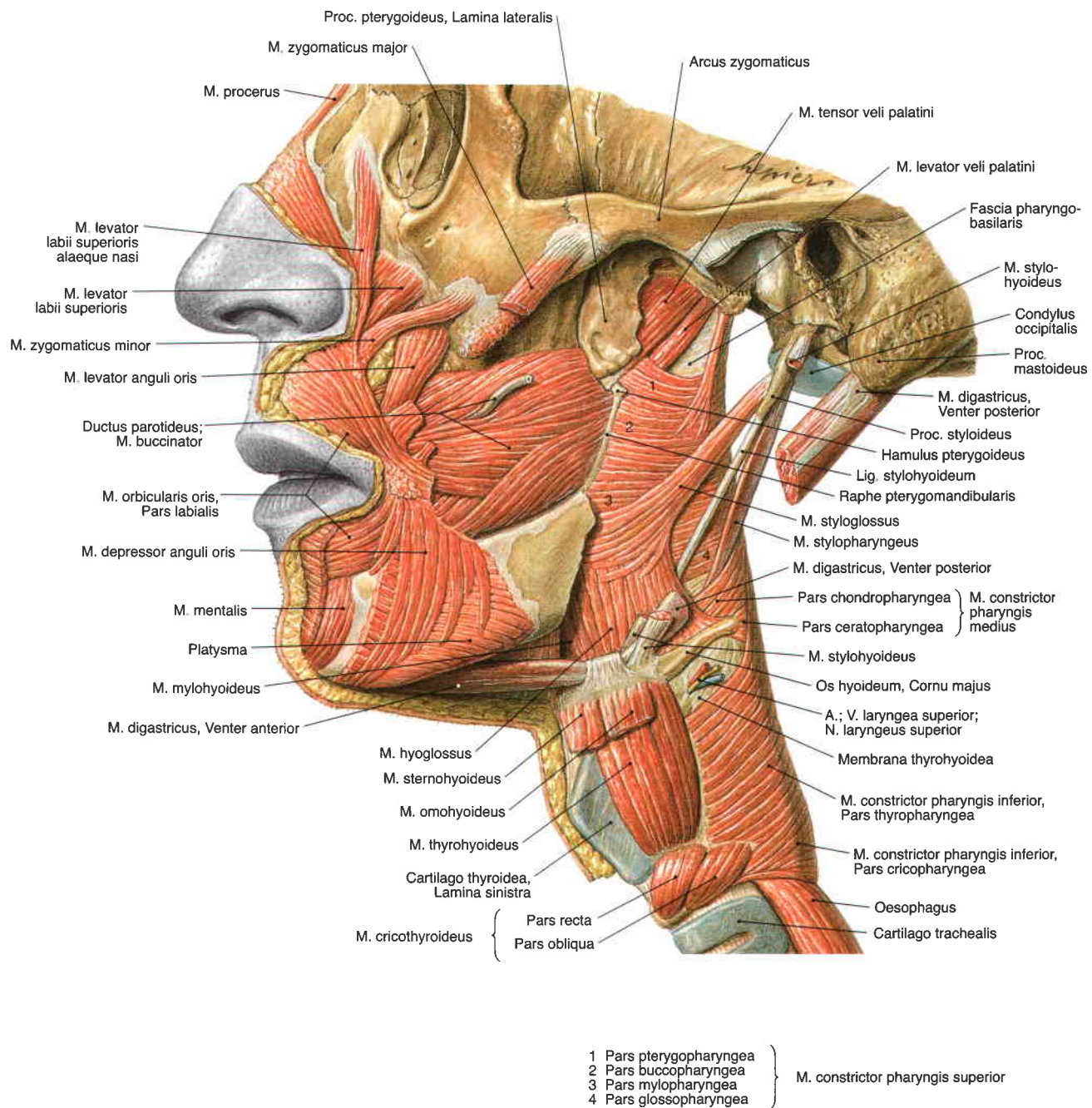
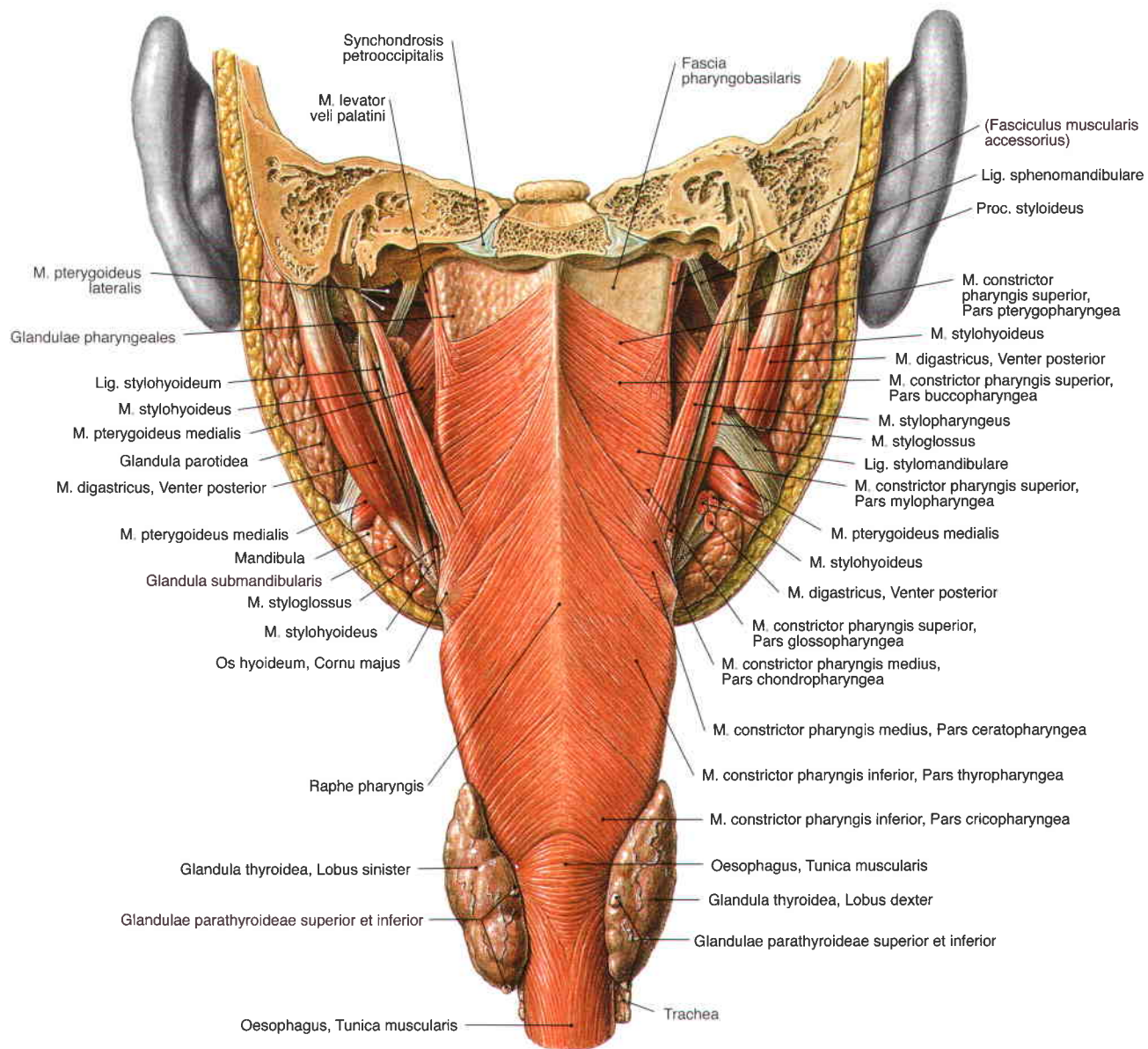


Fig. 247 Pharyngeal muscles, Mm. pharyngis, and facial muscles, Mm. faciei.

→ T 1e, f, T 5

Pharyngeal muscles

→ T 5

Fig. 248 Pharyngeal muscles, Mm. pharyngis.

Inner contour of the pharynx

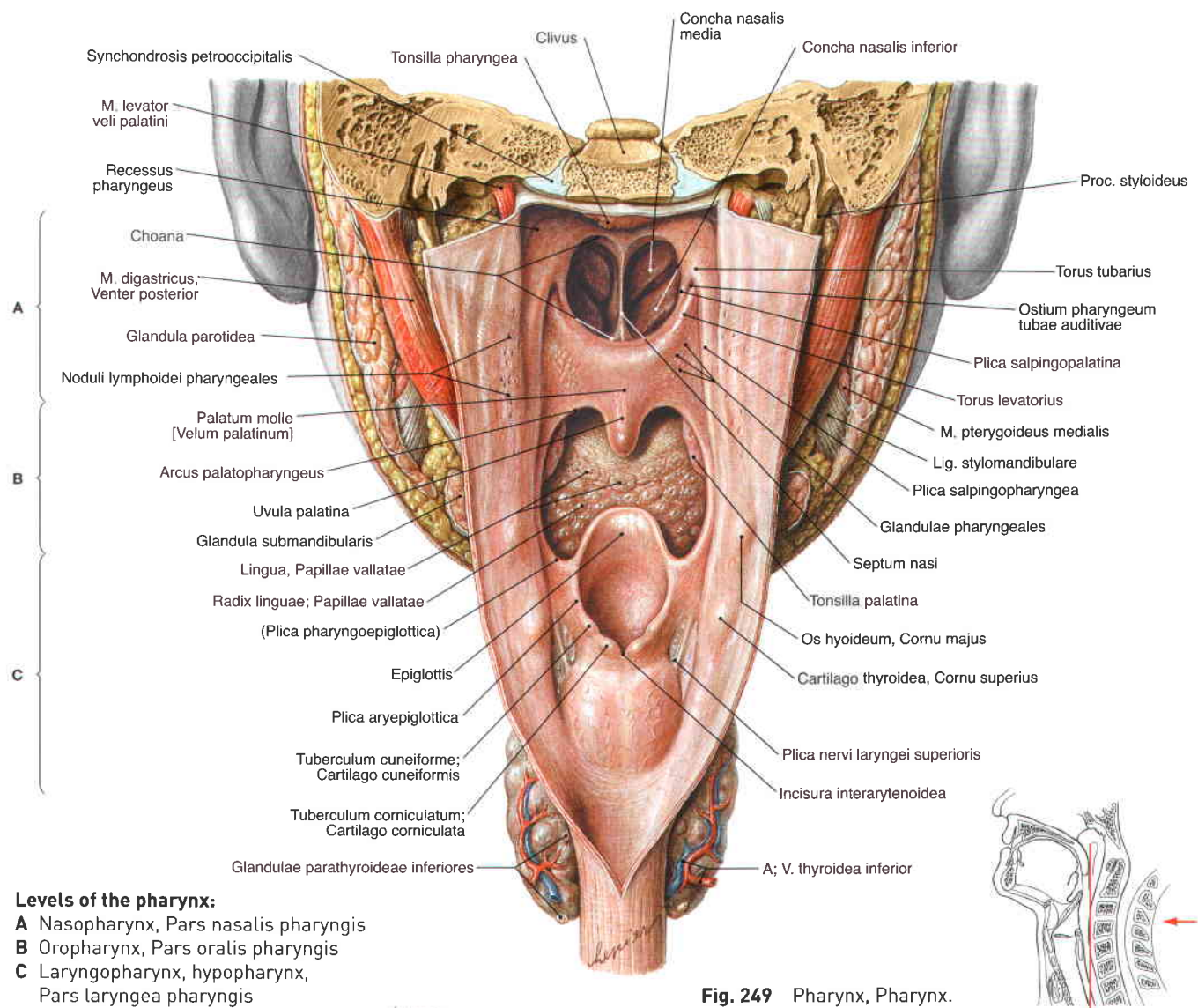
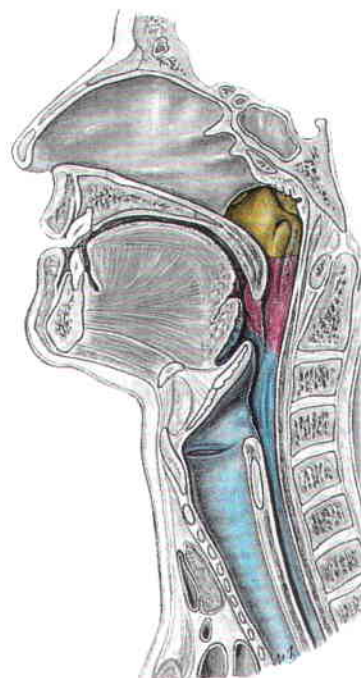


Fig. 249 Pharynx, Pharynx.



- N. maxillaris [V/2]
- N. glossopharyngeus [IX]
- N. vagus [X]

Fig. 250 Sensible innervation of the pharynx, Pharynx.

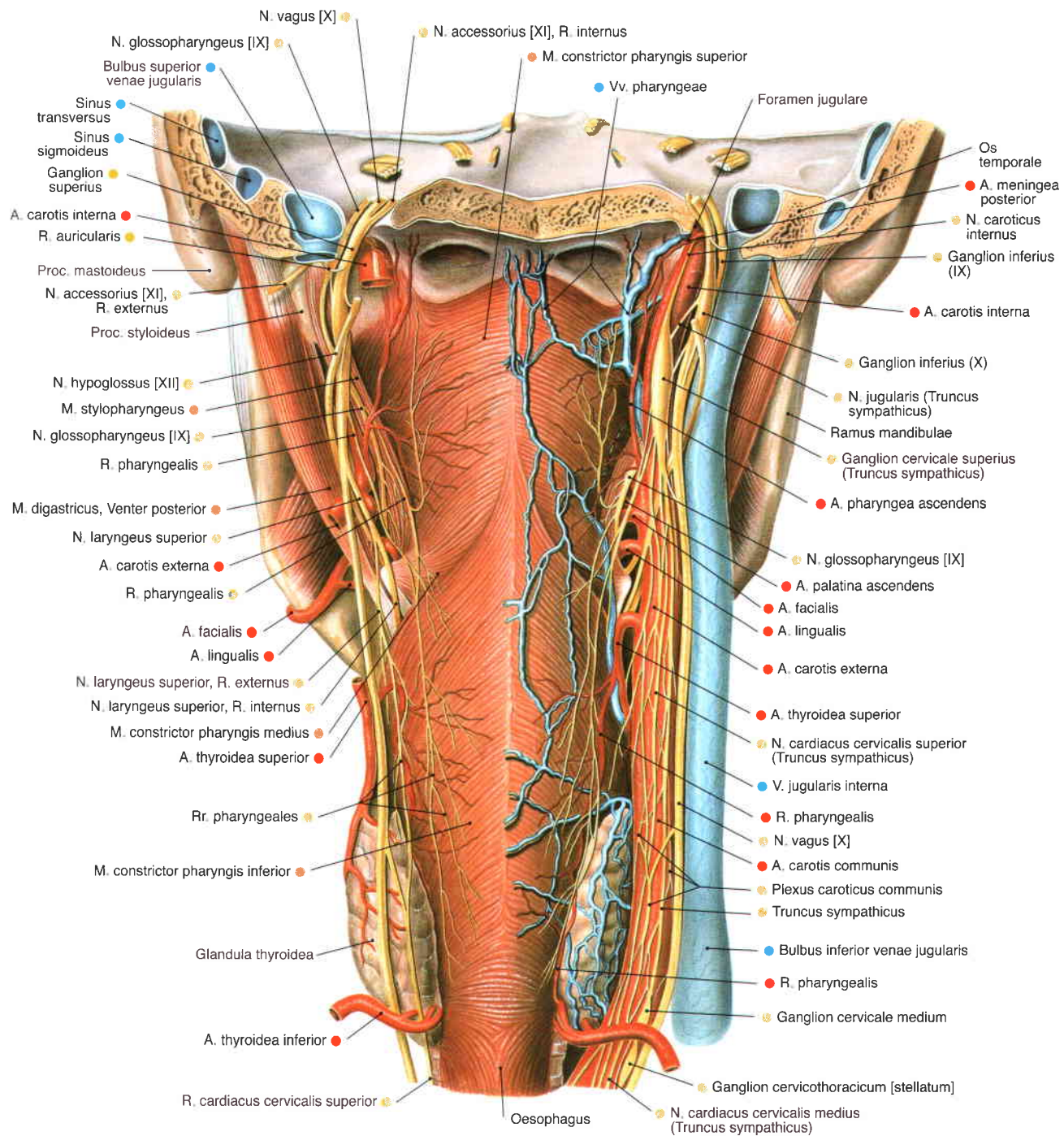
Vessels and nerves of the parapharyngeal space

Fig. 251 Vessels and nerves of the pharynx, Pharynx, and the parapharyngeal space, Spatium lateropharyngeum.

Vessels and nerves of the parapharyngeal space

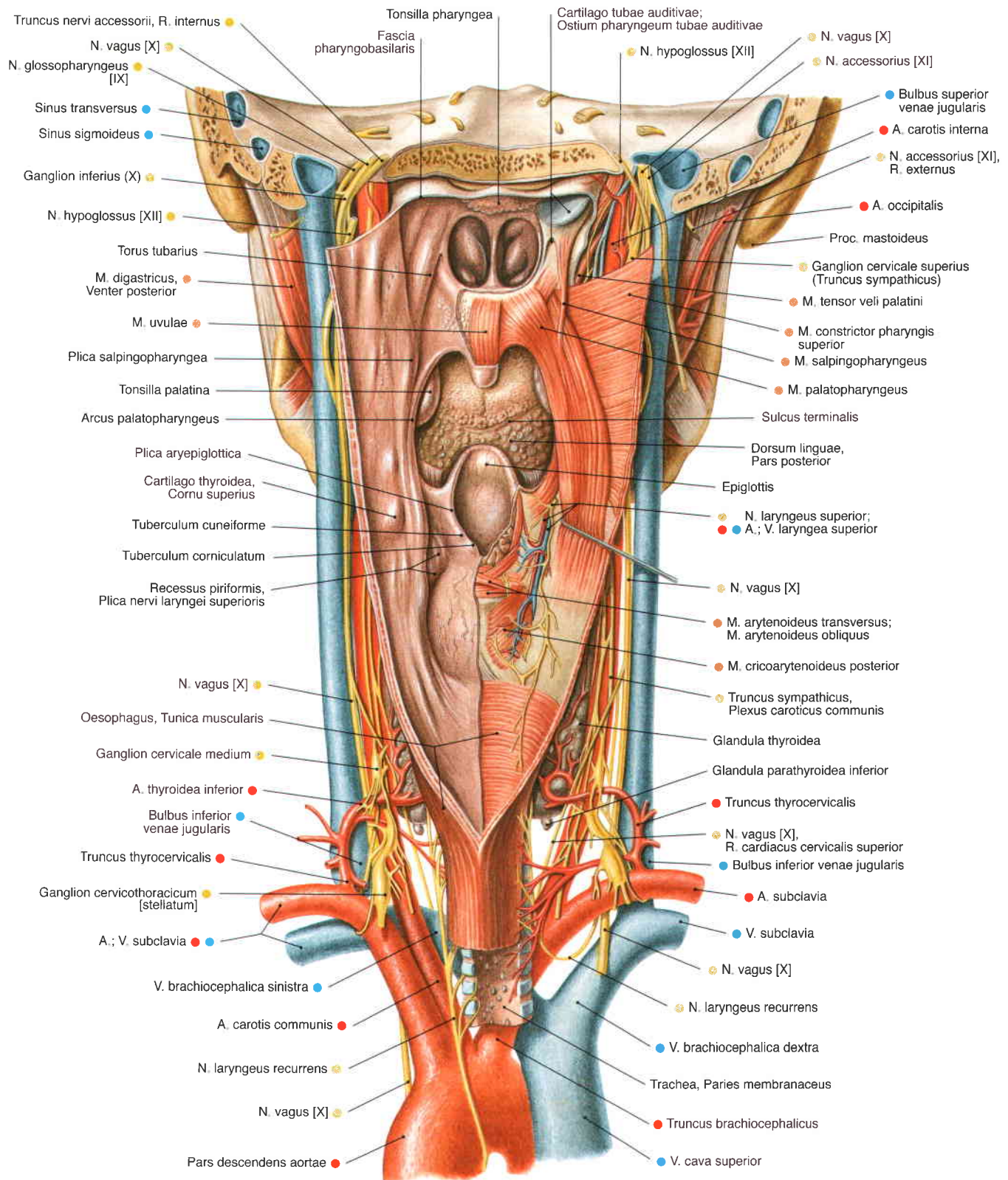
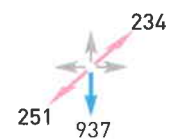
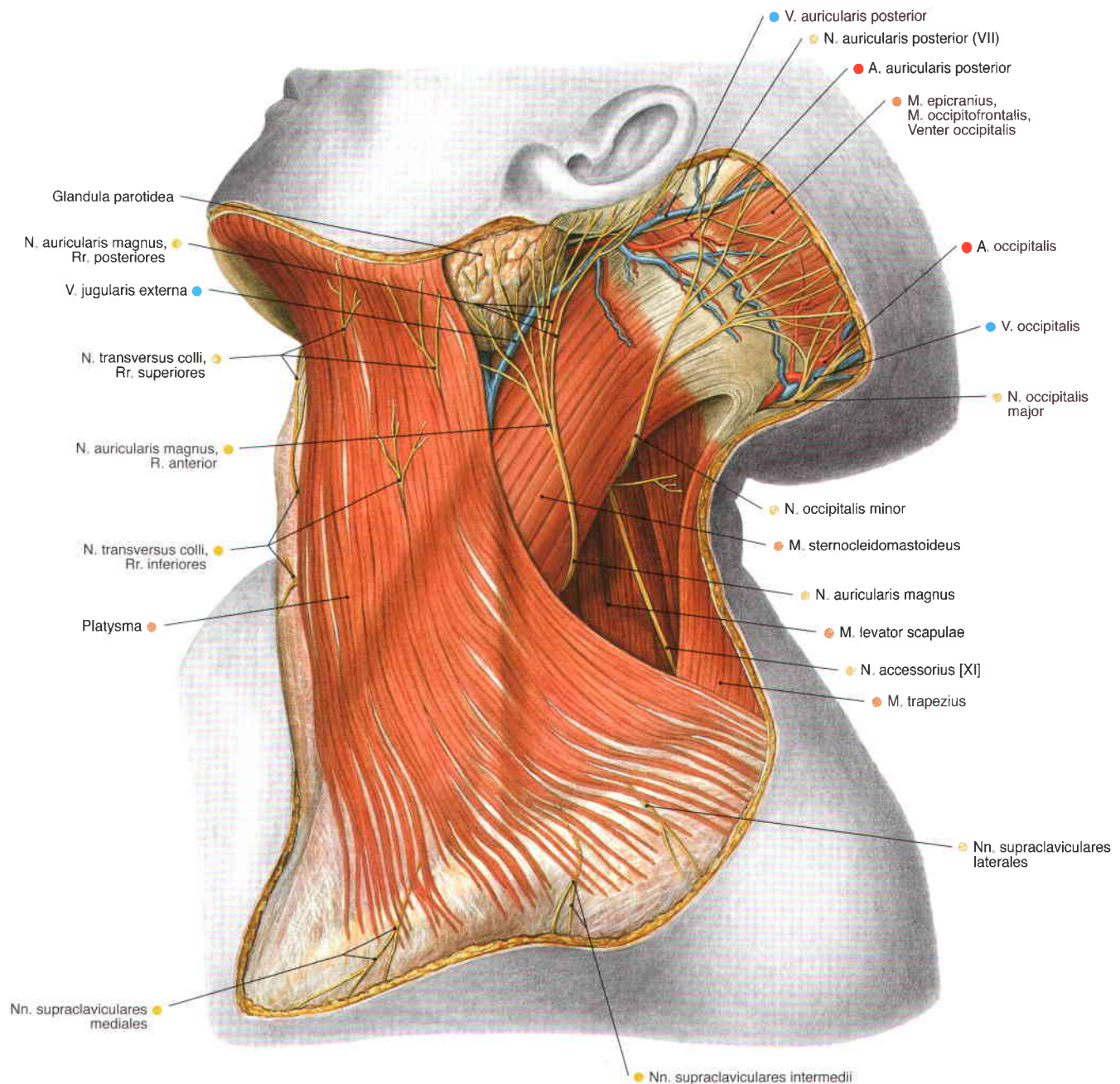


Fig. 252 Vessels and nerves of the pharynx, Pharynx, and the parapharyngeal space, Spatium lateropharyngeum.

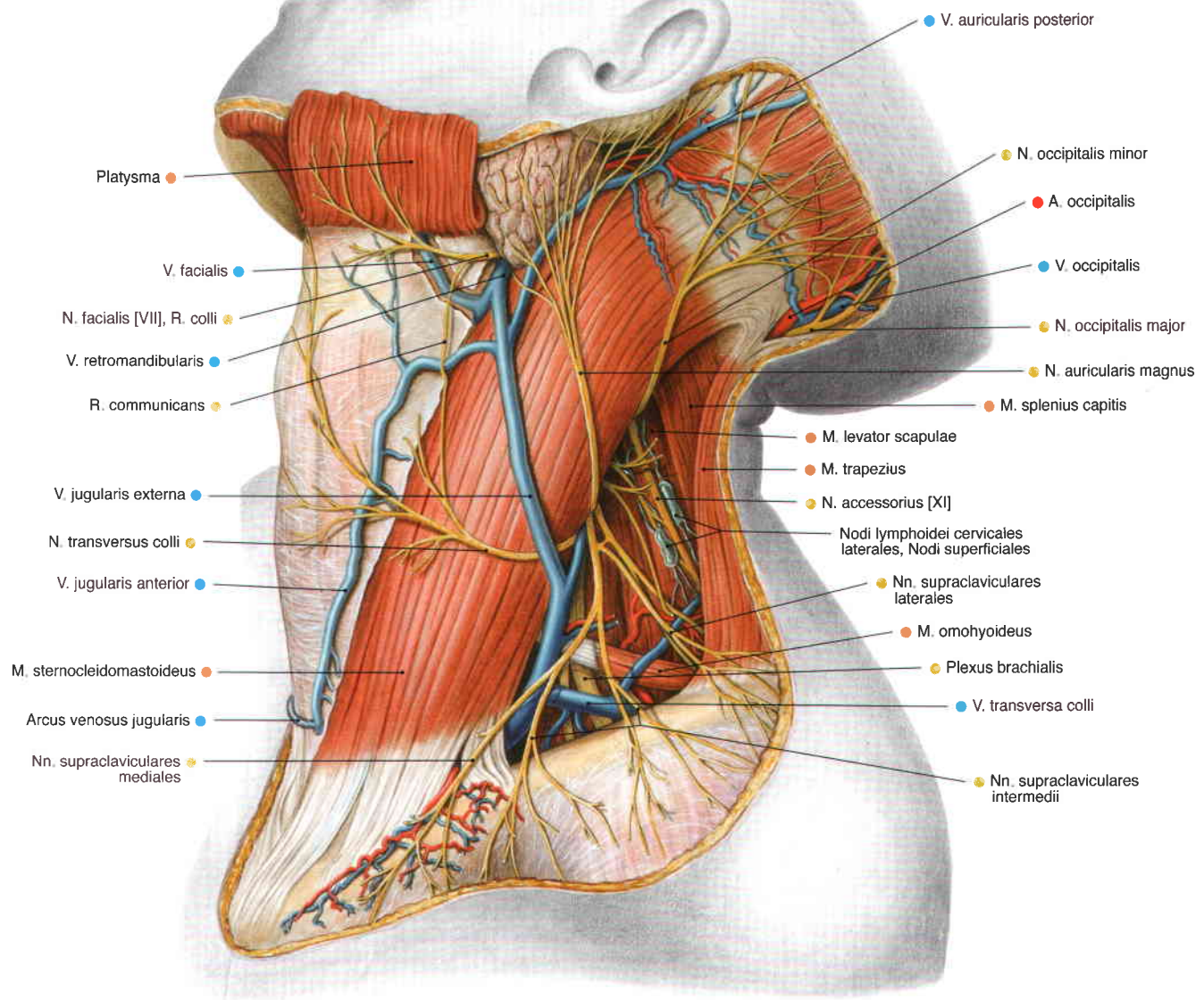


Vessels and nerves of the neck

→ 46, T 7



Fig. 253 Vessels and nerves of the anterior and the lateral region of the neck, *Regiones cervicales anterior et lateralis*; superficial layer.



→ 46, T 7

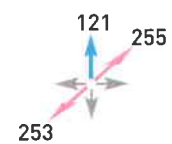
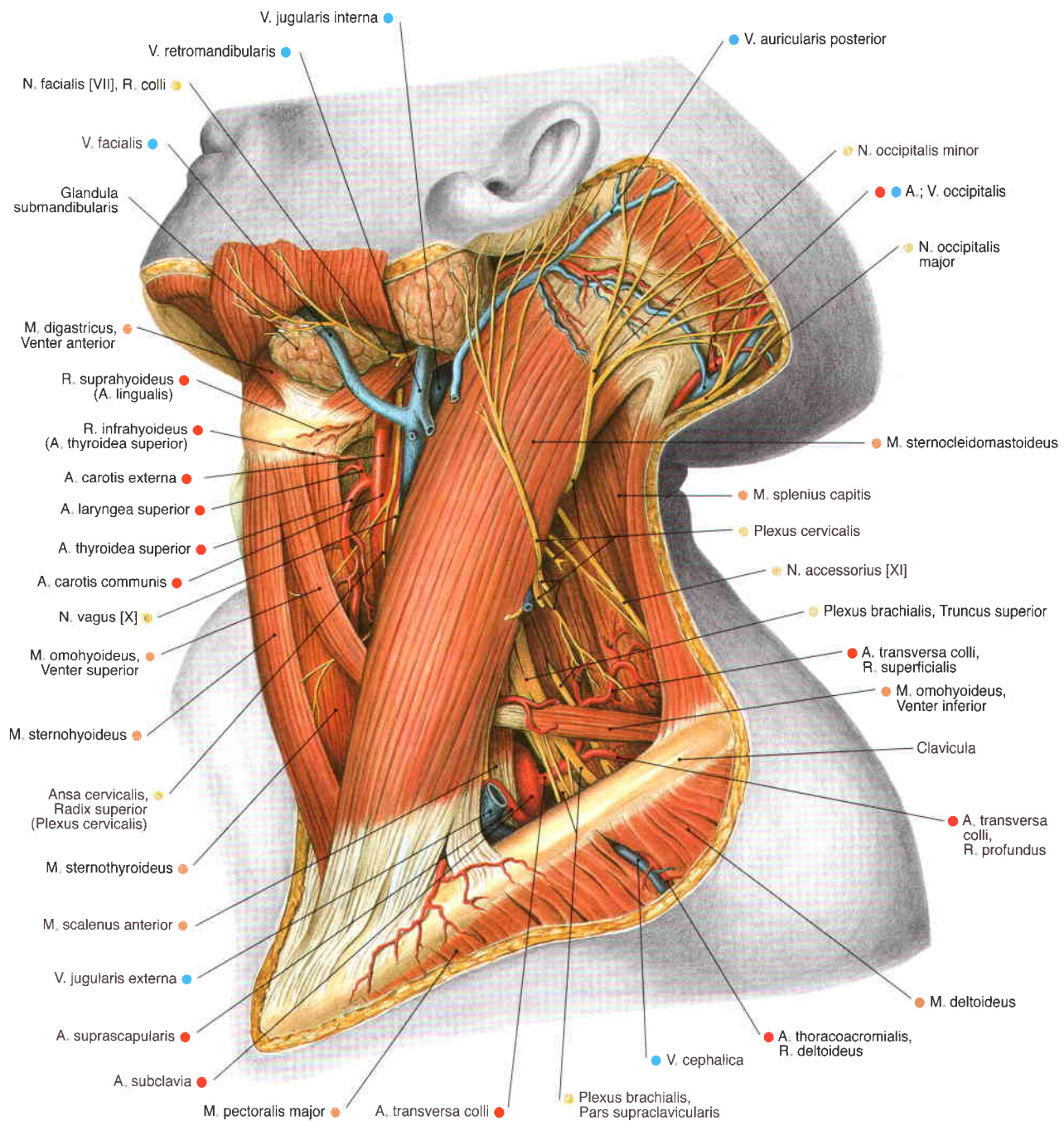


Fig. 254 Vessels and nerves of the lateral region of the neck, Regio cervicalis lateralis; parts of the platysma have been reflected cranially and the superficial layer of the cervical fascia has been largely removed.

Vessels and nerves of the neck

→ 46, T 7

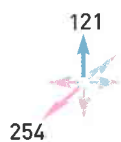
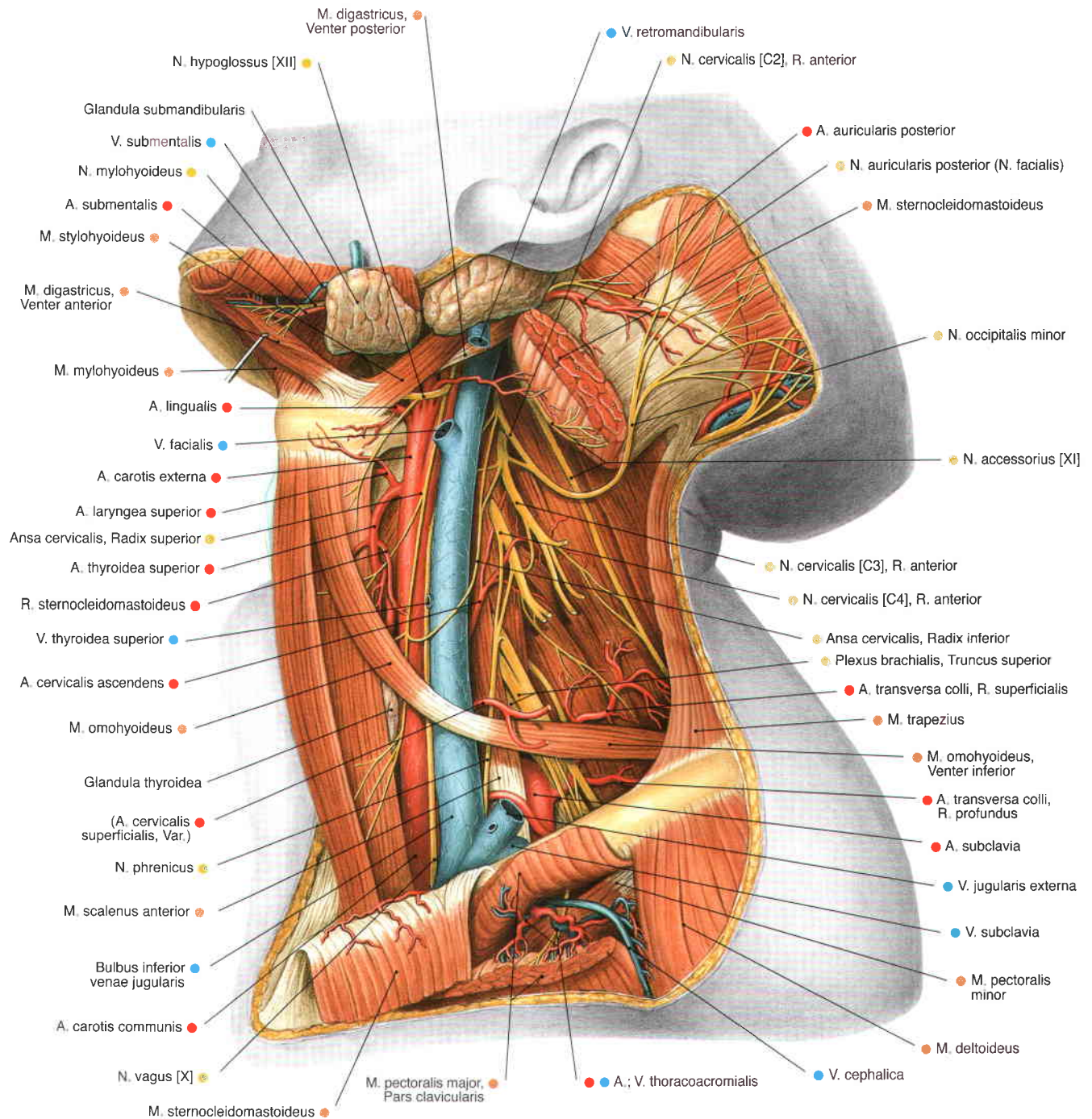


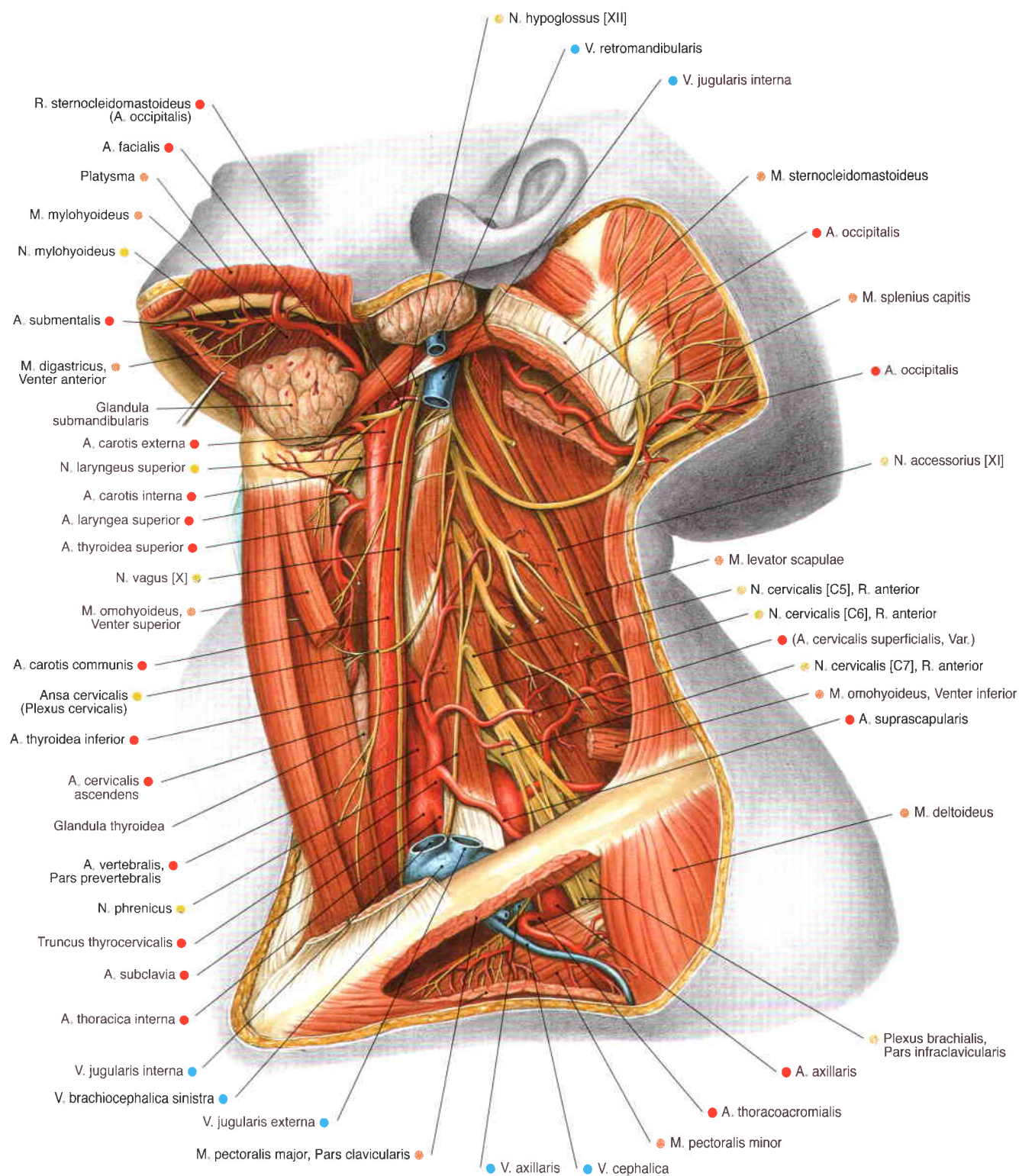
Fig. 255 Vessels and nerves of the anterior and the lateral region of the neck, *Regiones cervicales anterior et lateralis*; the superficial and the middle layer of the cervical fascia have been removed.



→ 46, T 7

Fig. 256 Vessels and nerves of the lateral region of the neck, Regio cervicalis lateralis; after almost complete removal of the sternocleidomastoid muscle.



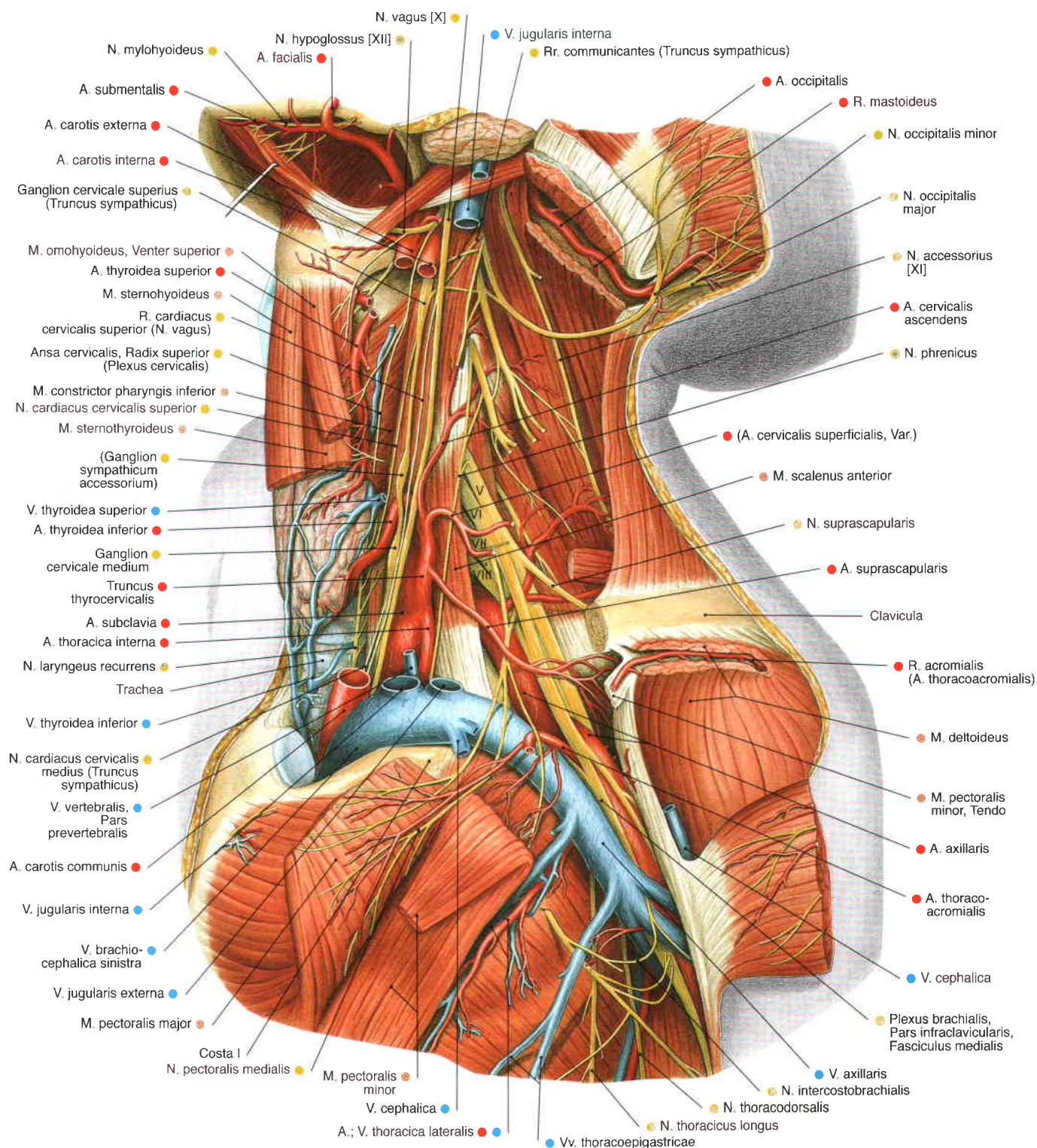
Vessels and nerves of the neck

→ 46, T 7



Fig. 257 Vessels and nerves of the lateral region of the neck, Regio cervicalis lateralis; deep layer.

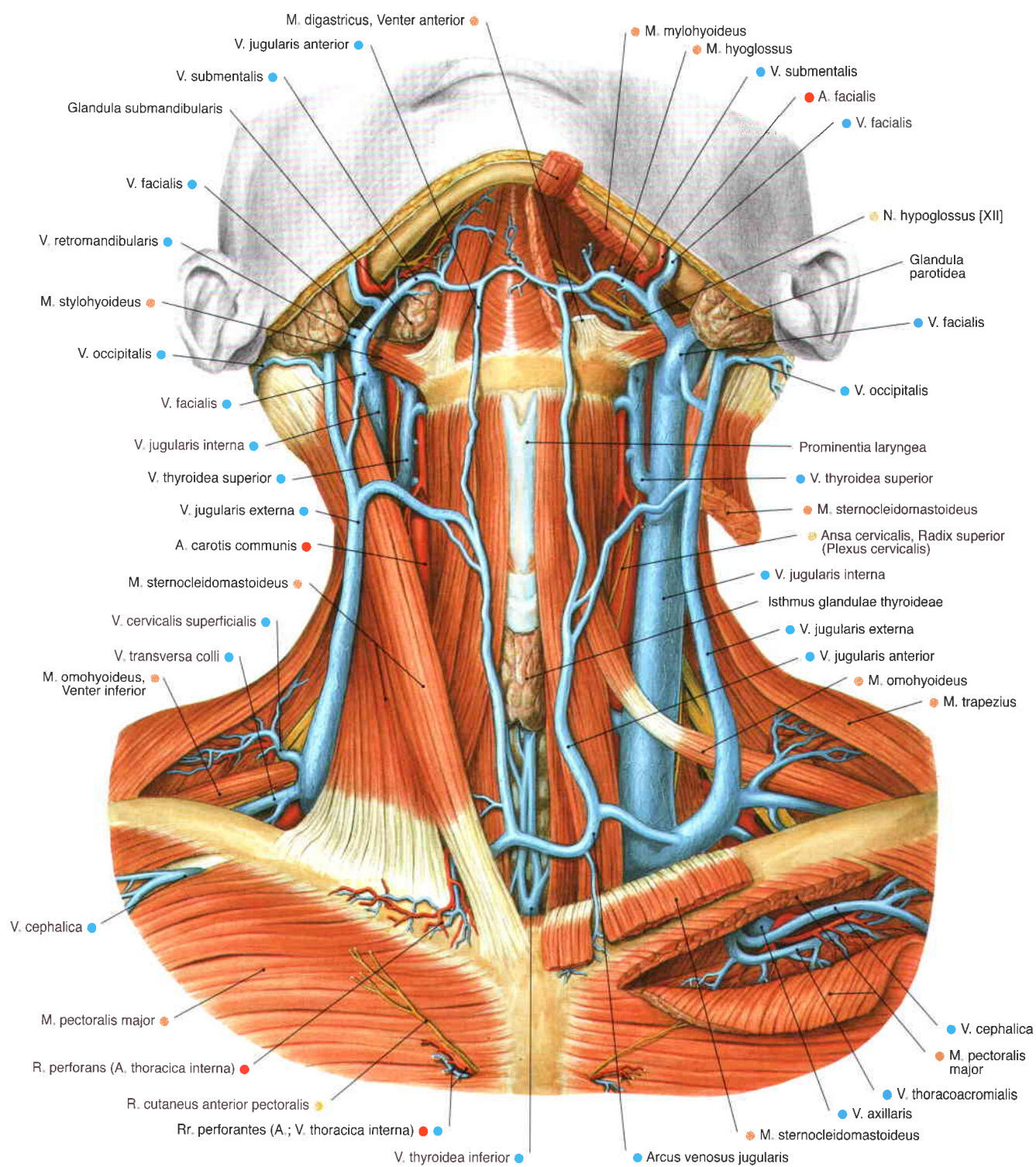
Vessels and nerves of the neck and the axilla



→ 46, T7

Fig. 258 Vessels and nerves of the lateral region of the neck, Regio cervicalis lateralis, and the axillary region, Regio axillaris. The numbers V–VIII indicate ventral branches of the corresponding cervical nerves.



Veins of the neck**Fig. 259** Veins of the neck, Collum.

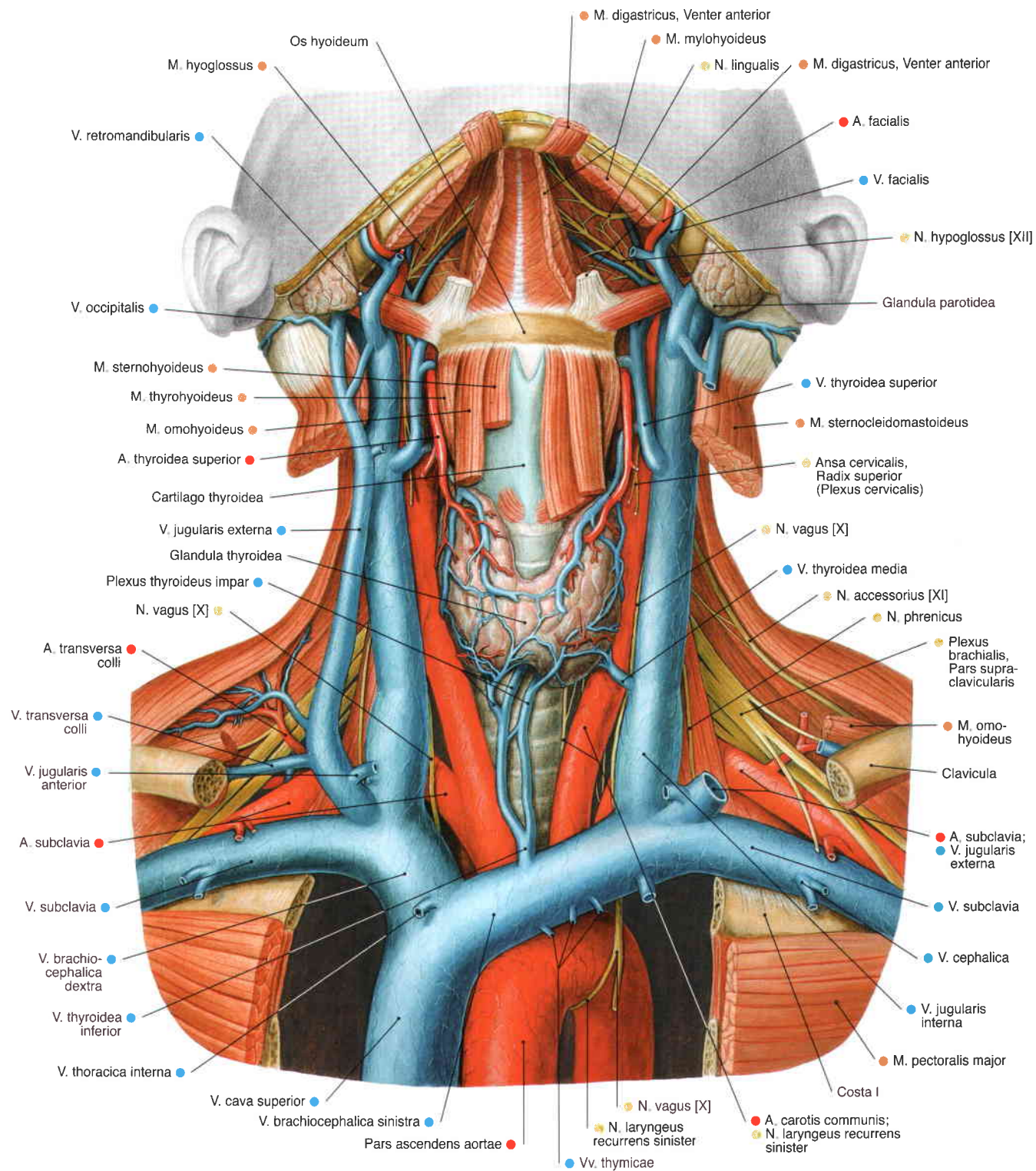
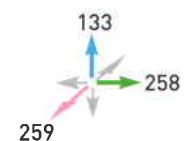
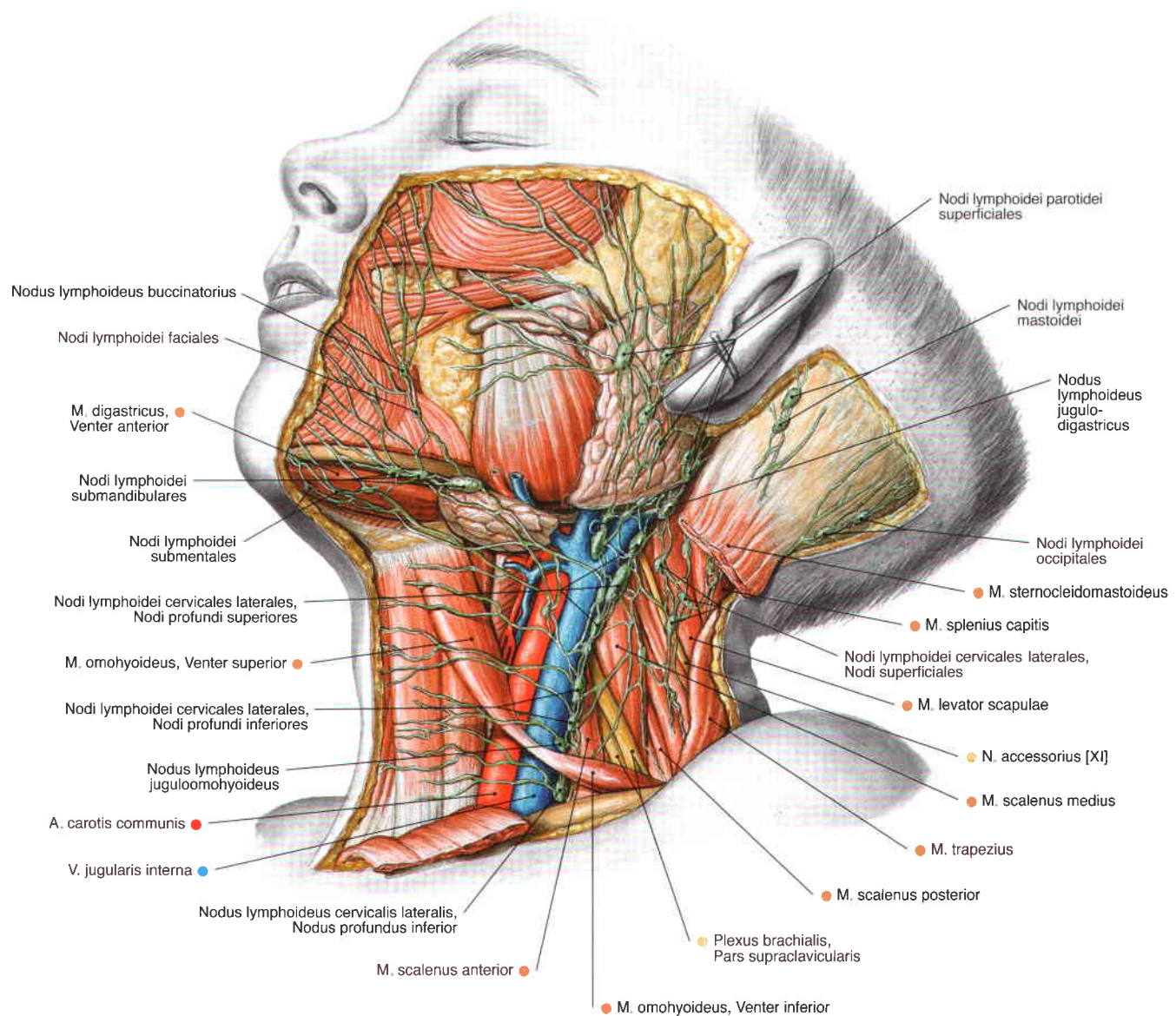
Vessels and nerves of the neck and the upper thoracic aperture

Fig. 260 Vessels and nerves of the neck, Collum, and the upper thoracic aperture, Apertura thoracis superior.



Lymphatics of the neck

→ 125, 126

Fig. 261 Superficial lymphatics, Vasa lymphatica superficialia, and lymph nodes, Nodi lymphoidei, of the head and the neck of an 8-year-old child.

Vessels and nerves of the submandibular triangle

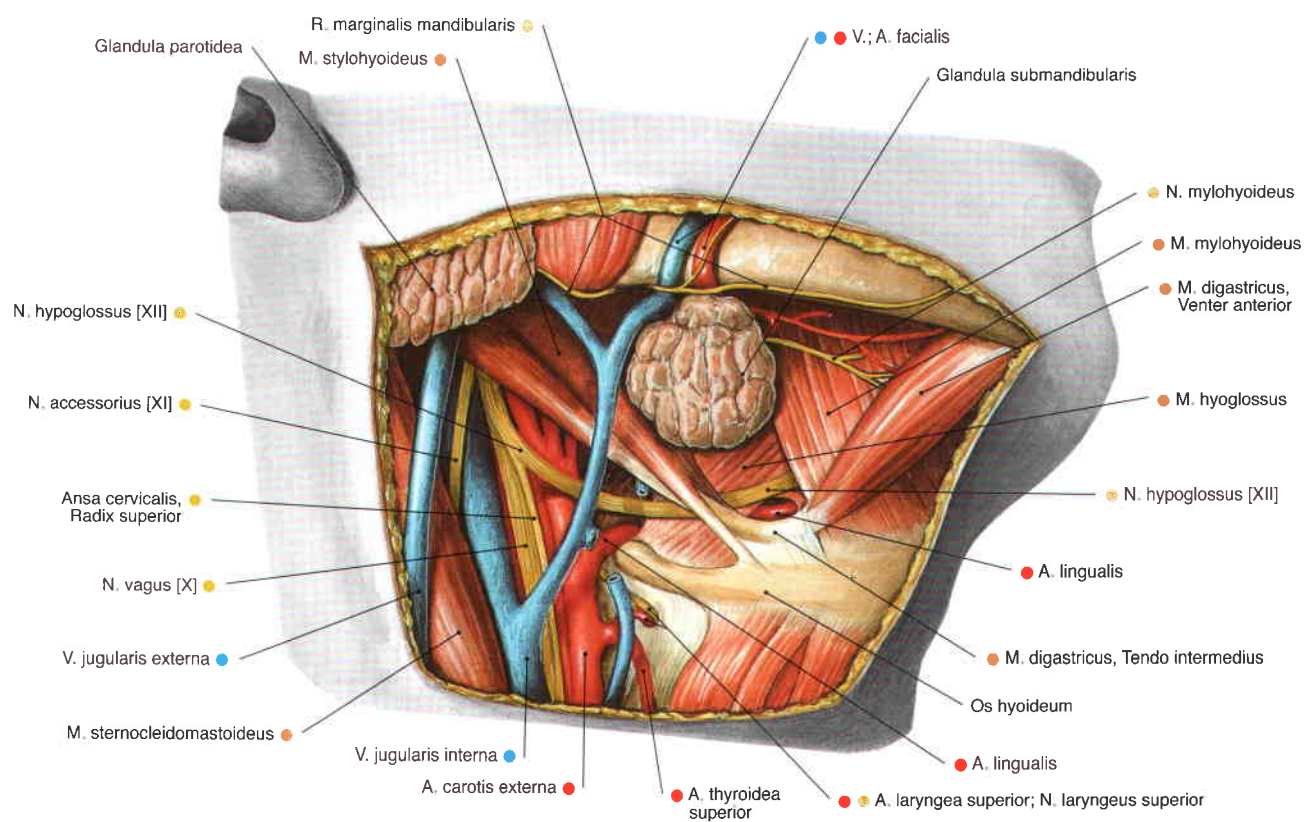


Fig. 262 Vessels and nerves of the submandibular triangle, Trigonum submandibulare.

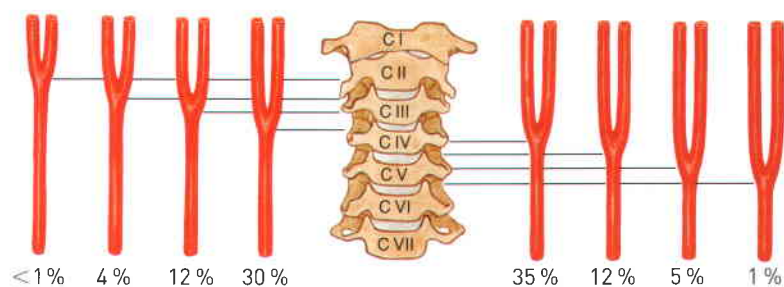


Fig. 263 Level of the bifurcation of the common carotid artery, A. carotis communis, in relation to the cervical vertebrae.

Subclavian artery

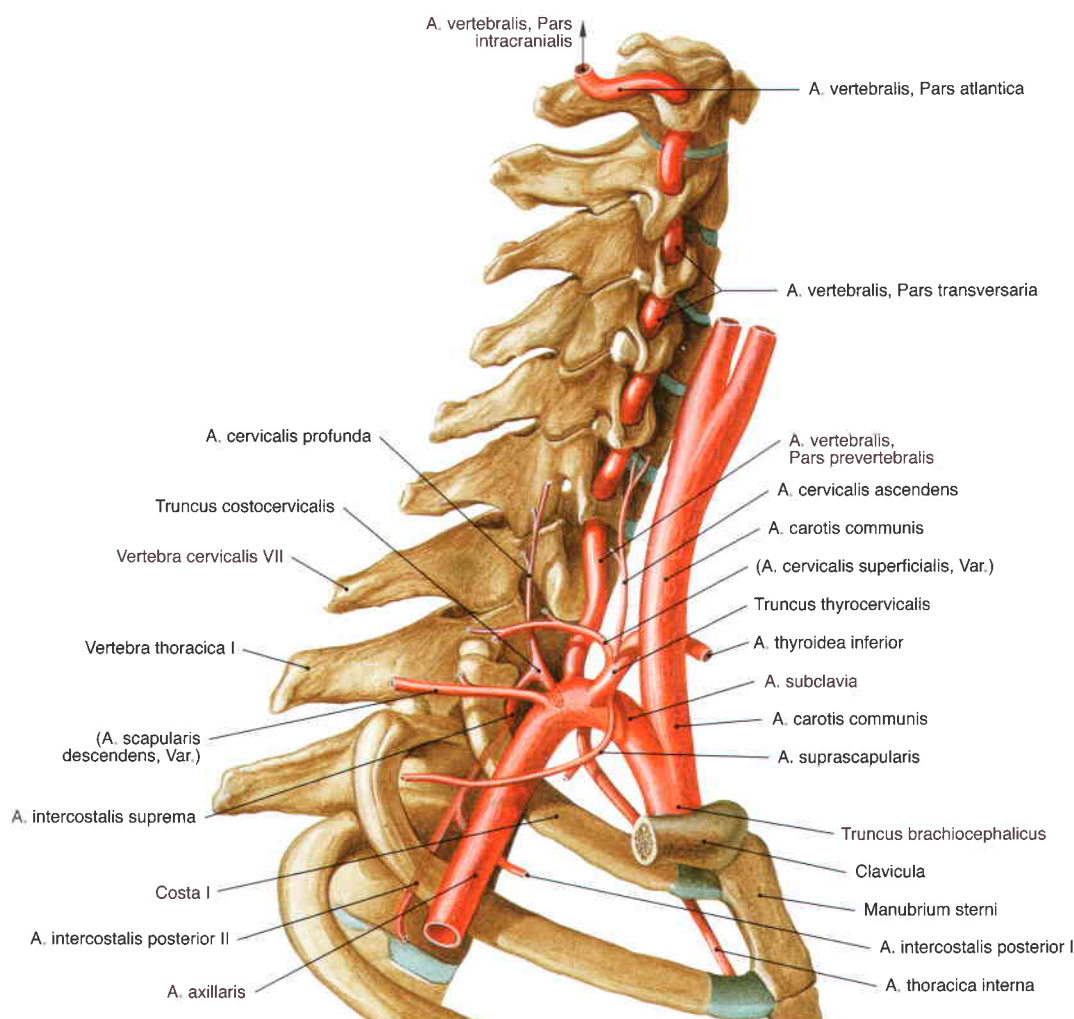


Fig. 264 Subclavian artery, A. subclavia.

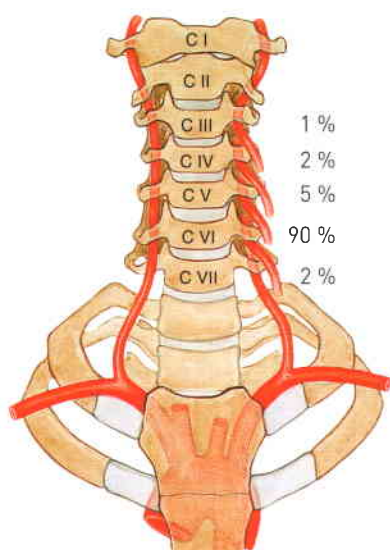


Fig. 265 Level of the entry of the vertebral artery, A. vertebralis, into the transverse foramina, Foramina transversaria.

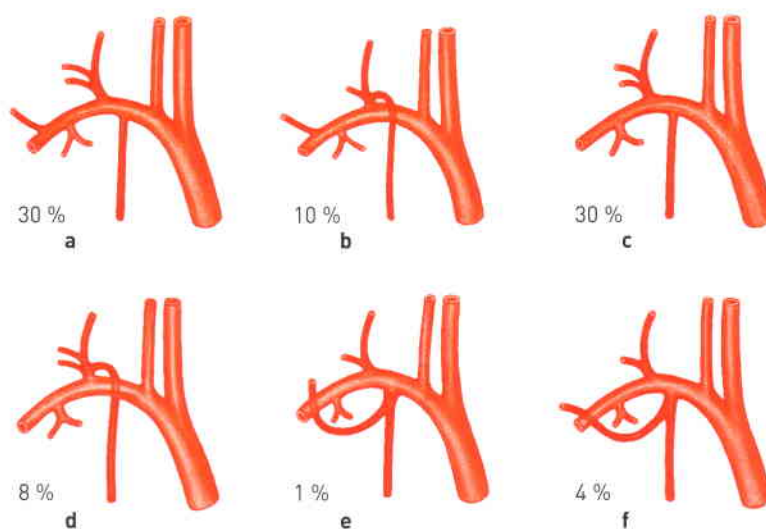


Fig. 266 a-f Variations in the truncus formed by the inferior thyroid artery, A. thyroidea inferior, the suprascapular artery, A. suprascapularis, the transverse cervical artery, A. transversa colli, and the internal thoracic artery, A. thoracica interna, when the vertebral artery, A. vertebralis, branches off separately from the costocervical truncus, Truncus costocervicalis.

Vessels and nerves of the neck and the upper thoracic aperture

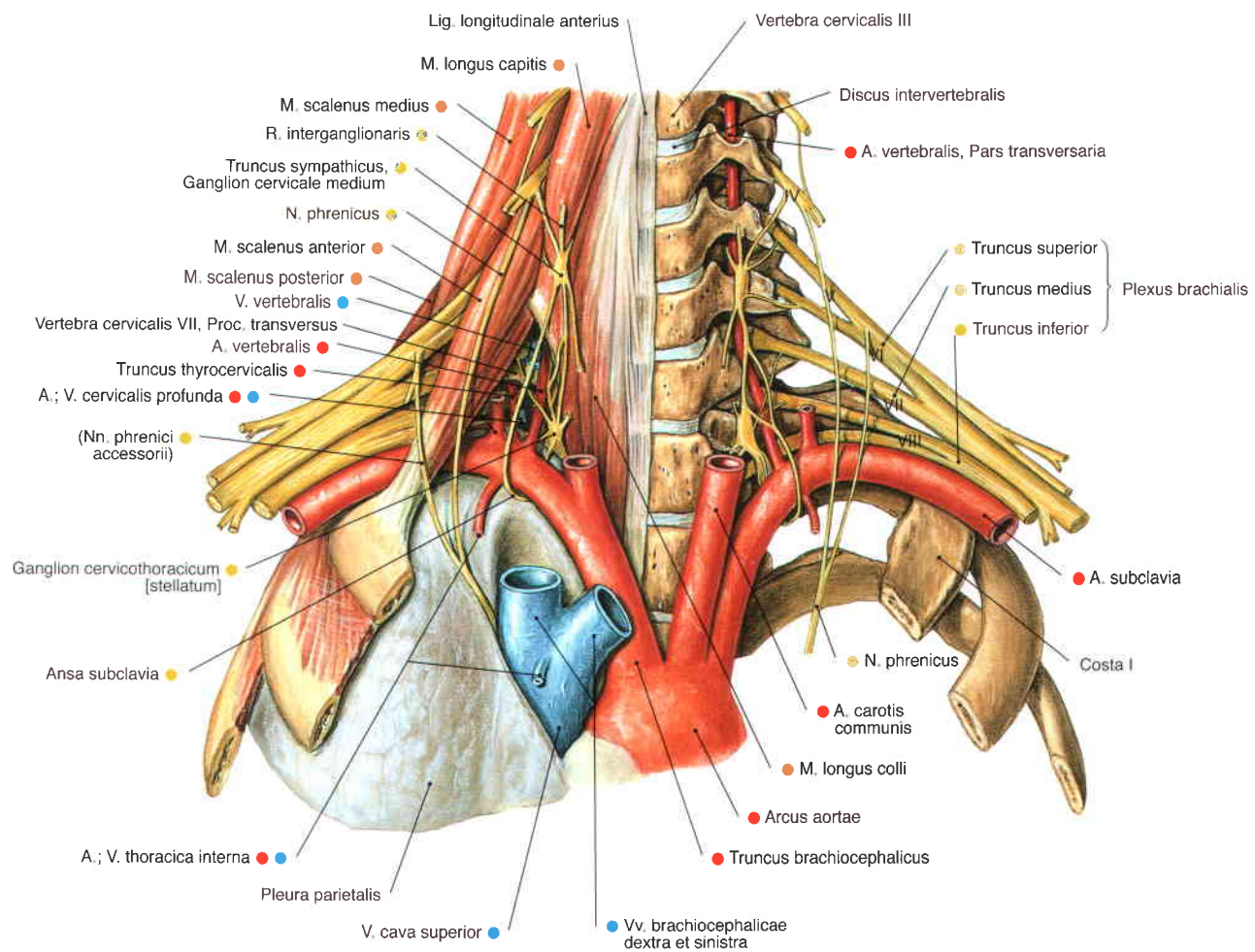


Fig. 267 Vessels and nerves at the transition from the neck to the thorax.
The numbers IV–VIII indicate ventral branches of the corresponding spinal nerves.

→ 46, T 7, T 24

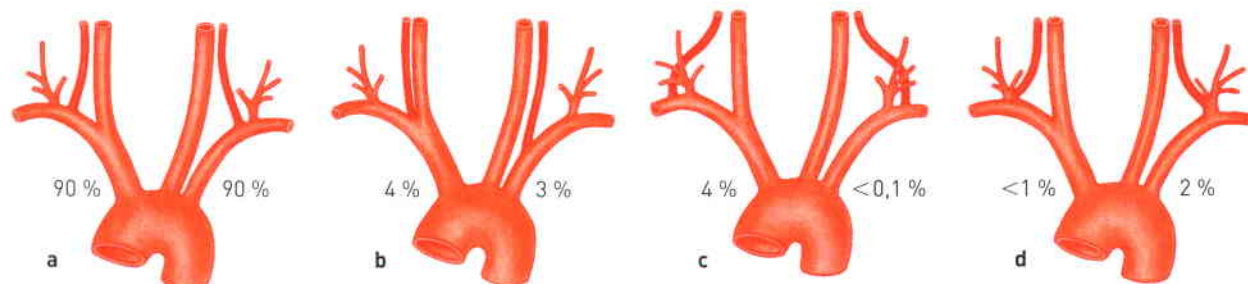
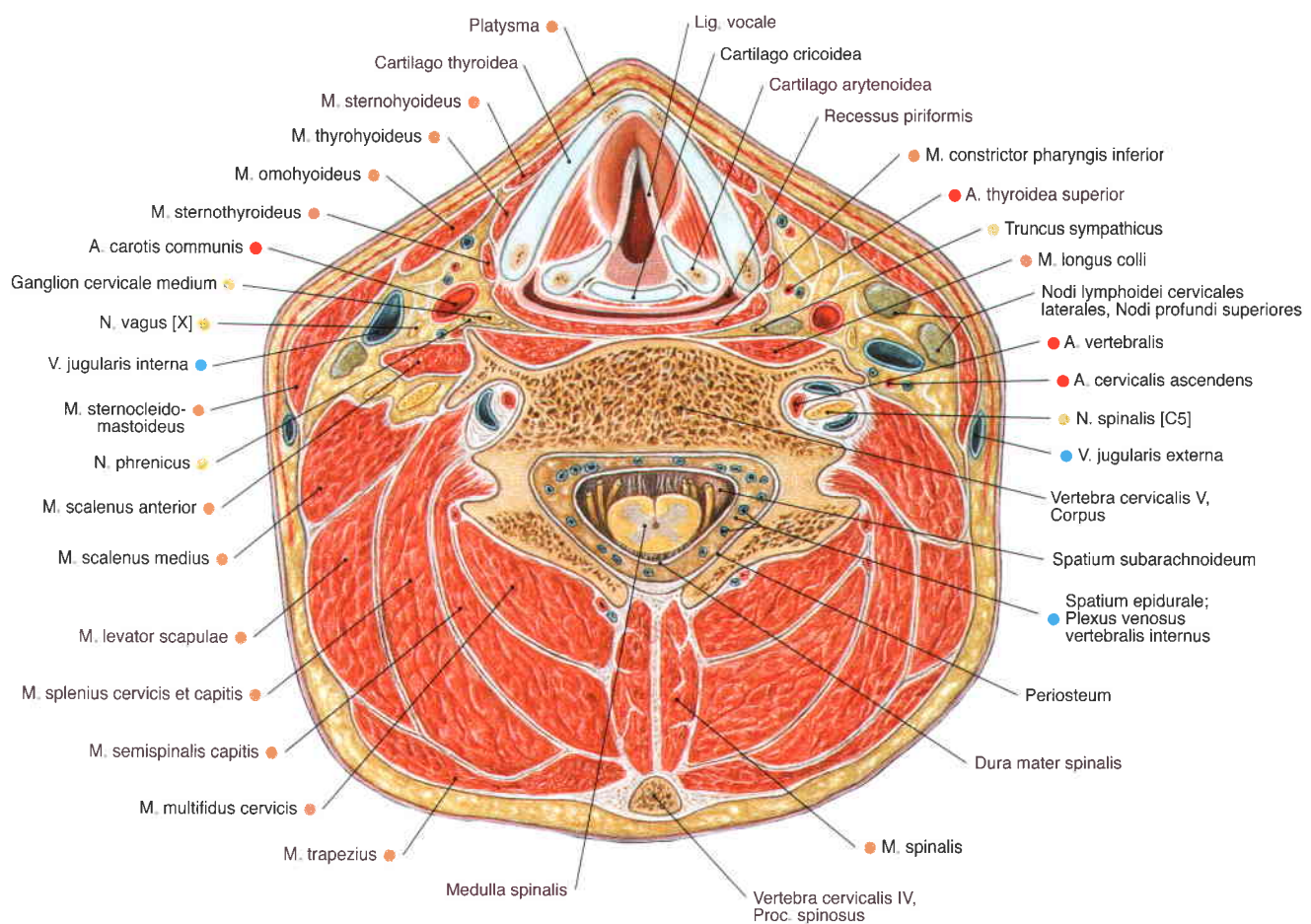
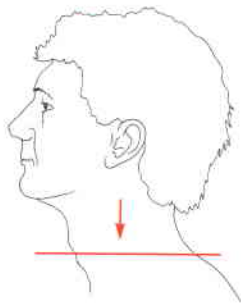


Fig. 268 a–d Variations in the origin of the vertebral artery, A. vertebralis.

Neck, transverse section



→ 236

Fig. 269 Neck, Collum; transverse section at the level of the vocal cord.

Neck, transverse section

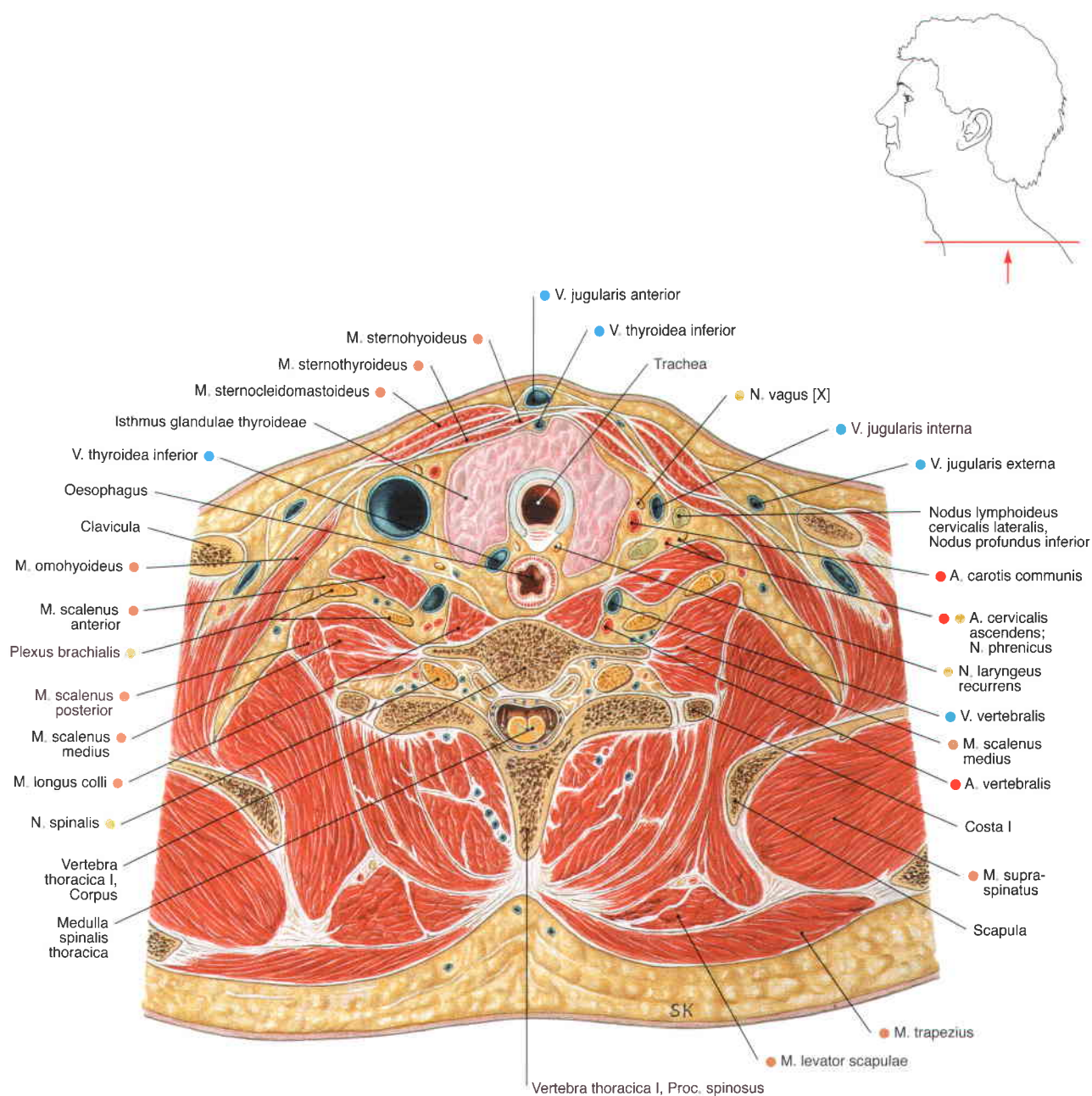
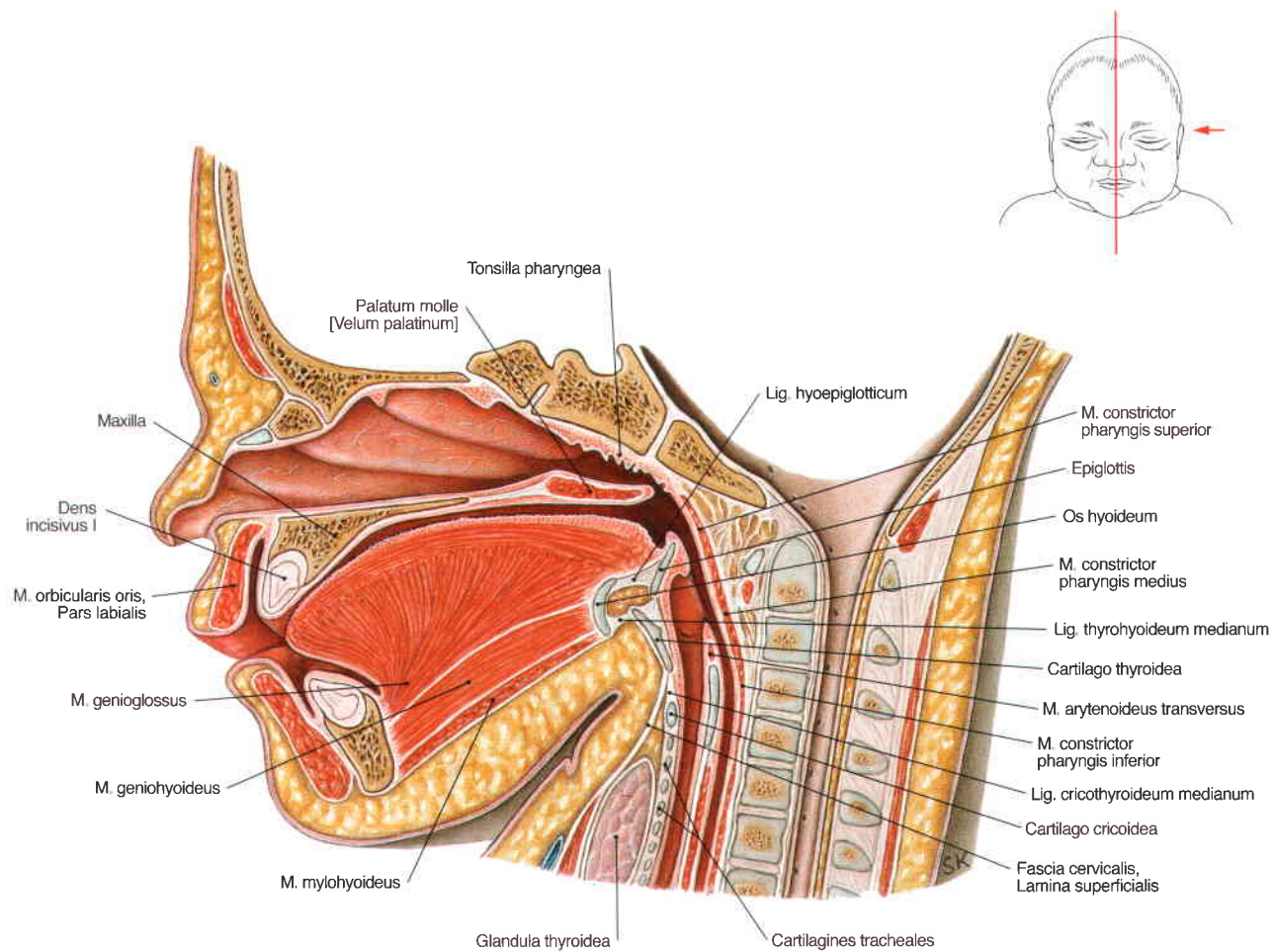


Fig. 270 Neck, Collum; transverse section at the level of the first thoracic vertebra.

Oral cavity and pharynx, median section

→ 246

Fig. 271 Facial part of the head, Caput, and neck, Collum; median section through the head of a neonate.

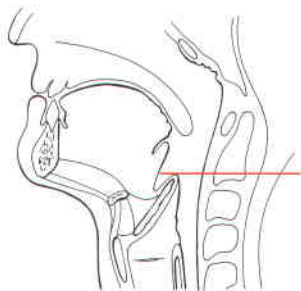


Fig. 272 Schema illustrating the distance between the root of the tongue, Radix linguae, and the epiglottis, in the adult.

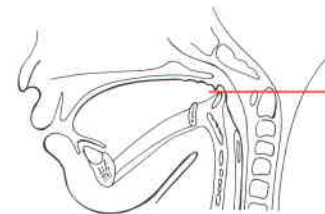


Fig. 273 Schema illustrating that the larynx in the neonate is positioned considerably higher than in the adult.

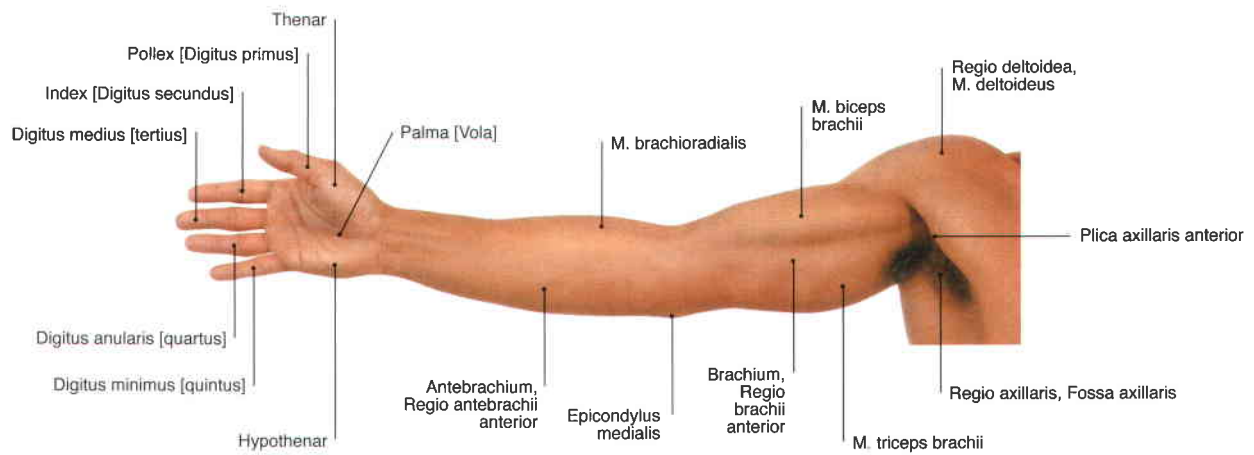


Fig. 274 Upper limb, Membrum superius.

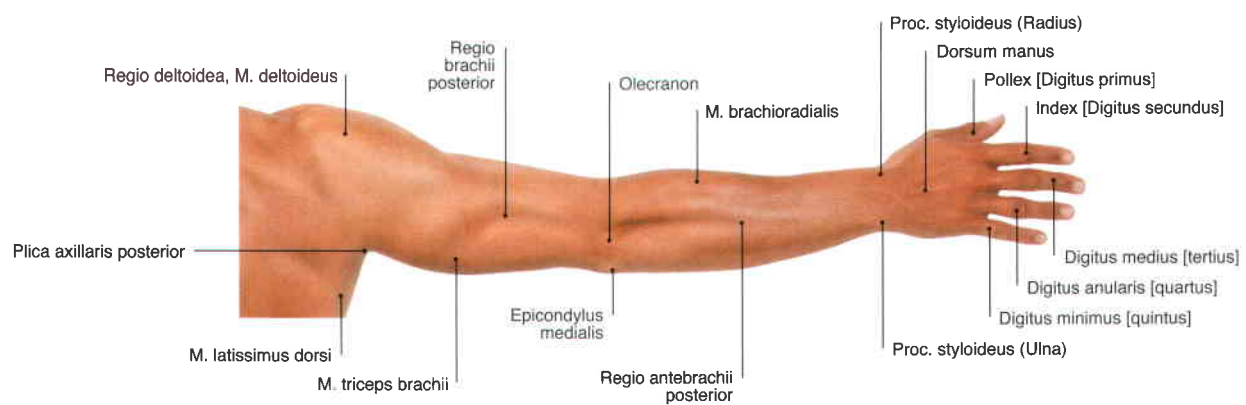


Fig. 275 Upper limb, Membrum superius.

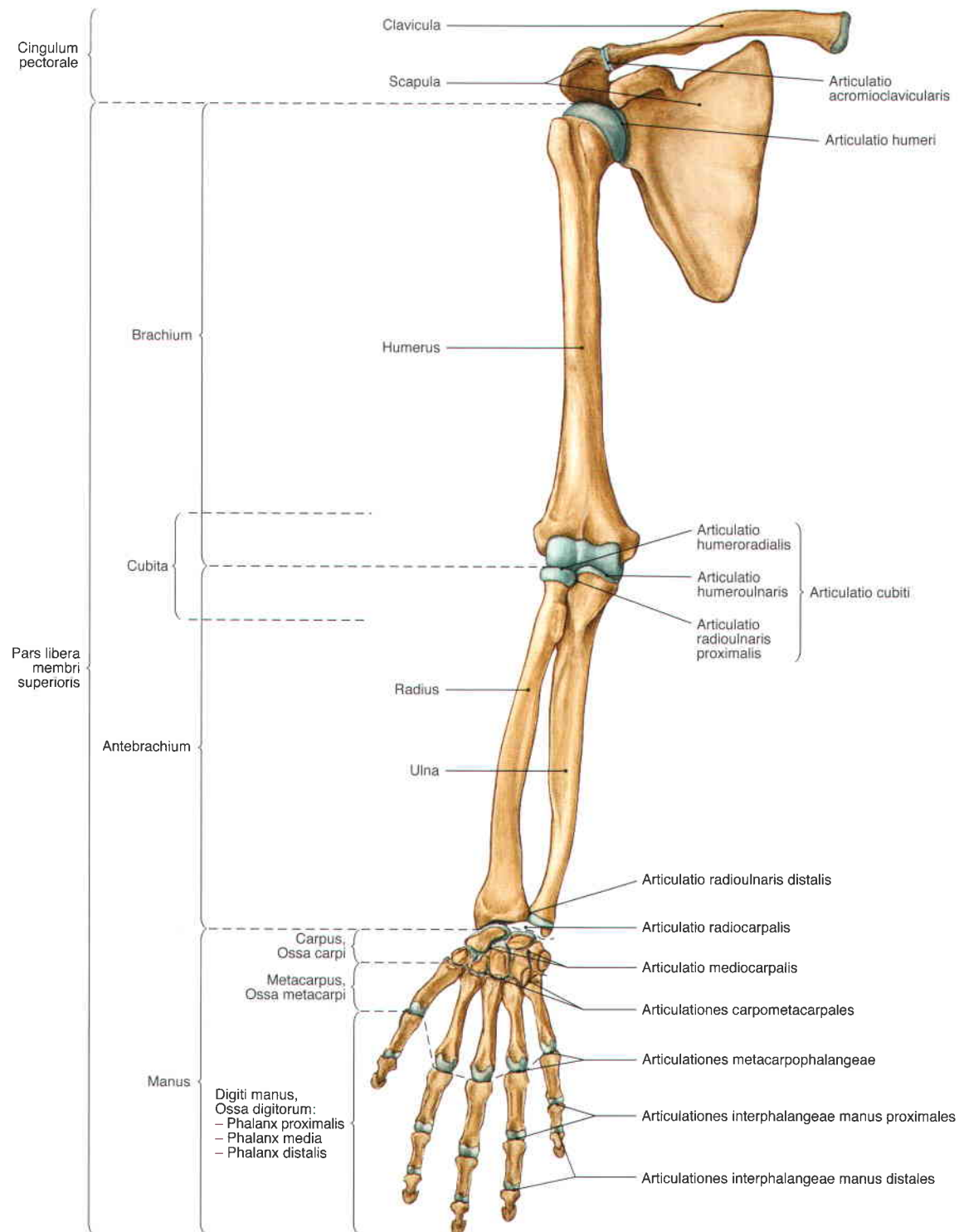
Skeleton of the upper limb

Fig. 276 Upper limb, Membrum superius; overview, bones and joints.

Clavicle

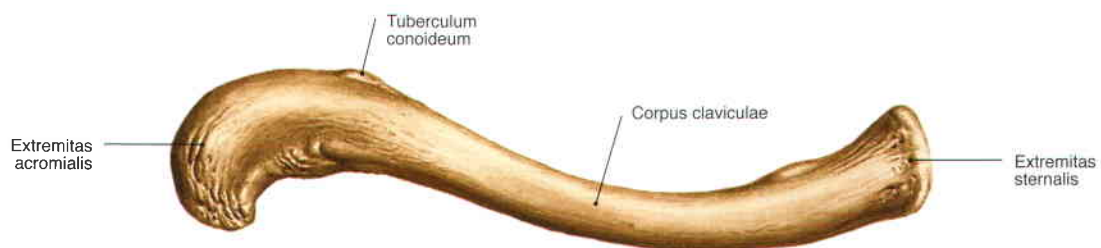


Fig. 277 Clavicle, Clavicula; superior view.

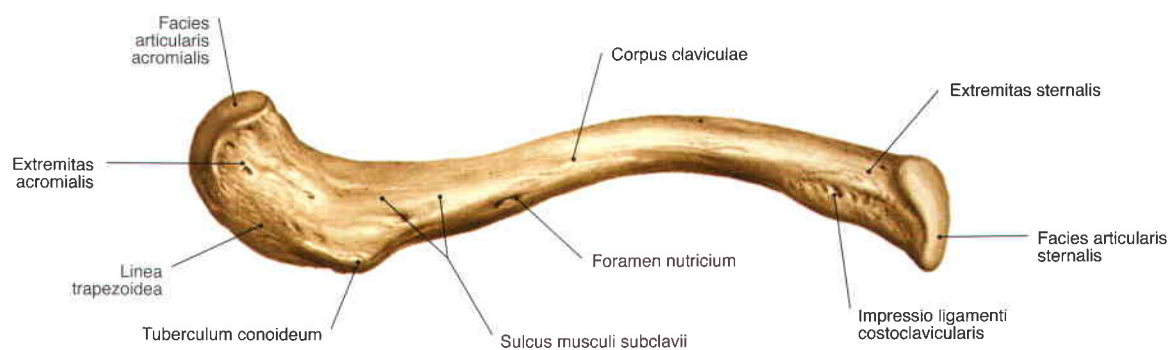


Fig. 278 Clavicle, Clavicula; inferior view.

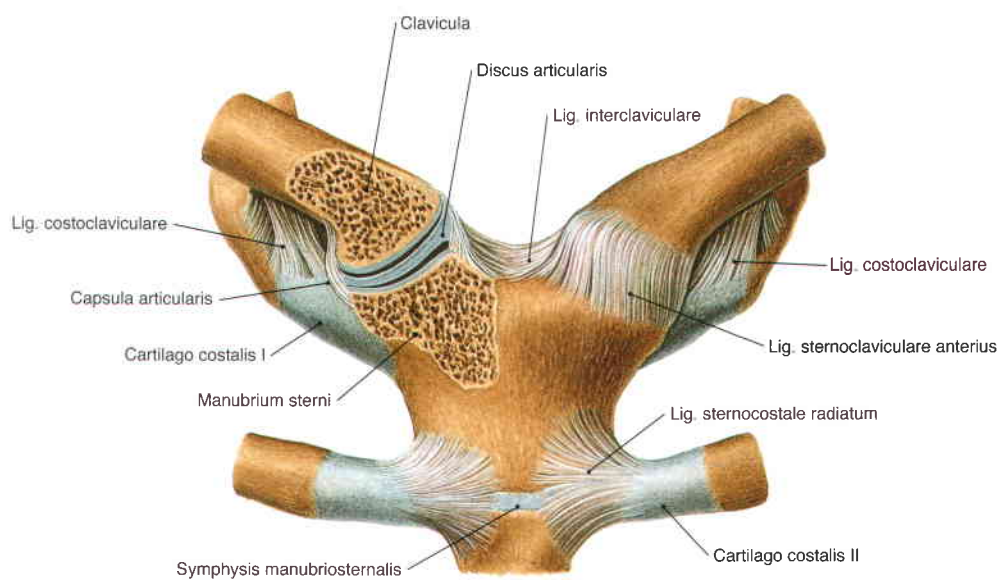


Fig. 279 Sternoclavicular joint, Articulatio sternoclavicularis; ventral view.

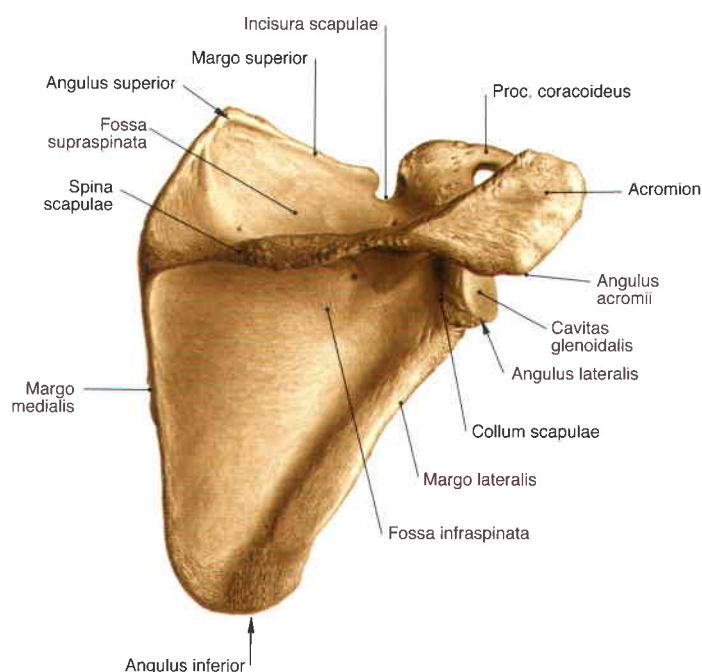
Scapula

Fig. 280 Scapula, Scapula;
dorsal view.

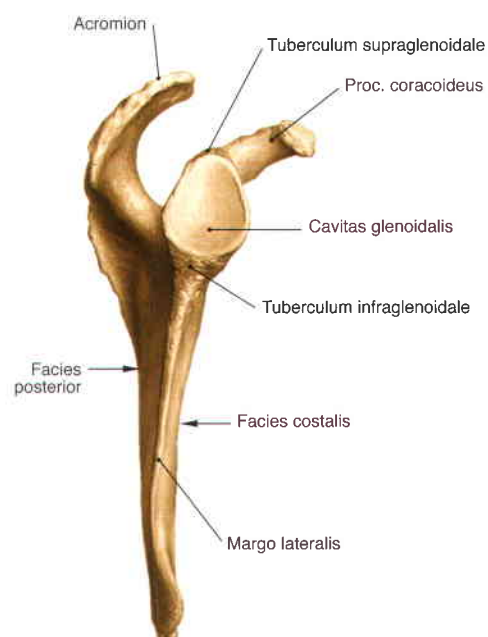


Fig. 281 Scapula, Scapula;
lateral view.

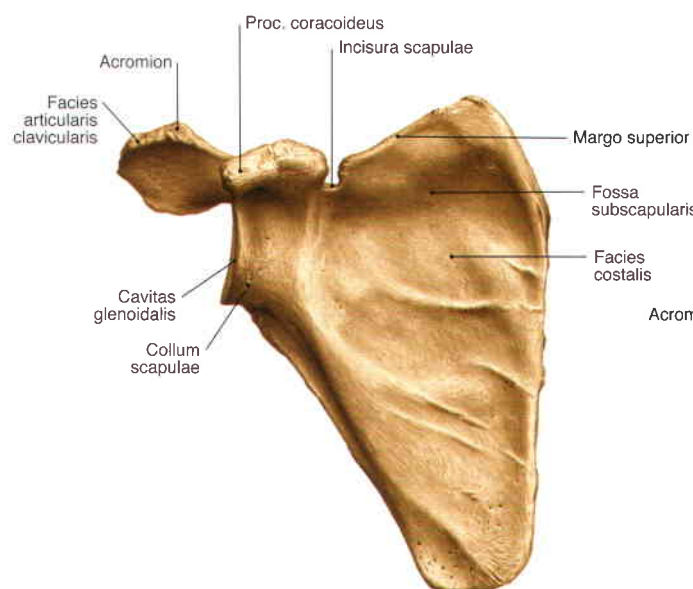


Fig. 282 Scapula, Scapula;
ventral view.

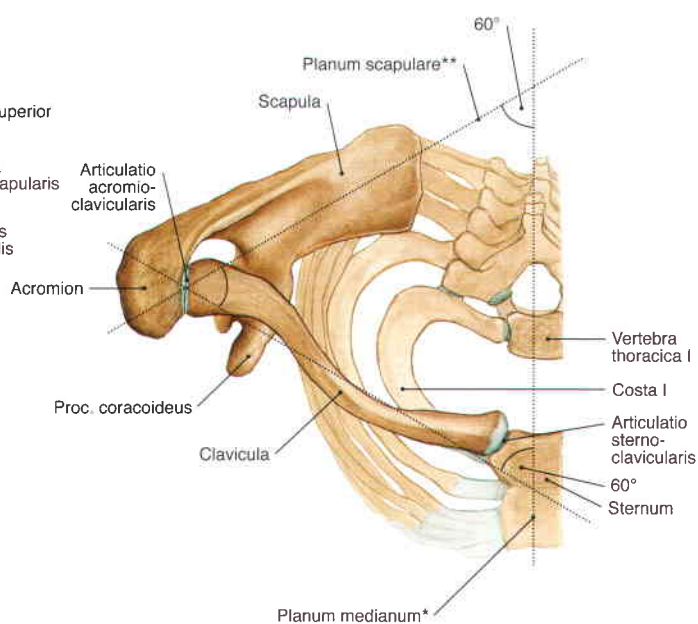


Fig. 283 Shoulder girdle, Cingulum pectorale;
superior view.
The angles refer to the average relations in the adult.

* Median plane

** Scapular plane

Humerus

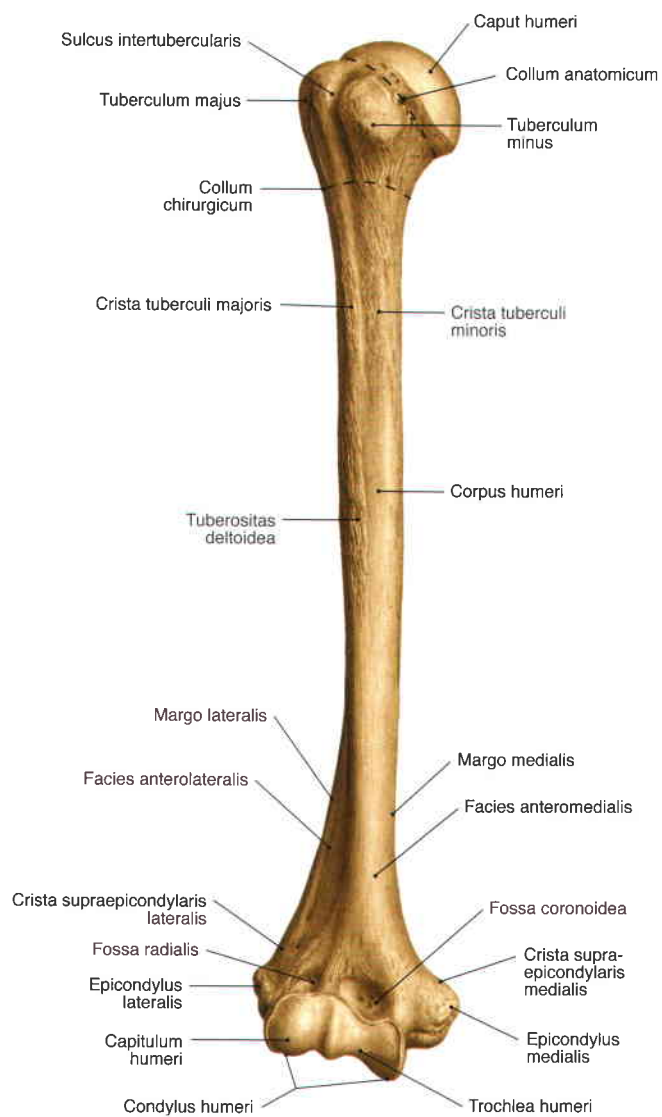


Fig. 284 Humerus, Humerus;
ventral view.



Fig. 285 Humerus, Humerus;
dorsal view.

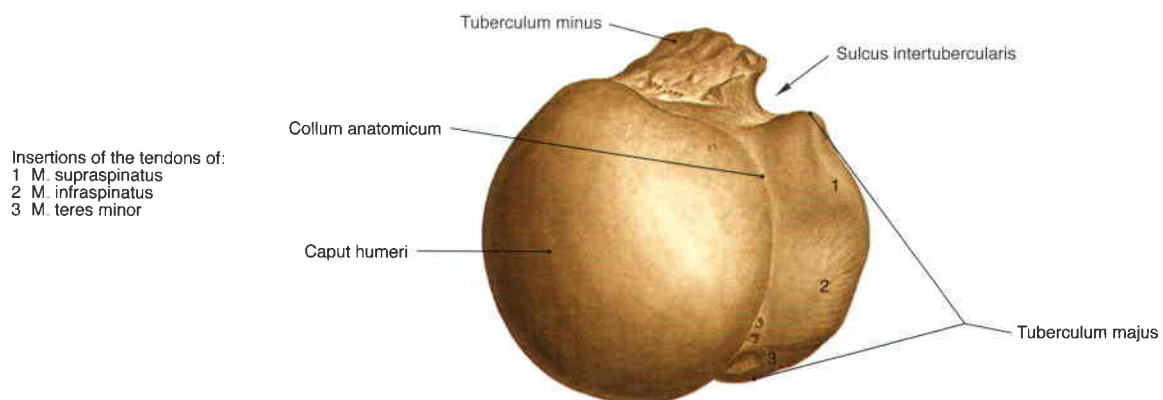


Fig. 286 Humerus, Humerus;
proximal view.

Shoulder joint

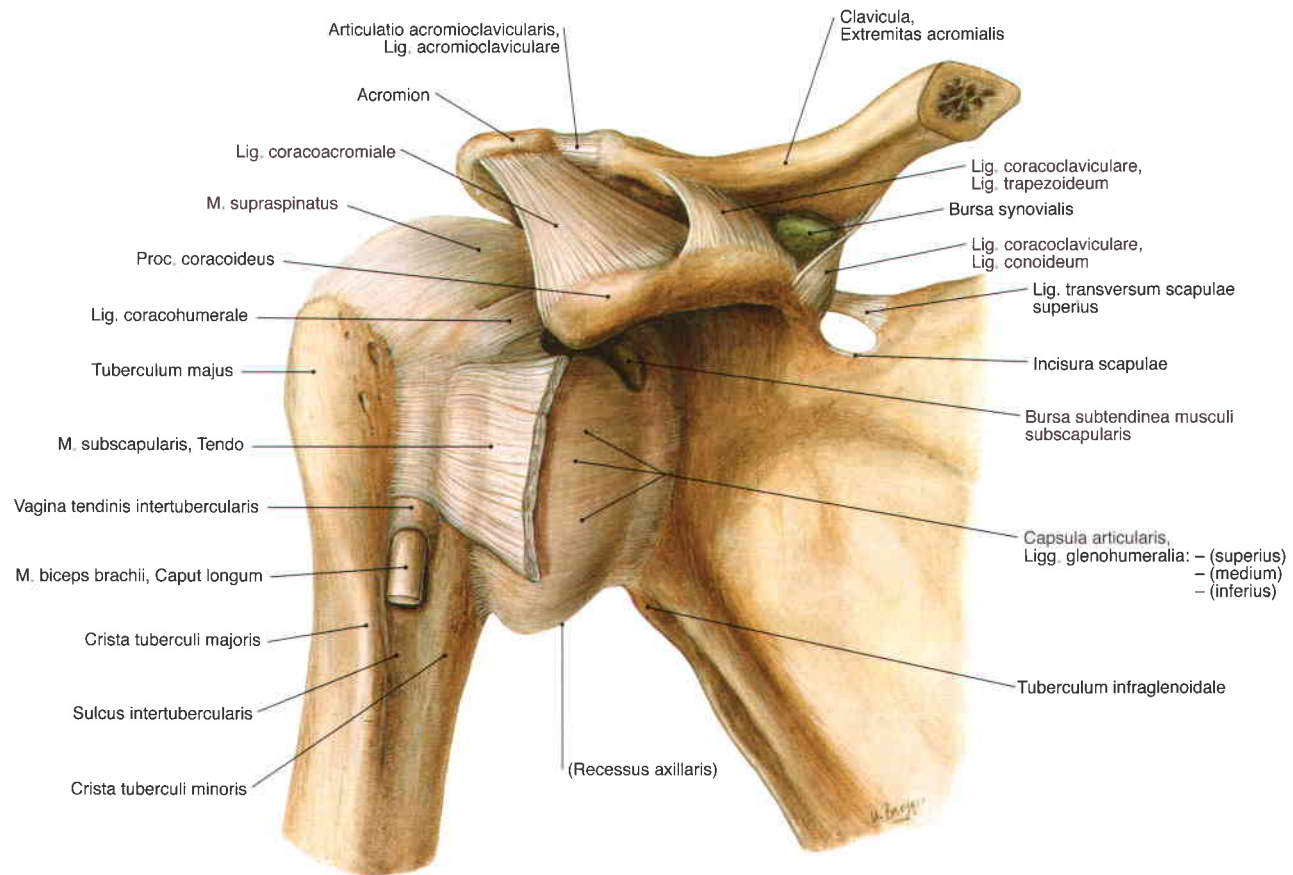


Fig. 287 Shoulder joint, Articulatio humeri; ventral view.

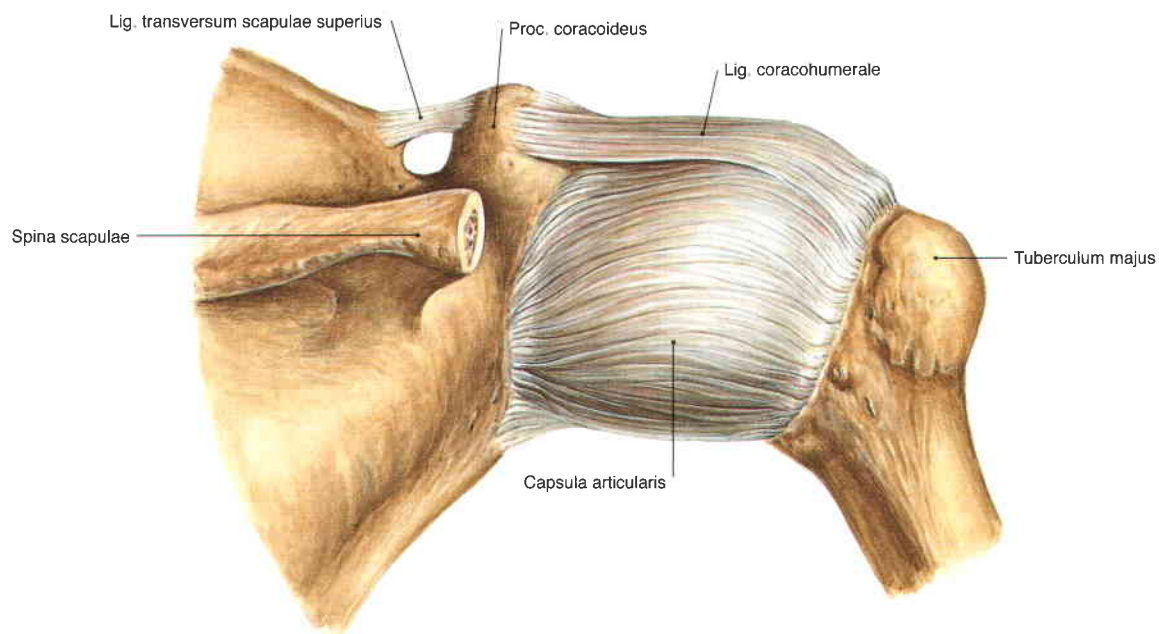


Fig. 288 Shoulder joint, Articulatio humeri; the acromion has been removed; dorsal view.

Shoulder joint

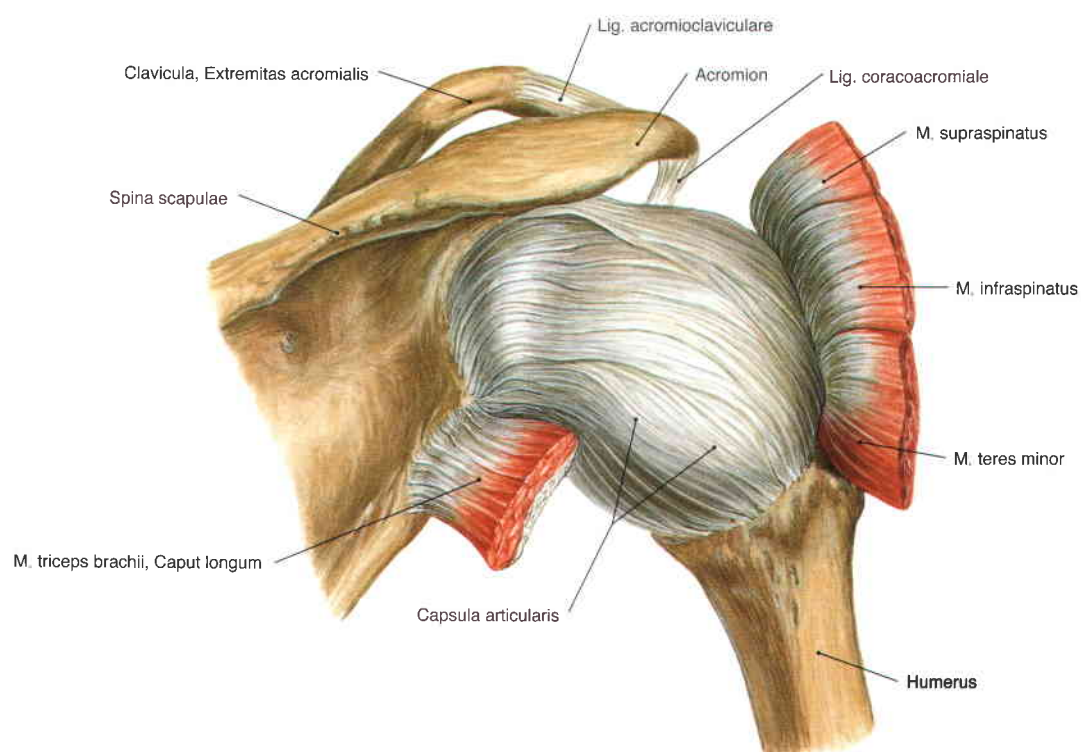


Fig. 289 Shoulder joint, Articulatio humeri; dorsal view.

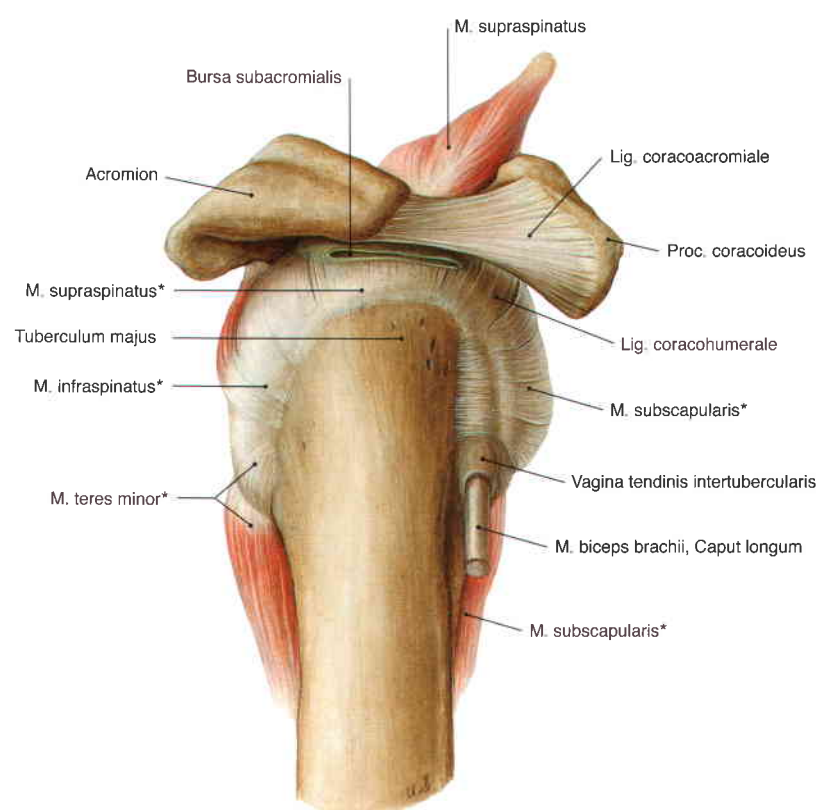


Fig. 290 Shoulder joint, Articulatio humeri; lateral view.

Together, the muscle tendons marked with * form the so-called rotator cuff.

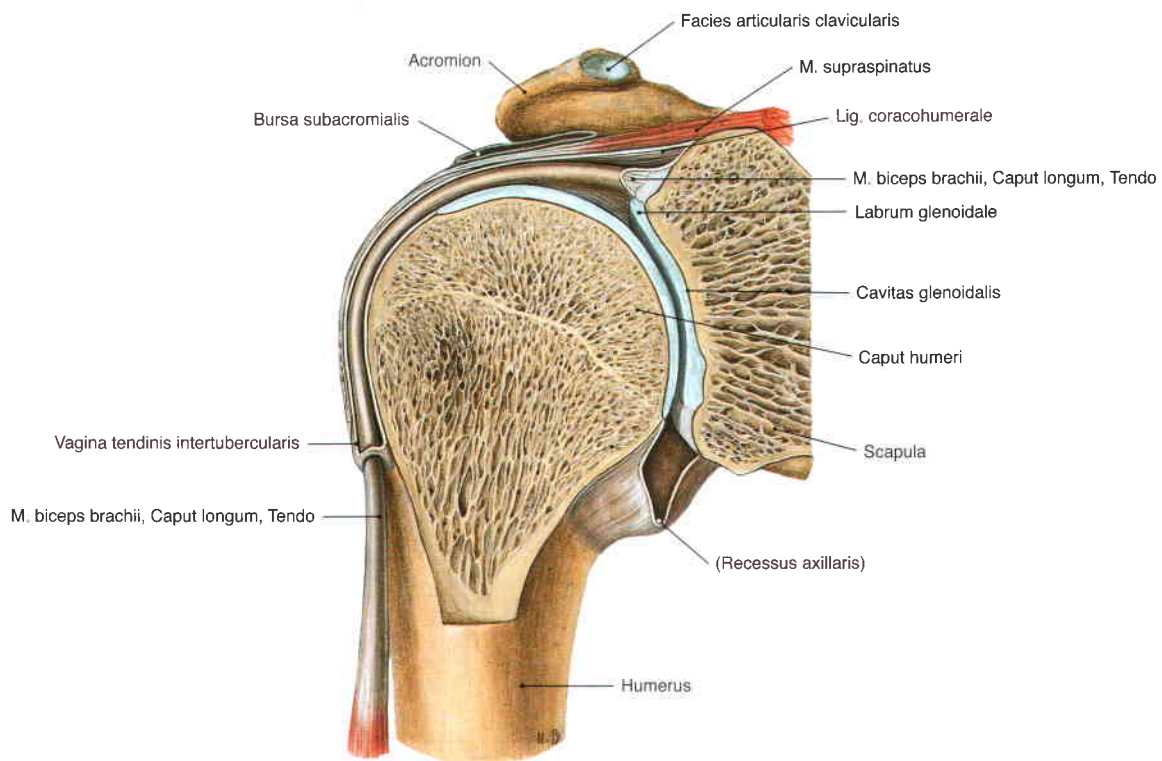


Fig. 291 Shoulder joint, Articulatio humeri; section at the level of the scapula; ventral view.

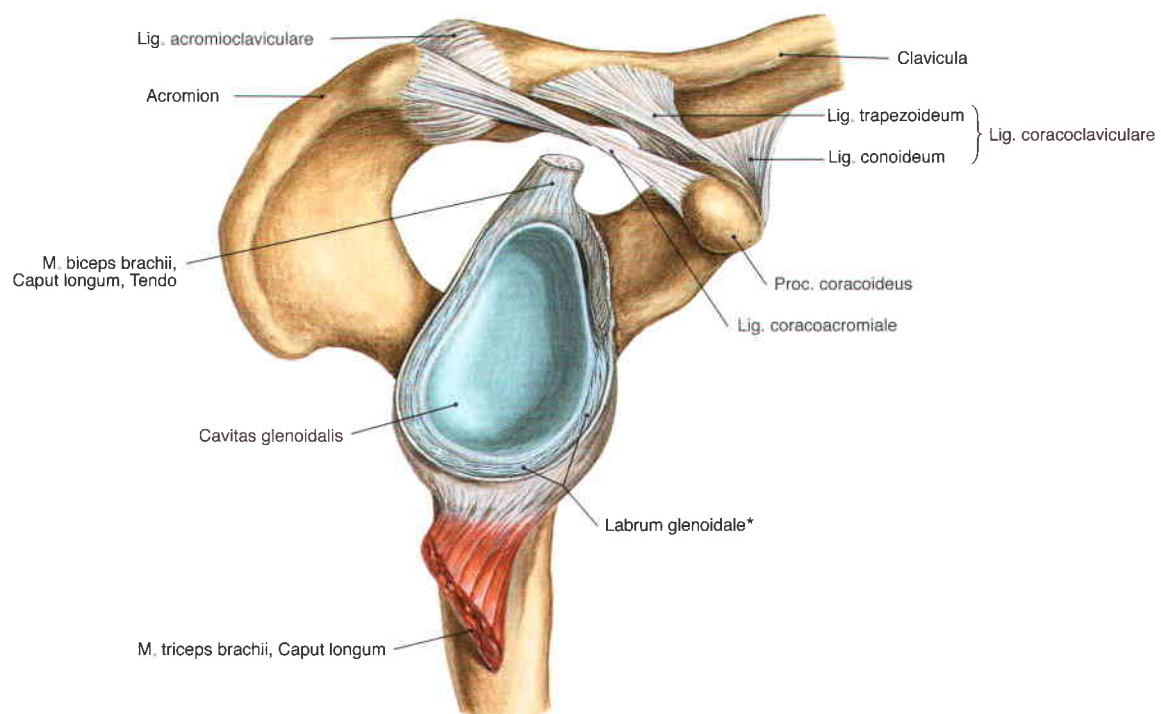


Fig. 292 Shoulder joint, Articulatio humeri; lateral view.

Next to its origin at the supraglenoidal tubercle, the tendon of the biceps muscle is predominantly attached to the glenoid labrum.

* It forms a fibrocartilaginous collar around the glenoid cavity.

Shoulder joint, radiography

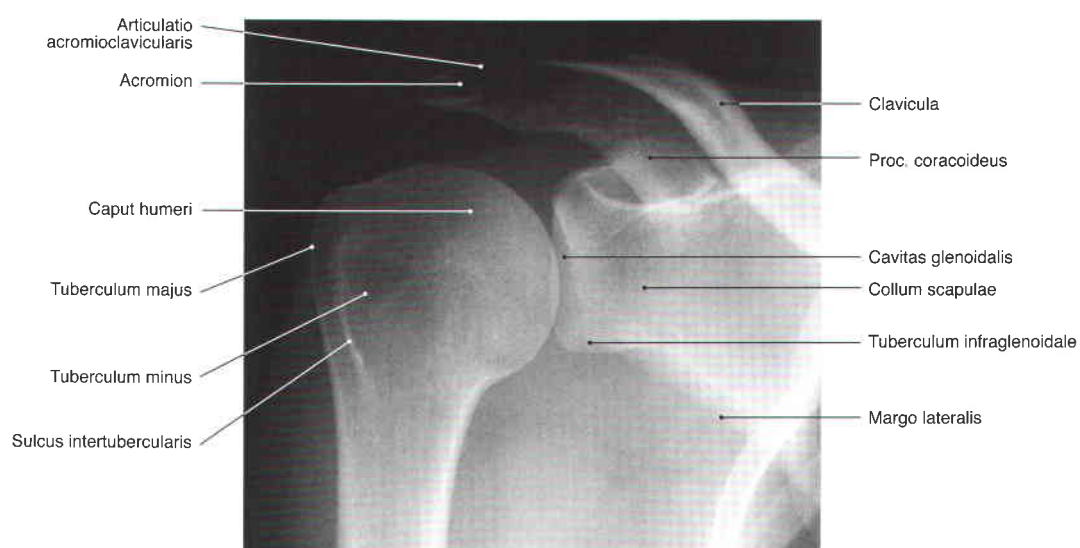


Fig. 293 Shoulder joint, Articulatio humeri; AP-radiograph.

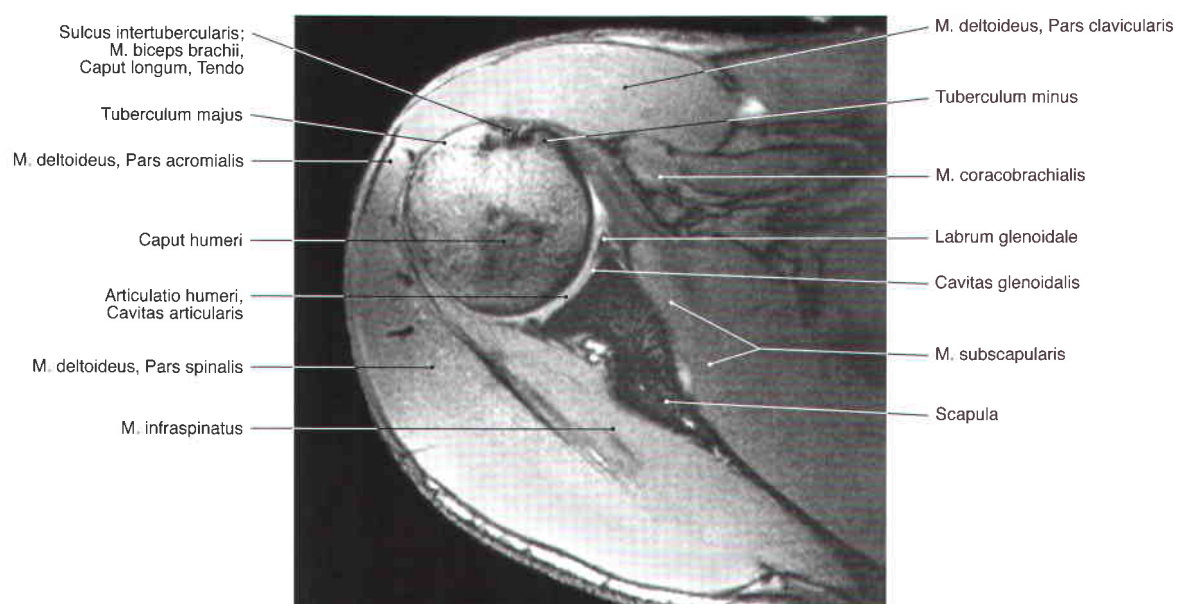
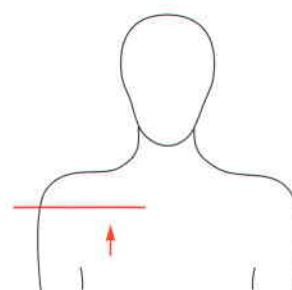


Fig. 294 Shoulder joint, Articulatio humeri; computed tomographic (CT) cross-section; the joint cavity is filled with air (pneumo-CT); inferior view.

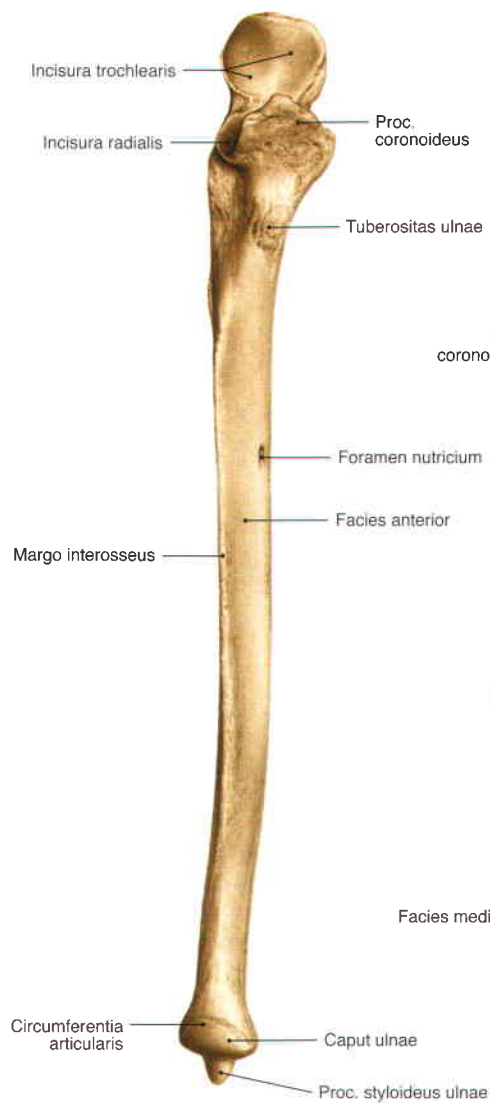
Ulna

Fig. 295 Ulna, Ulna;
ventral view.

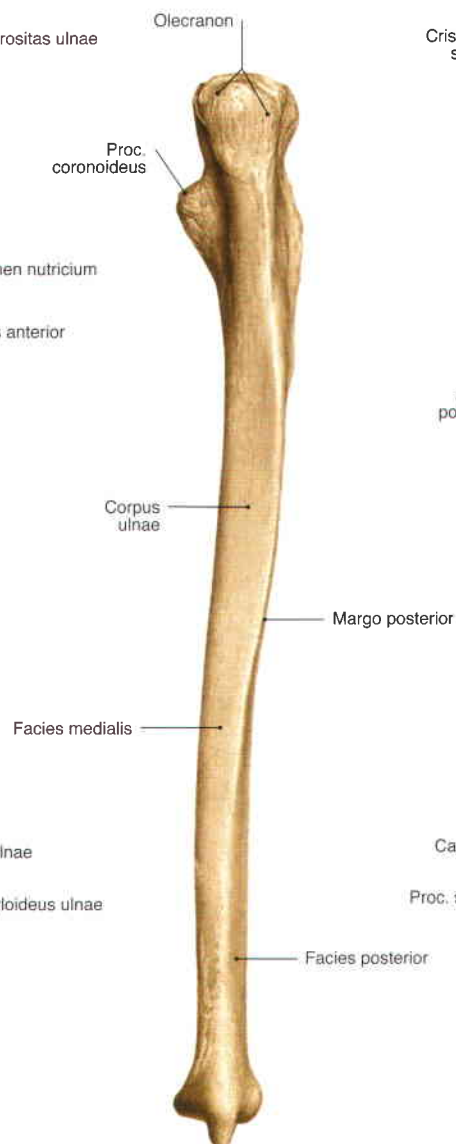


Fig. 296 Ulna, Ulna;
dorsal view.

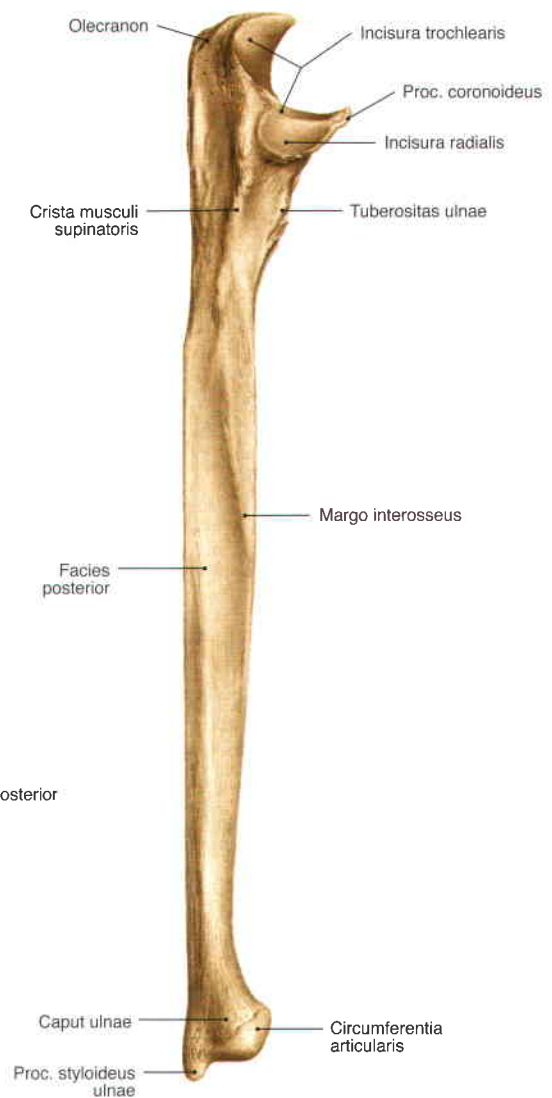


Fig. 297 Ulna, Ulna;
radial view.

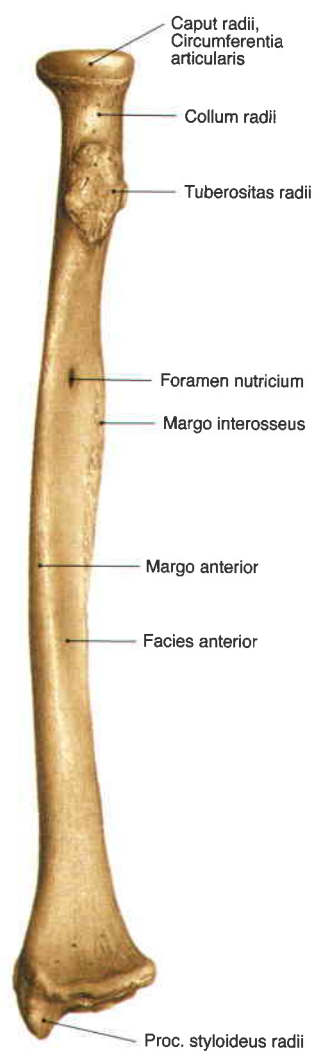


Fig. 298 Radius, Radius;
ventral view.

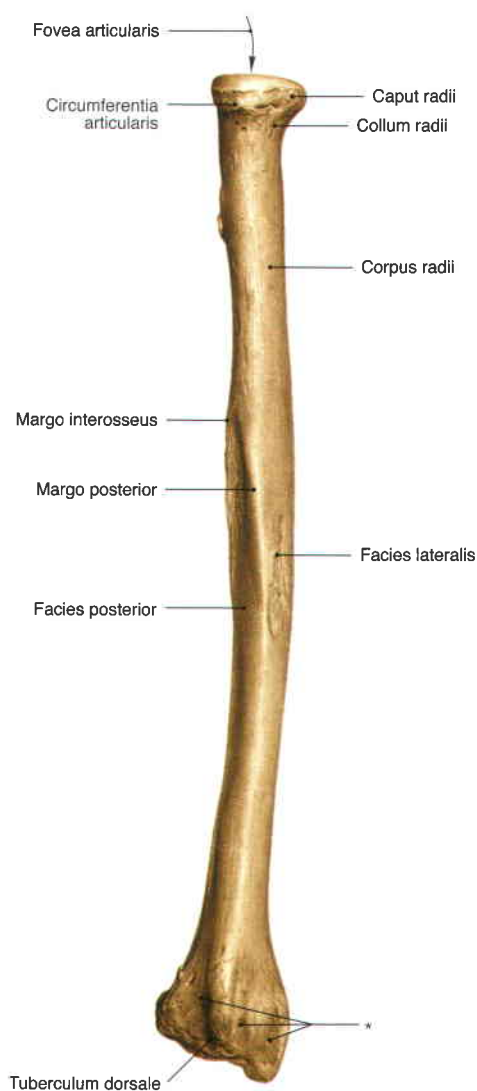


Fig. 299 Radius, Radius;
dorsal view.

* Grooves and crests for the
attachment of the extensor
tendons

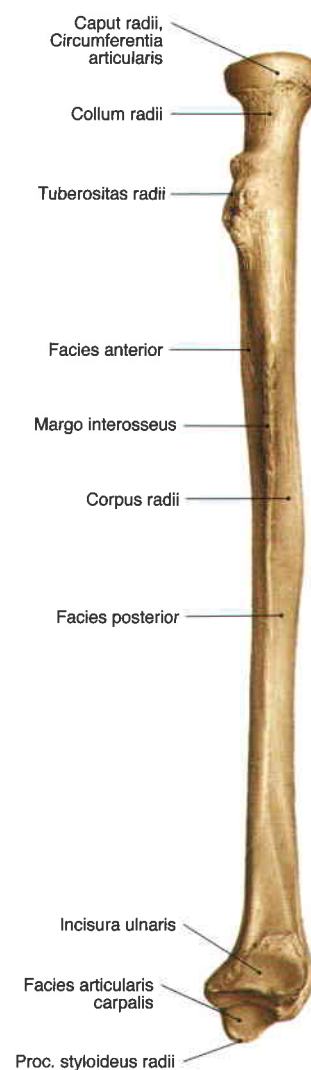


Fig. 300 Radius, Radius;
ulnar view.

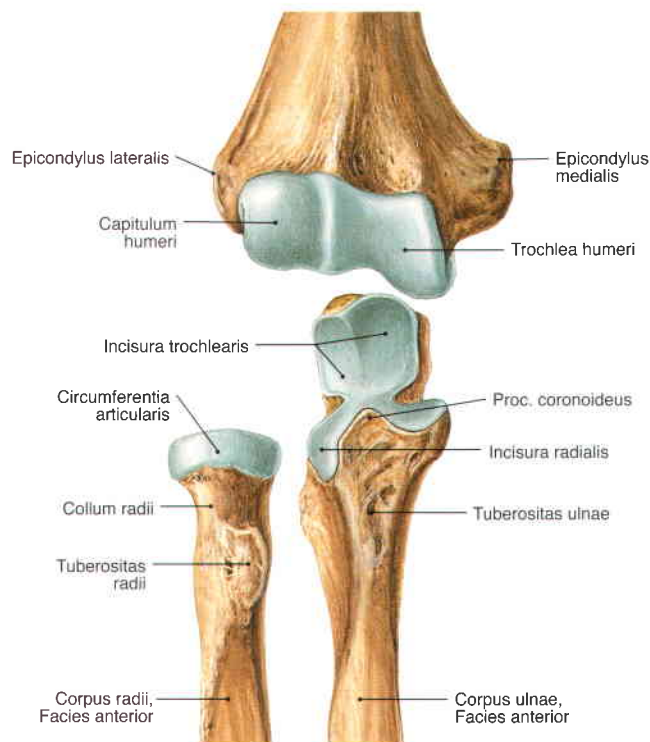


Fig. 301 Elbow joint, Articulatio cubiti; ventral view.



Fig. 302 Elbow joint, Articulatio cubiti, in 90° flexion and 90° supination; medial view.

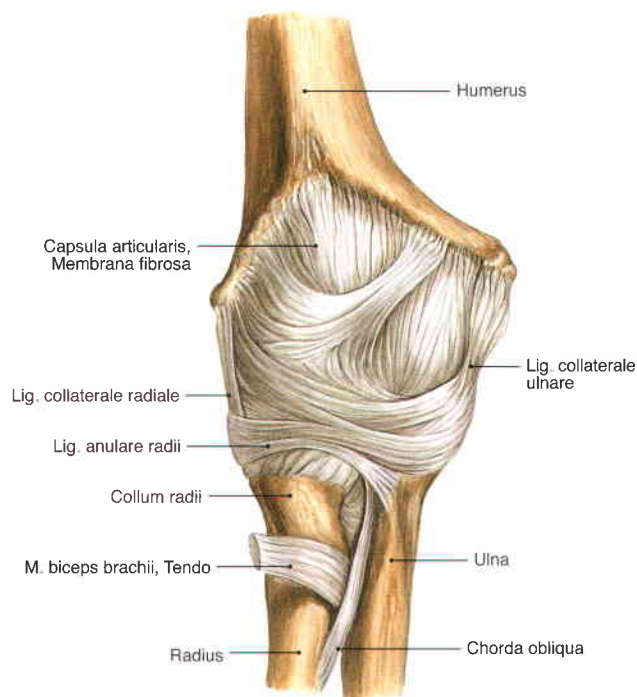


Fig. 303 Elbow joint, Articulatio cubiti; ventral view.

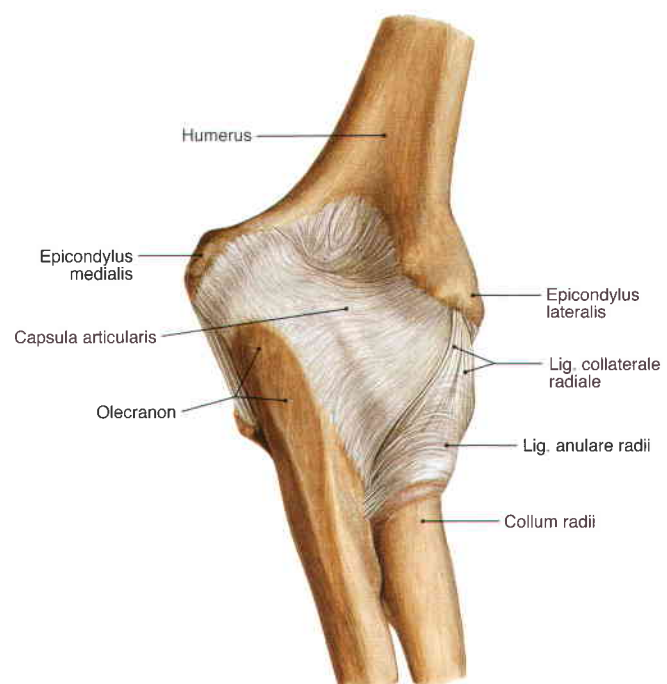


Fig. 304 Elbow joint, Articulatio cubiti; dorsal view.

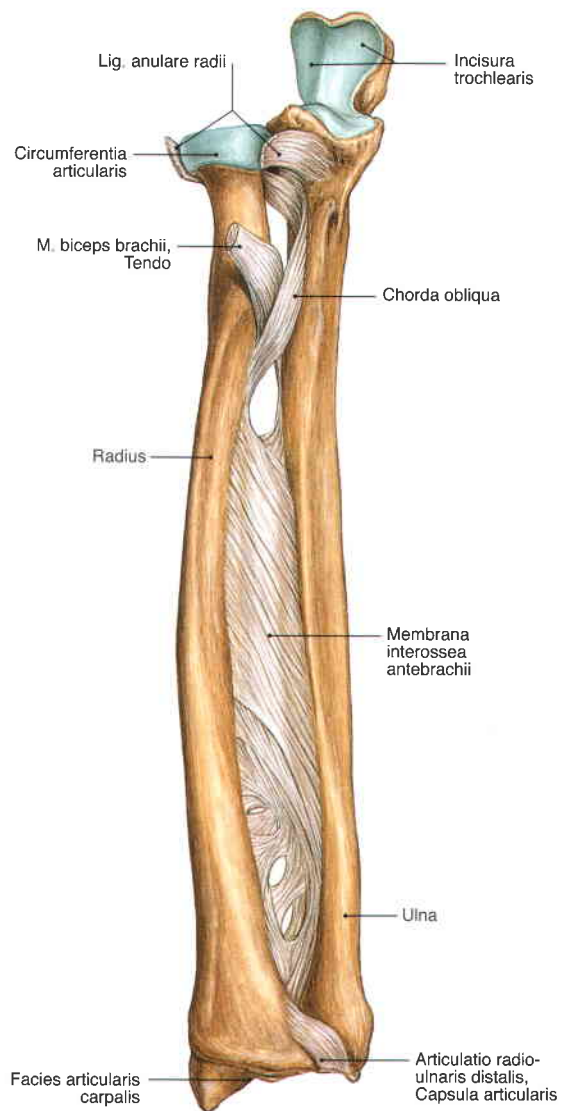
Junctions of the bones of the forearm

Fig. 305 Junctions of the bones of the forearm; in supination; ventral view.



Fig. 306 Junctions of the bones of the forearm; in pronation; ventral view of the ulna, dorsal view of the radius.

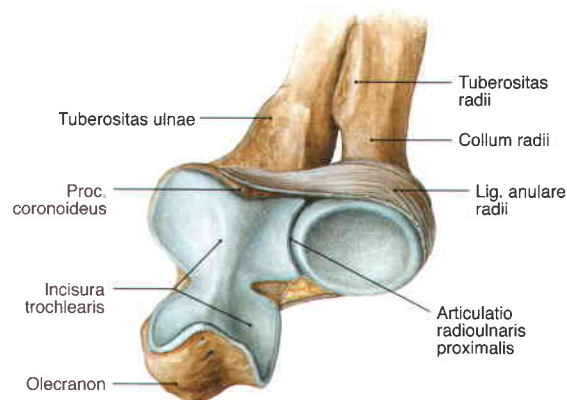


Fig. 307 Proximal radio-ulnar joint, Articulatio radio-ulnaris proximalis; ventroproximal view.

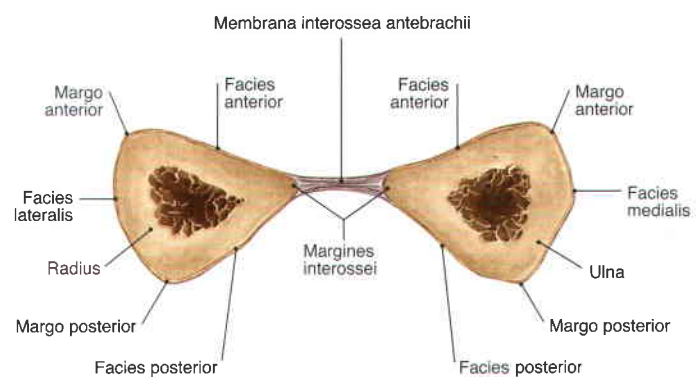


Fig. 308 Cross-section through the bones of the forearm; distal view.

Elbow joint, sections and radiography

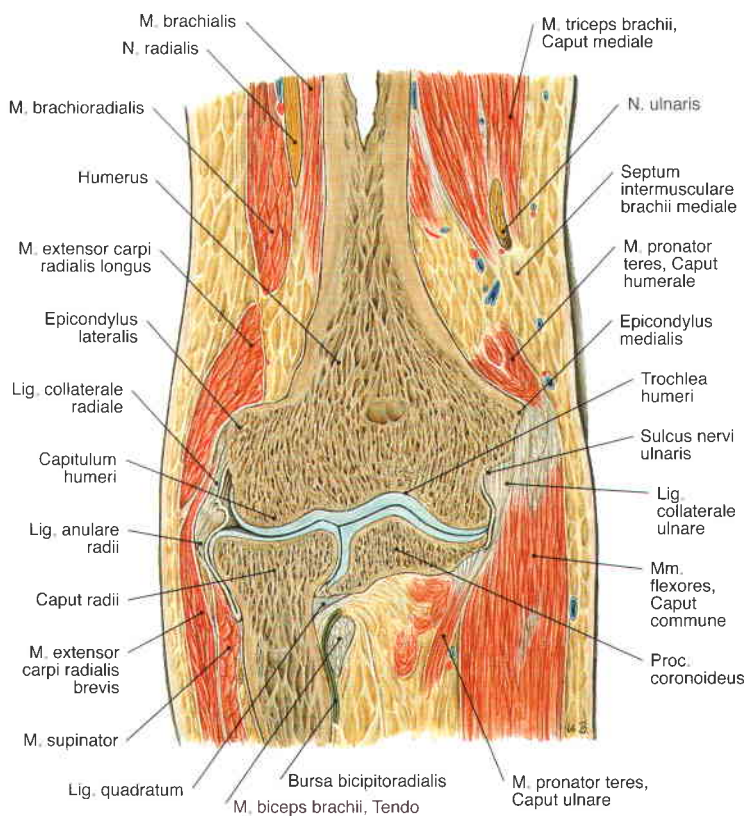


Fig. 309 Elbow joint, Articulatio cubiti; frontal section.

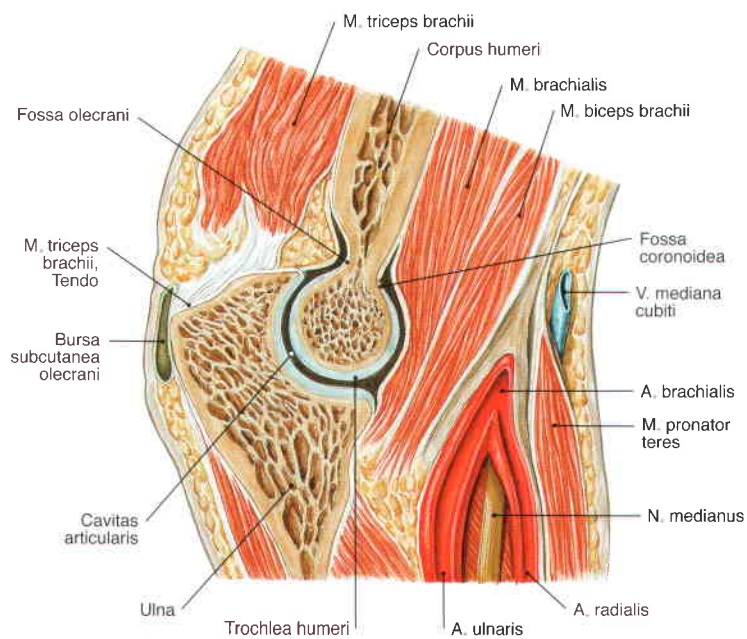
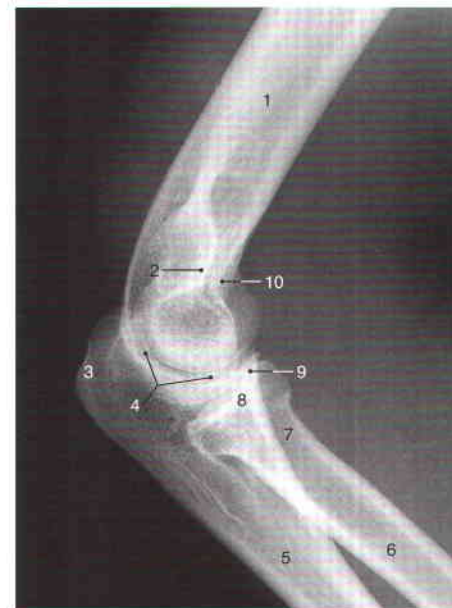


Fig. 311 Elbow joint, Articulatio cubiti; sagittal section.



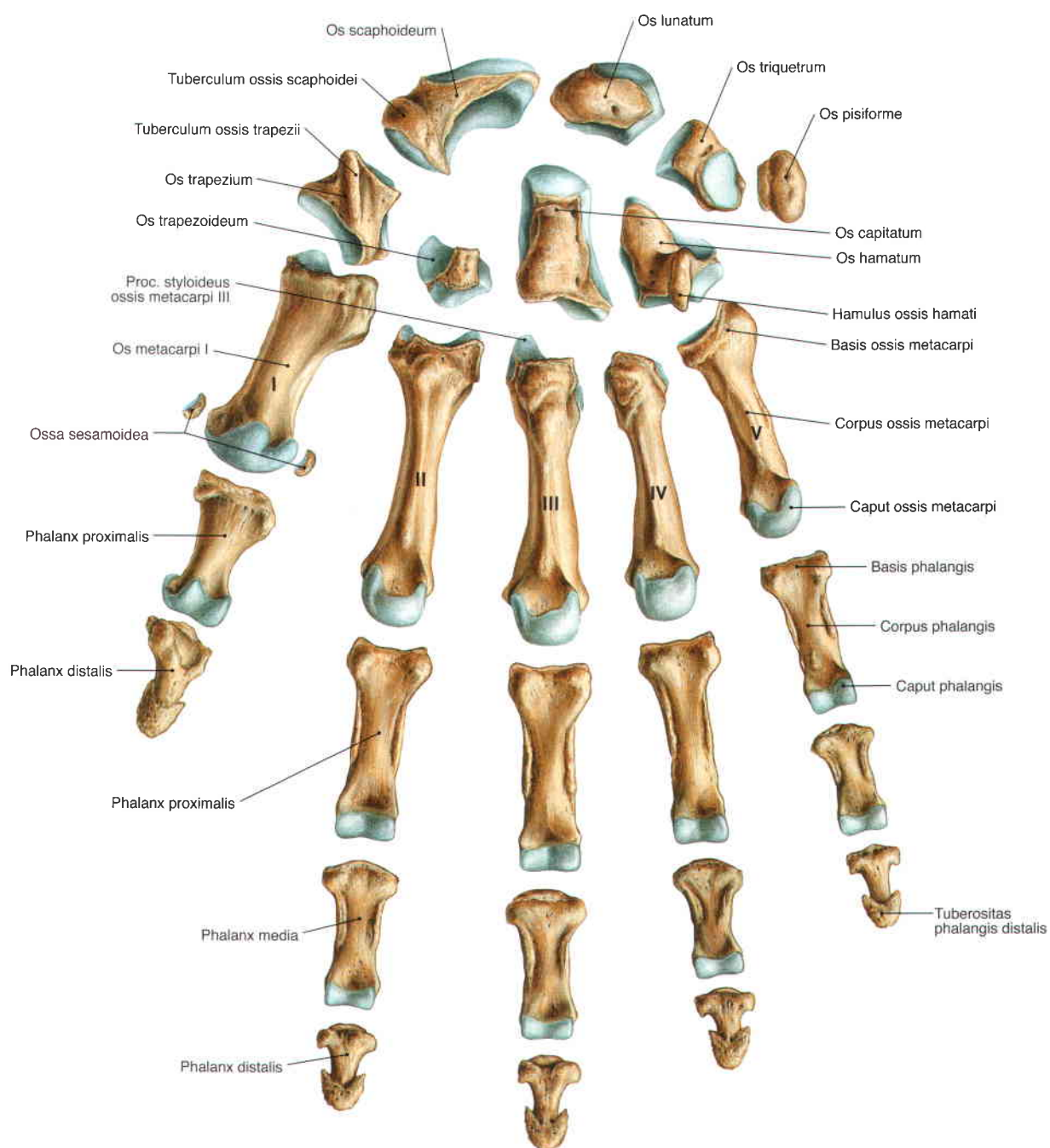
- | | |
|---------------------------------------|---------------------------------------|
| 1 Crista supraepicondylaris lateralis | 6 Tuberositas radii |
| 2 Epicondylus lateralis | 7 Proc. coronoideus |
| 3 Capitulum humeri | 8 Trochlea humeri |
| 4 Caput radii | 9 Olecranon |
| 5 Collum radii | 10 Epicondylus medialis |
| | 11 Crista supraepicondylaris medialis |

Fig. 310 Elbow joint, Articulatio cubiti; AP-radiograph.



- | | |
|------------------------|---------------------|
| 1 Humerus | 6 Radius |
| 2 Fossa olecrani | 7 Collum radii |
| 3 Olecranon | 8 Caput radii |
| 4 Incisura trochlearis | 9 Proc. coronoideus |
| 5 Ulna | 10 Fossa coronoidea |

Fig. 312 Elbow joint, Articulatio cubiti; lateral radiograph.



- I Pollex [Digitus primus]
- II Index [Digitus secundus]
- III Digitus medius [Digitus tertius]
- IV Digitus anularis [Digitus quartus]
- V Digitus minimus [Digitus quintus]

Fig. 313 Bones of the hand, Ossa manus; palmar view.

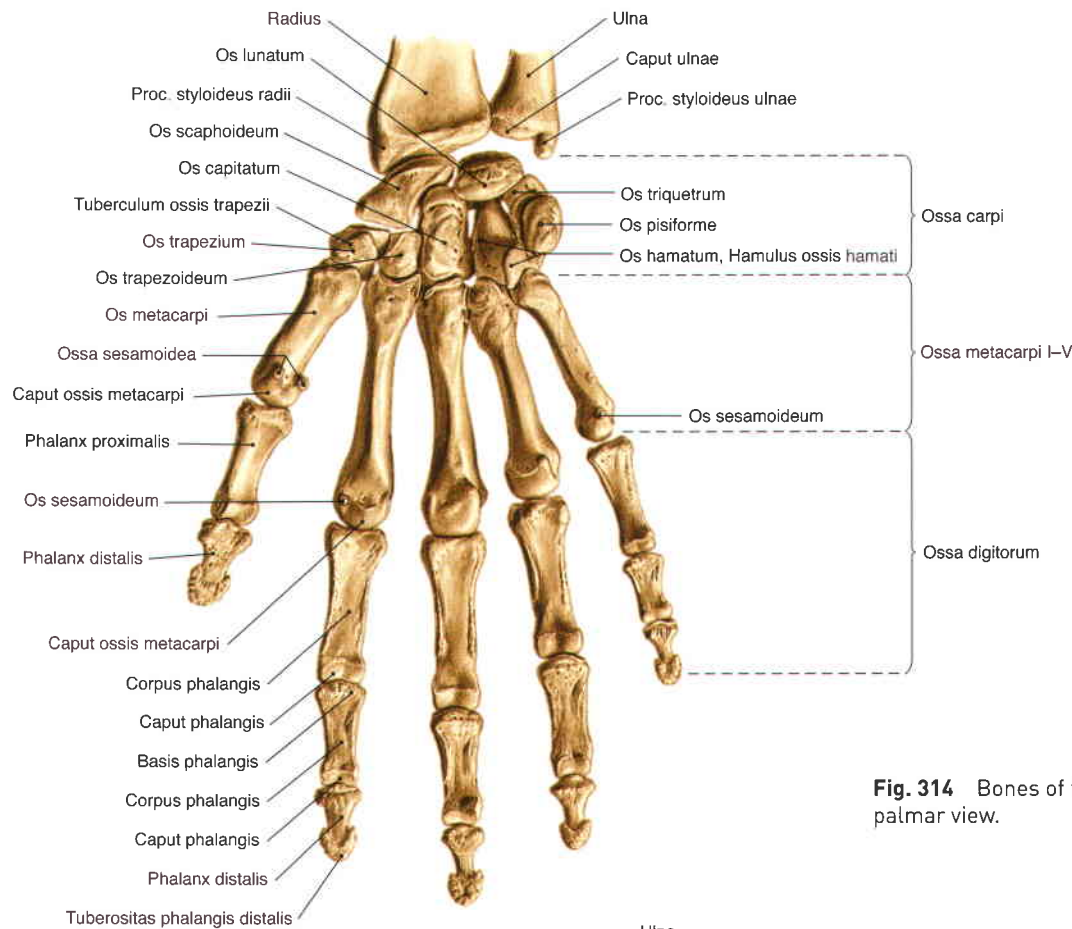
Skeleton of the hand

Fig. 314 Bones of the hand, Ossa manus; palmar view.

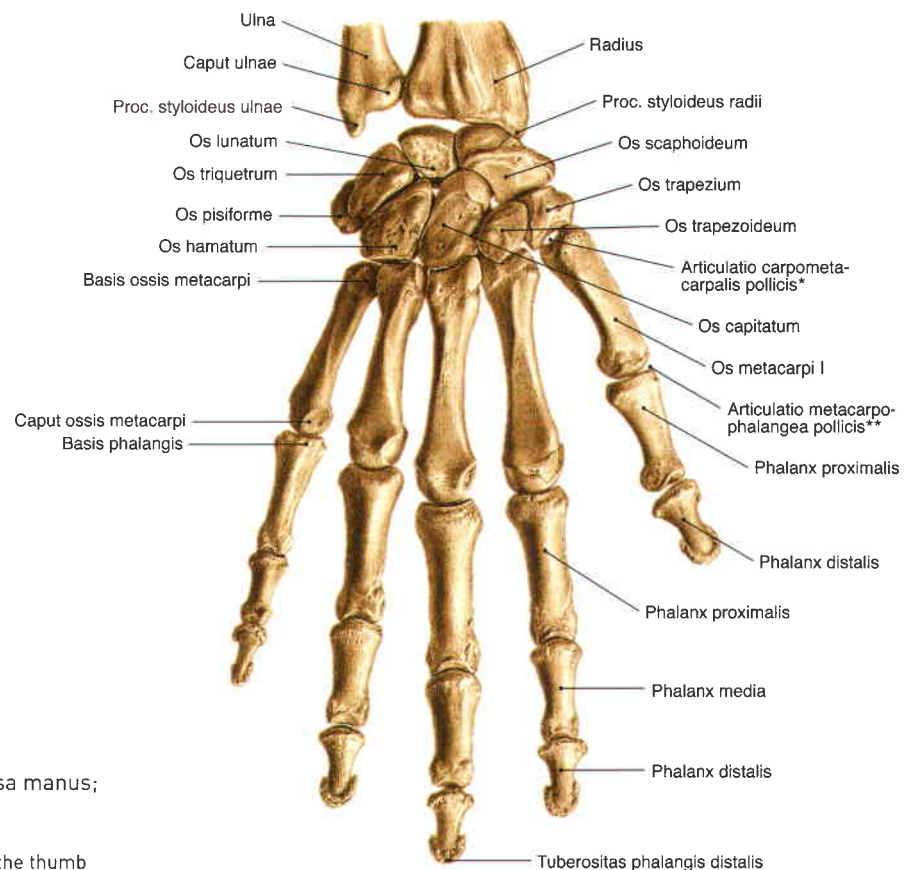


Fig. 315 Bones of the hand, Ossa manus; dorsal view.

* Also: saddle joint of the thumb

** Also: proximal phalangeal joint of the thumb

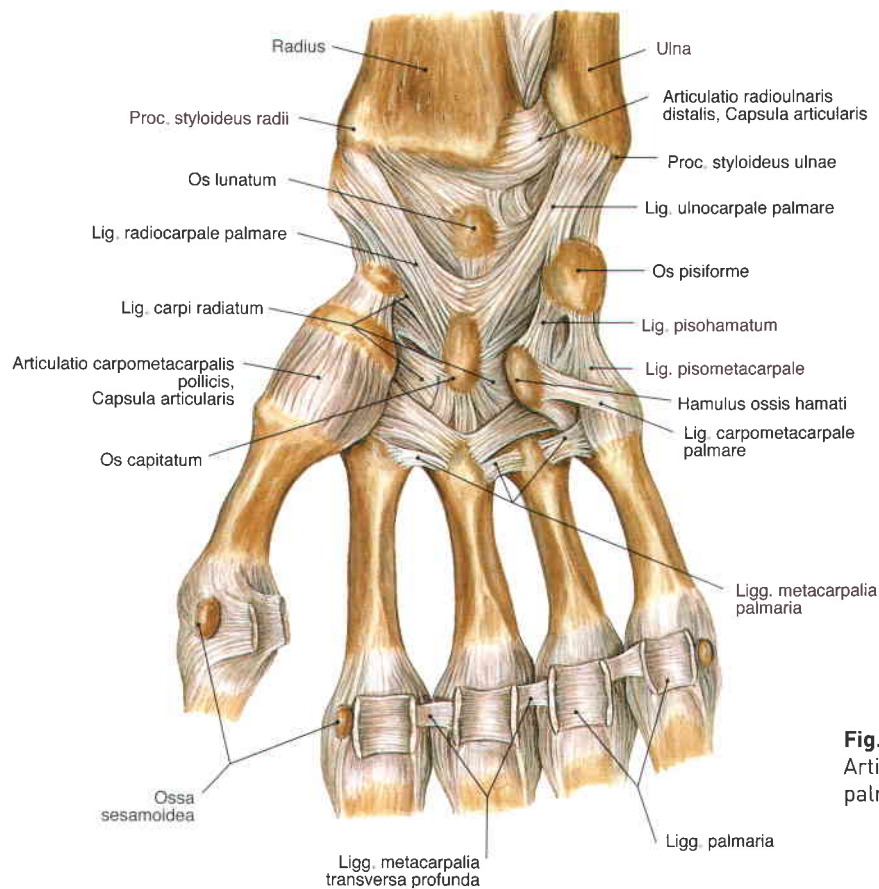


Fig. 316 Joints and ligaments of the hand, Articulationes et Ligamenta manus; palmar view.

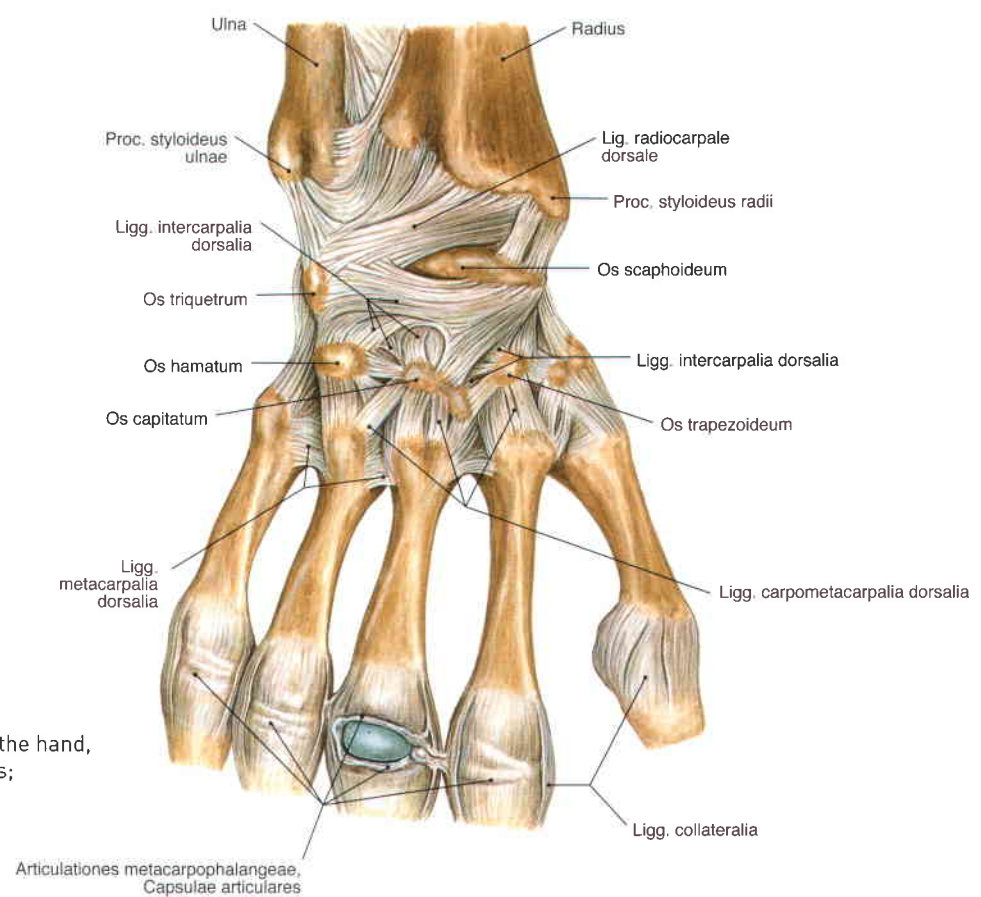


Fig. 317 Joints and ligaments of the hand, Articulationes et Ligamenta manus; dorsal view.

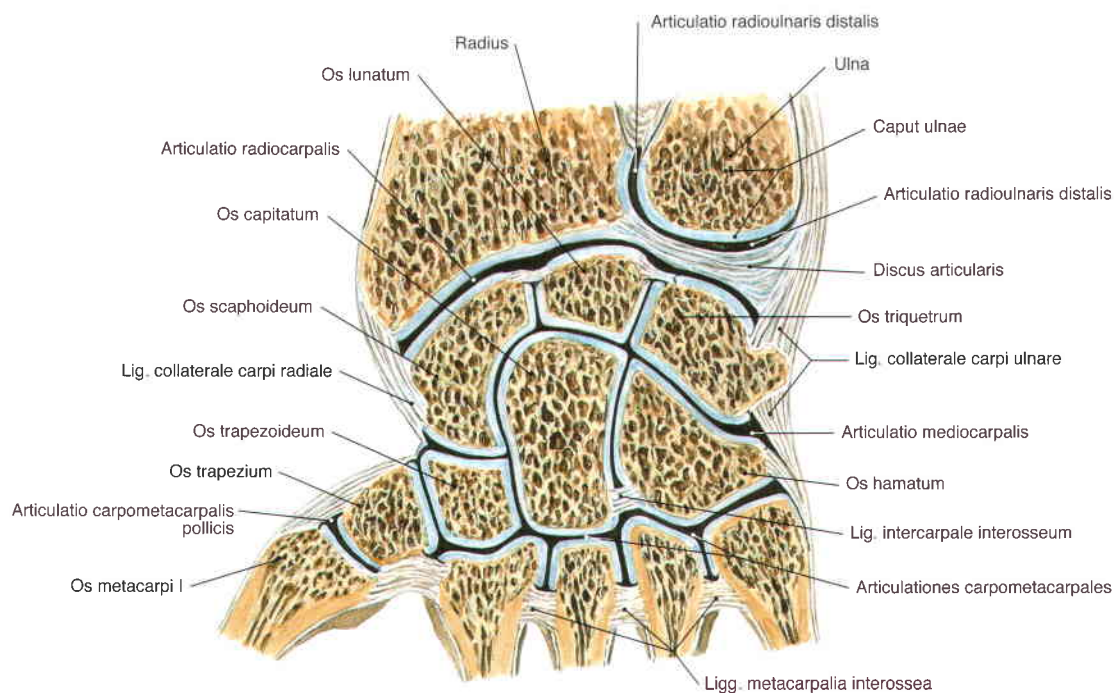


Fig. 318 Carpal joints, Articulationes carpi; longitudinal section parallel to the dorsum of the hand.

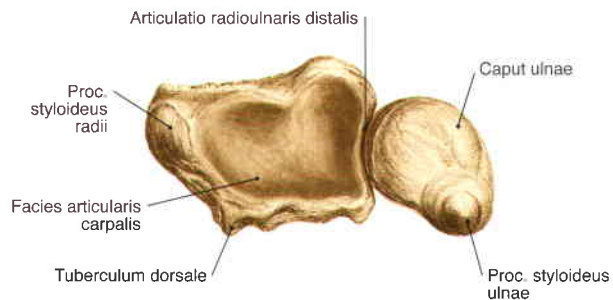


Fig. 319 Ulna and radius, Ulna et Radius; distal view.

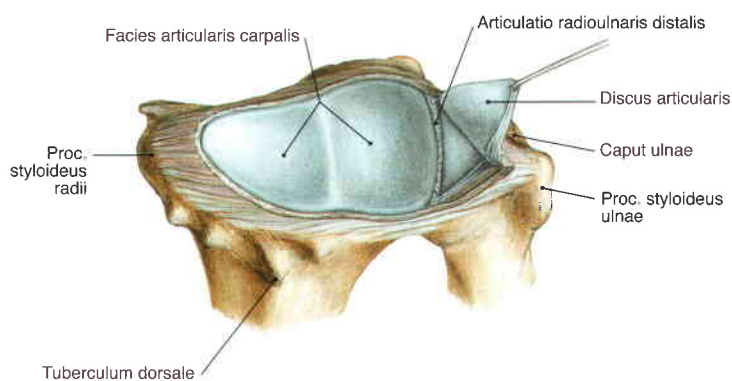


Fig. 320 Distal radio-ulnar joint, Articulatio radioulnaris distalis; distal-dorsal view.

Finger joints

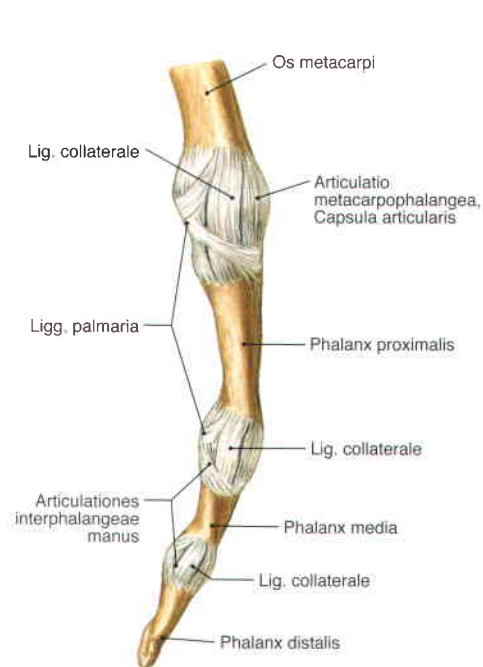


Fig. 321 Finger joints, Articulationes digiti; lateral view.



Fig. 322 Metacarpophalangeal joint of the thumb, Articulatio metacarpophalangea pollicis; radial-palmar view.

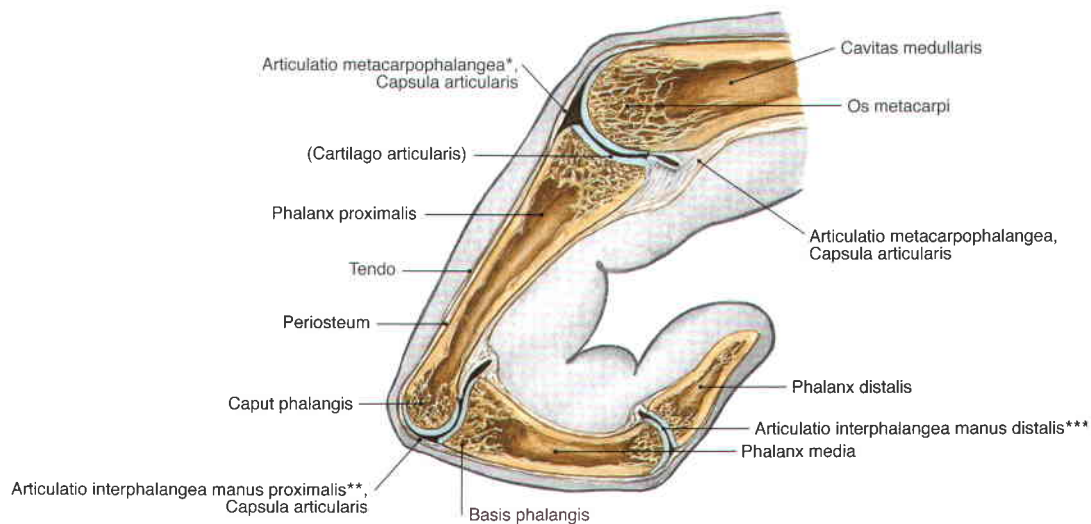


Fig. 323 Finger joints, Articulationes digiti; sagittal section; lateral view.

* Clinical term: **MP** (= metacarpophalangeal joint)

** Clinical term: **PIP** (= proximal interphalangeal joint)

*** Clinical term: **DIP** (= distal interphalangeal joint)

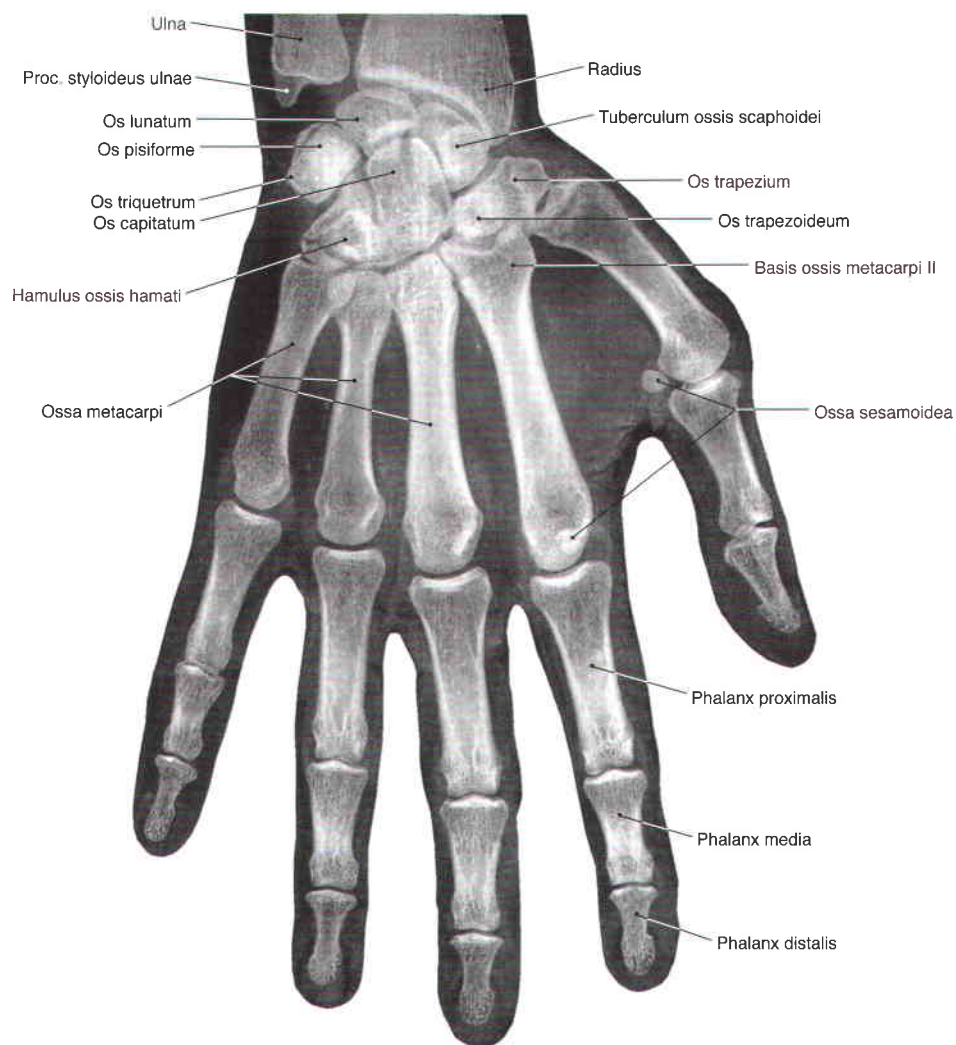
Wrist, radiography

Fig. 324 Hand, Manus;
PA-radiograph.
Note: The pisiform bone is projected onto
the triquetral bone.

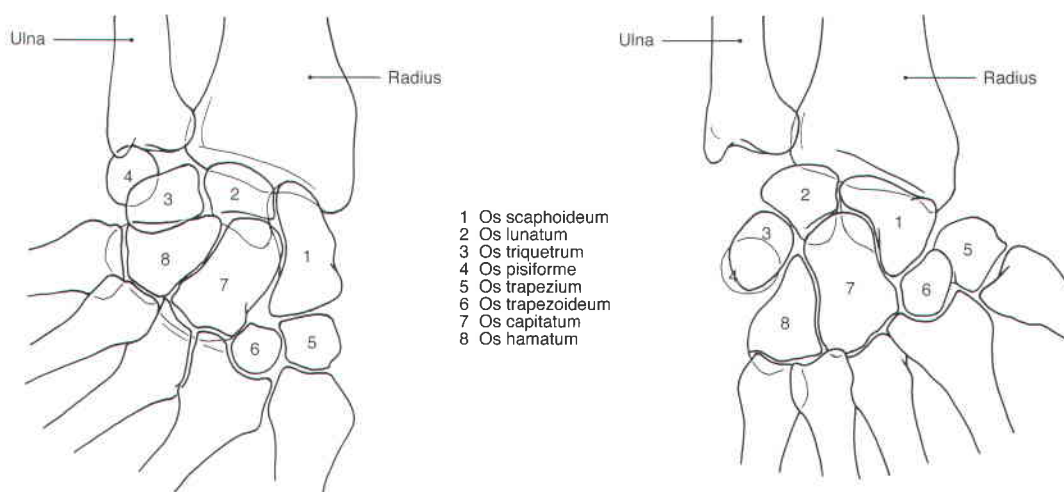


Fig. 325 Ulnar abduction of the hand;
schema of a PA-radiograph.

Fig. 326 Radial abduction of the hand;
schema of a PA-radiograph.



Fig. 327 PA-radiograph of the hand of a 4½-year-old boy.

1 Ulna, Diaphysis
2 Radius, Diaphysis
3 Ulna, Epiphysis distalis

4 Radius, Epiphysis distalis
5 Os lunatum
6 Os triquetrum



Fig. 328 PA-radiograph of the hand of a 7-year-old boy.

7 Os scaphoideum
8 Os hamatum
9 Os capitatum

10 Os trapezoidum
11 Os trapezium
12 Os pisiforme



Fig. 329 PA-radiograph of the hand of an 11-year-old boy.



Fig. 330 PA-radiograph of the hand of a 13-year-old boy.

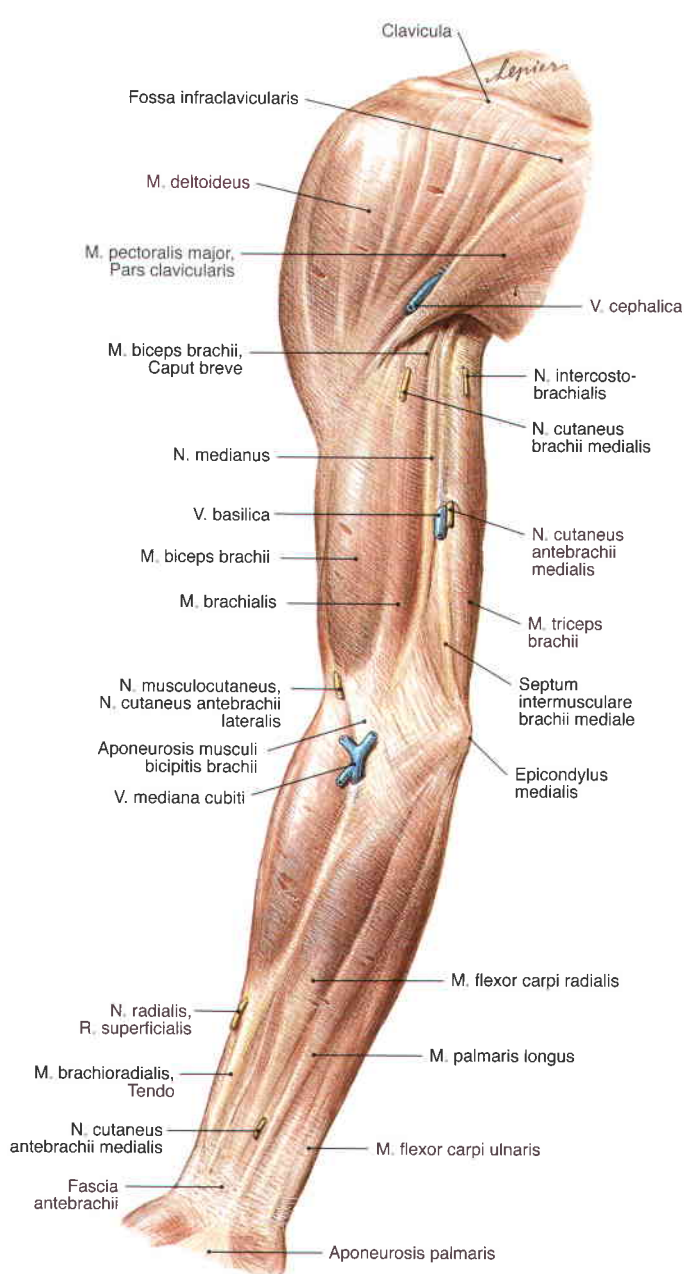


Fig. 331 Fascia of the flexor aspect of the upper limb.

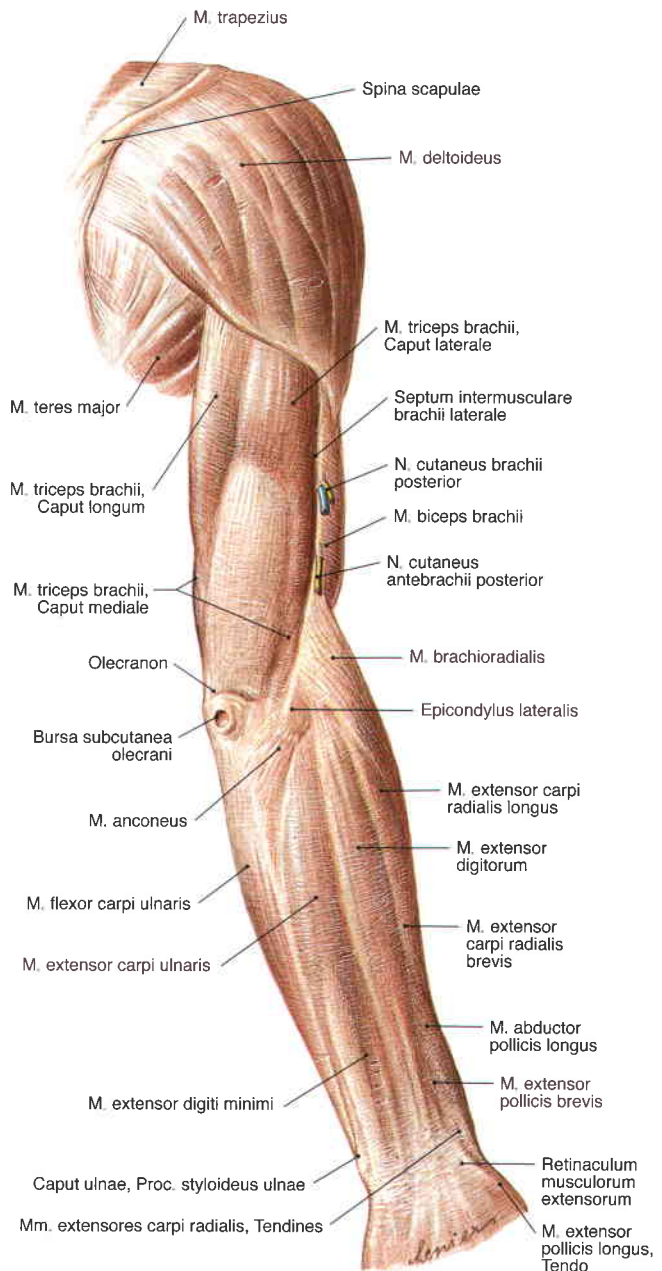


Fig. 332 Fascia of the extensor aspect of the upper limb.

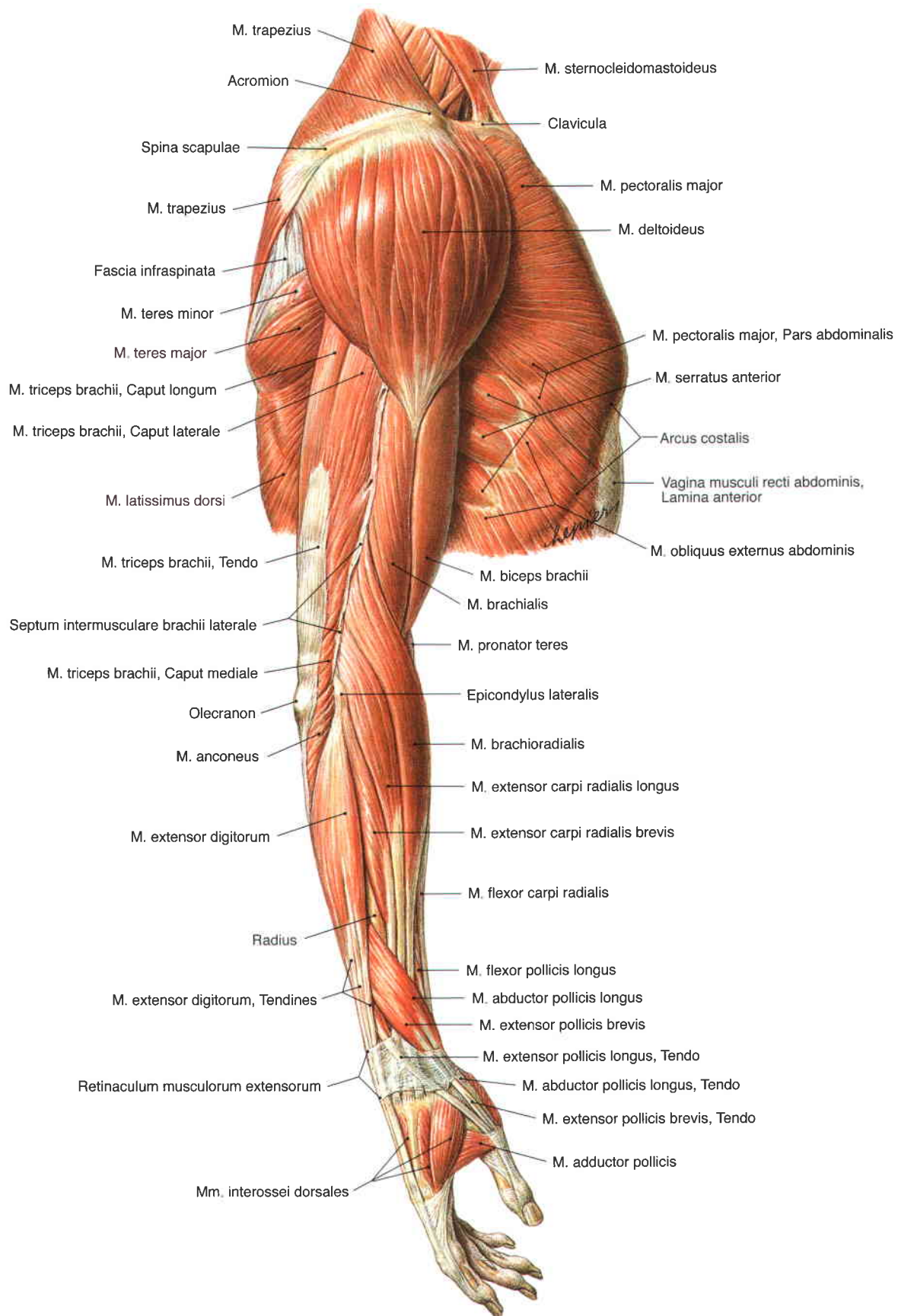
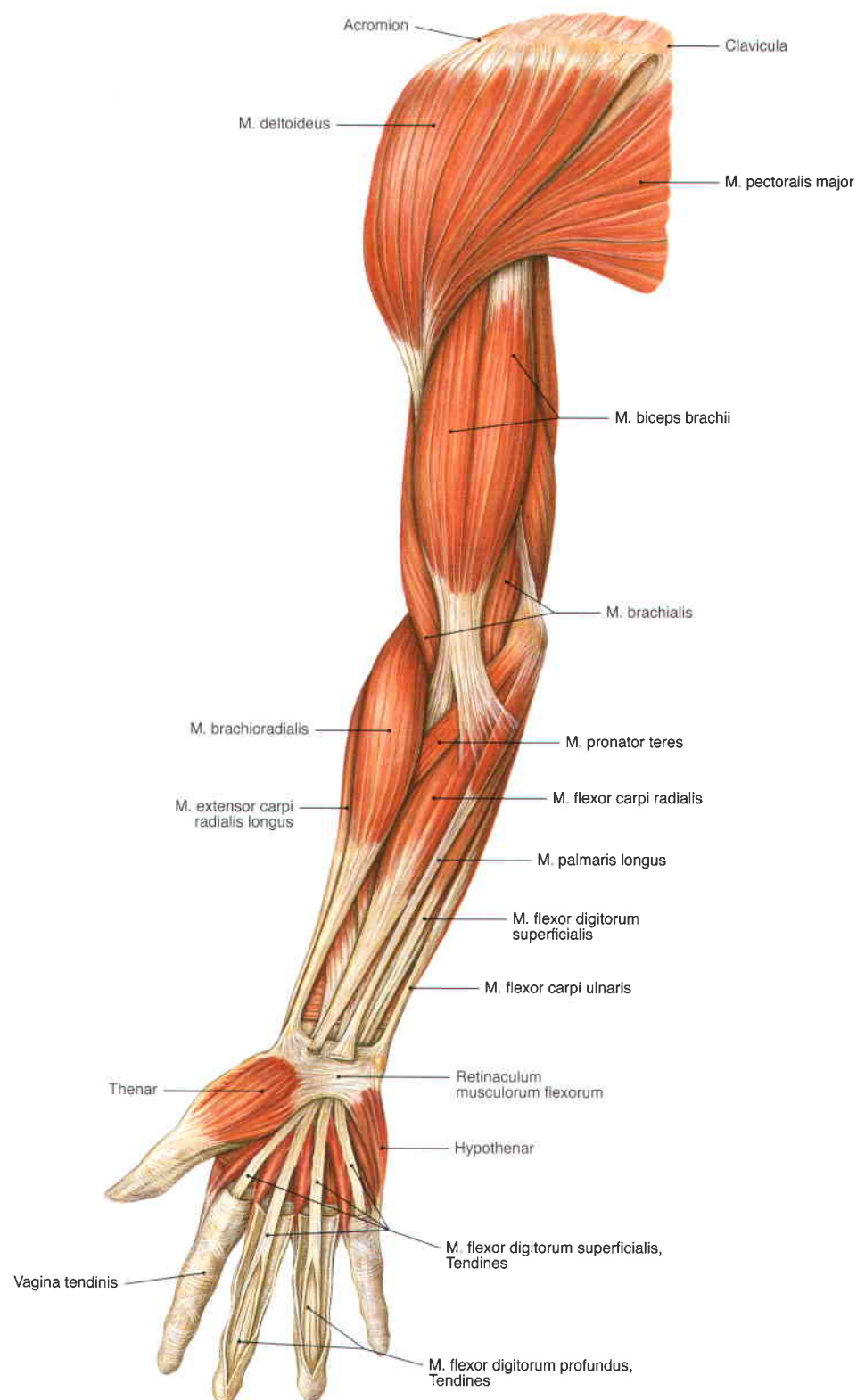
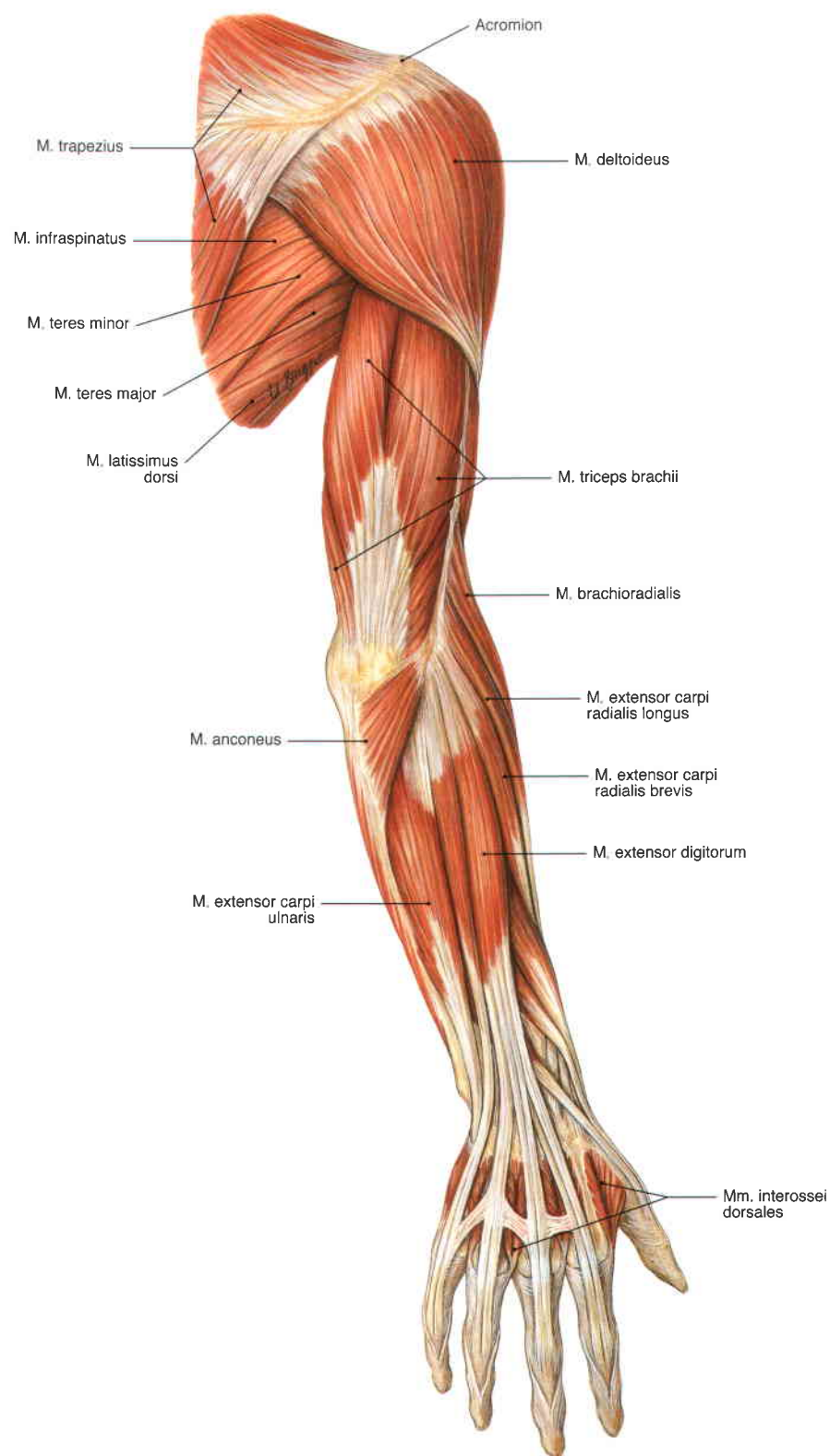
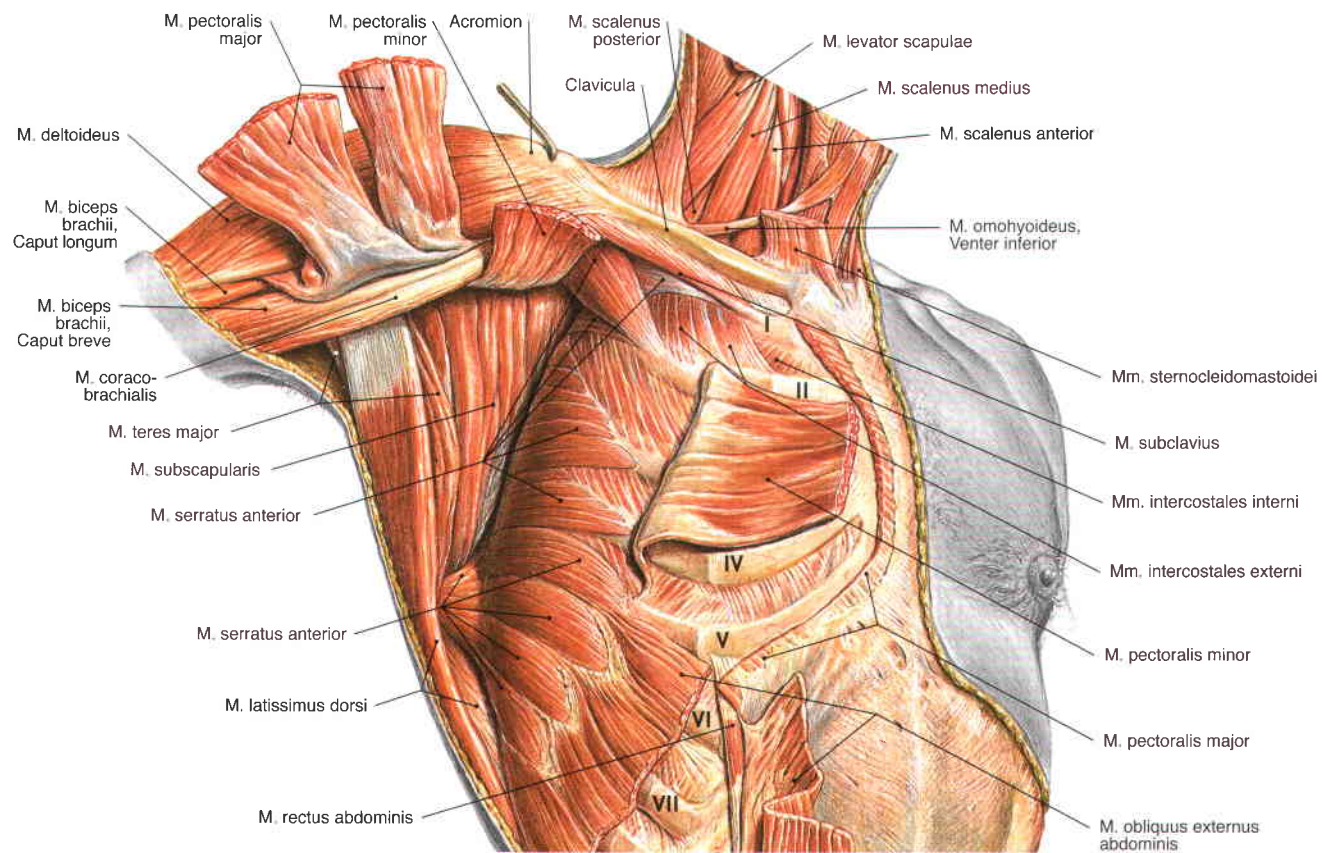
Muscles of the upper limb

Fig. 333 Muscles of the upper limb, the thorax and the inferior region of the neck.

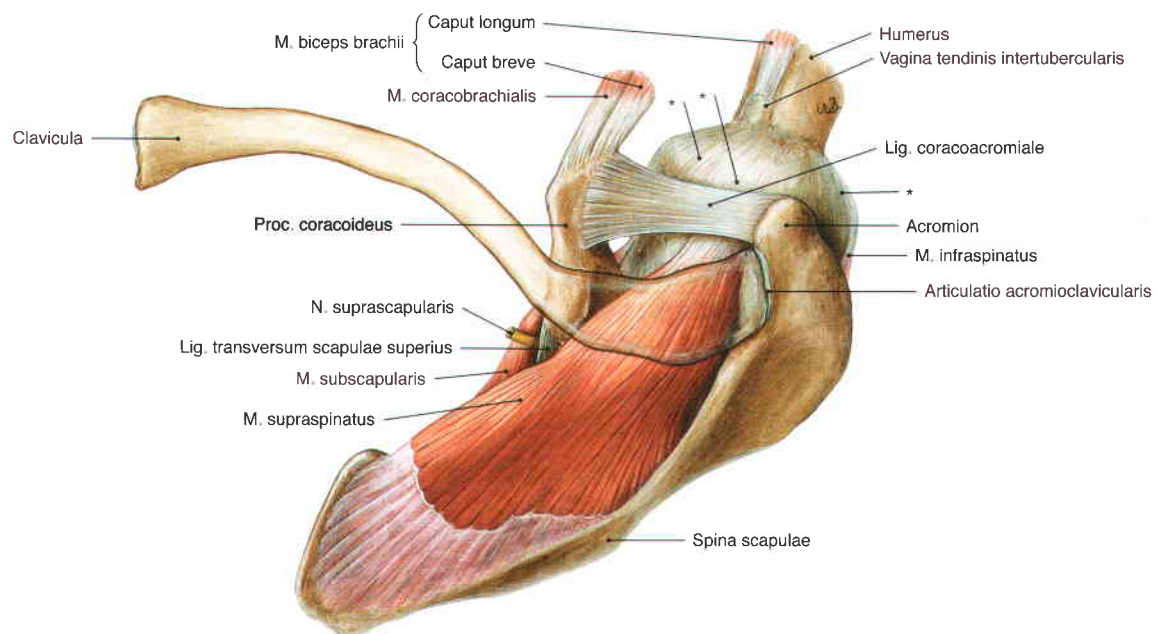
Muscles of the upper limb

Muscles of the upper limb**Fig. 335** Muscles of the extensor aspect of the upper limb.

Muscles of the shoulder

→ 204, 838, 839

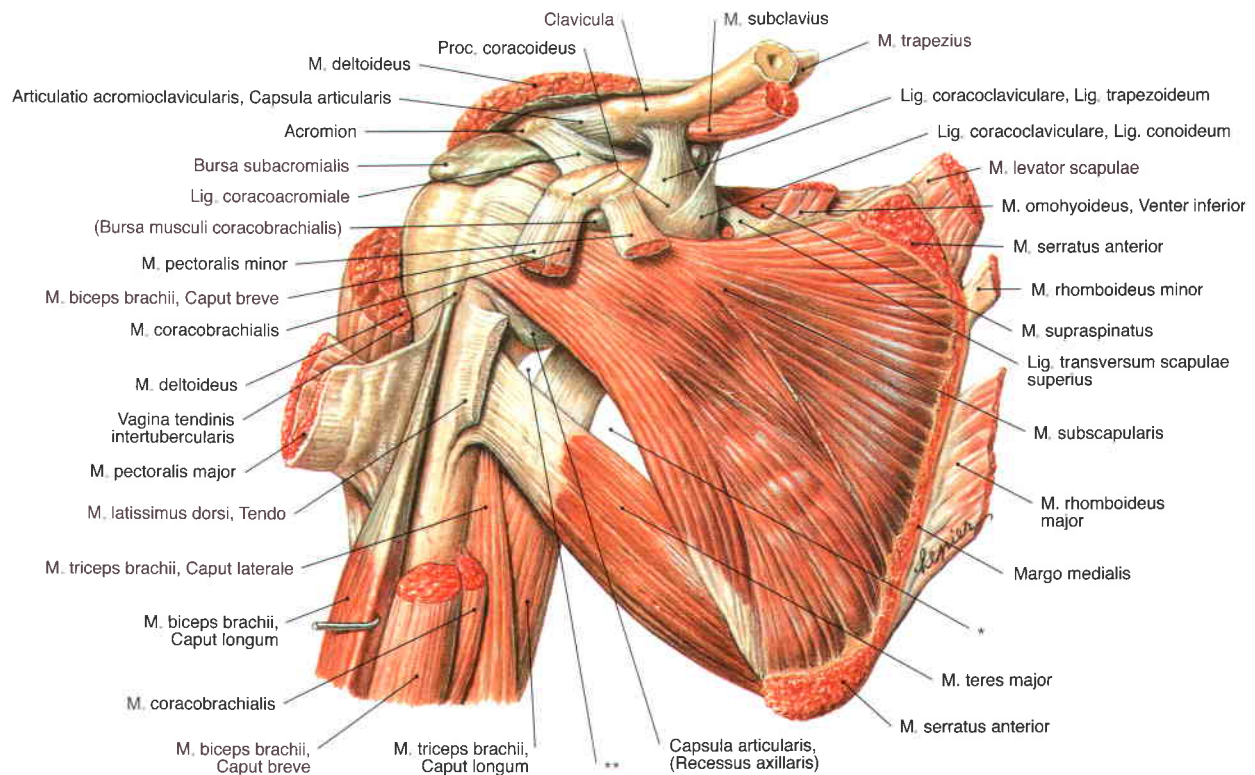
Fig. 336 Muscles of the arm, the thorax and the inferior region of the neck.
I, II, IV-VII indicate the corresponding ribs.



→ T 27

Fig. 337 Shoulder and muscles of the shoulder.
Together, the muscle tendons marked with * form the so-called rotator cuff.

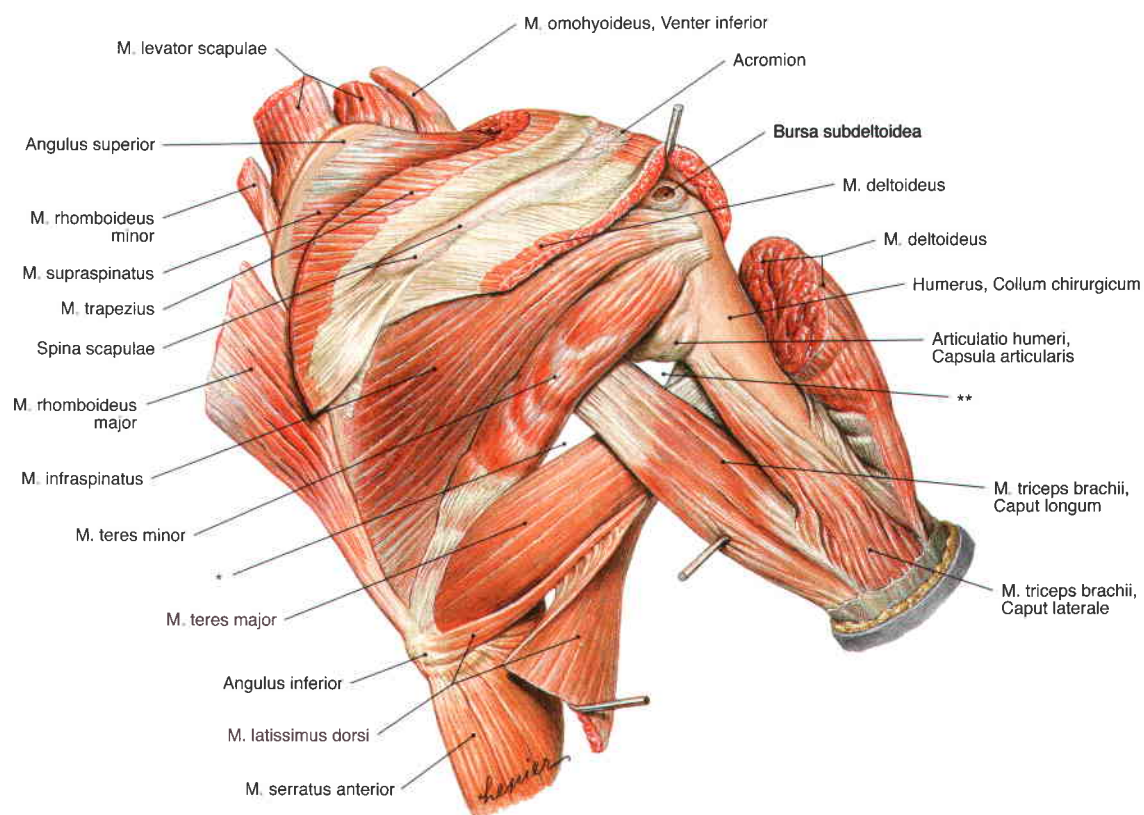
Muscles of the shoulder

**Fig. 338** Shoulder and muscles of the shoulder.

* Triangular space, Spatium axillare mediale

** Quadrangular space, Spatium axillare laterale

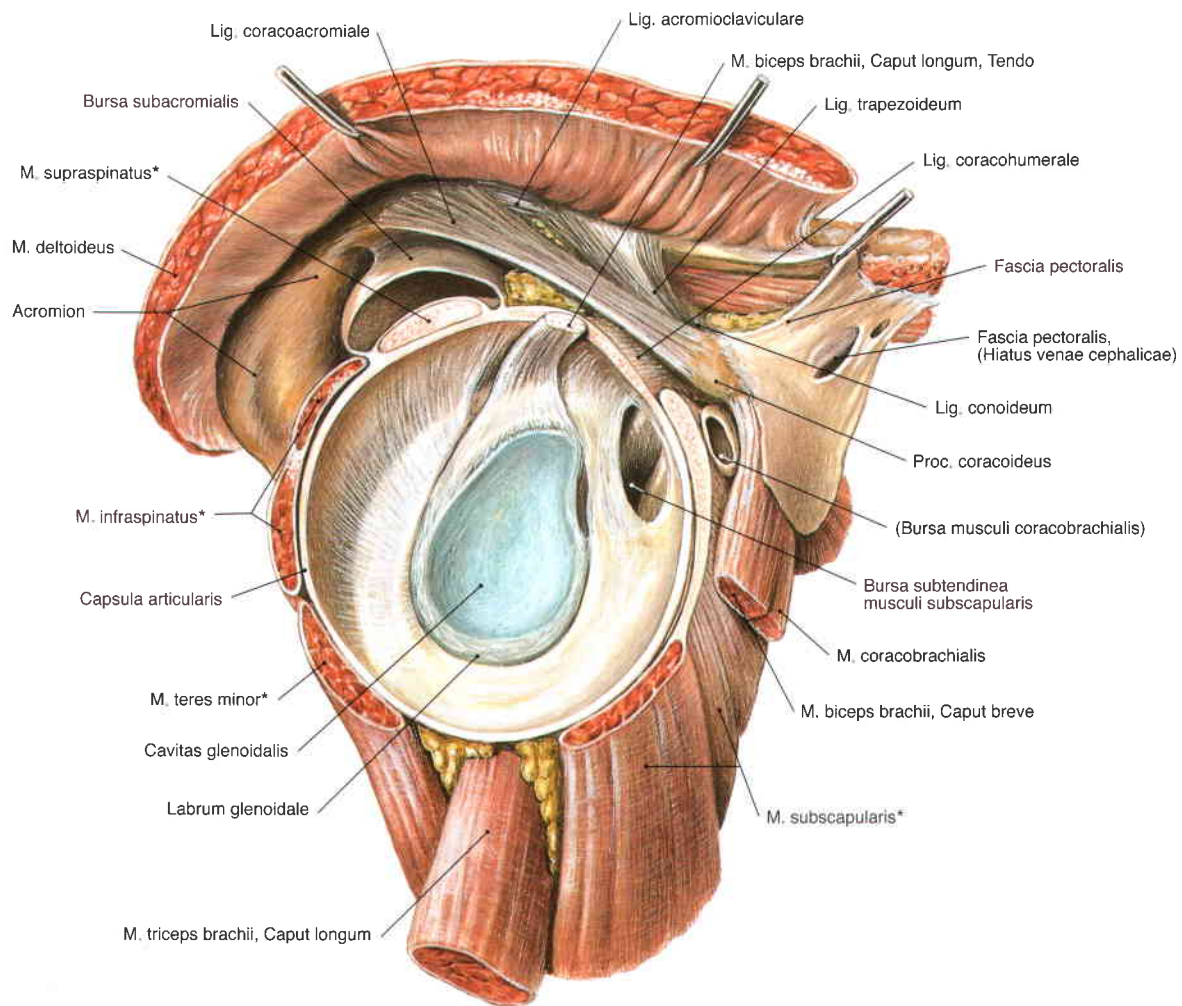
→ T26

**Fig. 339** Shoulder and muscles of the shoulder.

* Triangular space, Spatium axillare mediale

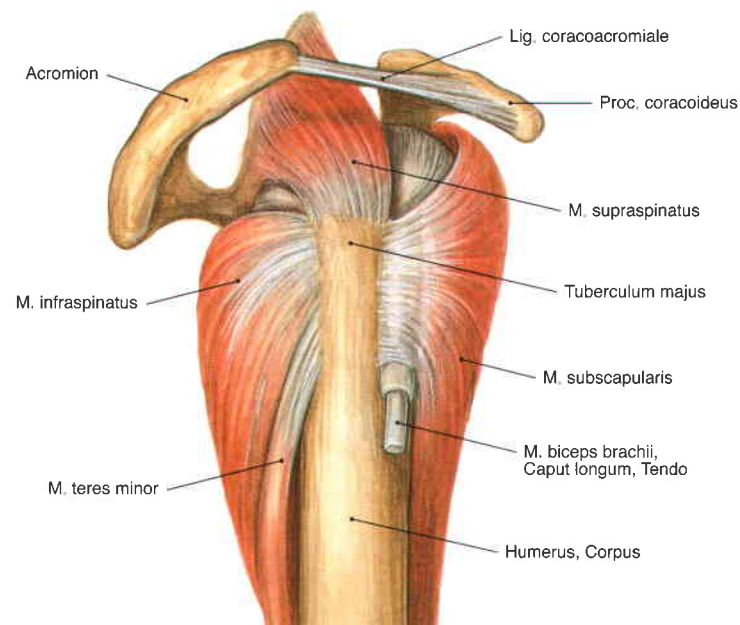
** Quadrangular space, Spatium axillare laterale

→ T28

Muscles of the shoulder

→ T 26–T 28

Fig. 340 Shoulder joint, *Articulatio humeri*; lateral view. Together, the muscle tendons marked with * form the so-called rotator cuff.



→ T 26–T 28

Fig. 341 Muscles of the so-called rotator cuff; lateral view.

Muscles of the arm

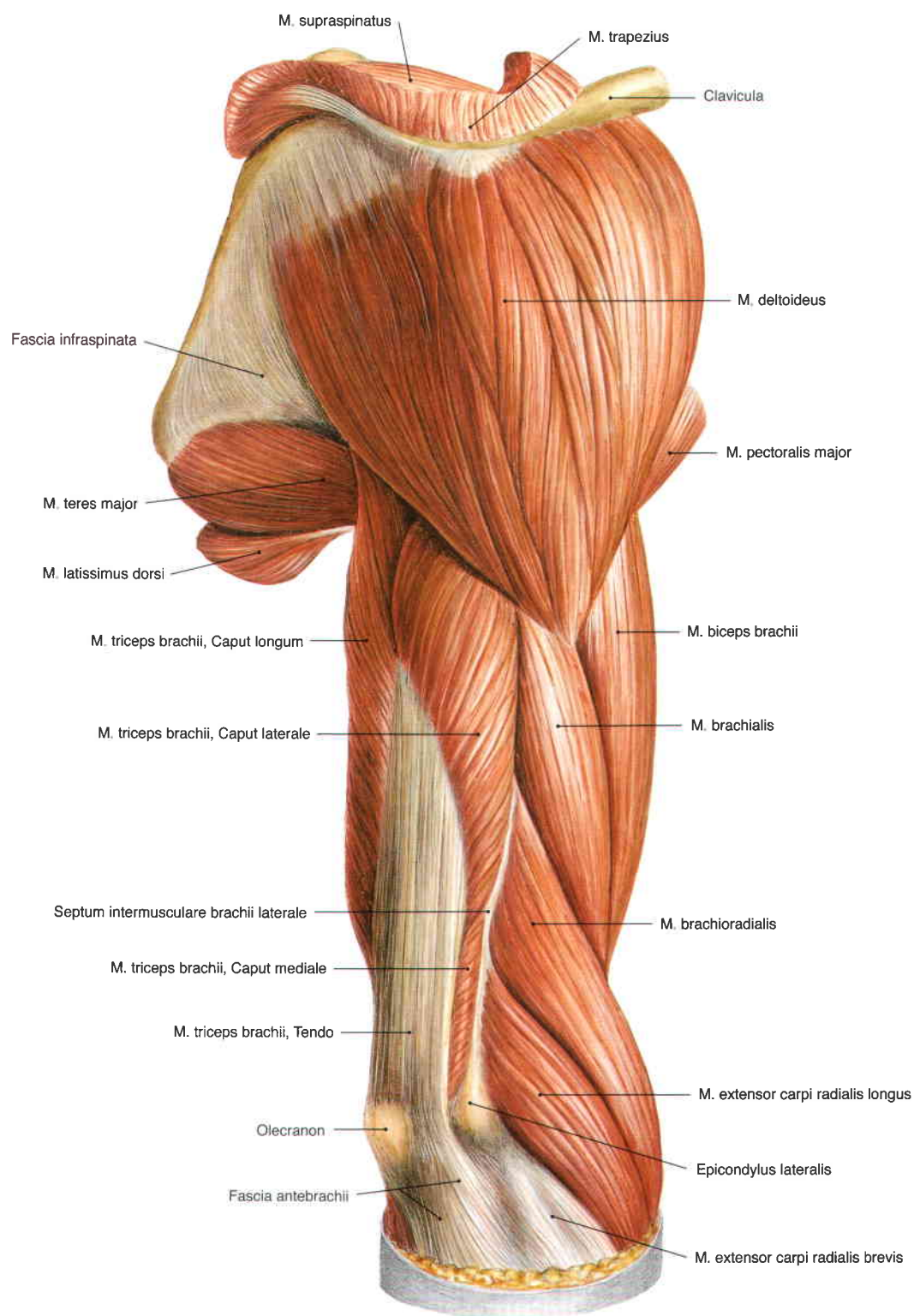
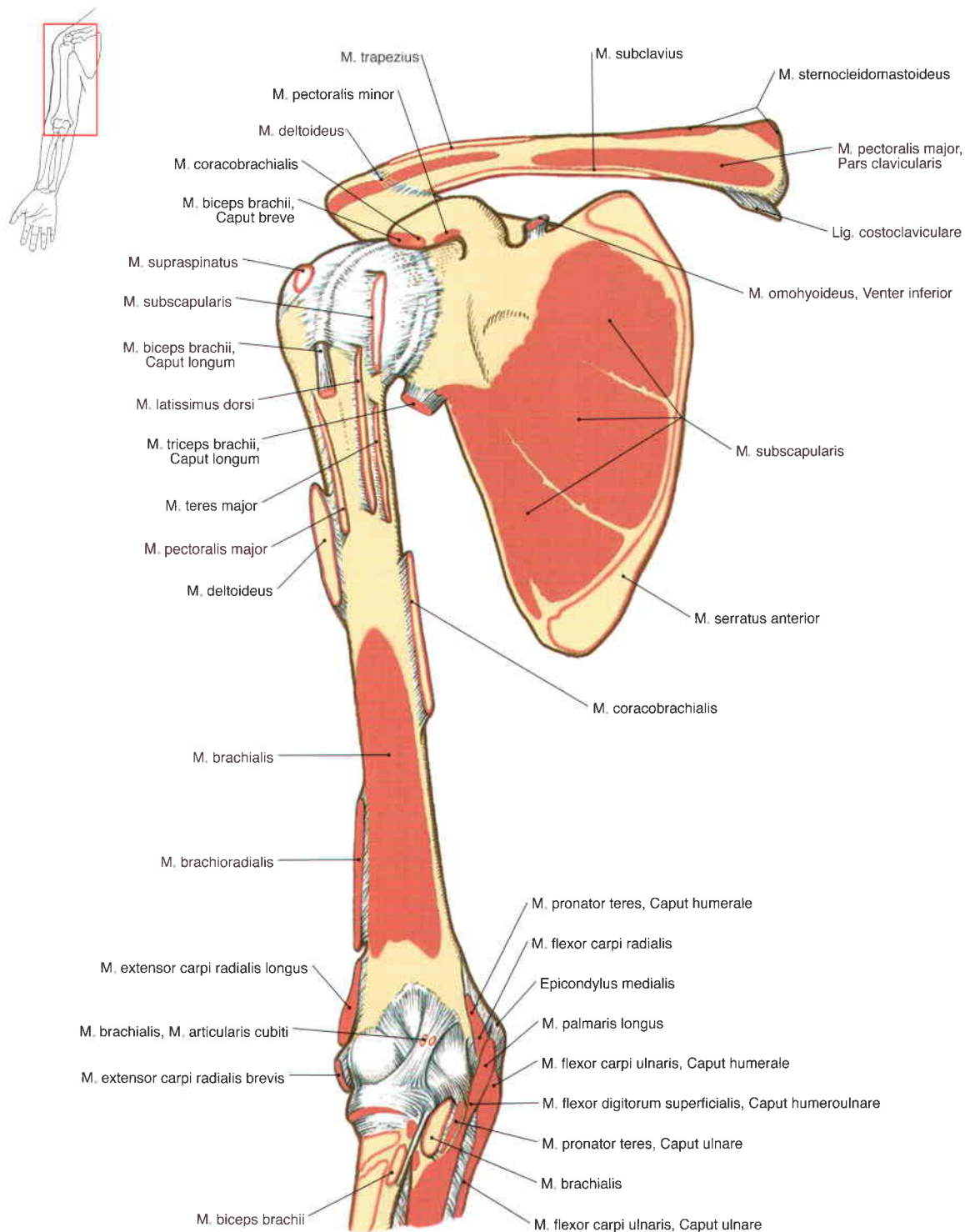


Fig. 342 Muscles of the arm; superficial layer; dorsolateral view.

→ T 27, T 30

Origins and insertions of the muscles of the shoulder and the arm

→ T 26–T 30

Fig. 343 Origins and insertions of the muscles at the clavicle, Clavicula, the scapula, Scapula, and the humerus, Humerus (as well as ulnar origins of multi-head muscles).

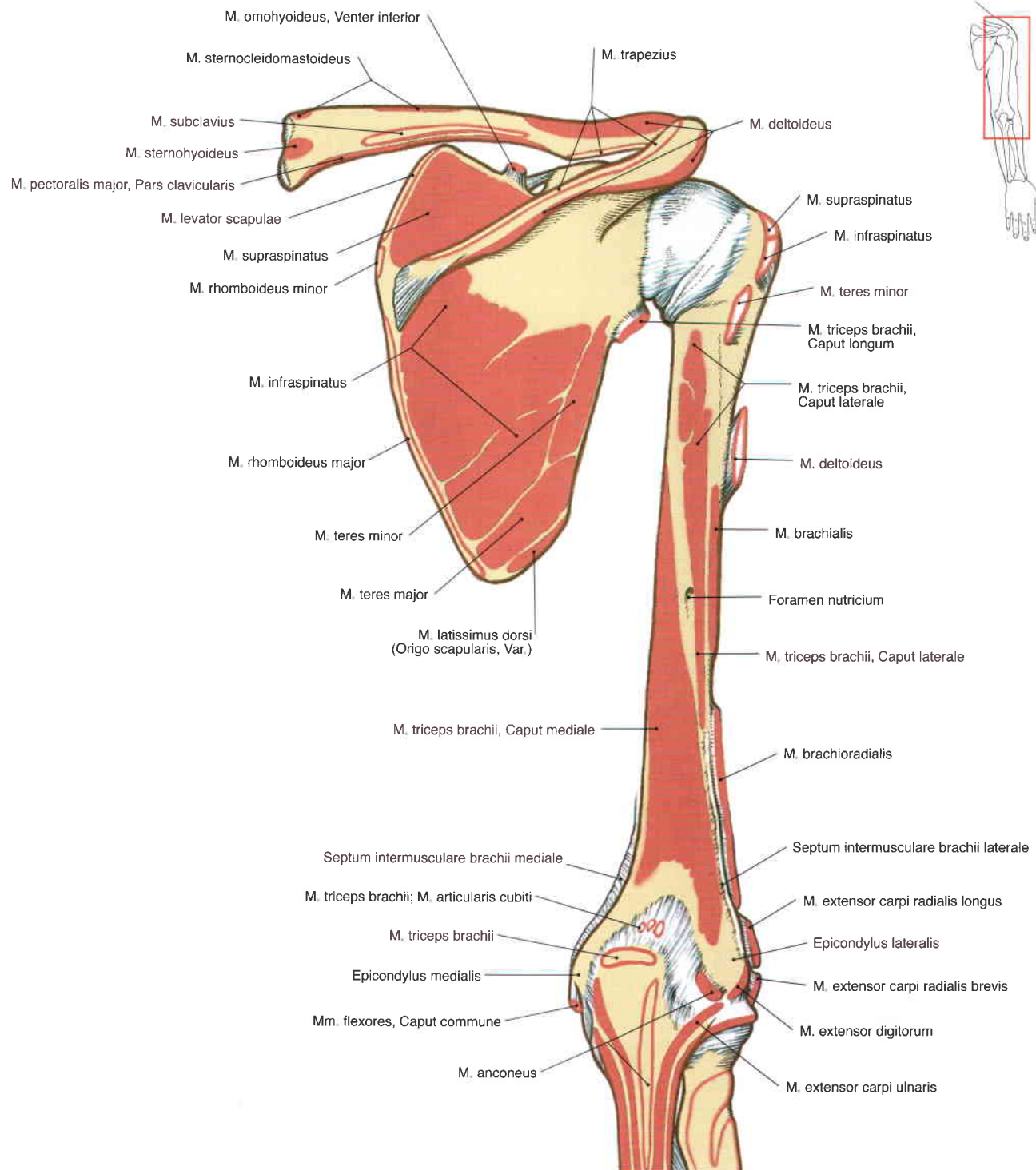
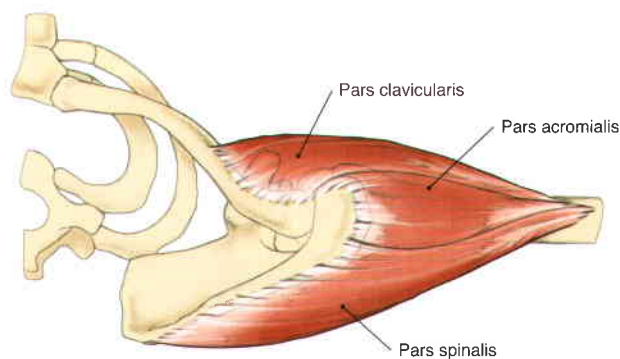
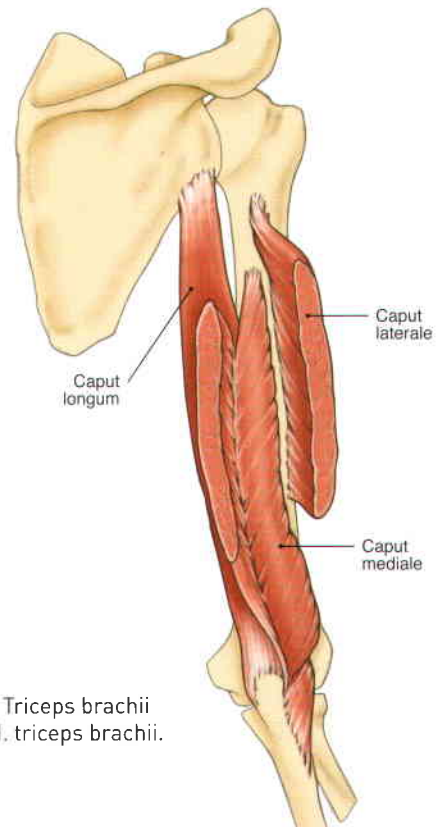
Origins and insertions of the muscles of the shoulder and the arm

Fig. 344 Origins and insertions of the muscles at the clavicle, Clavicula, the scapula, Scapula, and the humerus, Humerus (as well as ulnar origins of multi-head muscles).

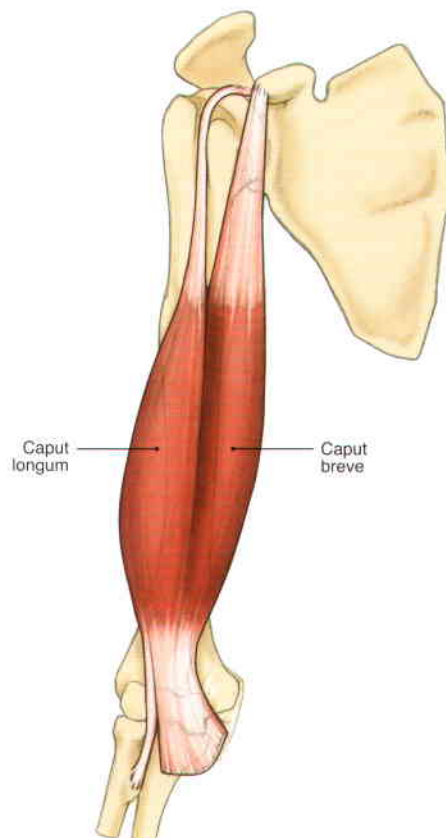
→ T 26–T 30

**Fig. 345** Deltoid muscle, M. deltoideus.

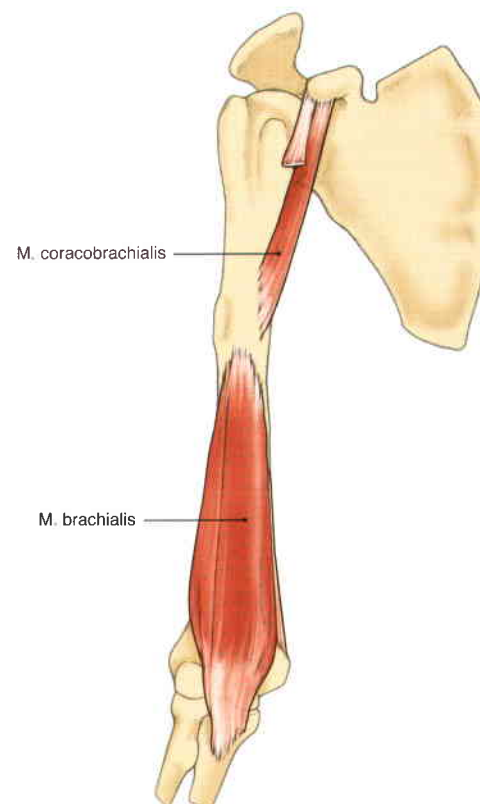
→ T 27

**Fig. 346** Triceps brachii muscle, M. triceps brachii.

→ T 30

**Fig. 347** Biceps brachii muscle, M. biceps brachii.

→ T 29

**Fig. 348** Brachial and coracobrachial muscles, Mm. brachialis et coracobrachialis.

→ T 29

Muscles of the arm

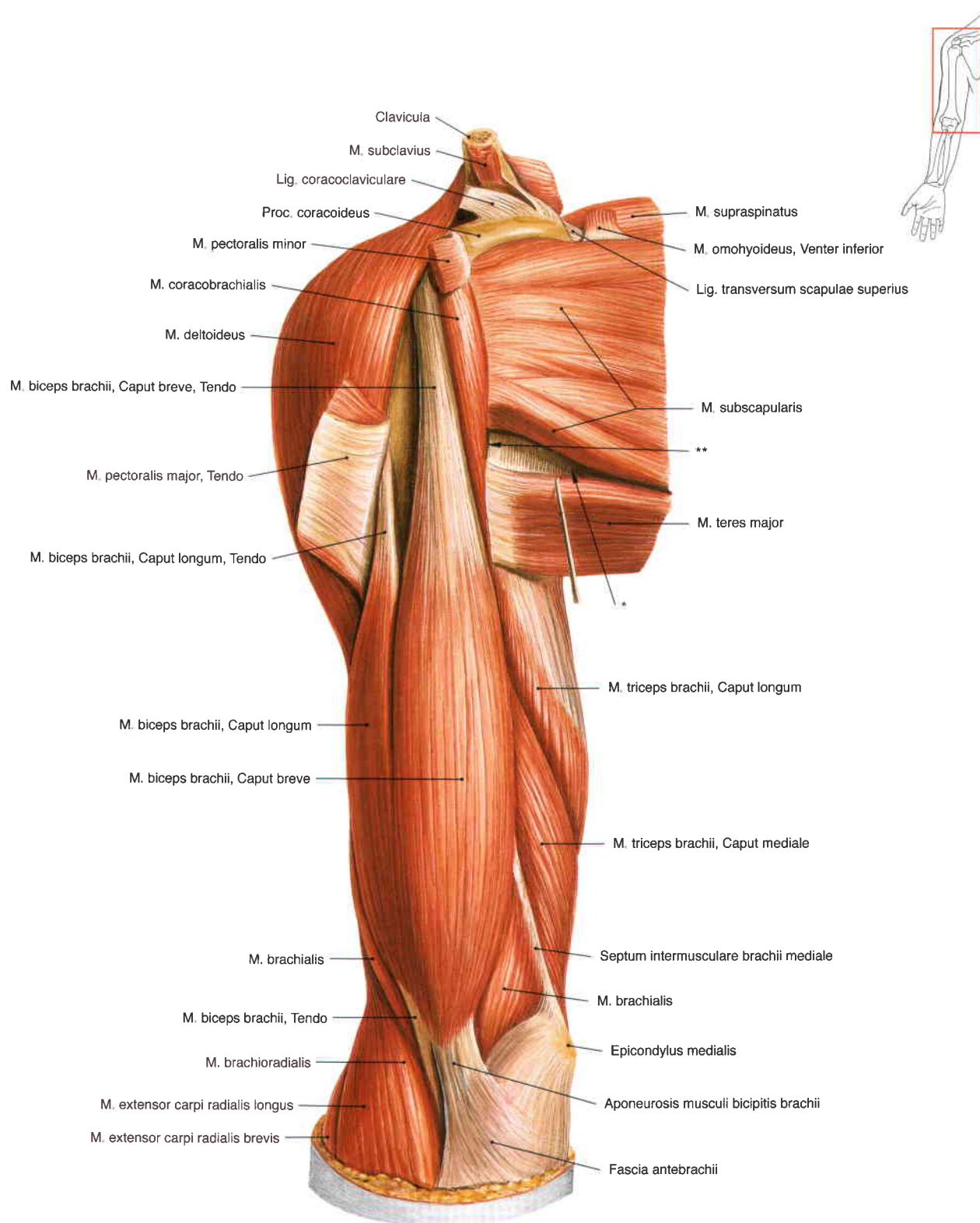
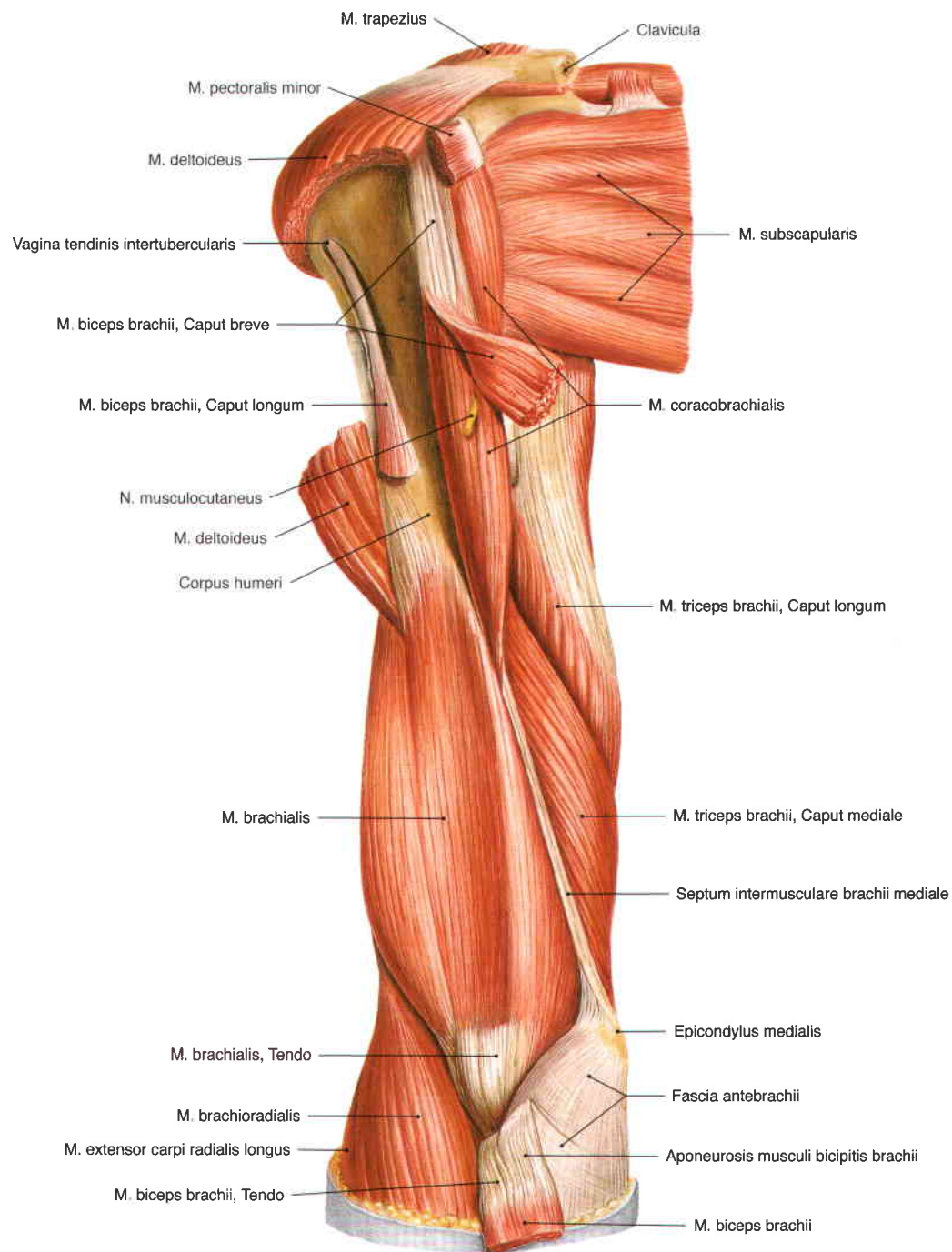
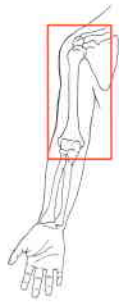


Fig. 349 Muscles of the arm; flexor aspect, superficial layer.

* Triangular space, Spatium axillare mediale

** Quadrangular space, Spatium axillare laterale

Muscles of the arm

Muscles of the arm

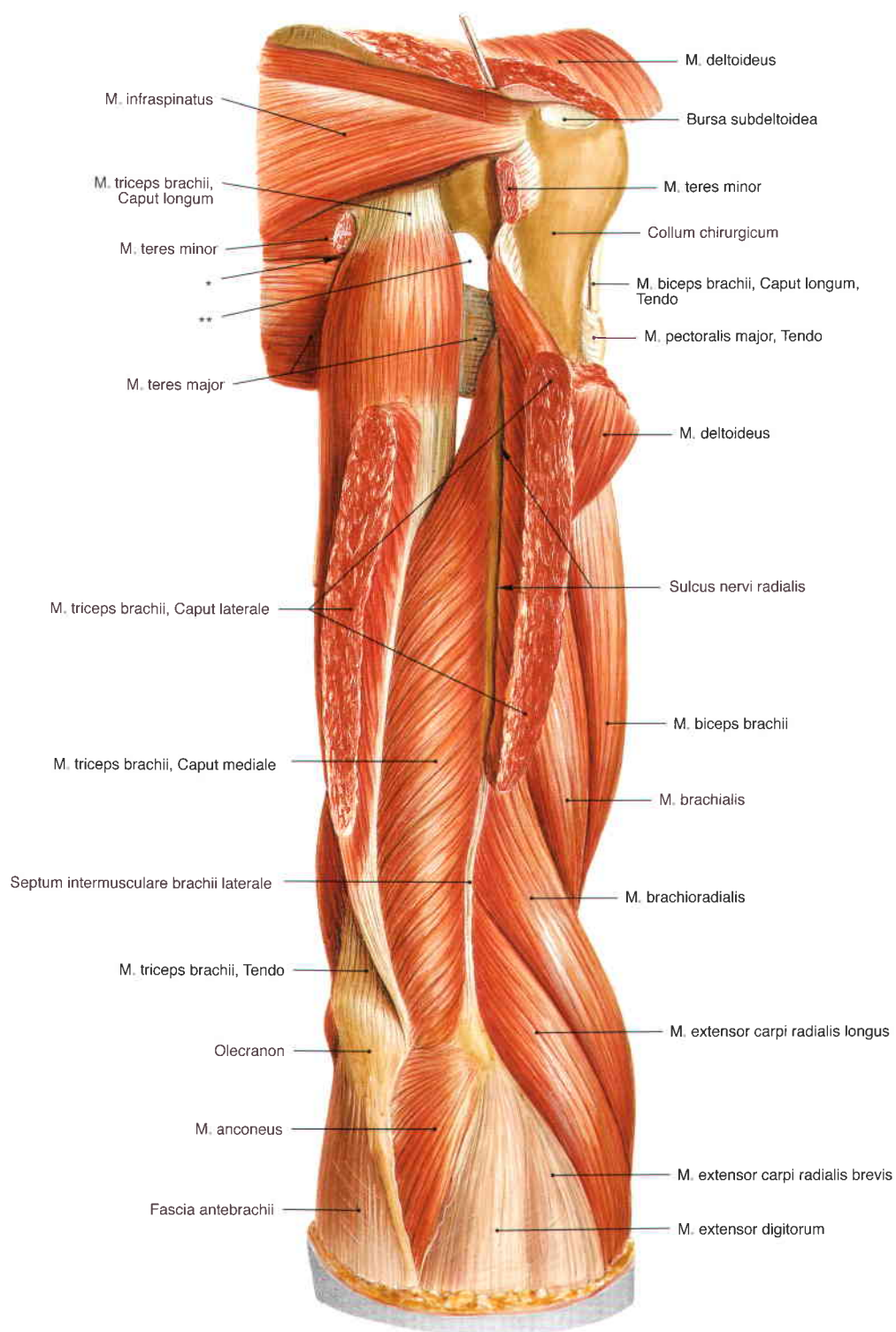
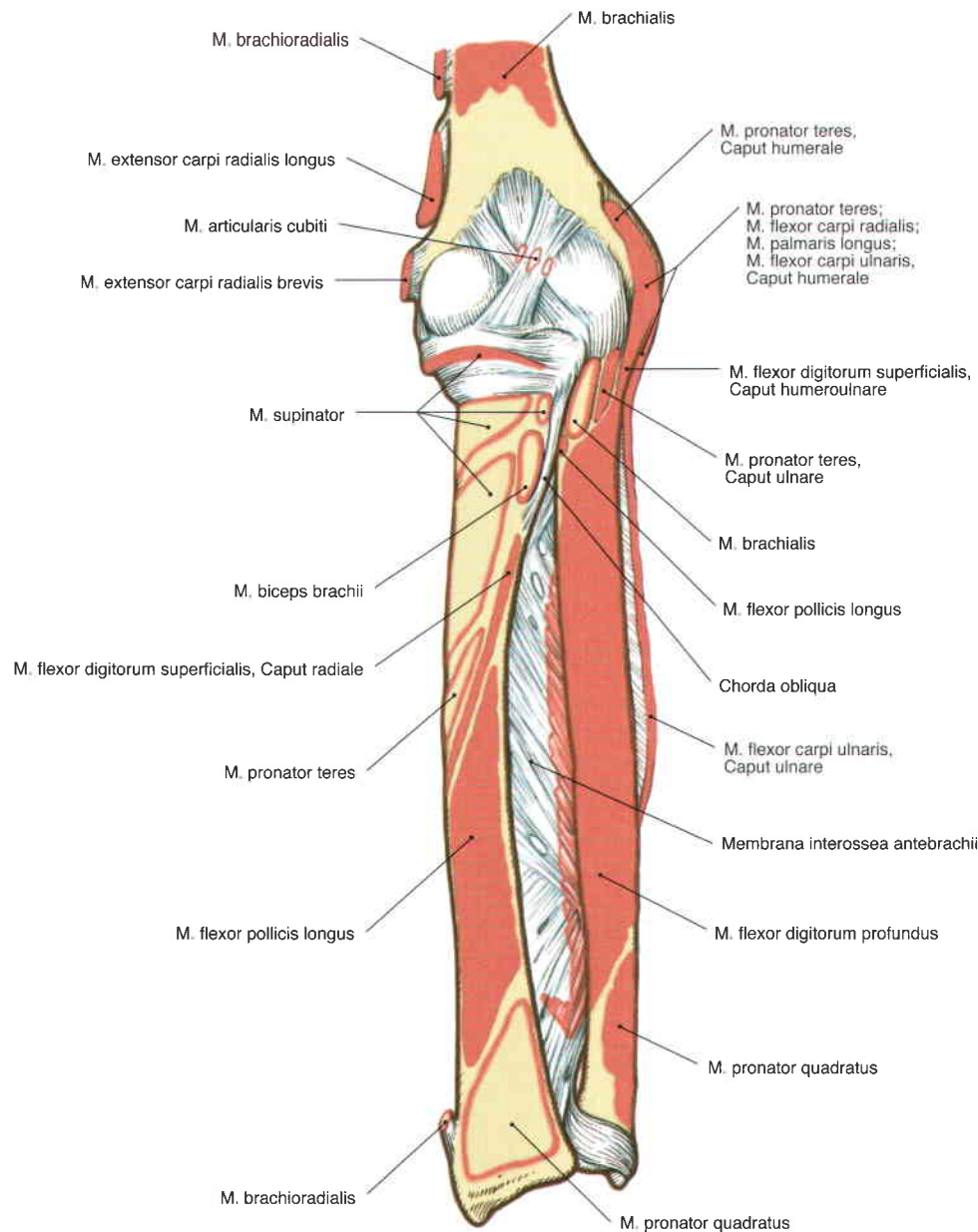
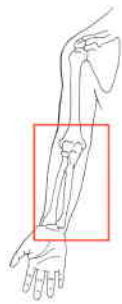


Fig. 351 Muscles of the arm;
extensor aspect, deep layer.

* Triangular space, Spatium axillare mediale

** Quadrangular space, Spatium axillare laterale

→ T 30

Origins and insertions of the ventral muscles of the forearm

→ T 31–T 33

Fig. 352 Origins and insertions of the muscles at the radius, Radius, the ulna, Ulna, and the distal part of the humerus, Humerus.

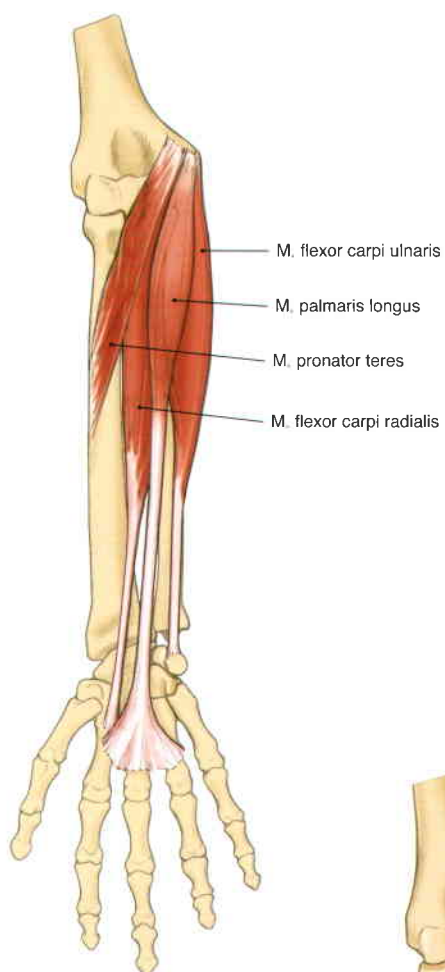


Fig. 353 Ventral muscles of the forearm; superficial layer.

→ T 31

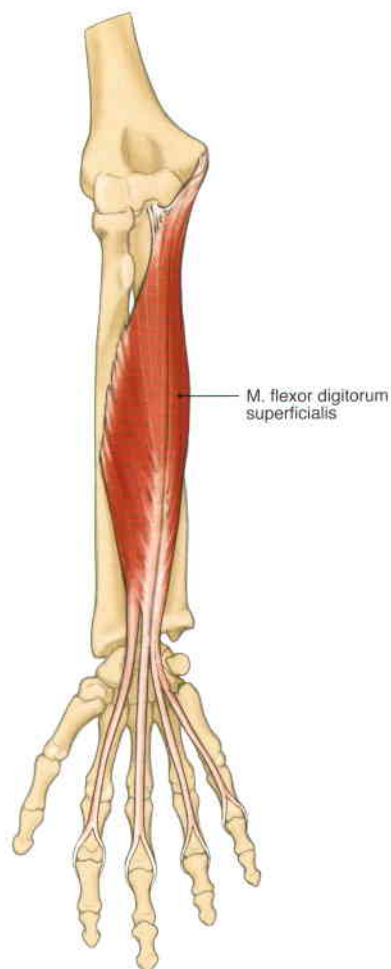


Fig. 354 Ventral muscles of the forearm; middle layer.

→ T 32

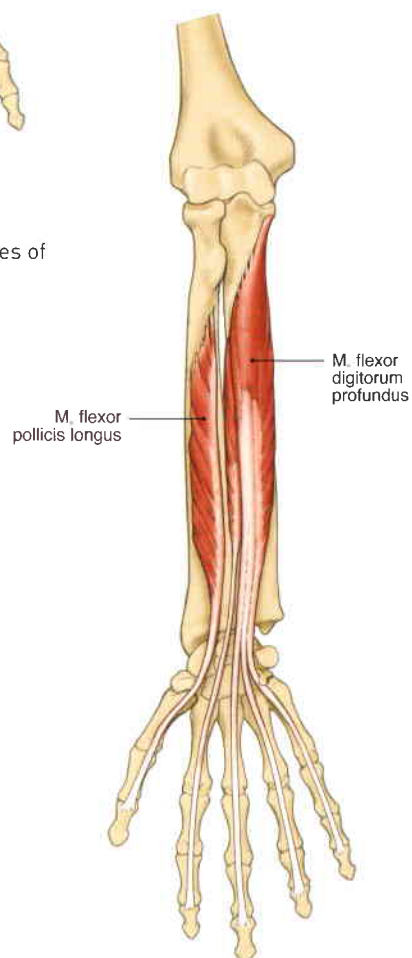


Fig. 355 Ventral muscles of the forearm; deep layer.

→ T 31, T 32

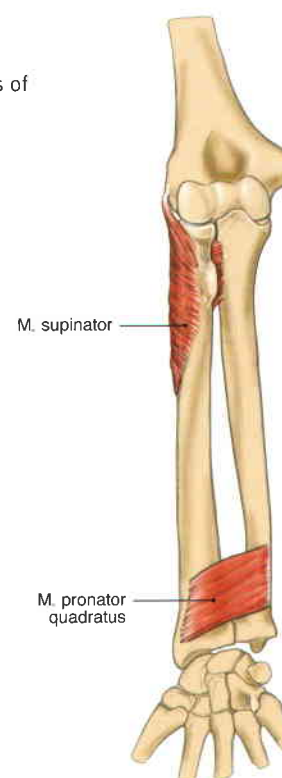
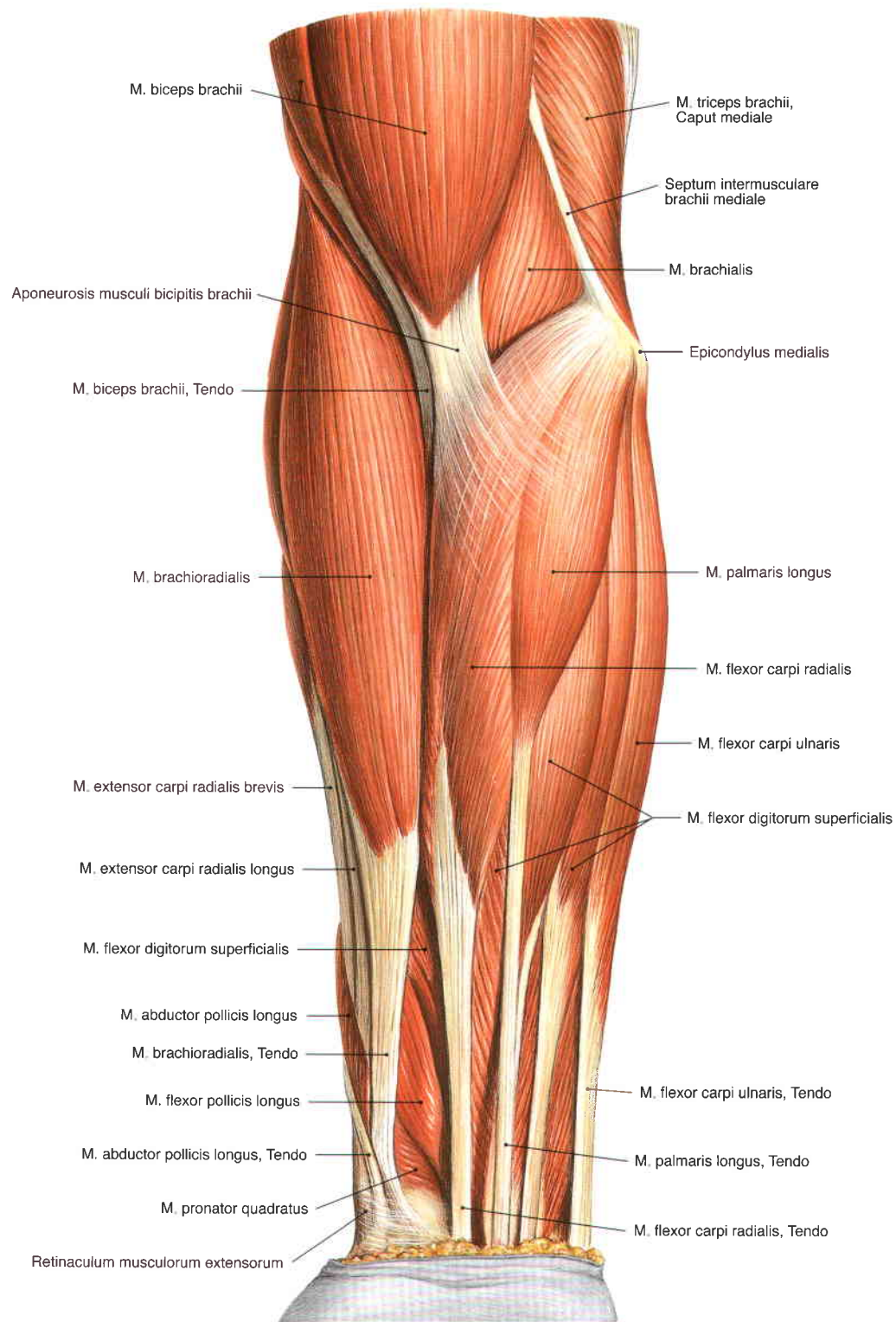
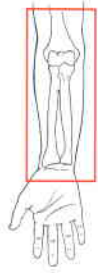


Fig. 356 Ventral muscles of the forearm; deepest layer.

→ T 31, T 35

Muscles of the forearm

→ T 31

Fig. 357 Muscles of the forearm; flexor aspect, superficial layer.

Muscles of the forearm

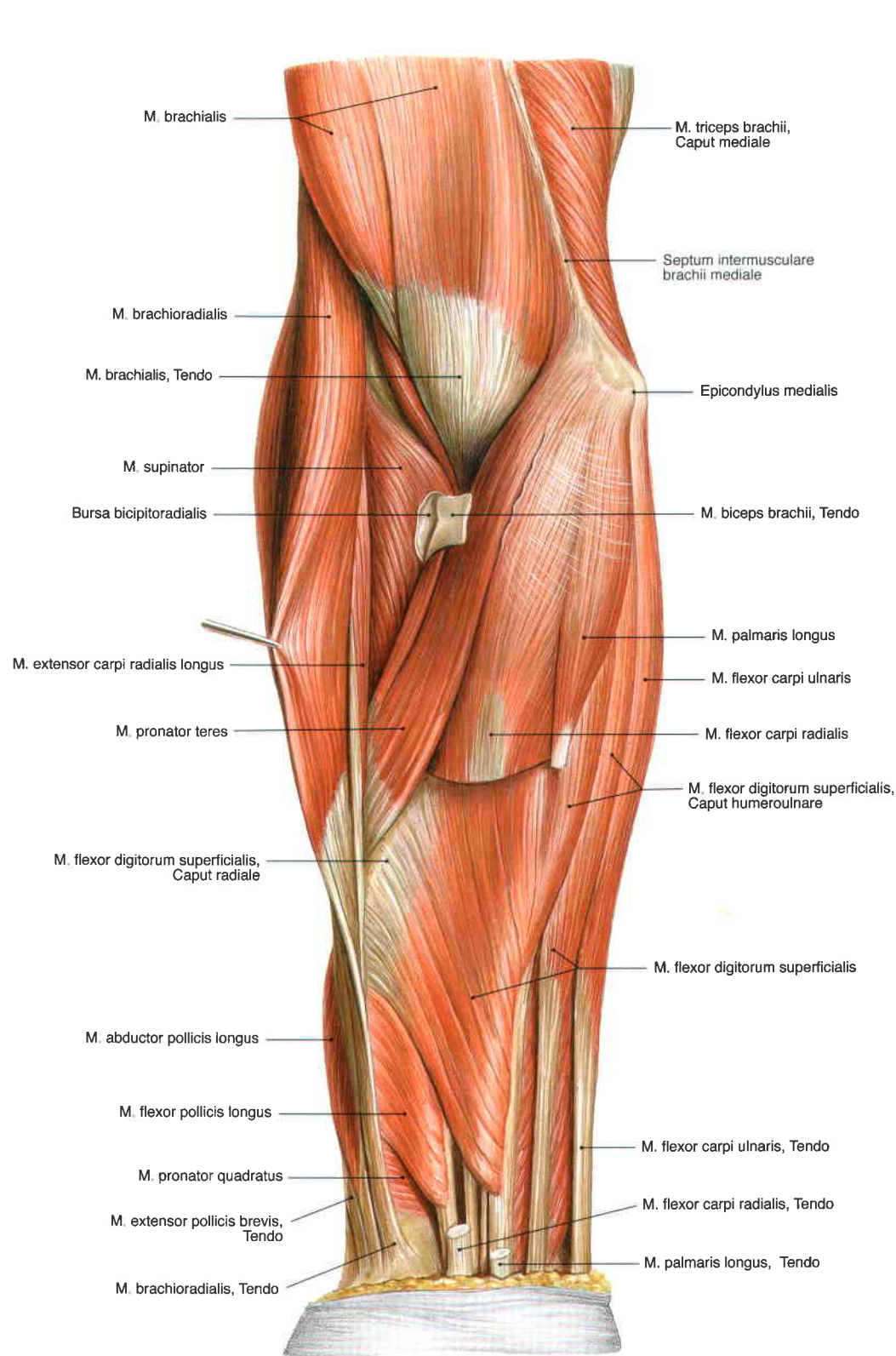
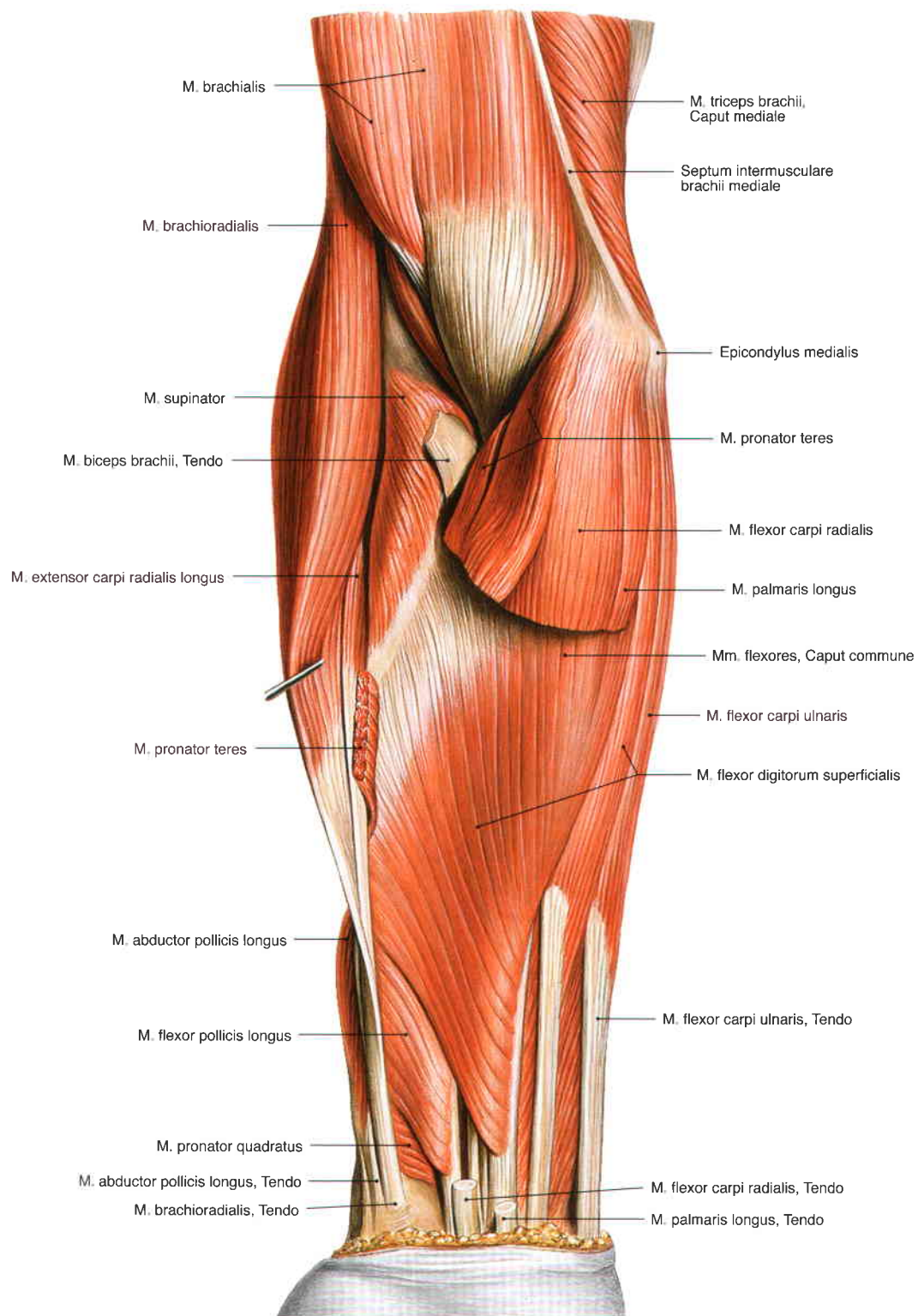
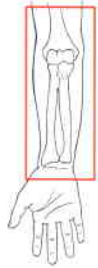


Fig. 358 Muscles of the forearm; flexor aspect, middle layer.

Muscles of the forearm

→ T 31, T 32

Fig. 359 Muscles of the forearm; flexor aspect, middle layer after section of the pronator teres muscle.

Muscles of the forearm

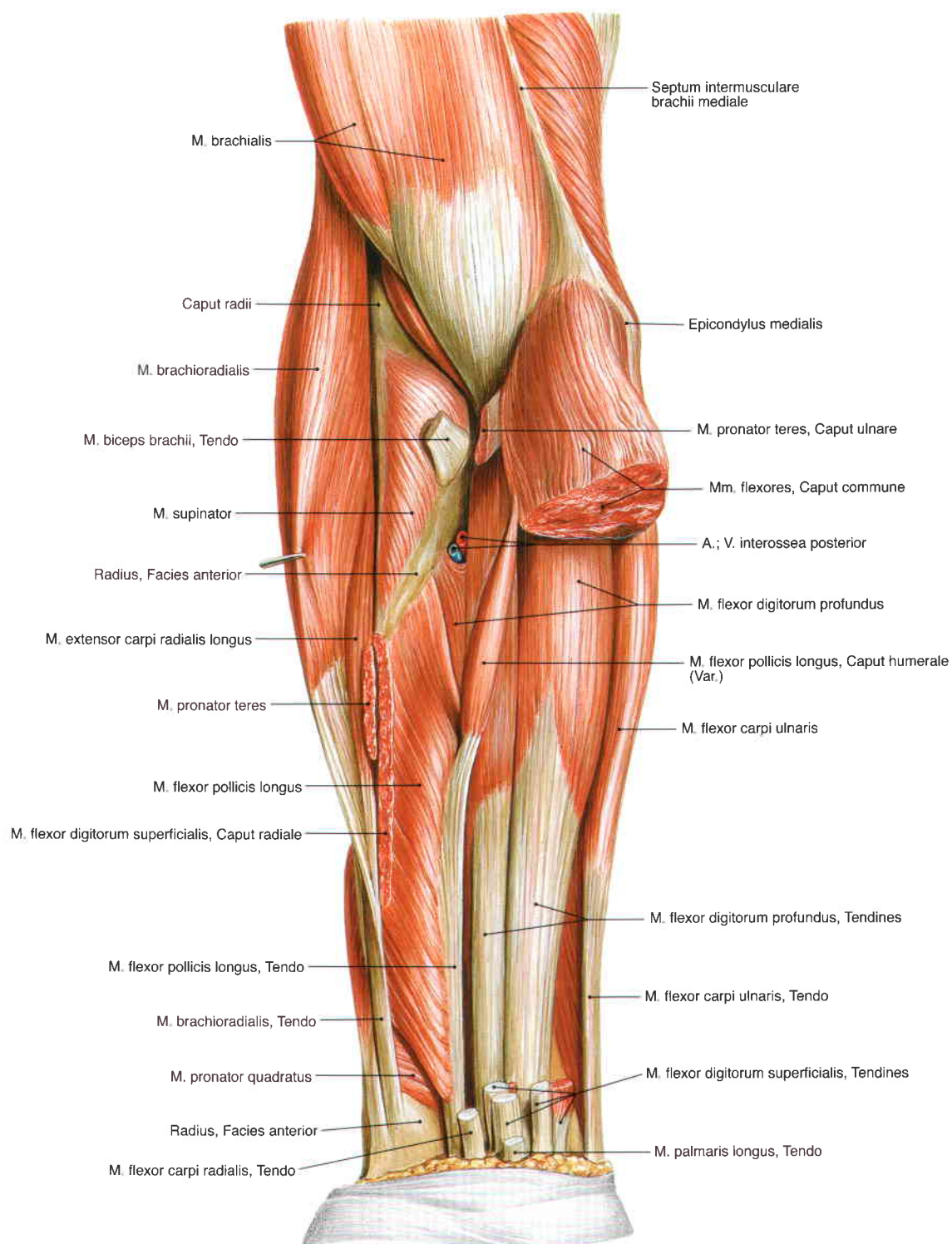
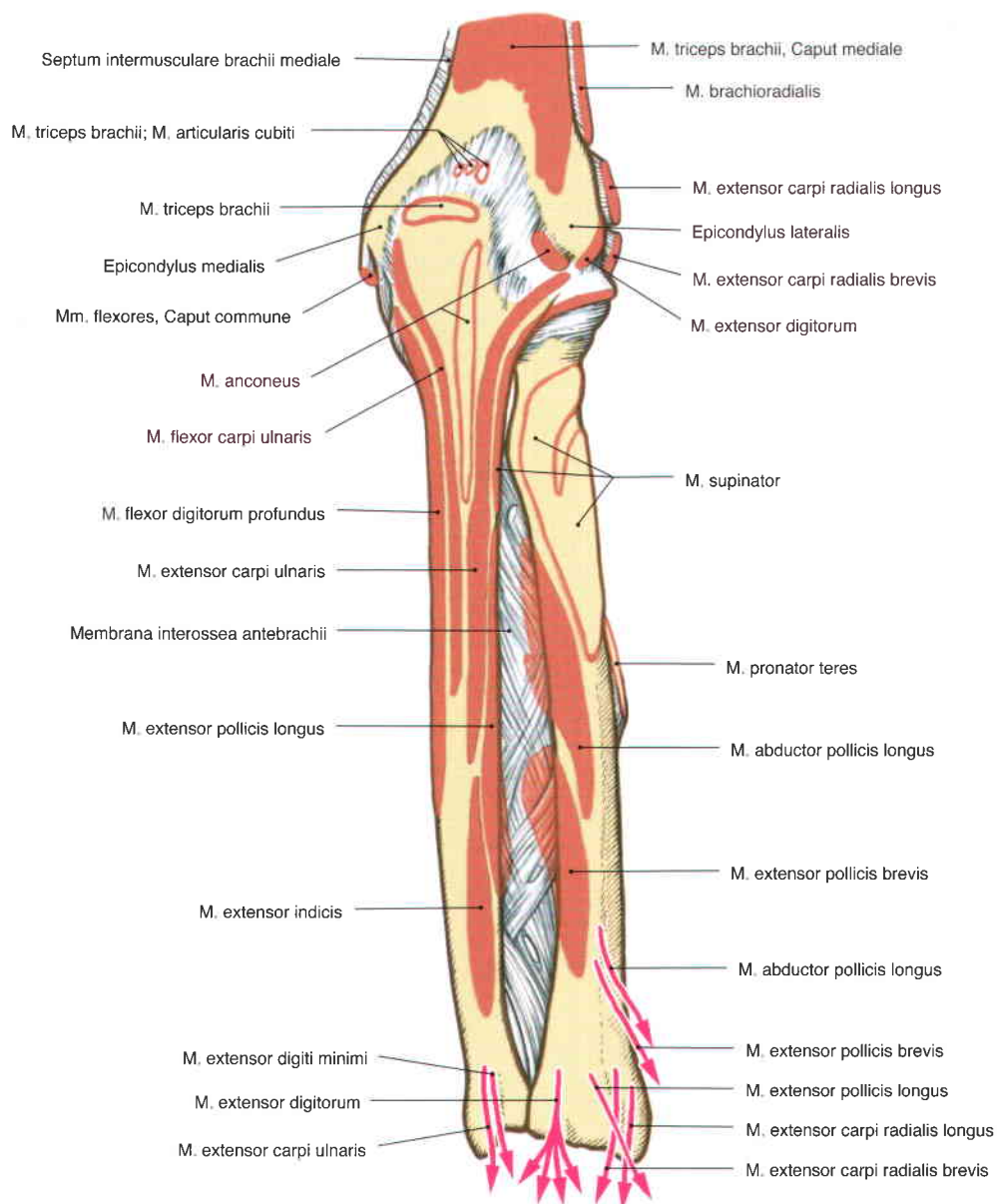
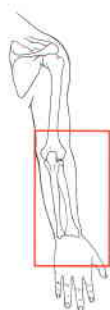


Fig. 360 Muscles of the forearm; flexor aspect, deep layer.

Origins and insertions of the dorsal muscles of the forearm

→ T 34, T 35

Fig. 361 Origins and insertions of the muscles at the radius, Radius, the ulna, Ulna, and the distal part of the humerus, Humerus.

Muscles of the forearm

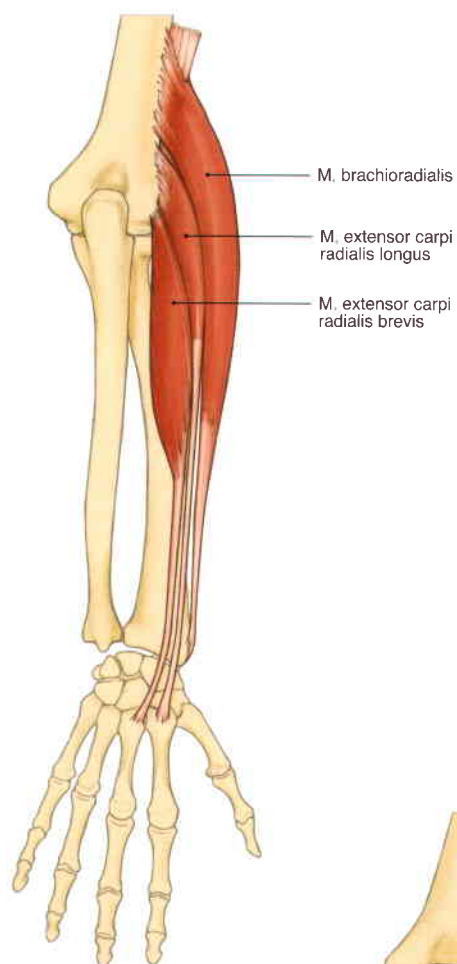


Fig. 362 Radial muscles of the forearm.

→ T 33

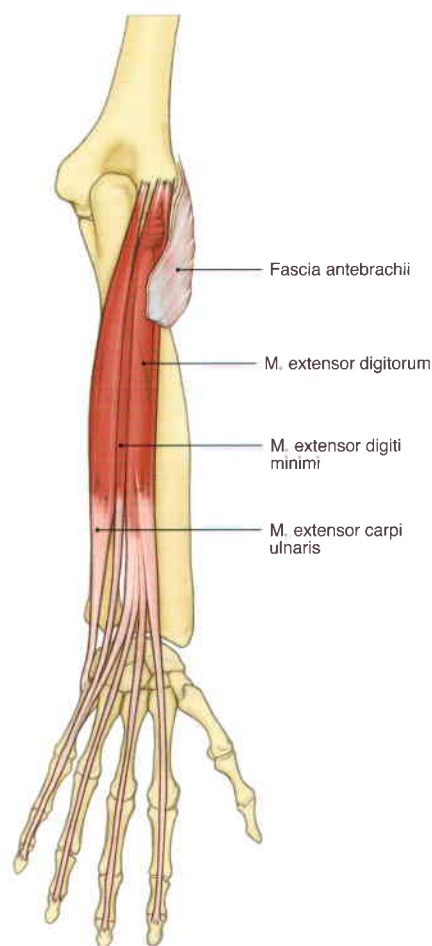


Fig. 363 Dorsal muscles of the forearm; superficial layer.

→ T 34

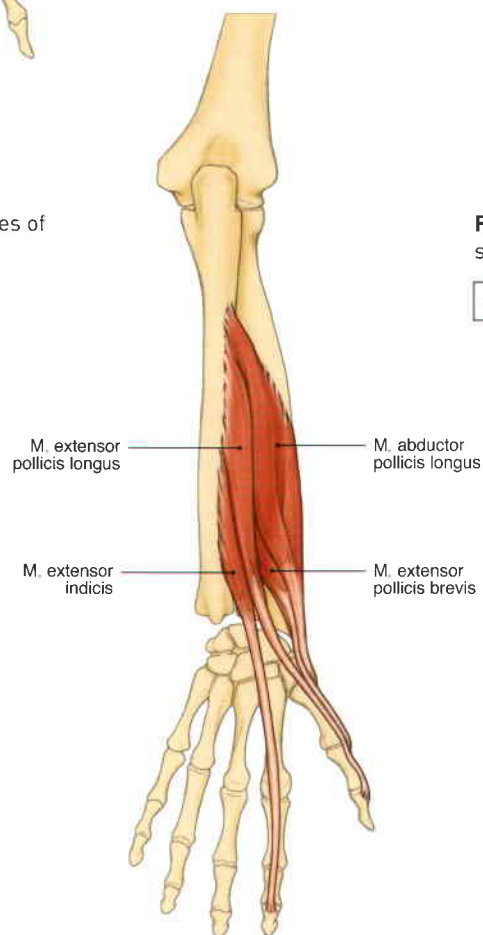


Fig. 364 Dorsal muscles of the forearm; middle layer.

→ T 35

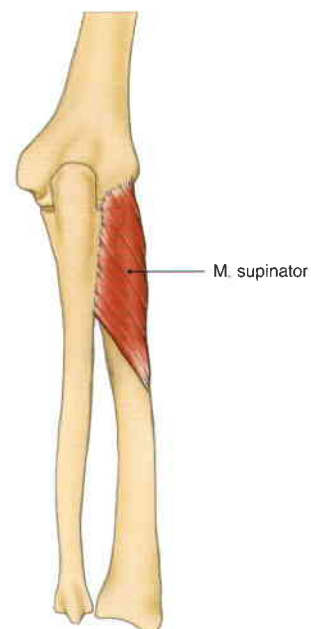
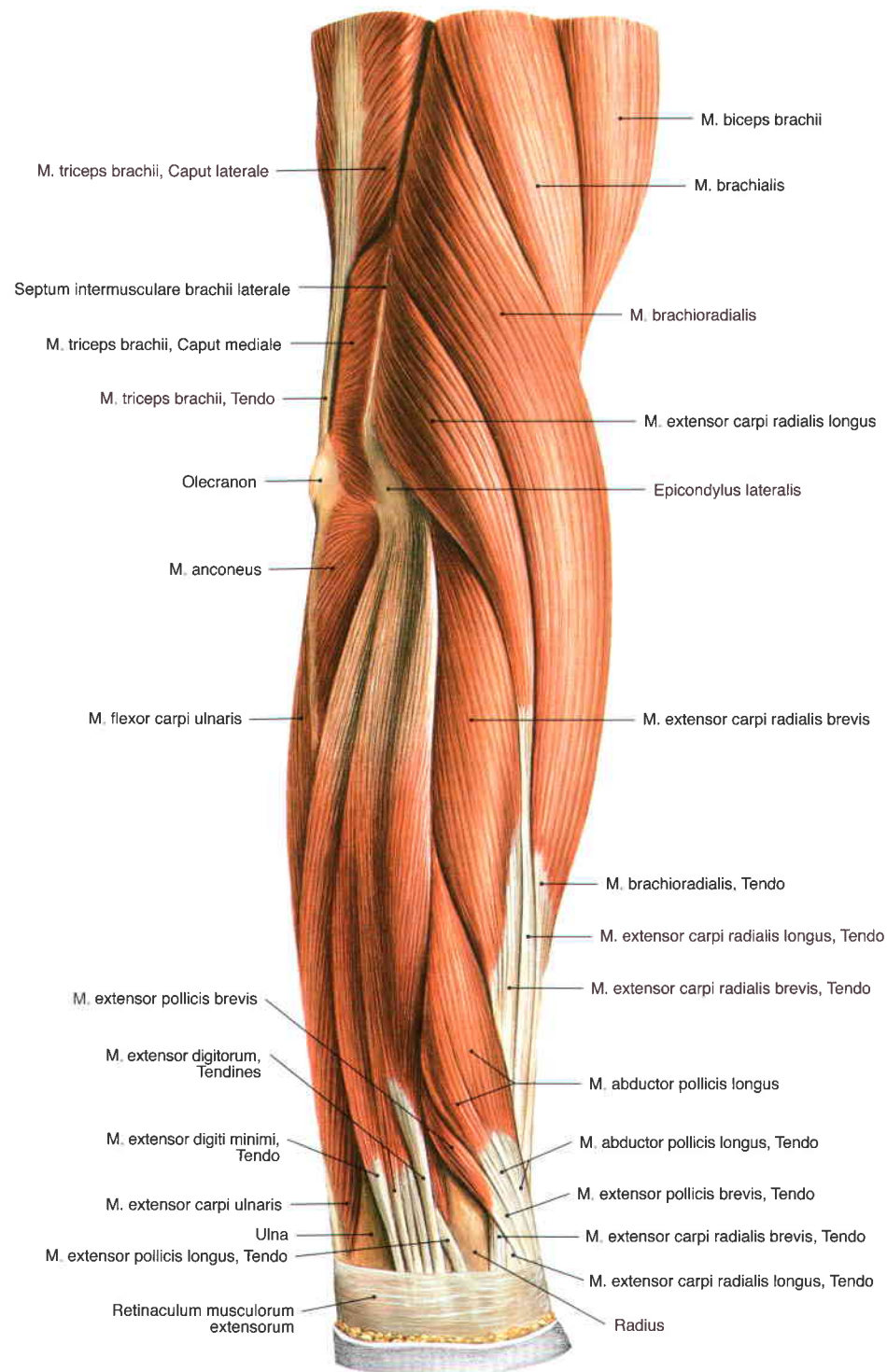


Fig. 365 Dorsal muscles of the forearm; deep layer.

→ T 35

Muscles of the forearm

→ T 33

Fig. 366 Muscles of the forearm and the distal part of the arm; lateral view; intermediate position of the forearm between supination and pronation.

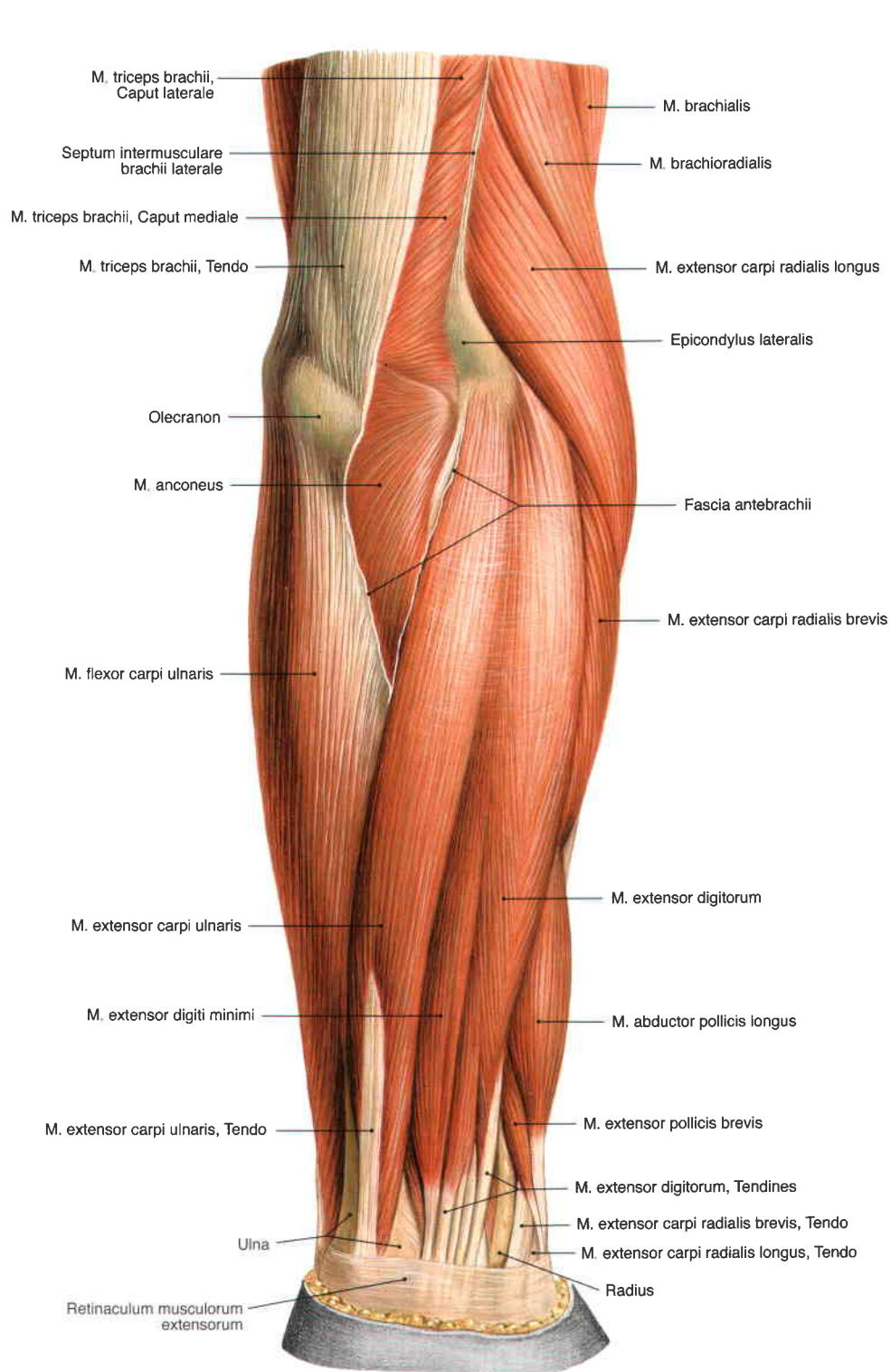
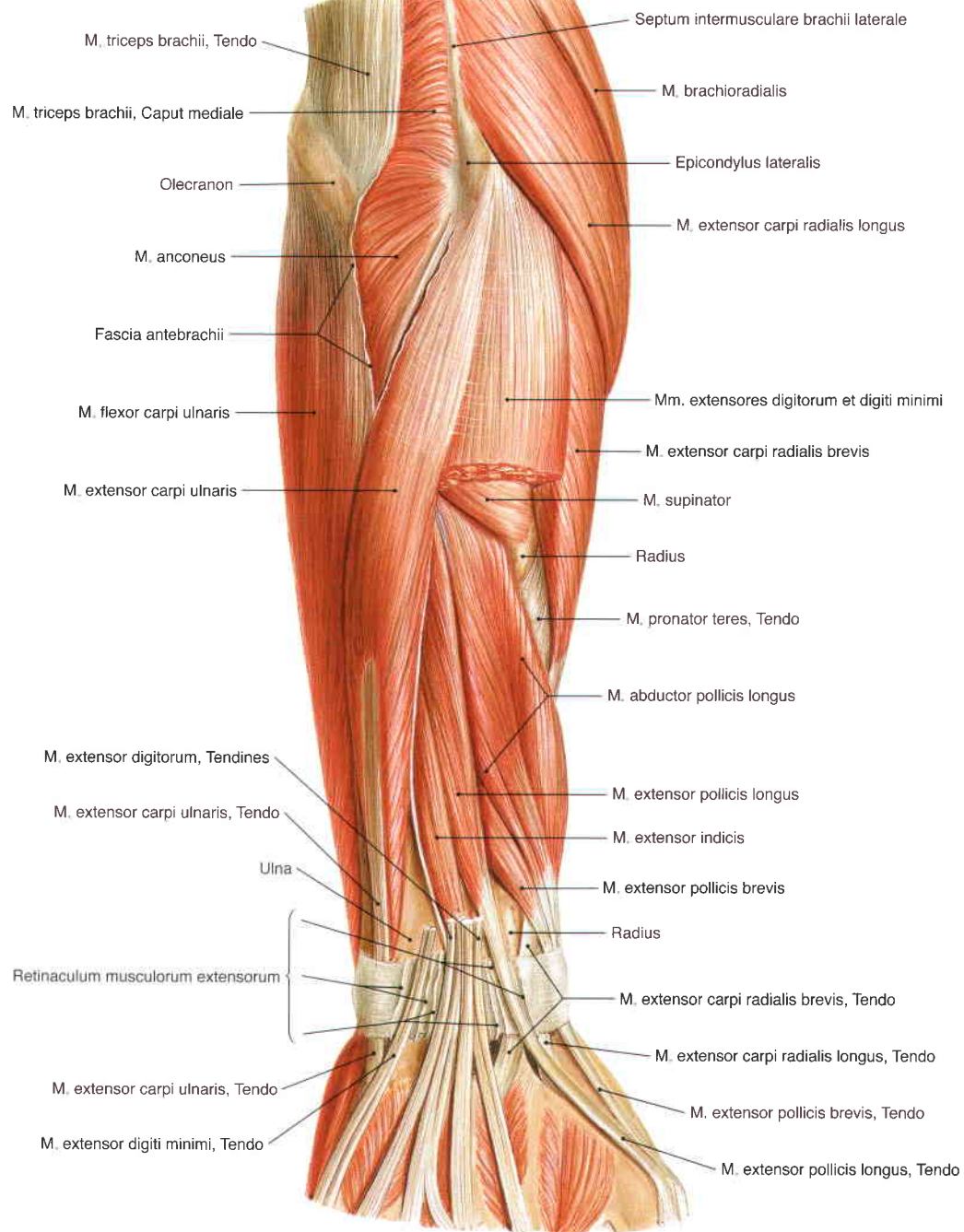
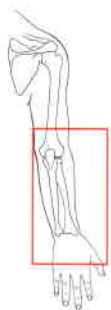
Muscles of the forearm

Fig. 367 Muscles of the forearm and the distal part of the arm; extensor aspect, superficial layer; intermediate position of the forearm between supination and pronation.

Muscles of the forearm

→ T 34, T 35

Fig. 368 Muscles of the forearm; extensor aspect, middle layer; intermediate position of the forearm between supination and pronation.

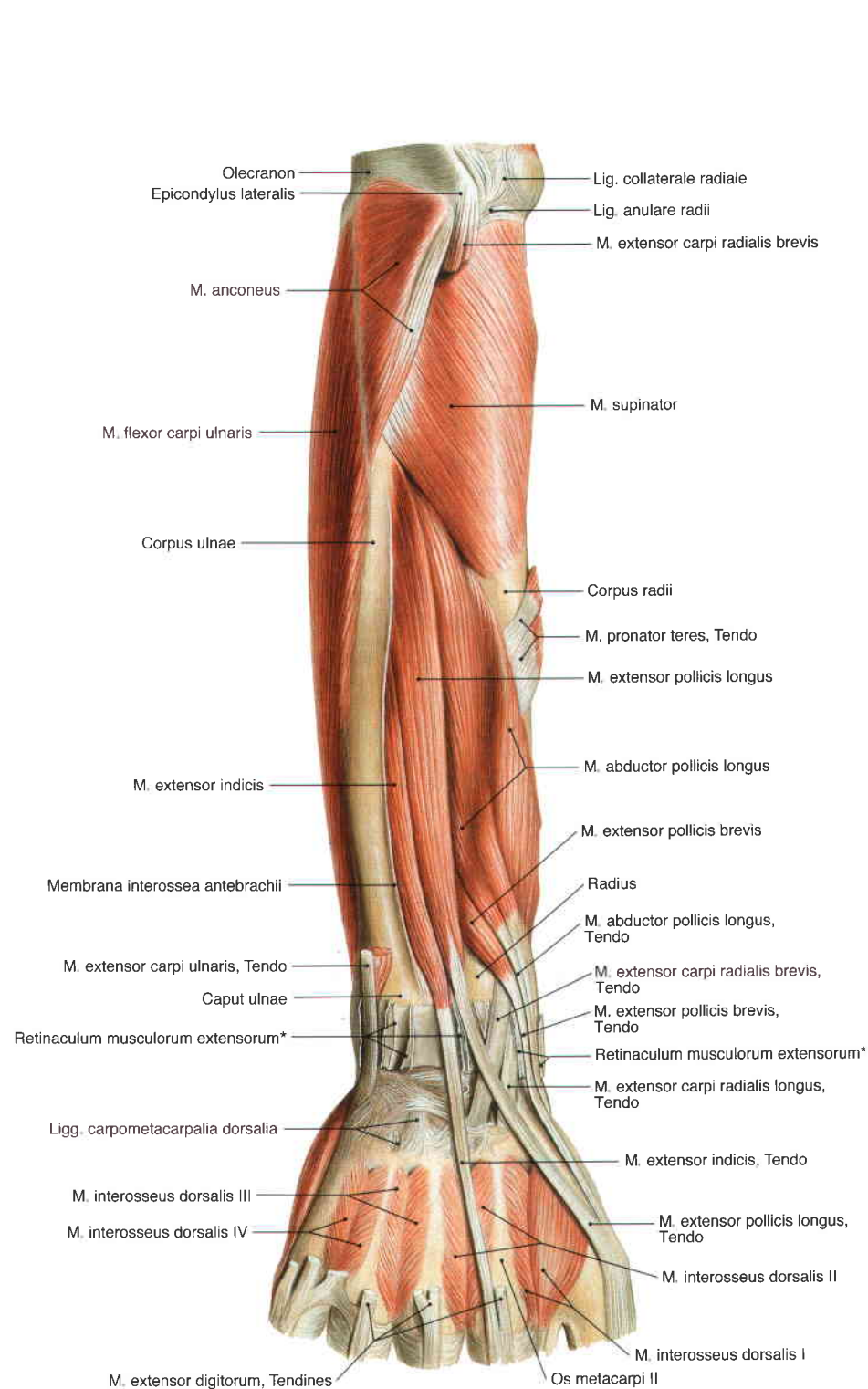


Fig. 369 Muscles of the forearm and the hand; extensor aspect, deep layer; intermediate position of the forearm between supination and pronation.

* The tendon compartments formed by the extensor retinaculum have been opened longitudinally.

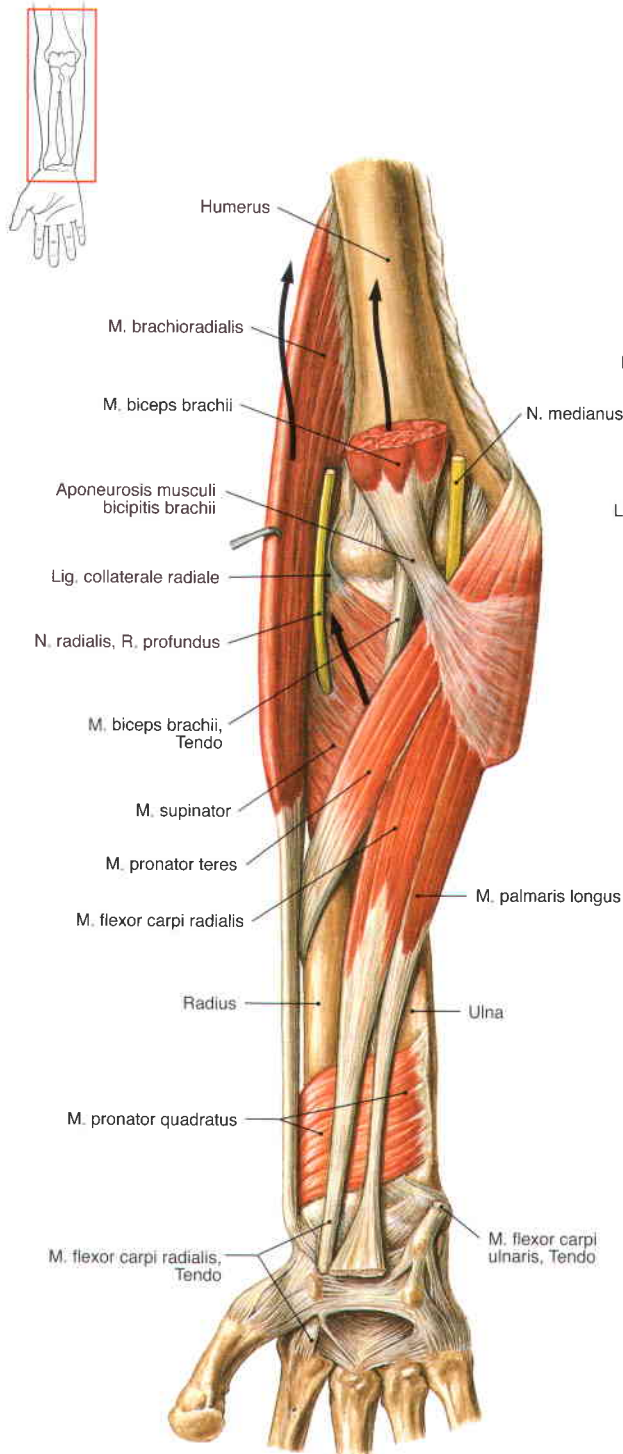


Fig. 370 Forearm in supination; ventropalmar view. Arrows indicate the direction of force generated by the main supinator muscles.

→ T 32, T 33, T 35

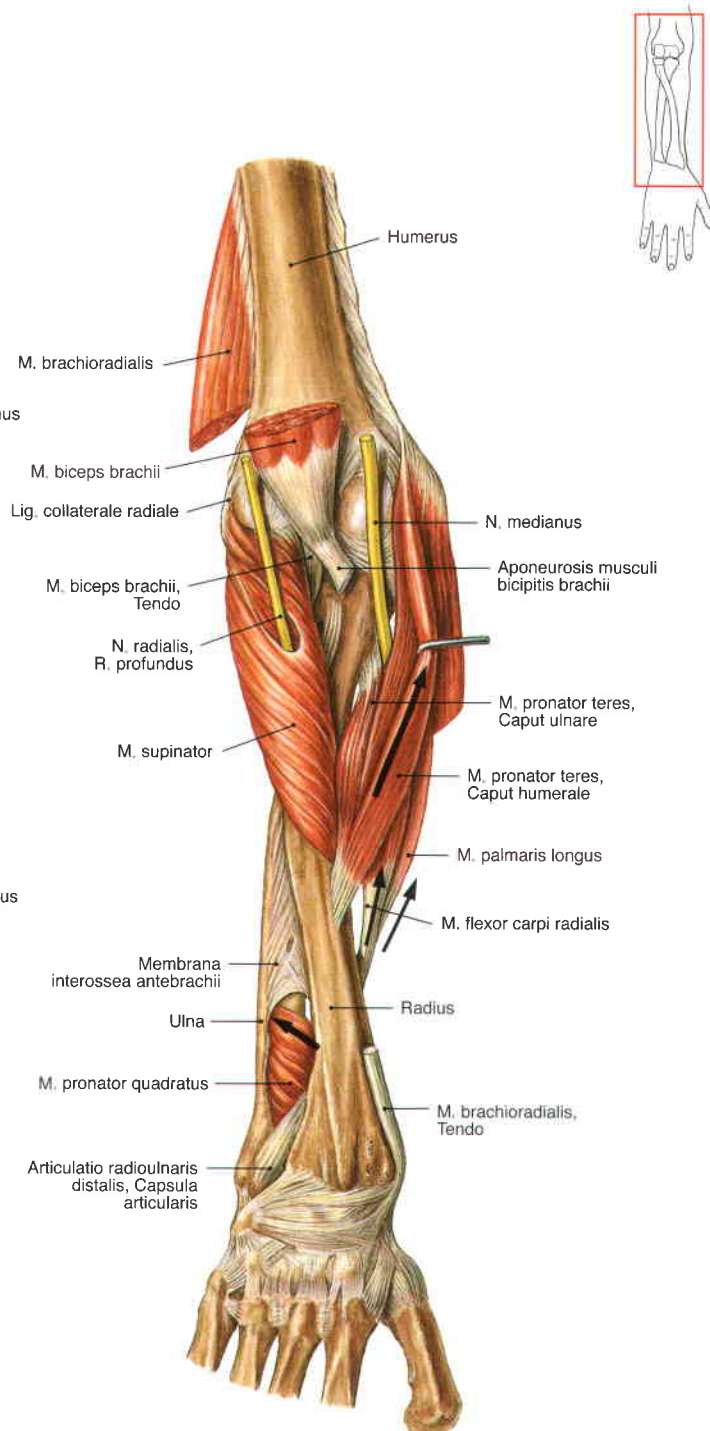


Fig. 371 Forearm in pronation; ventral view of the elbow region, dorsal view of the dorsum of the hand. Arrows indicate the direction of force generated by the main pronator muscles.

→ T 32, T 33, T 35

Origins and insertions of the muscles of the hand

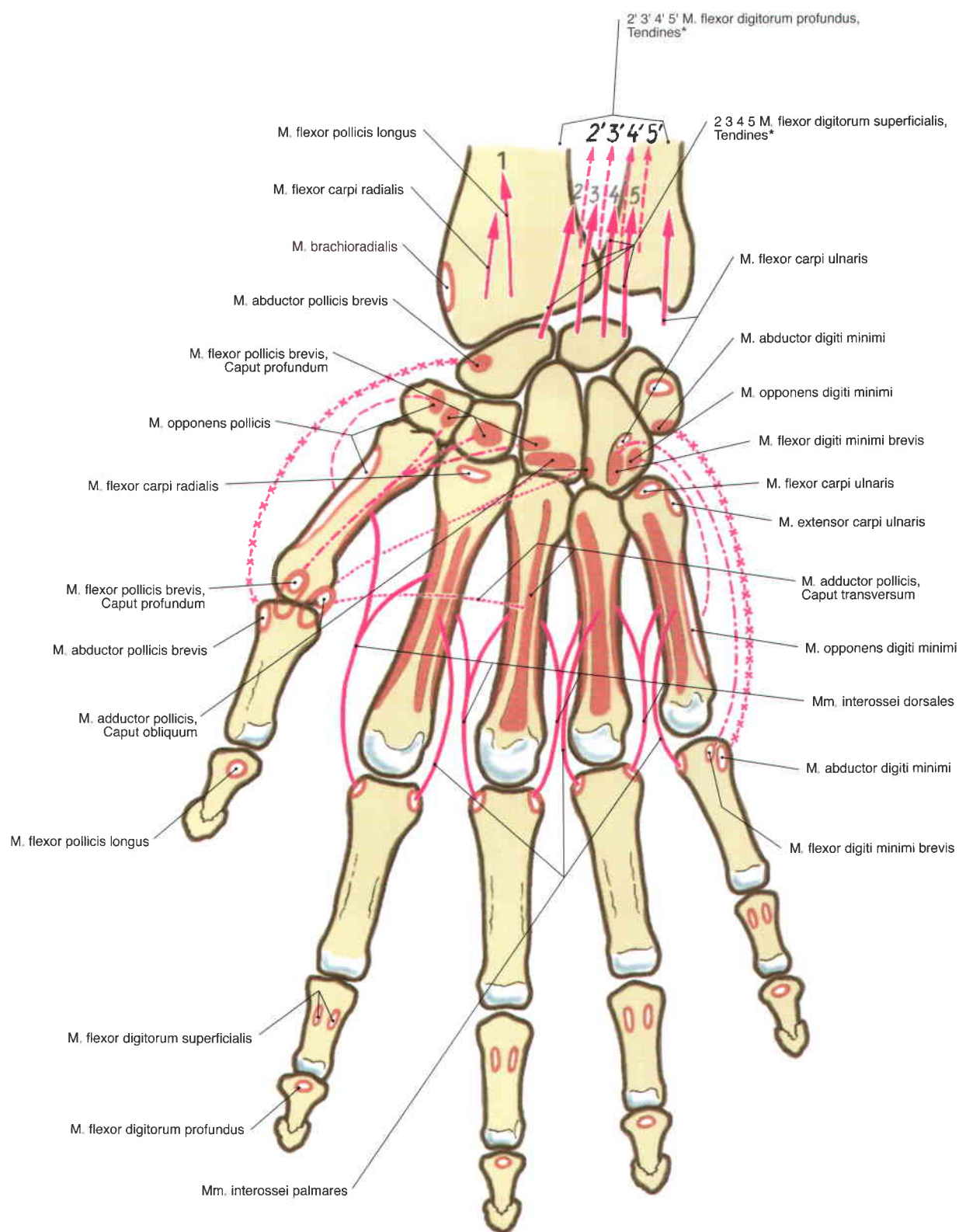
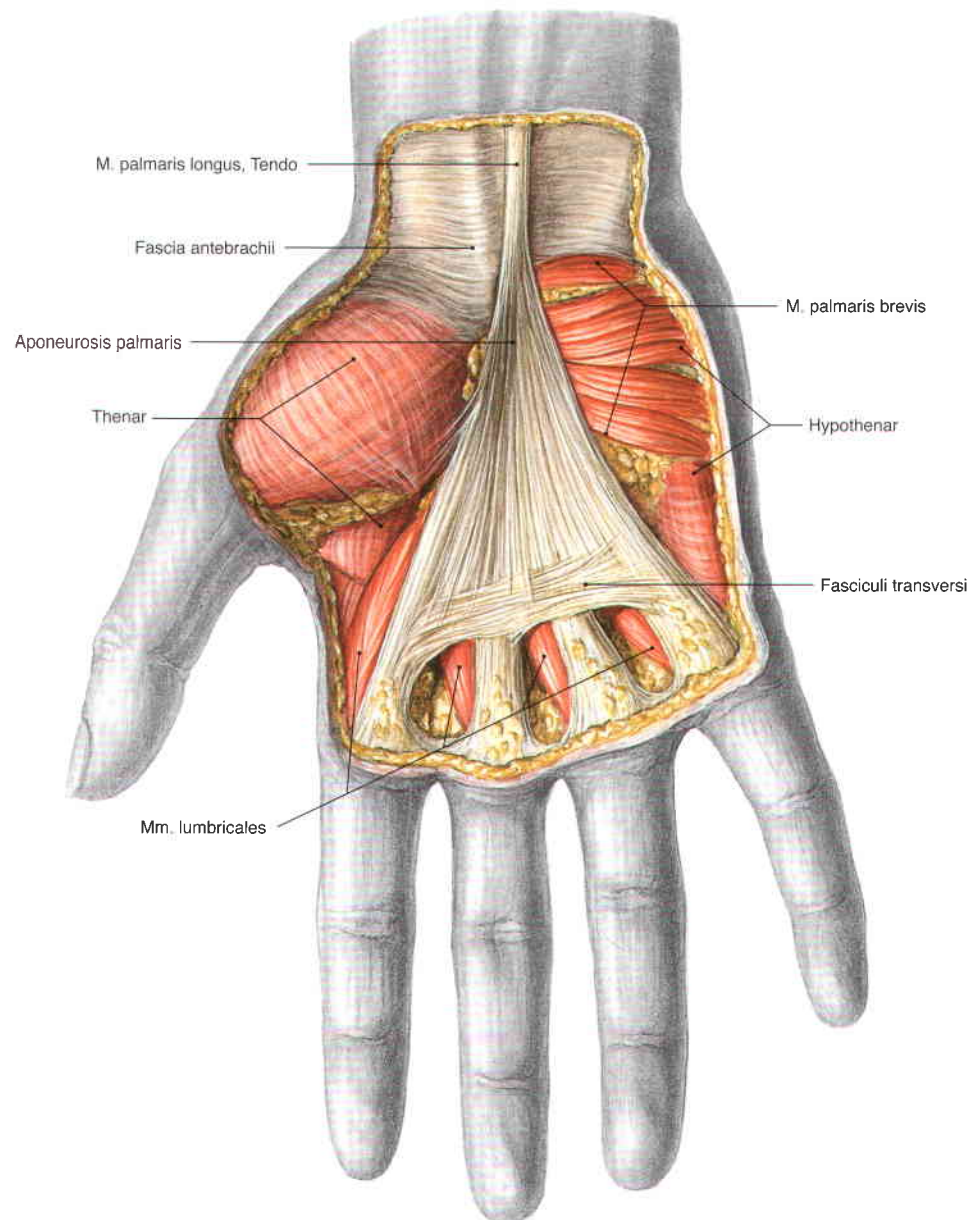


Fig. 372 Origins and insertions of the muscles of the hand at the bones of the hand.

* The flexors insert at the second to fifth digit.

→ T 36–T 38



→ T 31, T 36–T 38

Fig. 373 Muscles of the palm; superficial layer.

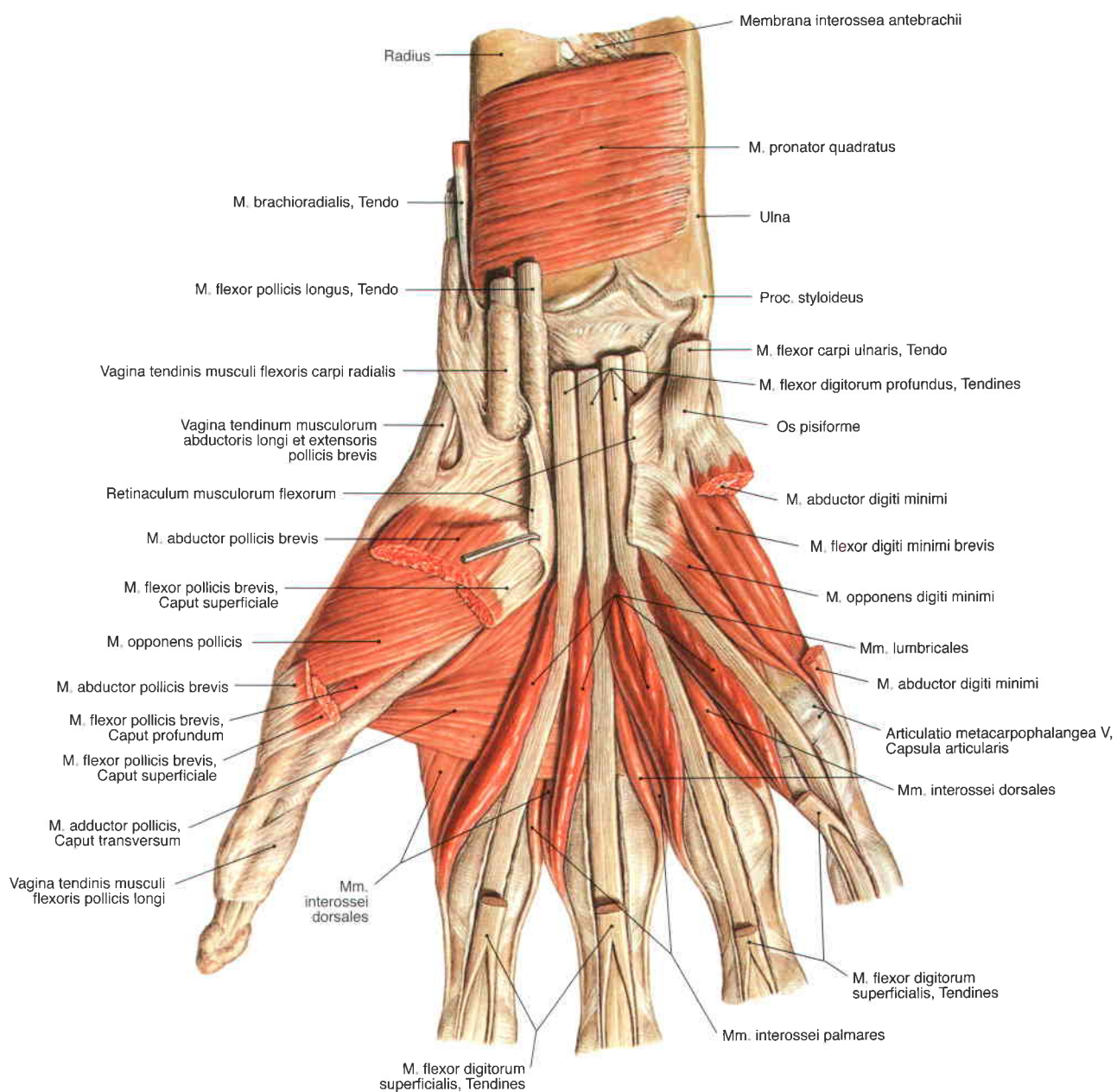


Fig. 374 Muscles of the palm; middle layer.

→ T 32, T 36–T 38

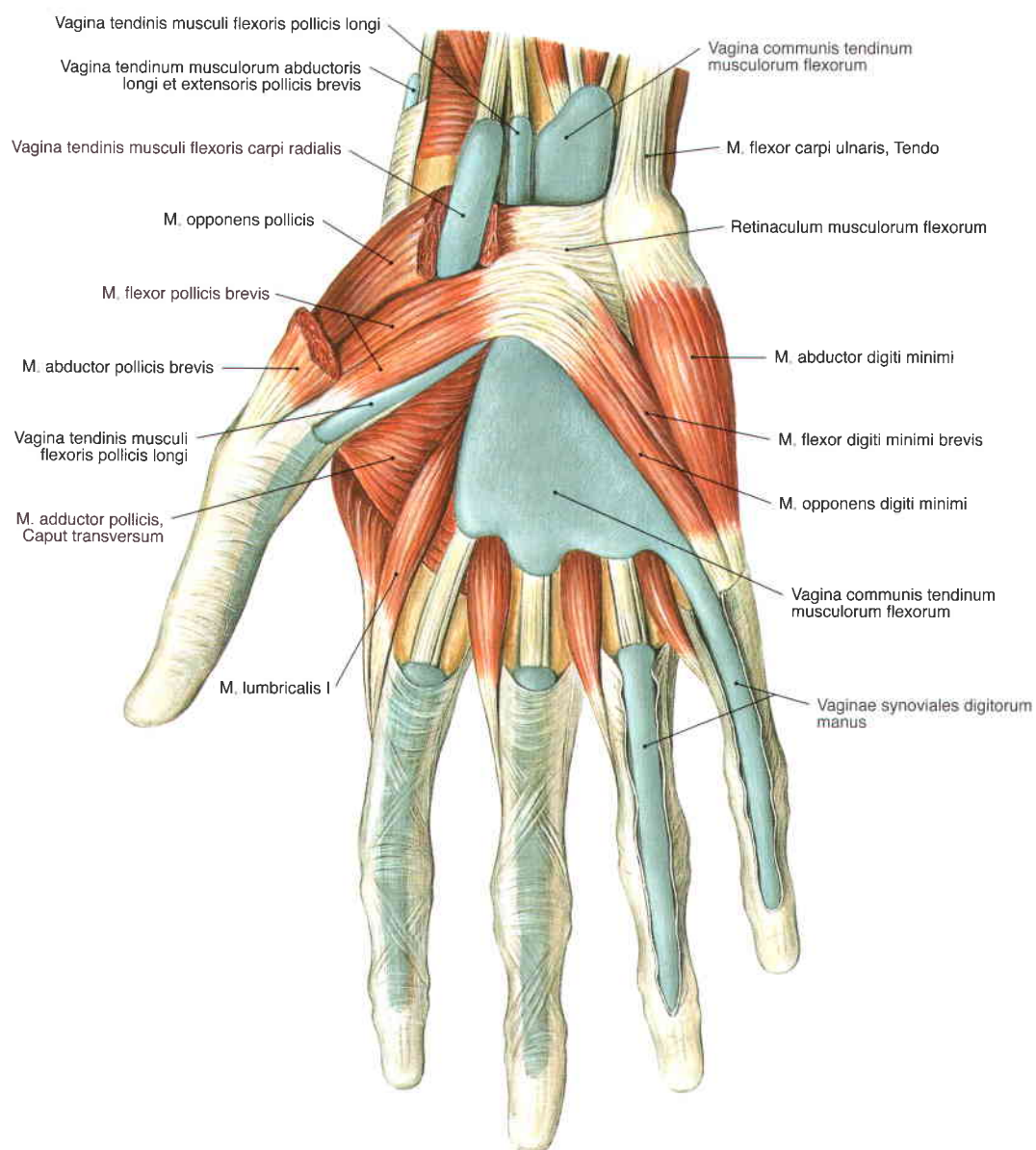
Tendon sheaths of the hand

Fig. 375 Tendon sheaths, Vaginae tendinum, of the hand.

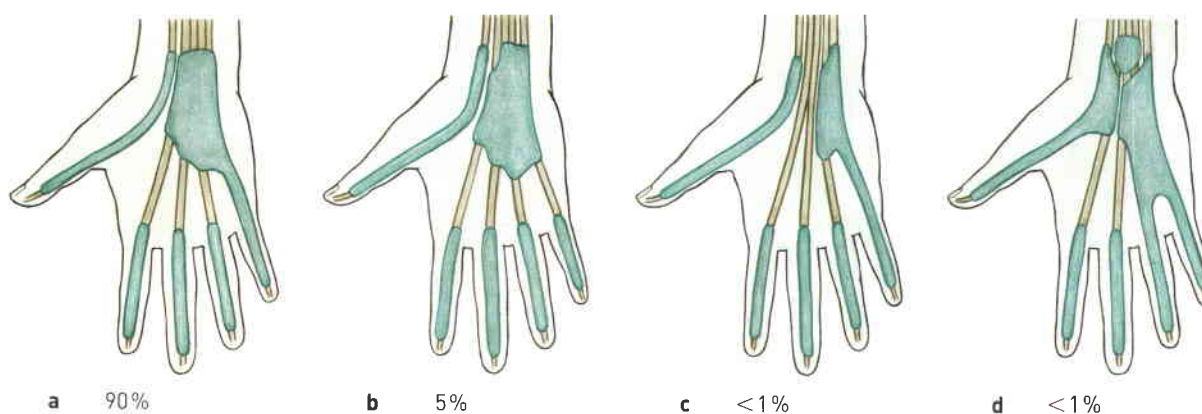


Fig. 376 a-d Frequent variations of the palmar tendon sheaths.

Muscles of the hand

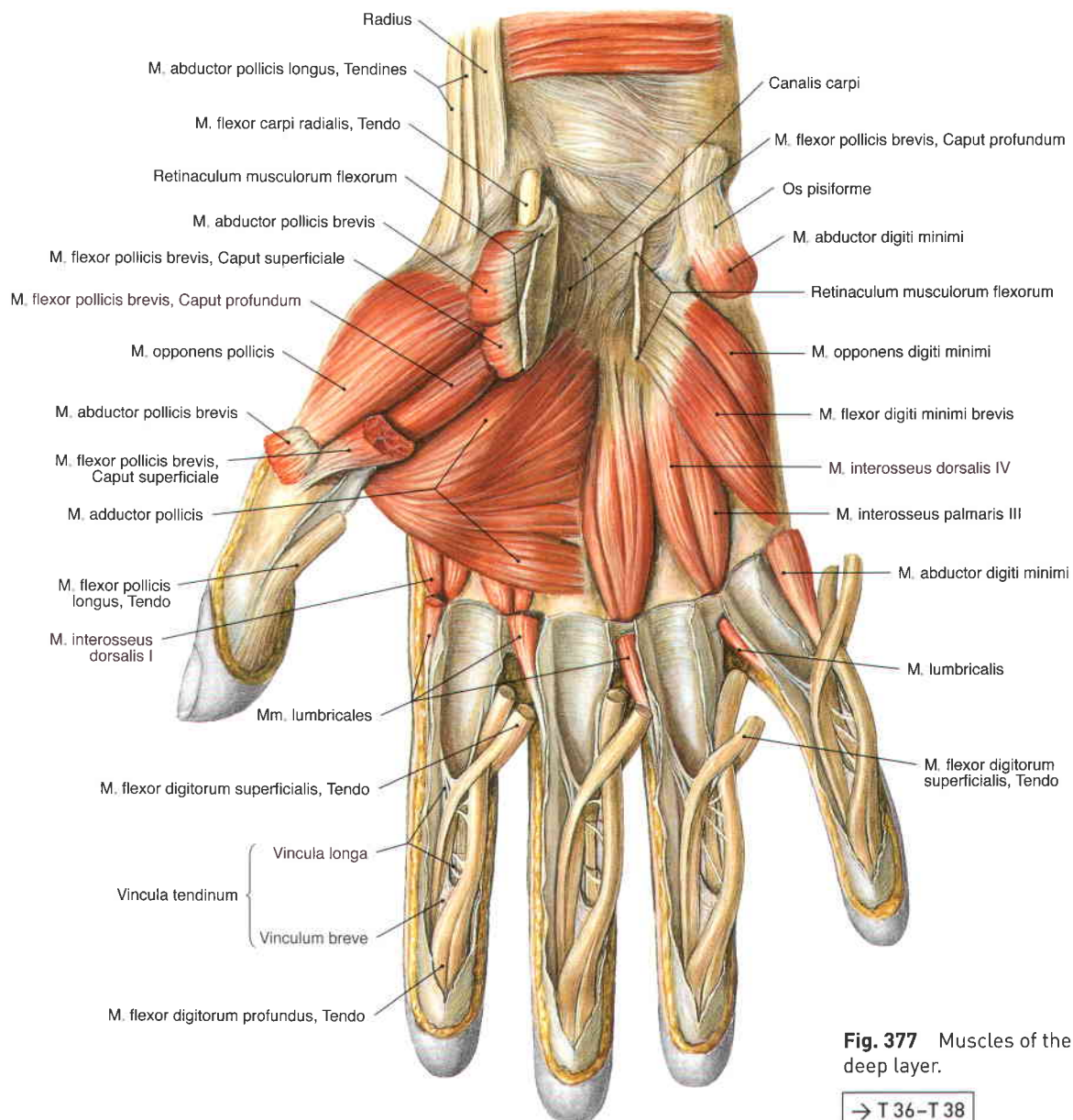


Fig. 377 Muscles of the palm; deep layer.

→ T 36–T 38

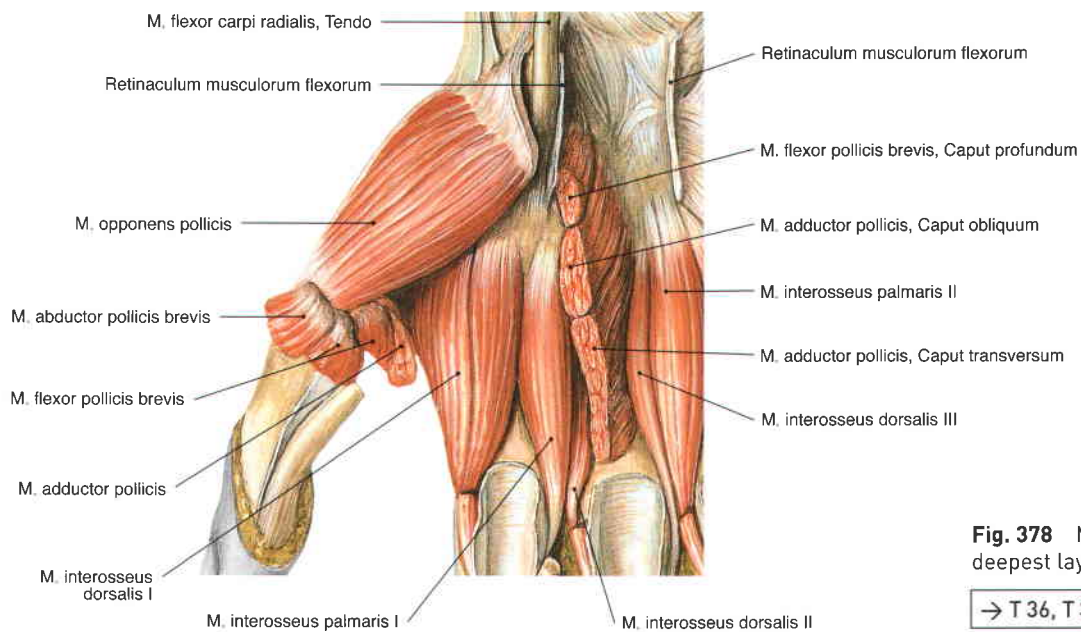
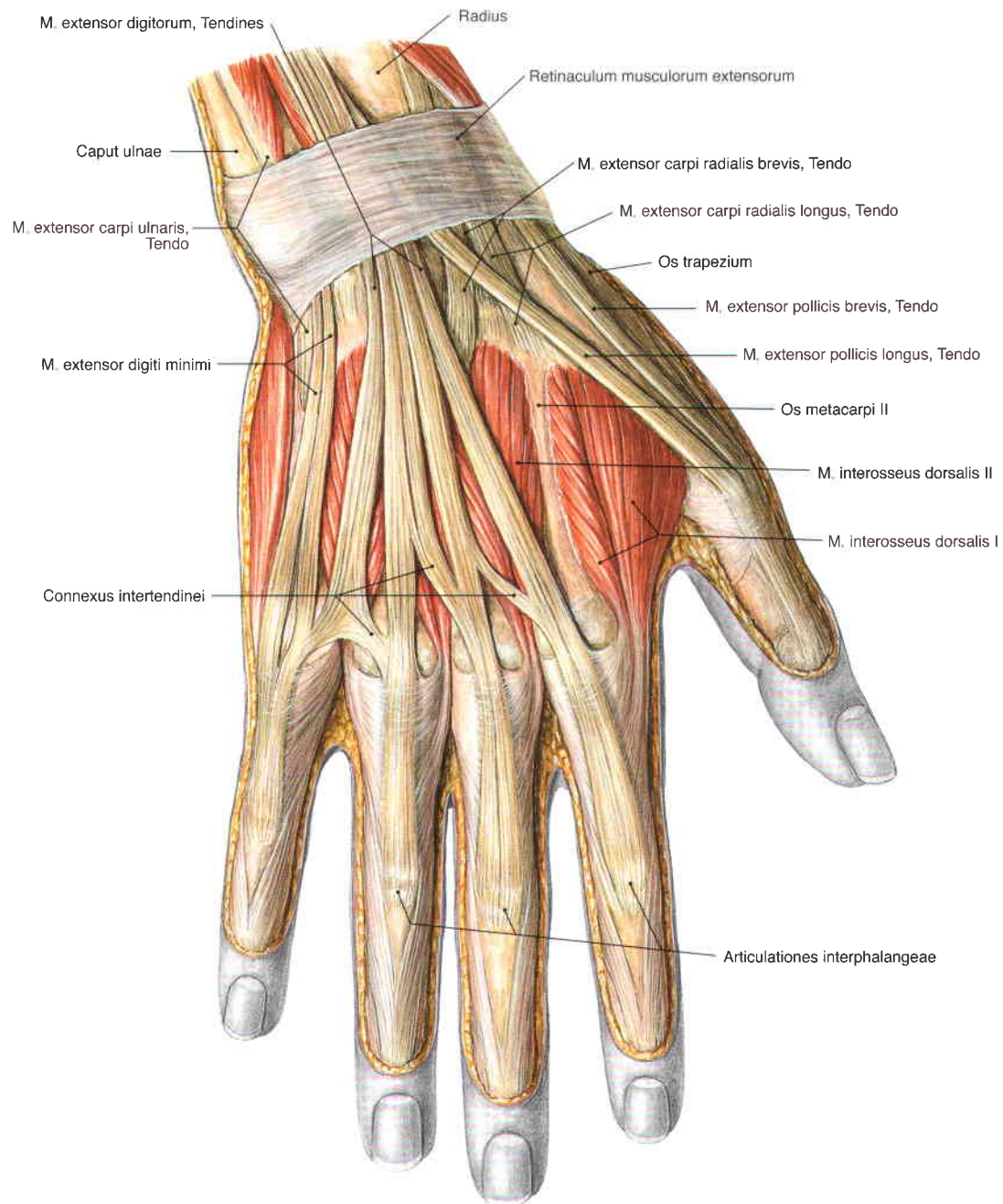


Fig. 378 Muscles of the palm; deepest layer.

→ T 36, T 37

Muscles of the hand

→ T 34, T 35, T 37

Fig. 379 Muscles of the dorsum of the hand.

Tendon sheaths of the hand

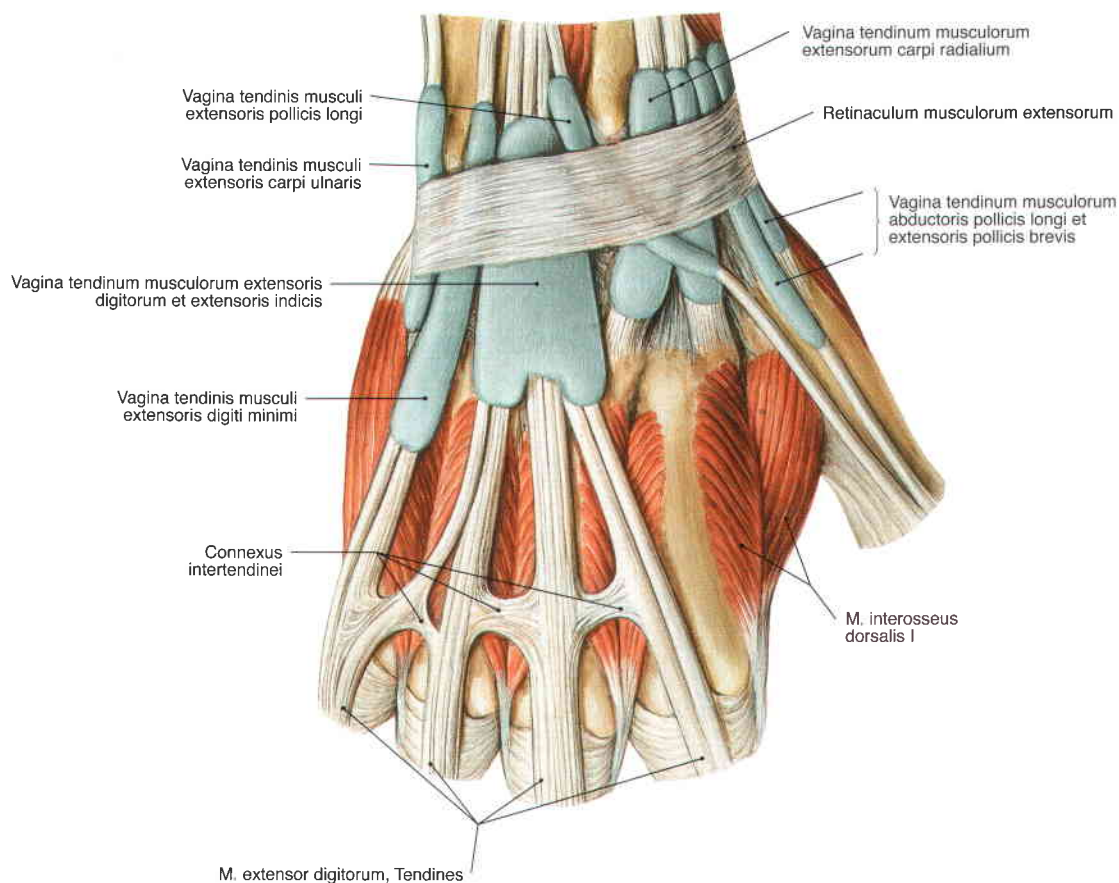


Fig. 380 Dorsal carpal tendon sheaths.

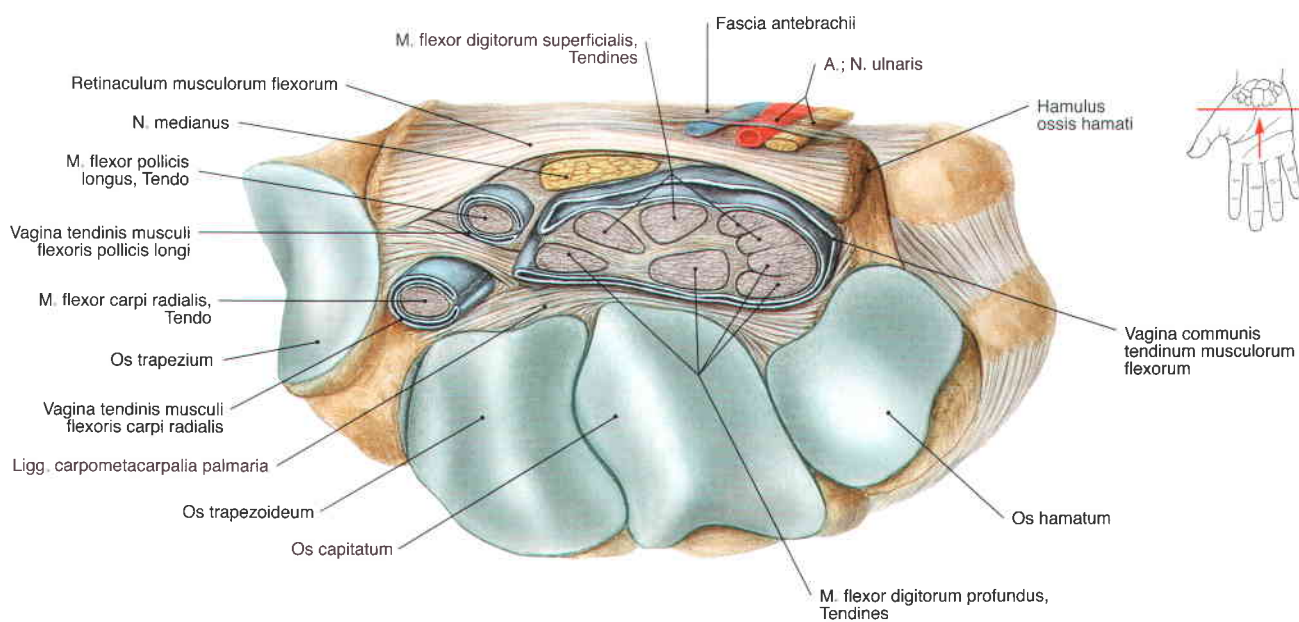


Fig. 381 Palmar carpal tendon sheaths; transverse section.

The compression of the median nerve in the carpal tunnel is known as "carpal tunnel syndrome".

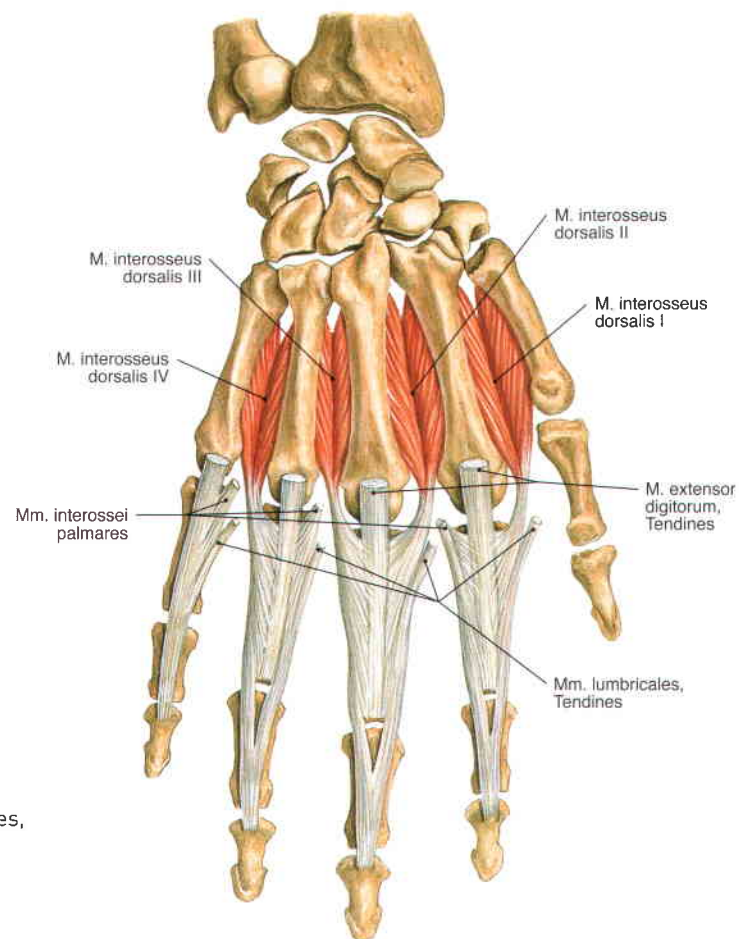
Muscles of the hand

Fig. 382 Dorsal interosseous muscles, Mm. interossei dorsales; dorsal view.

→ T 37

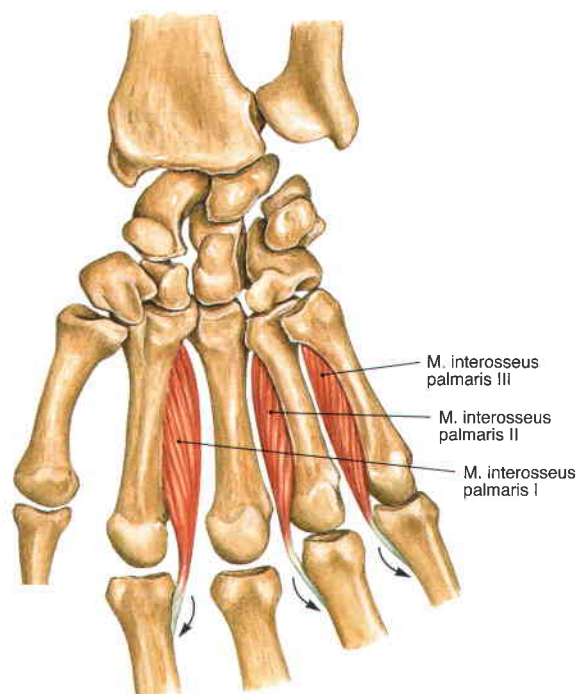


Fig. 383 Palmar interosseous muscles, Mm. interossei palmares; palmar view. The tendons of the interossei and the lumbrical muscles radiate into the so-called dorsal aponeurosis of the fingers (arrows).

→ T 37

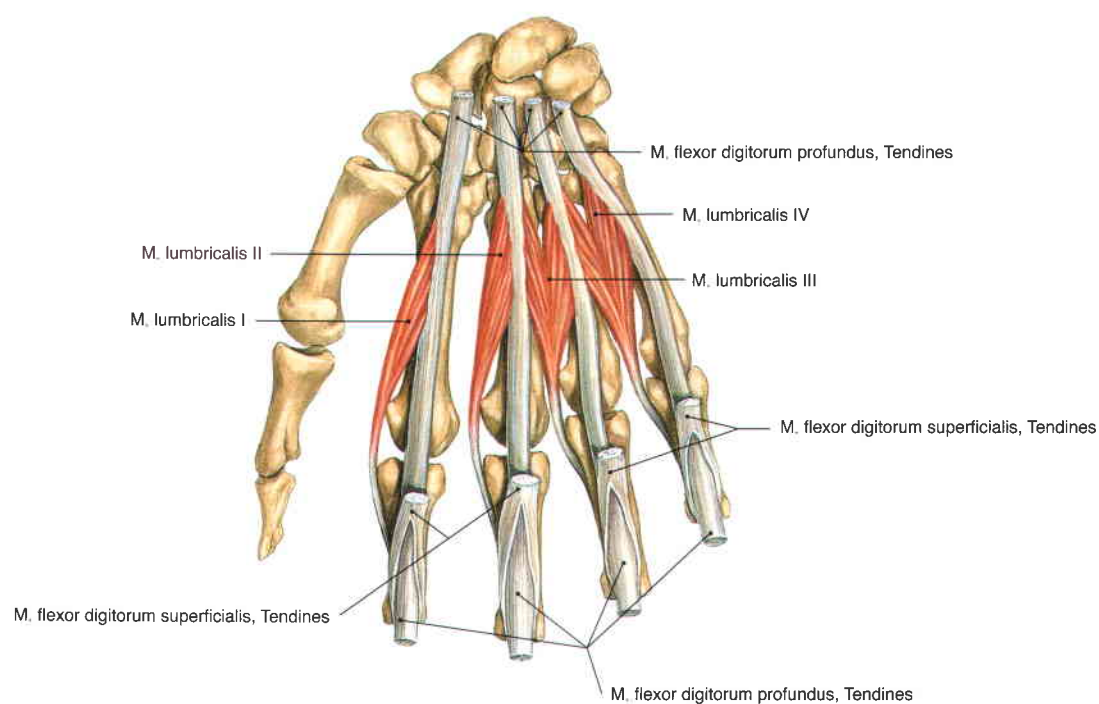


Fig. 384 Lumbrical muscles, Mm. lumbricales; palmar view.

→ T 37

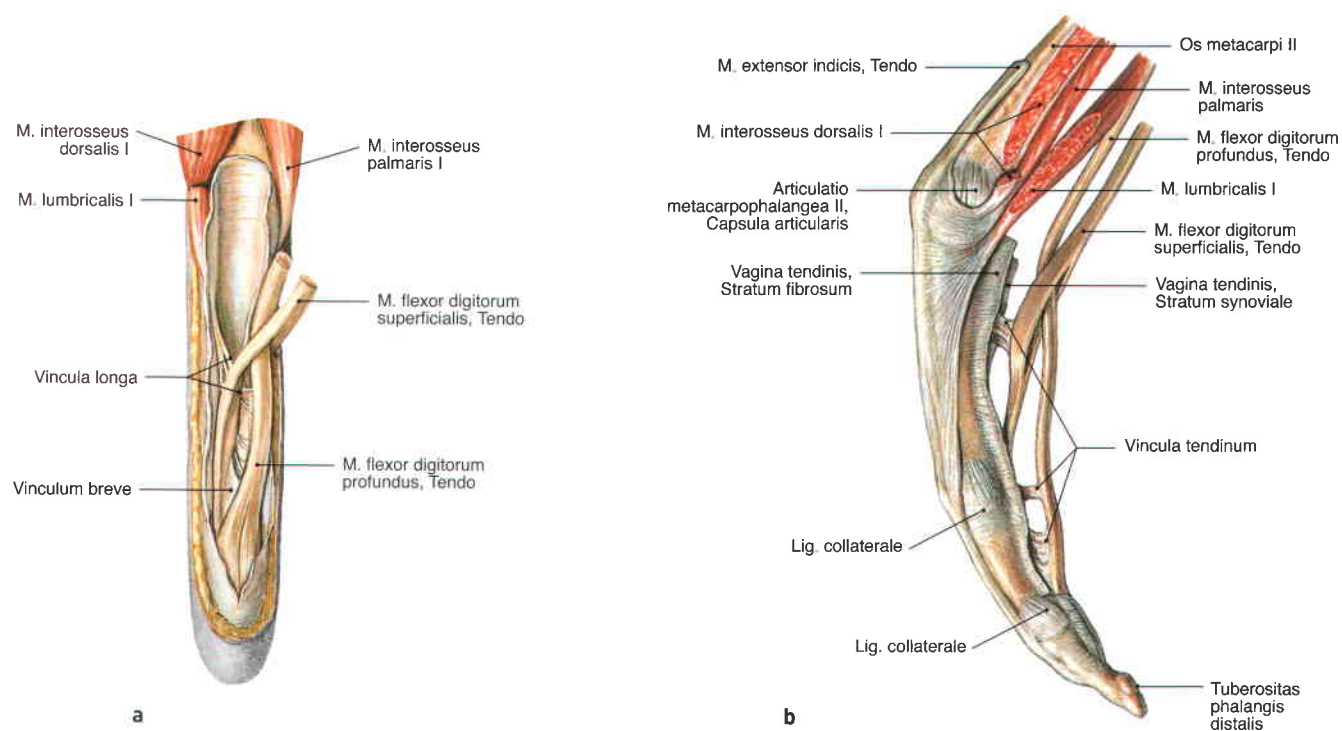
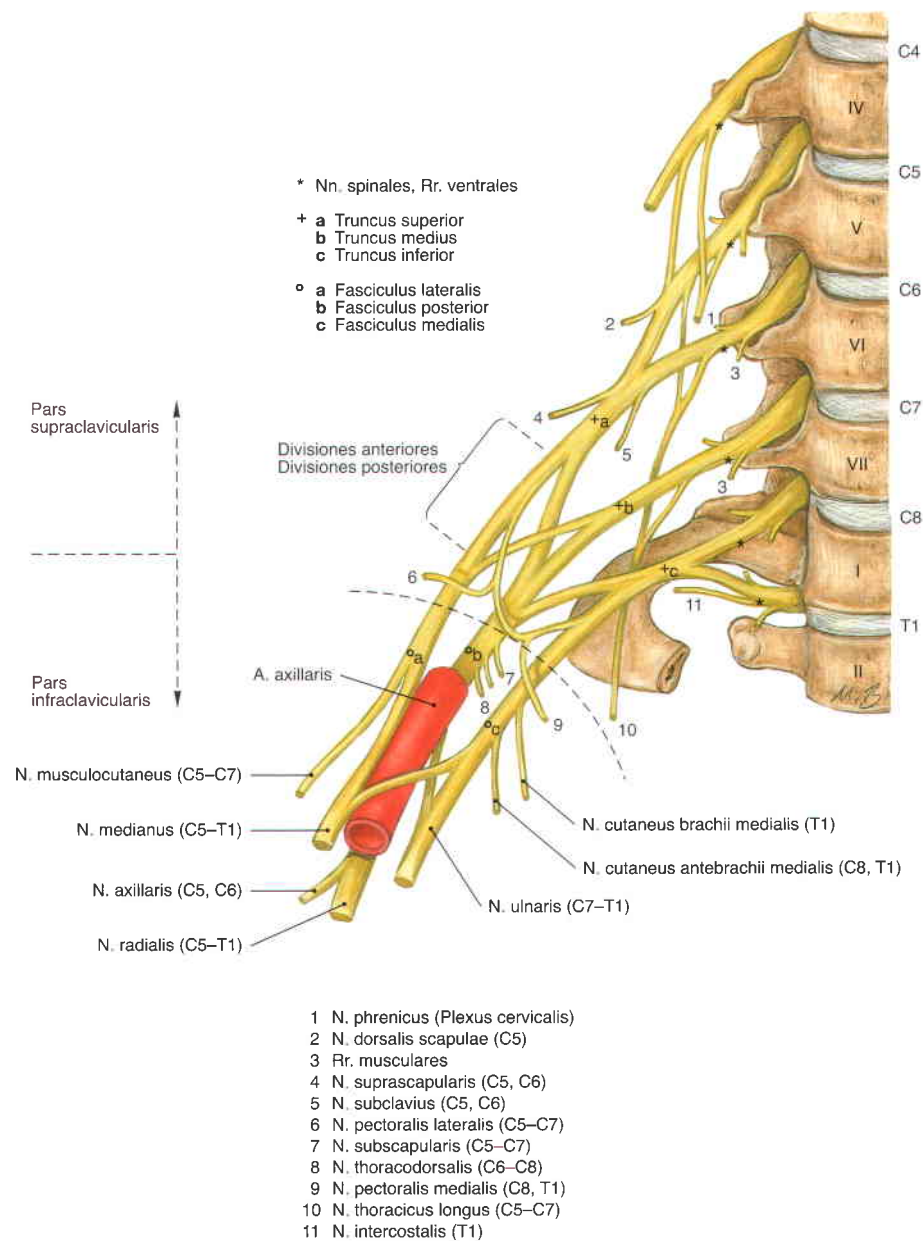


Fig. 385 a, b Tendon insertions at the index; the tendons of both flexors have been dissected from the tendon sheath.

a Palmar view

b Lateral view



Nerves of the upper limb

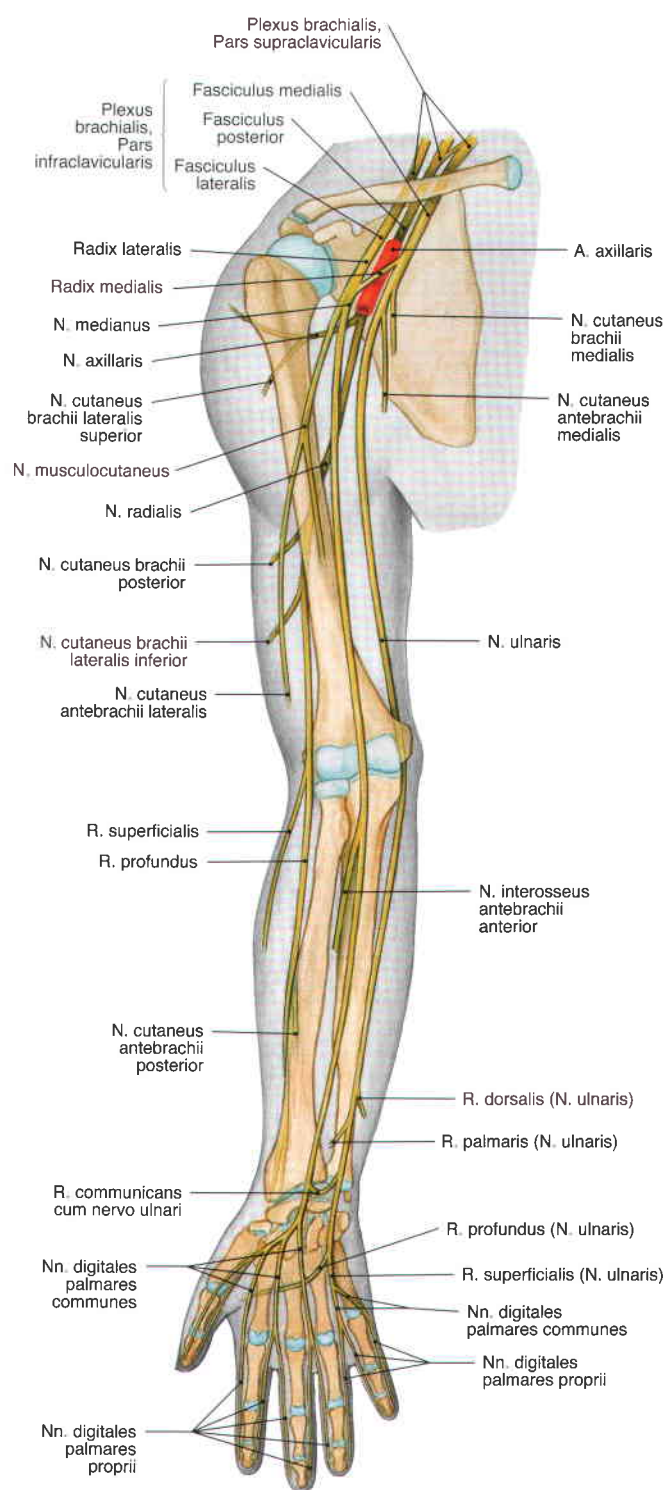
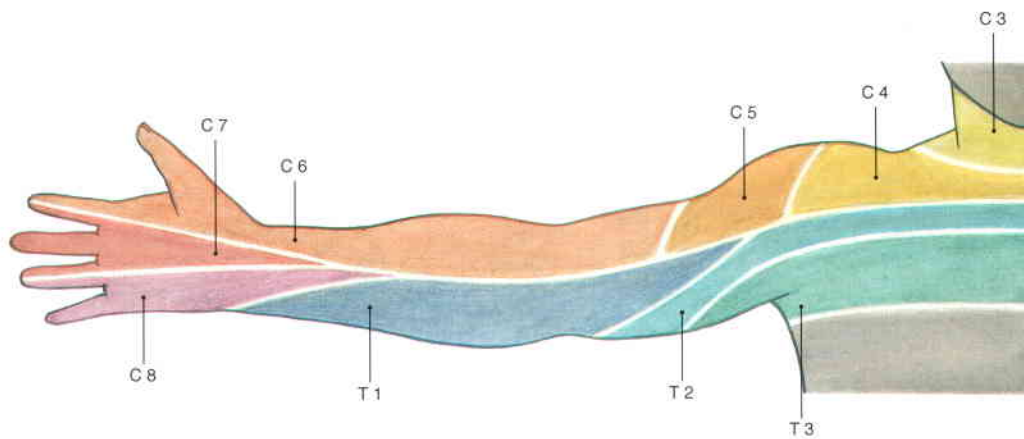
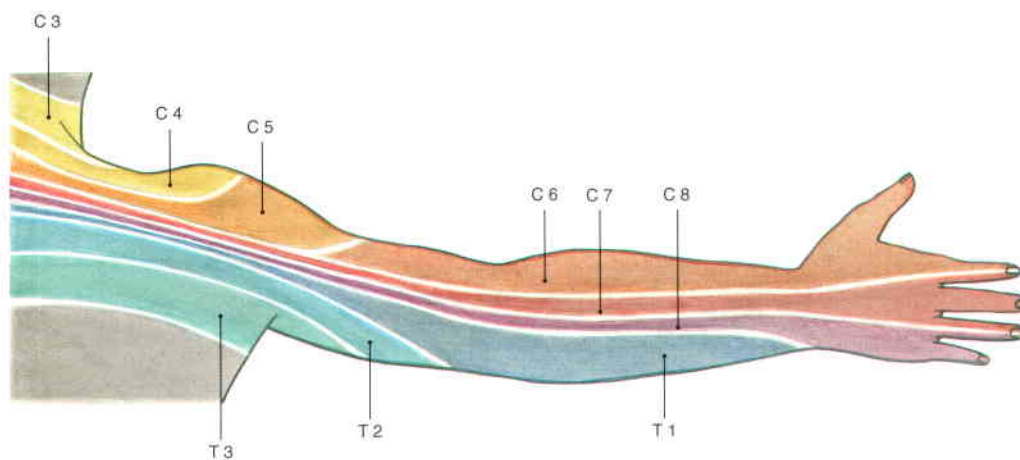


Fig. 387 Nerves of the upper limb; overview.

→ T 24, T 25

Cutaneous innervation

→ T 24

Fig. 388 Segmental cutaneous innervation (dermatomes) of the upper limb.

→ T 24

Fig. 389 Segmental cutaneous innervation (dermatomes) of the upper limb.

Cutaneous innervation

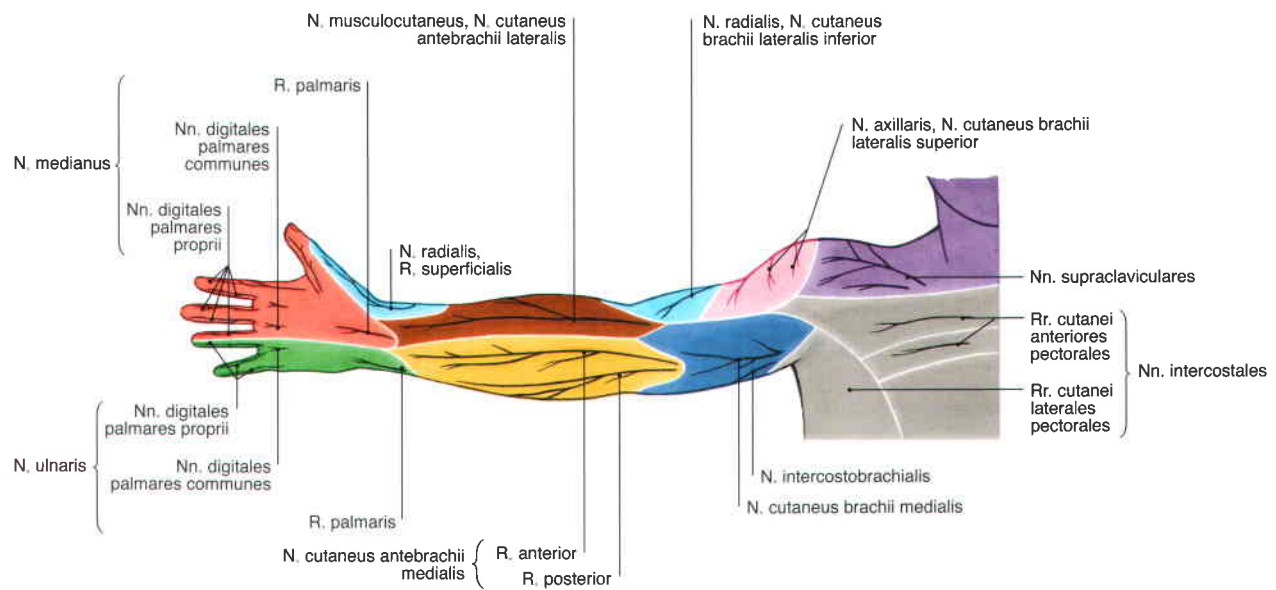


Fig. 390 Cutaneous nerves of the upper limb.

→ T 24

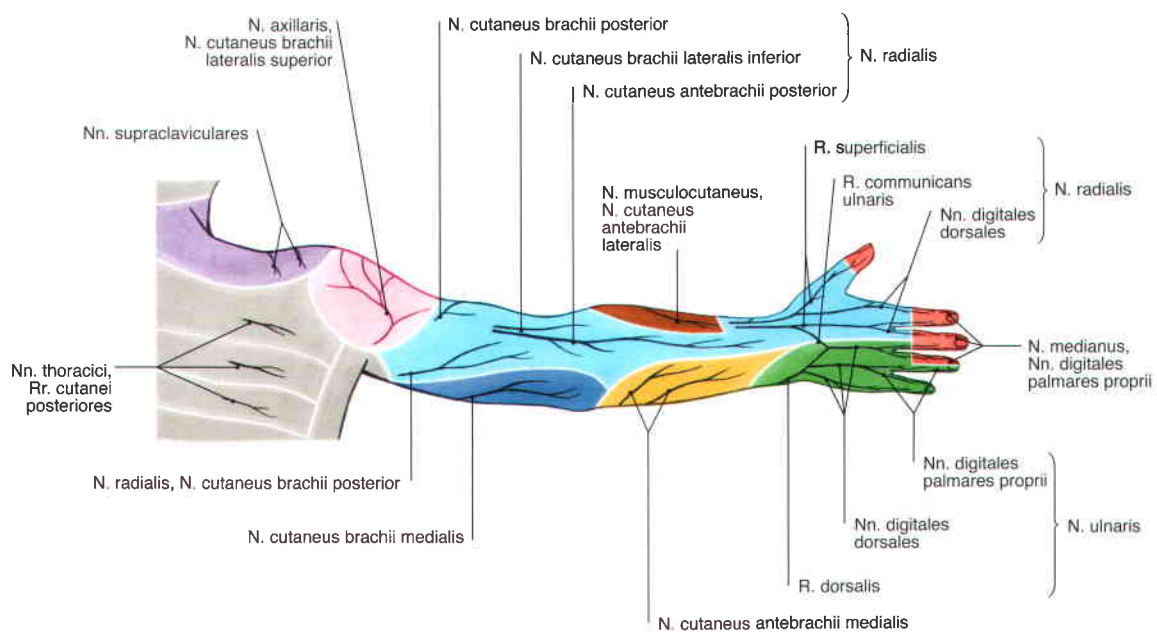


Fig. 391 Cutaneous nerves of the upper limb.

→ T 24

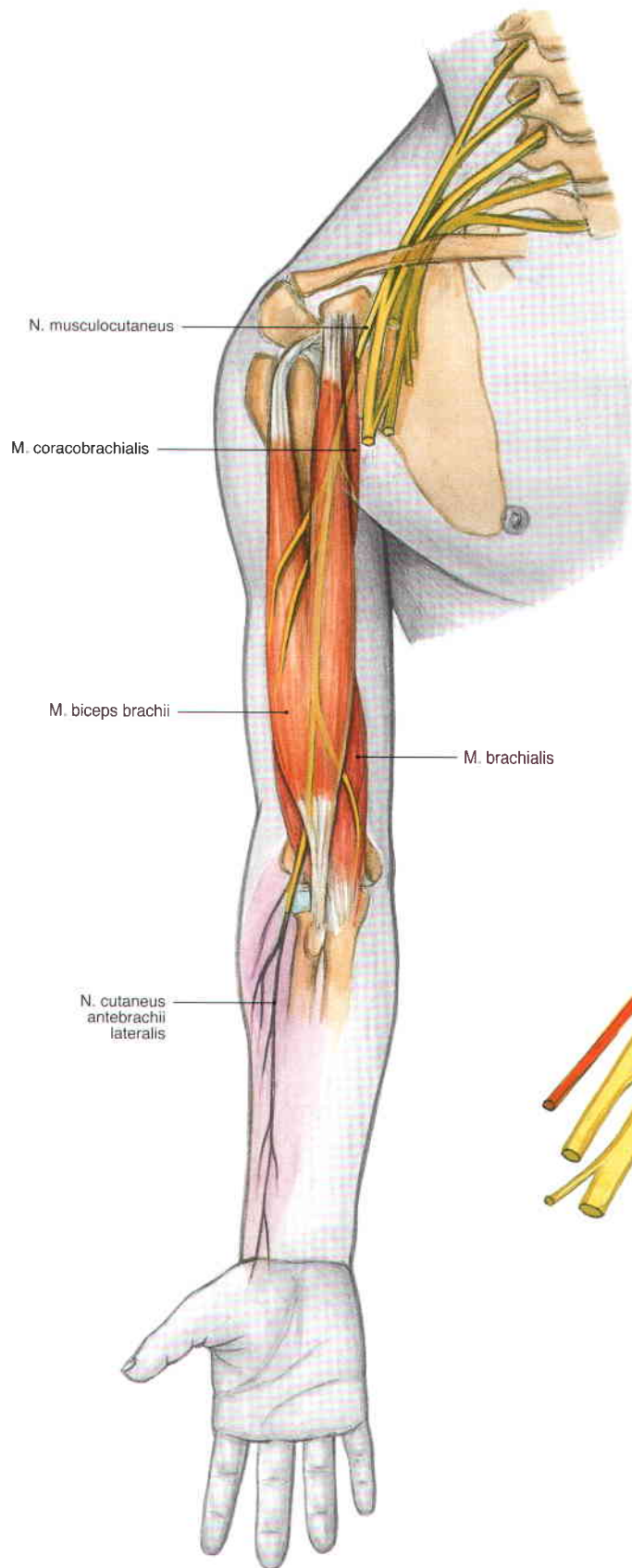


Fig. 392 Musculocutaneous nerve, N. musculocutaneus; supplying areas. The skin branches and the cutaneous innervation are illustrated in blue.

→ 46, 386, T 24, T 25

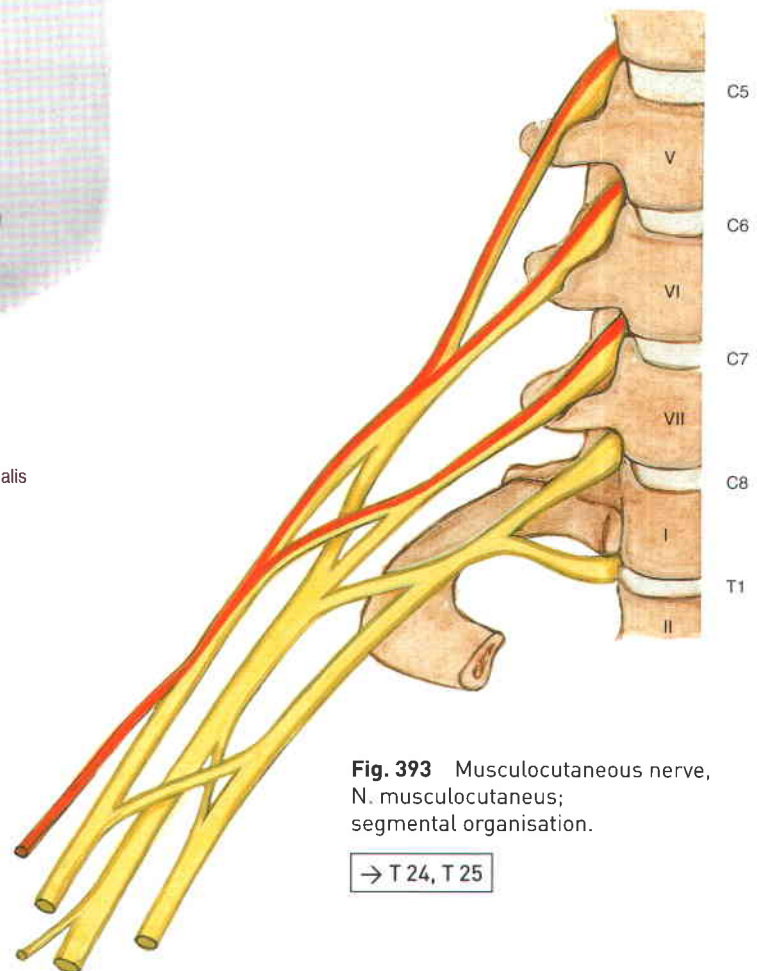


Fig. 393 Musculocutaneous nerve, N. musculocutaneus; segmental organisation.

→ T 24, T 25

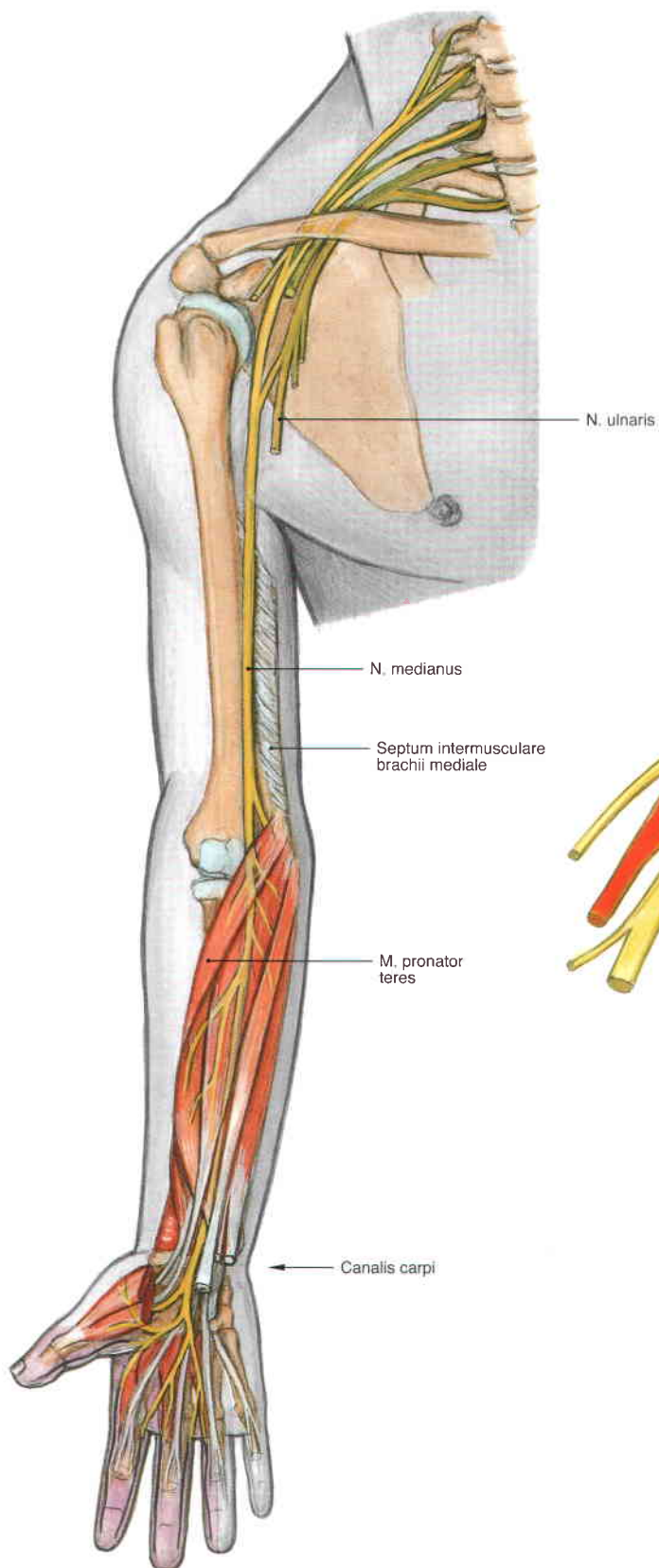


Fig. 394 Median nerve, N. medianus; supplying areas.

→ 46, 386, T 24, T 25

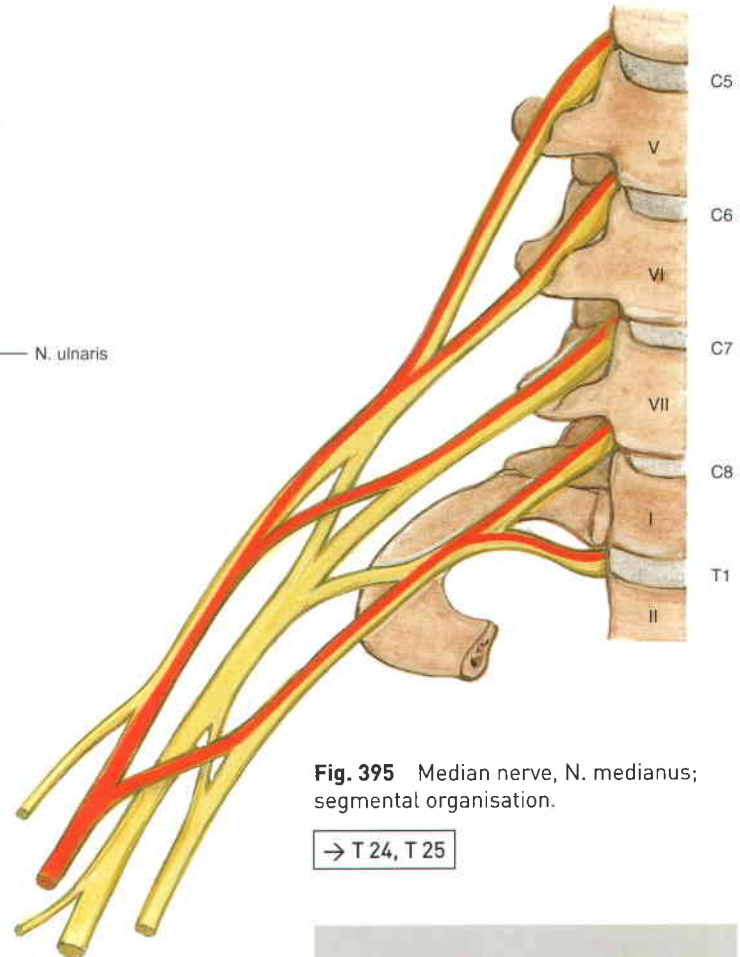


Fig. 395 Median nerve, N. medianus; segmental organisation.

→ T 24, T 25



Fig. 396 Median nerve, N. medianus; proximal palsy: typical posture.

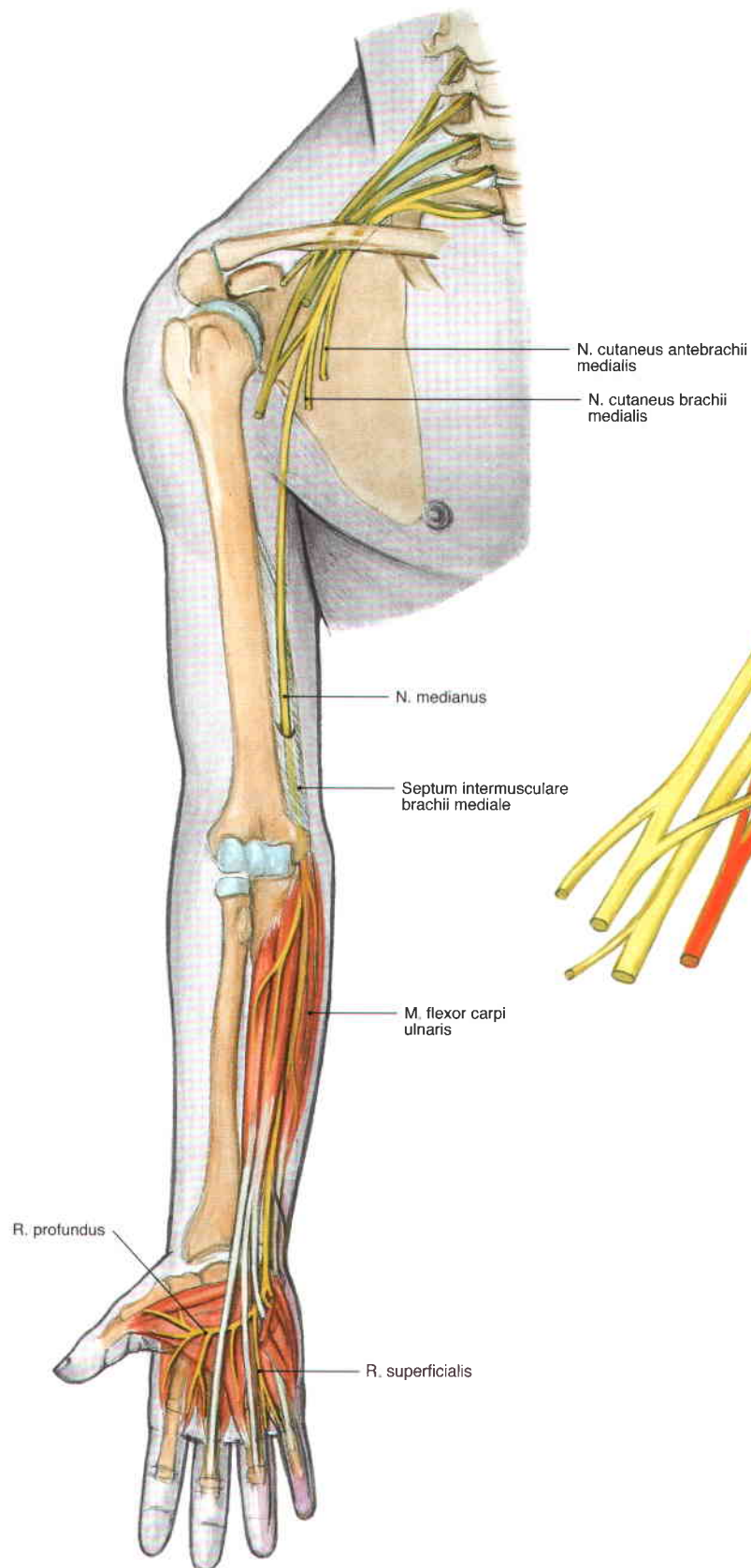


Fig. 397 Ulnar nerve, N. ulnaris; supplying areas.

→ 46, 386, T 24, T 25

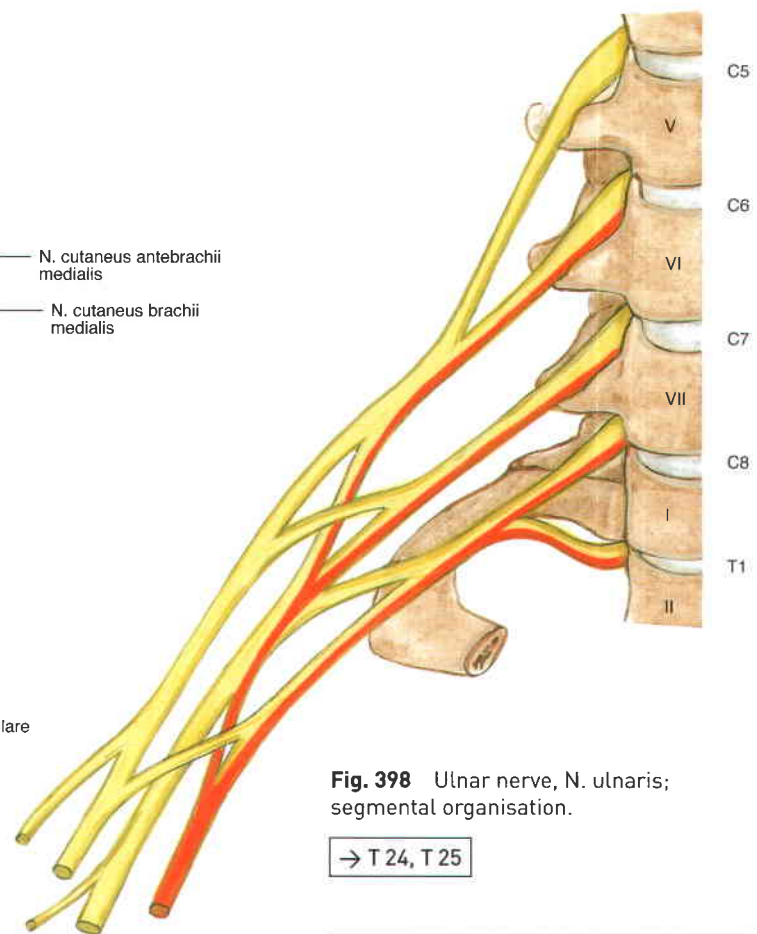


Fig. 398 Ulnar nerve, N. ulnaris; segmental organisation.

→ T 24, T 25



Fig. 399 Ulnar nerve, N. ulnaris; proximal palsy.

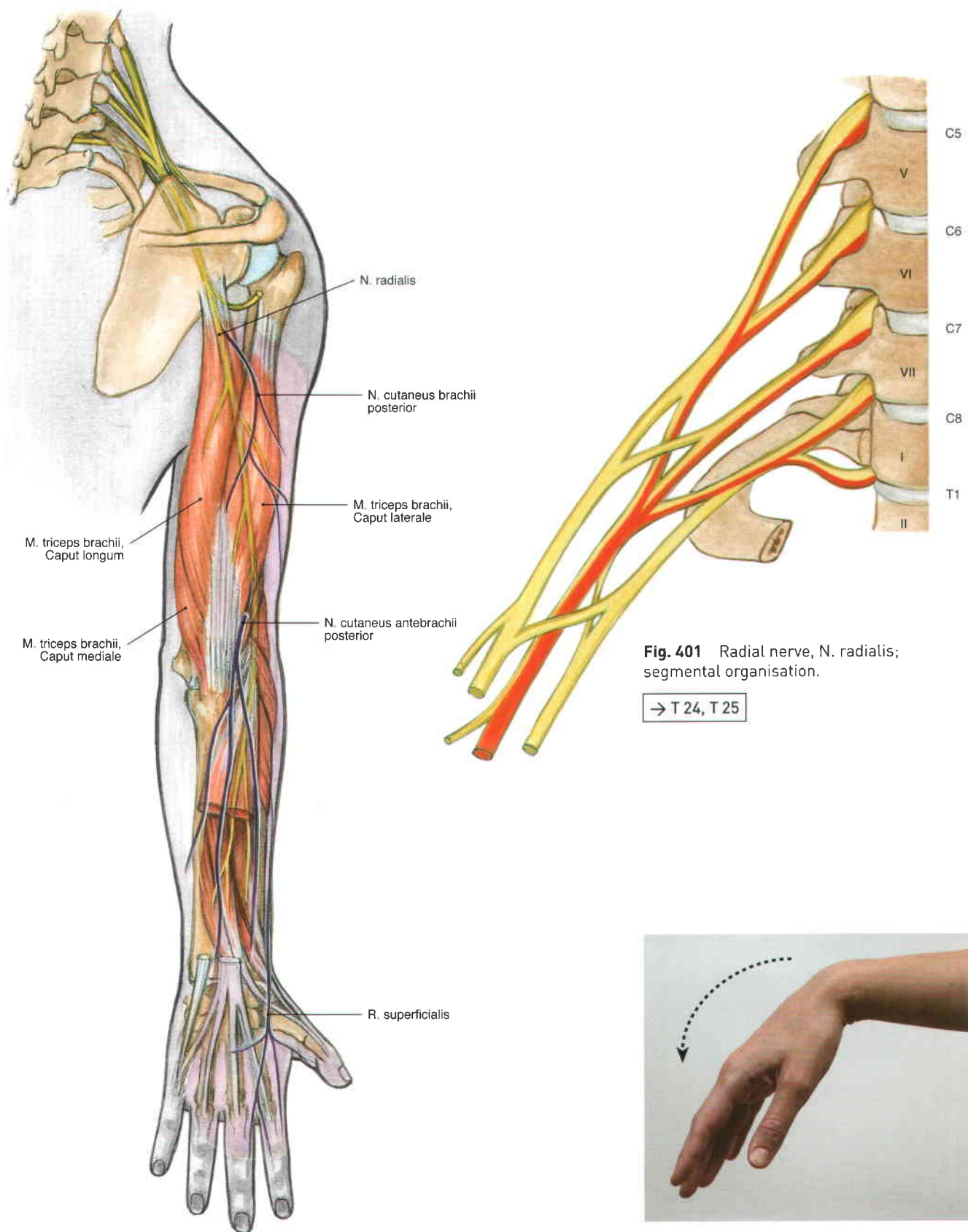


Fig. 400 Radial nerve, N. radialis; supplying areas.

→ 46, 386, T 24, T 25

Fig. 402 Radial nerve, N. radialis; proximal palsy.

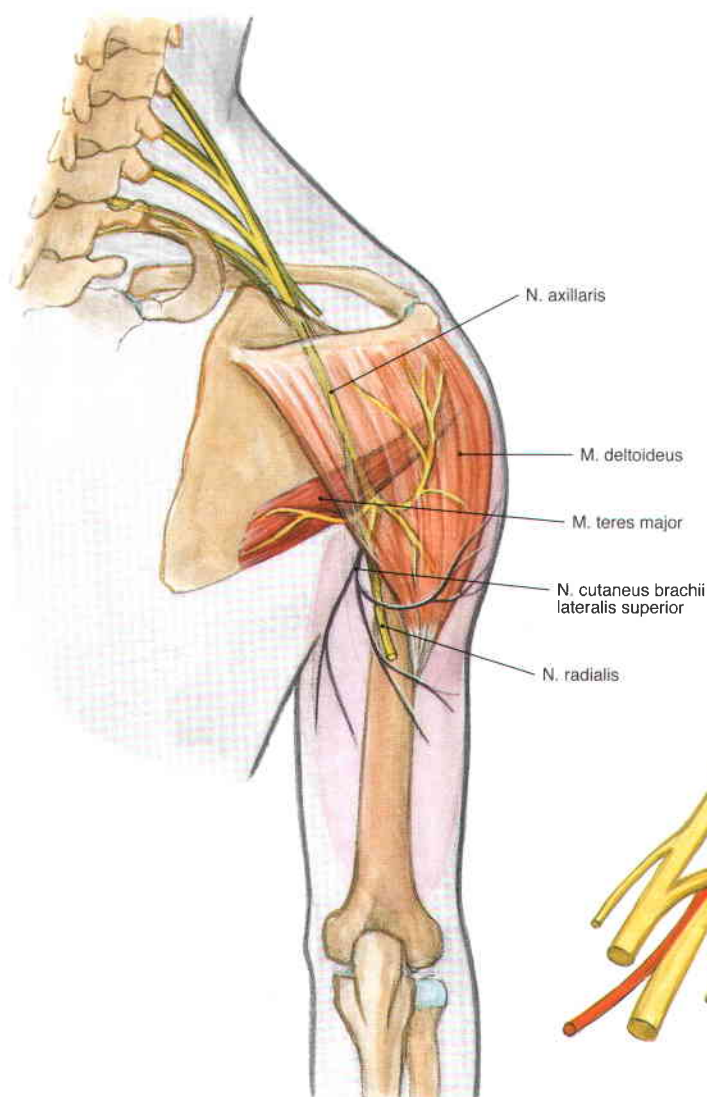


Fig. 403 Axillary nerve, N. axillaris; supplying areas.

The axillary nerve passes to the dorsal side of the arm through the quadrangular space along with the posterior circumflex humeral artery.

→ 46, 386, T 24, T 25

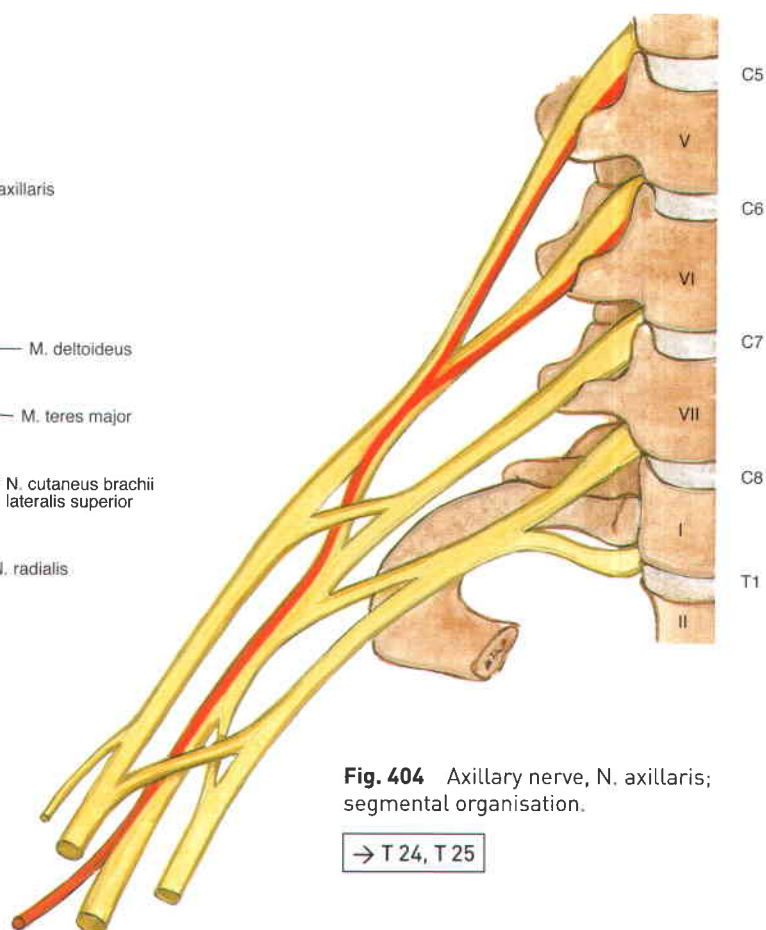


Fig. 404 Axillary nerve, N. axillaris; segmental organisation.

→ T 24, T 25



Fig. 405 Axillary nerve, N. axillaris; palsy: deltoid muscle atrophy.

Arteries of the upper limb

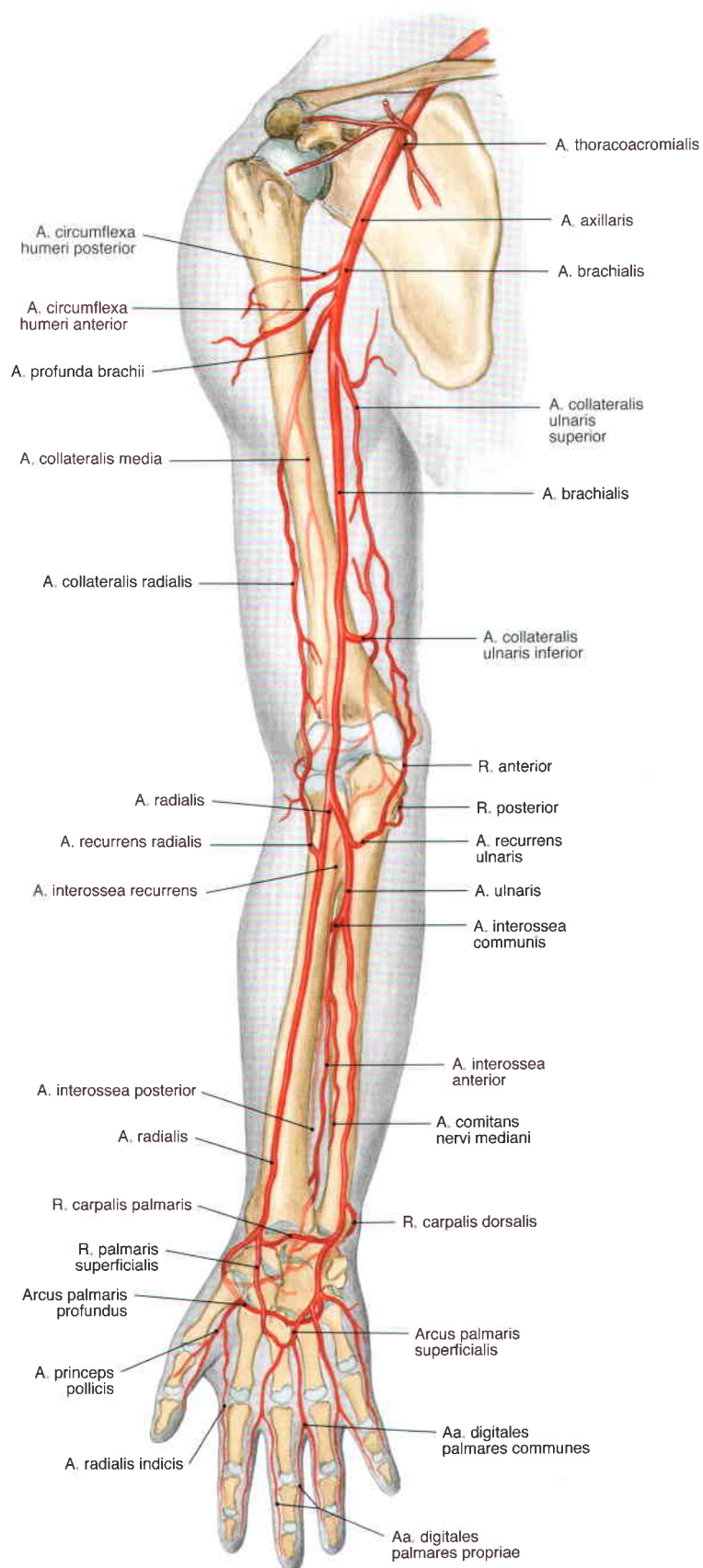
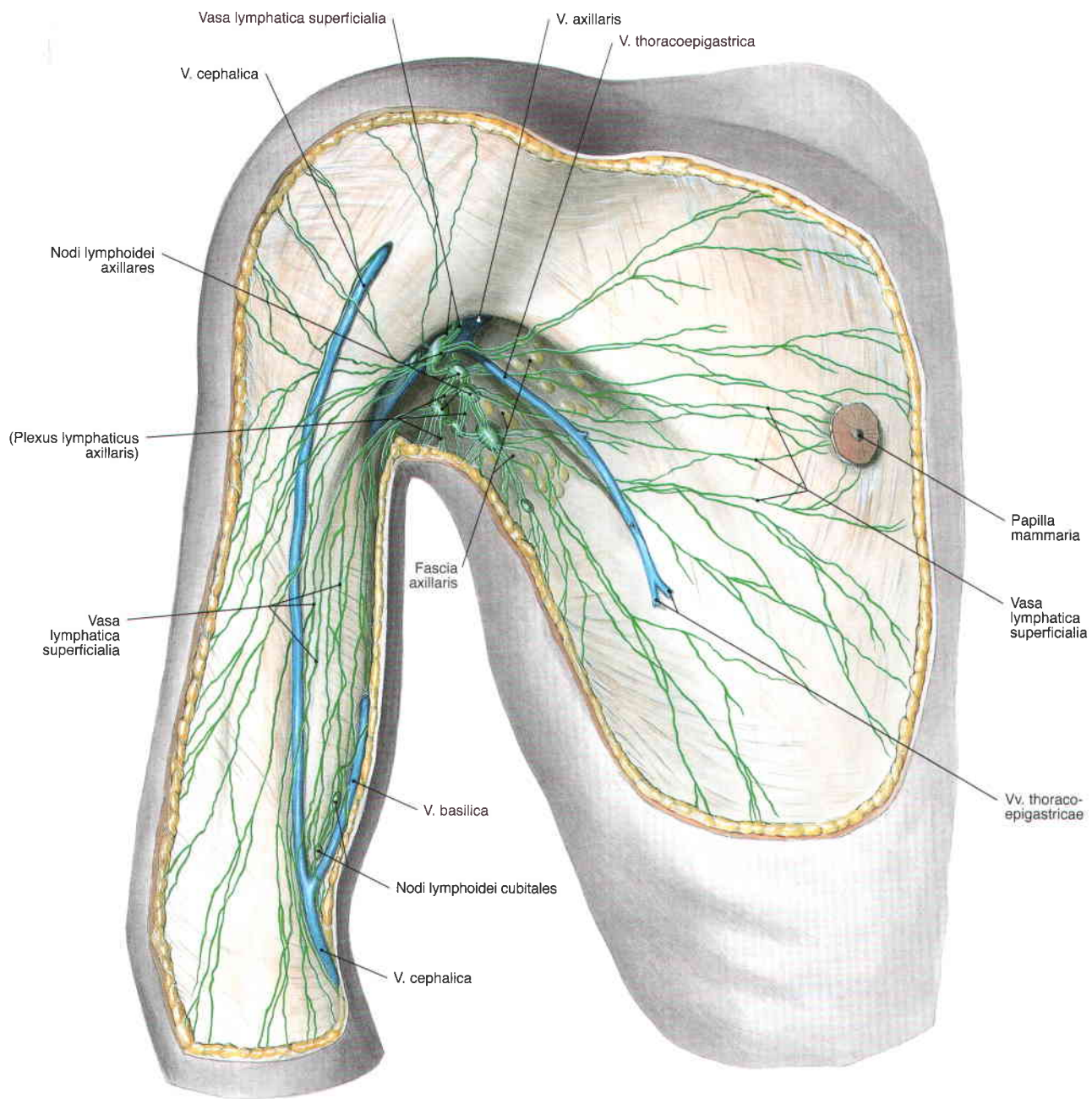


Fig. 406 Arteries of the upper limb; overview.

Arteries adjacent to the elbow joint form the cubital anastomosis.

Lymphatics of the axilla

→ 42



408

Fig. 407 Superficial lymphatics, lymph nodes and vein trunks in the regions of the arm, the lateral thoracic wall and the axilla.

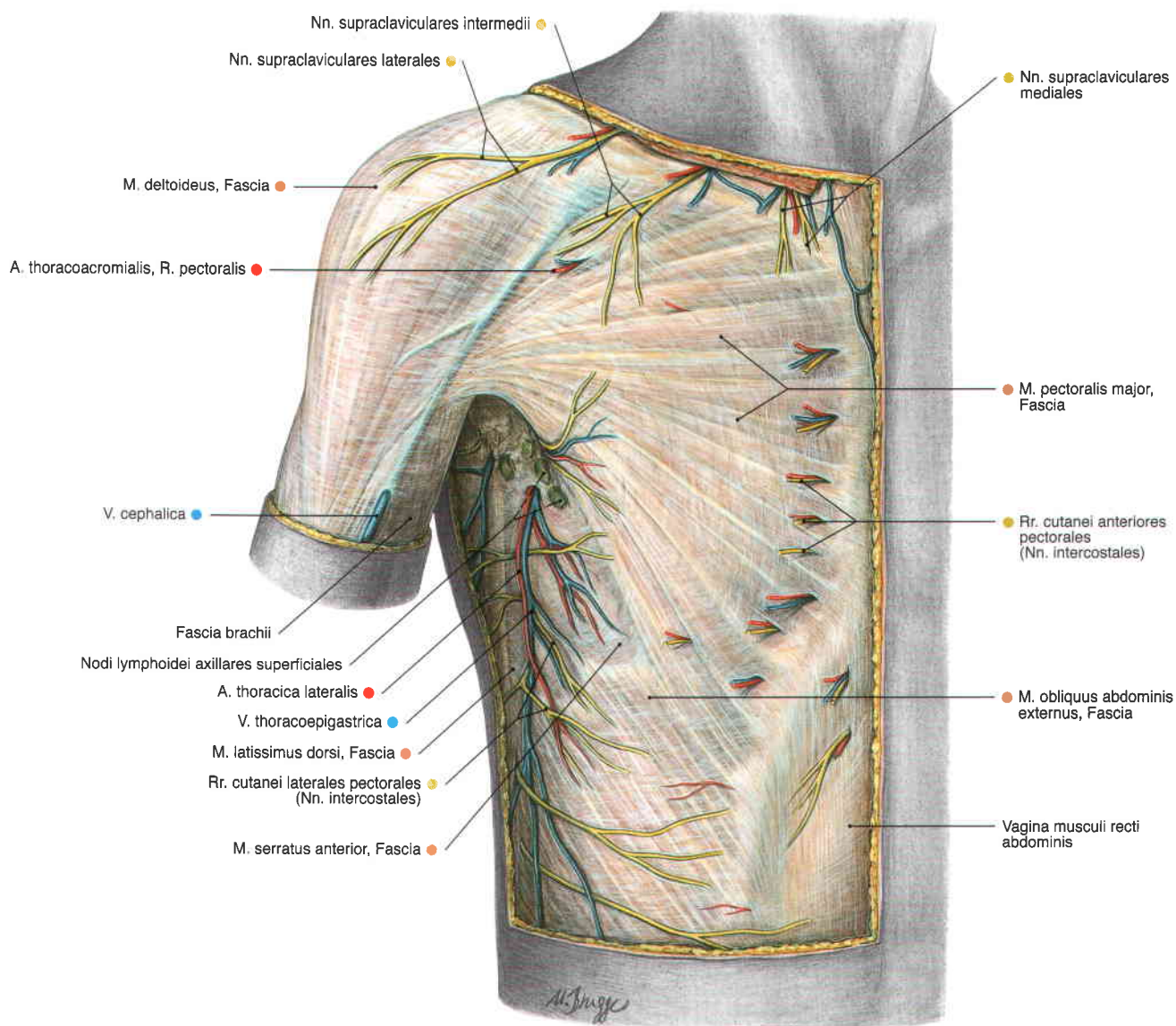
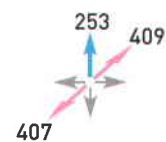


Fig. 408 Vessels and nerves in the regions of the upper arm as well as the shoulder, and the clavipectoral triangle, Trigonum clavipectorale.



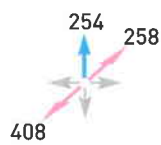
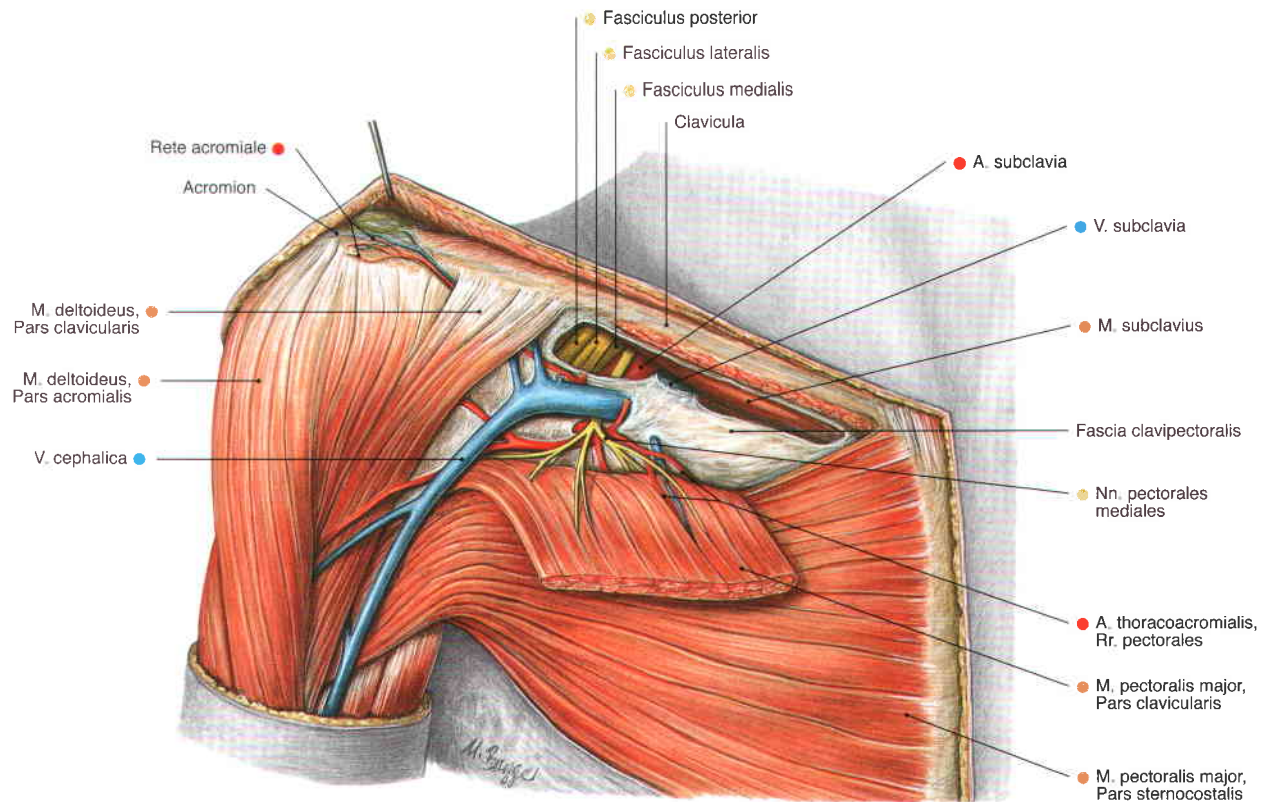
Clavipectoral triangle

Fig. 409 Clavipectoral triangle, Trigonum clavipectorale.

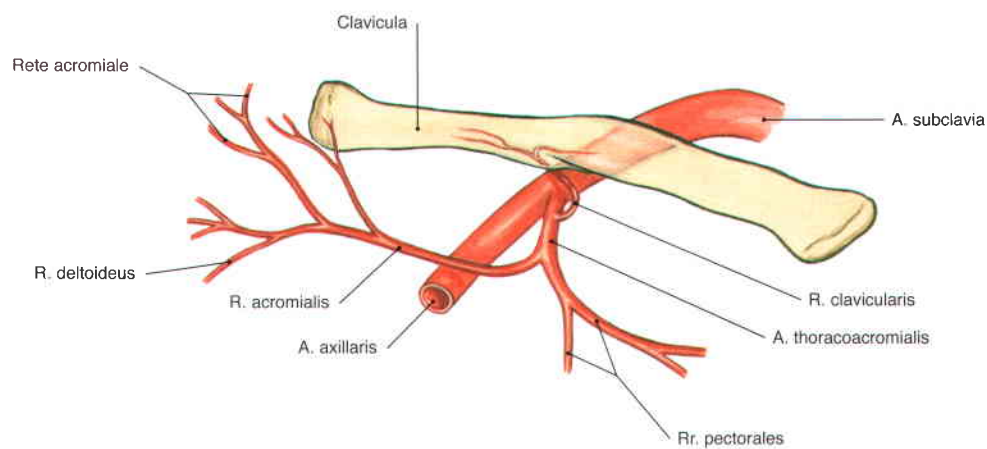


Fig. 410 Branching pattern of the thoraco-acromial artery, A. thoracoacromialis.

Axillary fossa

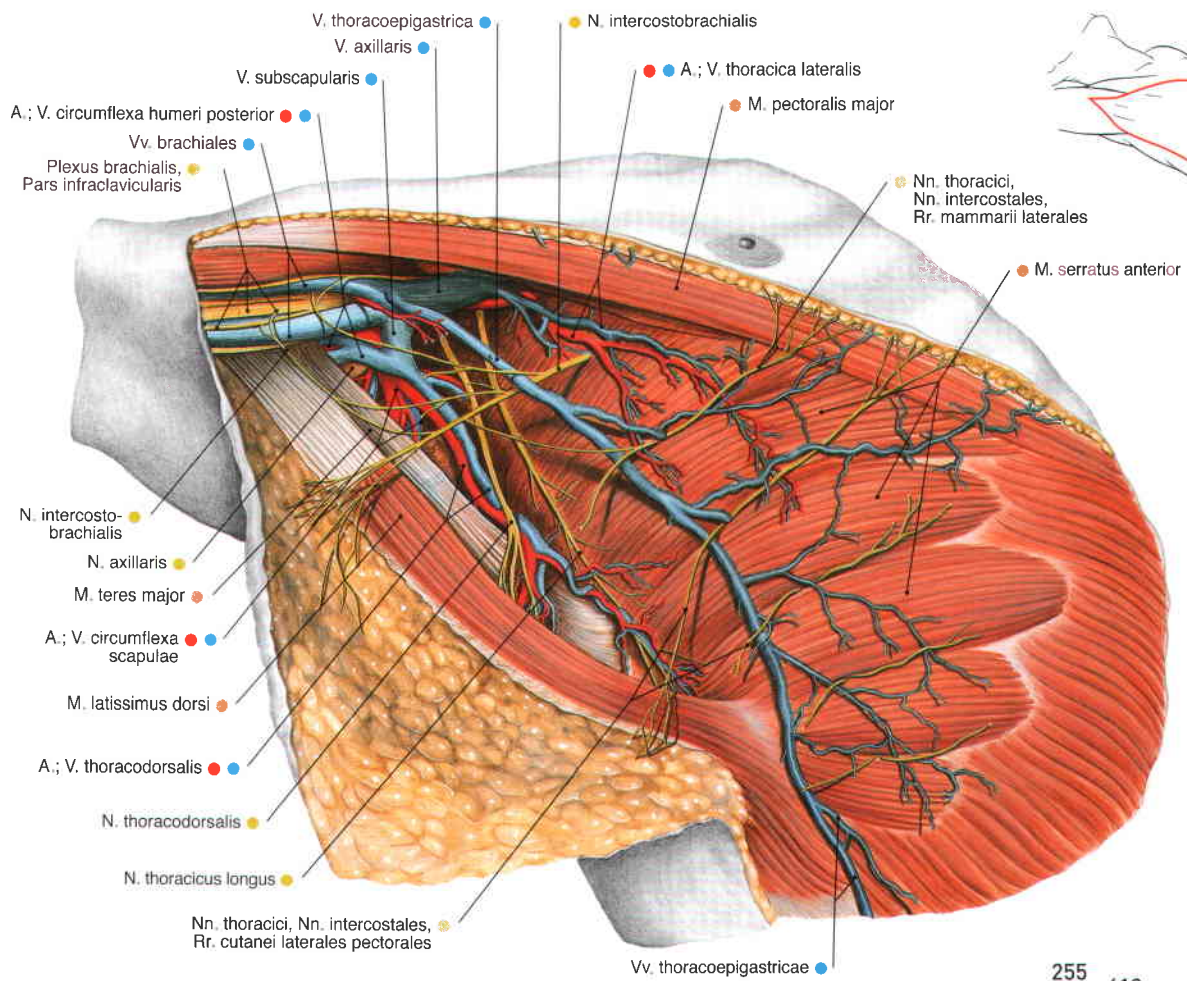


Fig. 411 Axillary fossa, Fossa axillaris.

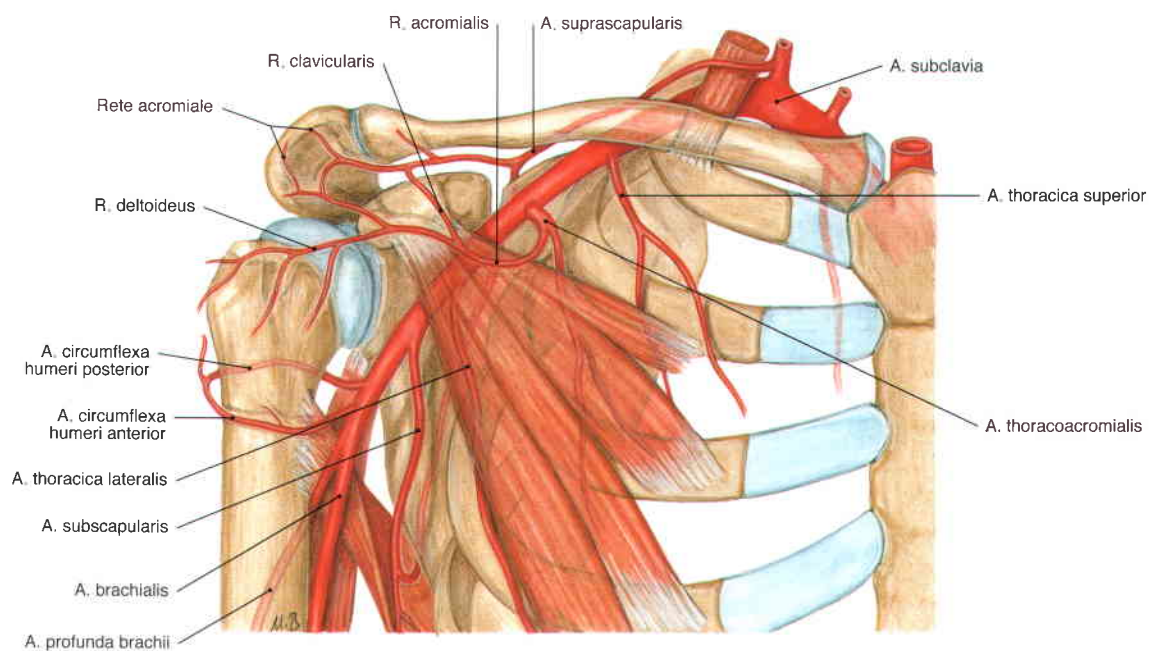
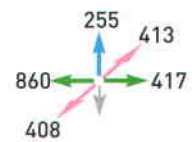


Fig. 412 Arteries of the shoulder region.

Neck and axillary fossa

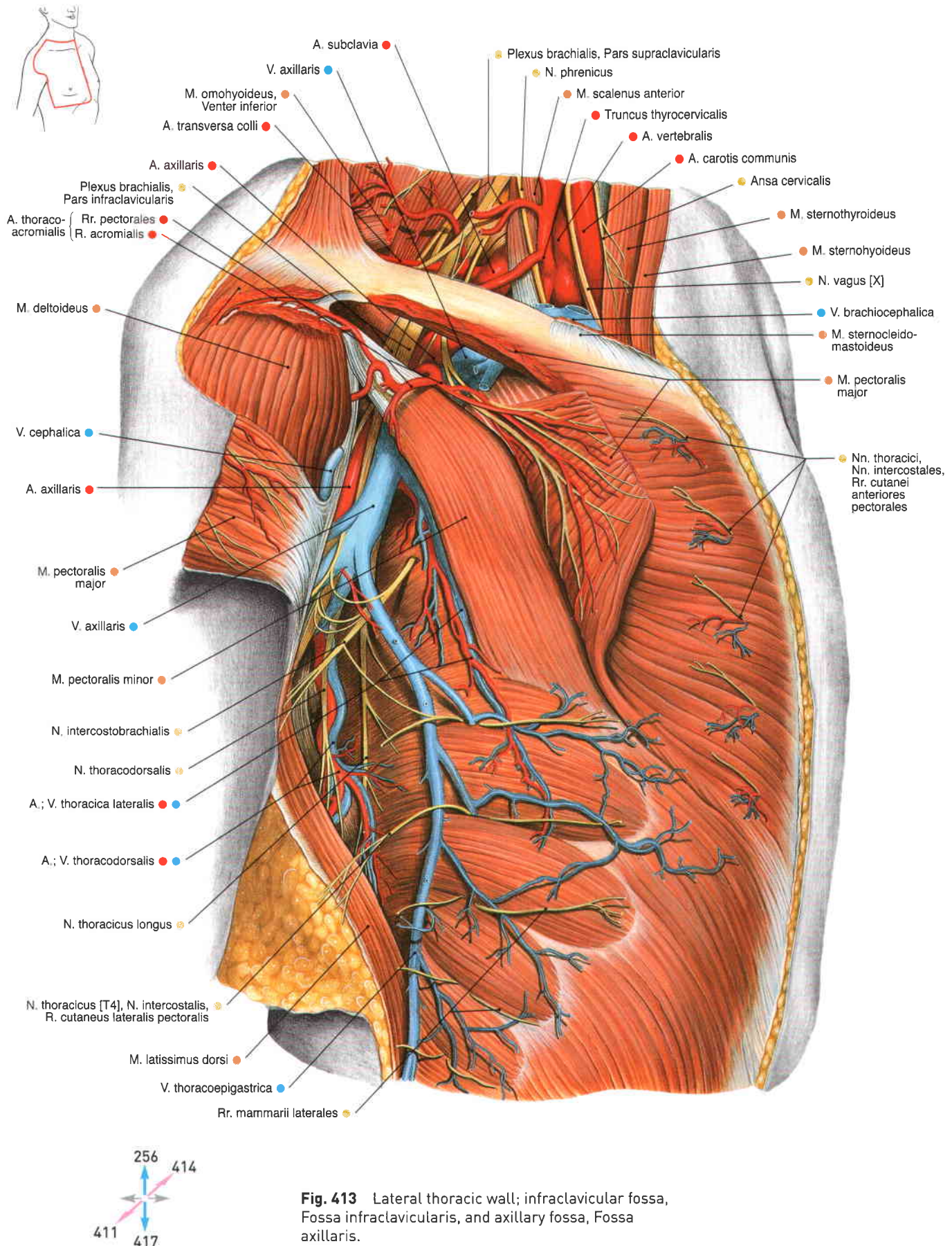


Fig. 413 Lateral thoracic wall; infraclavicular fossa, Fossa infraclavicularis, and axillary fossa, Fossa axillaris.

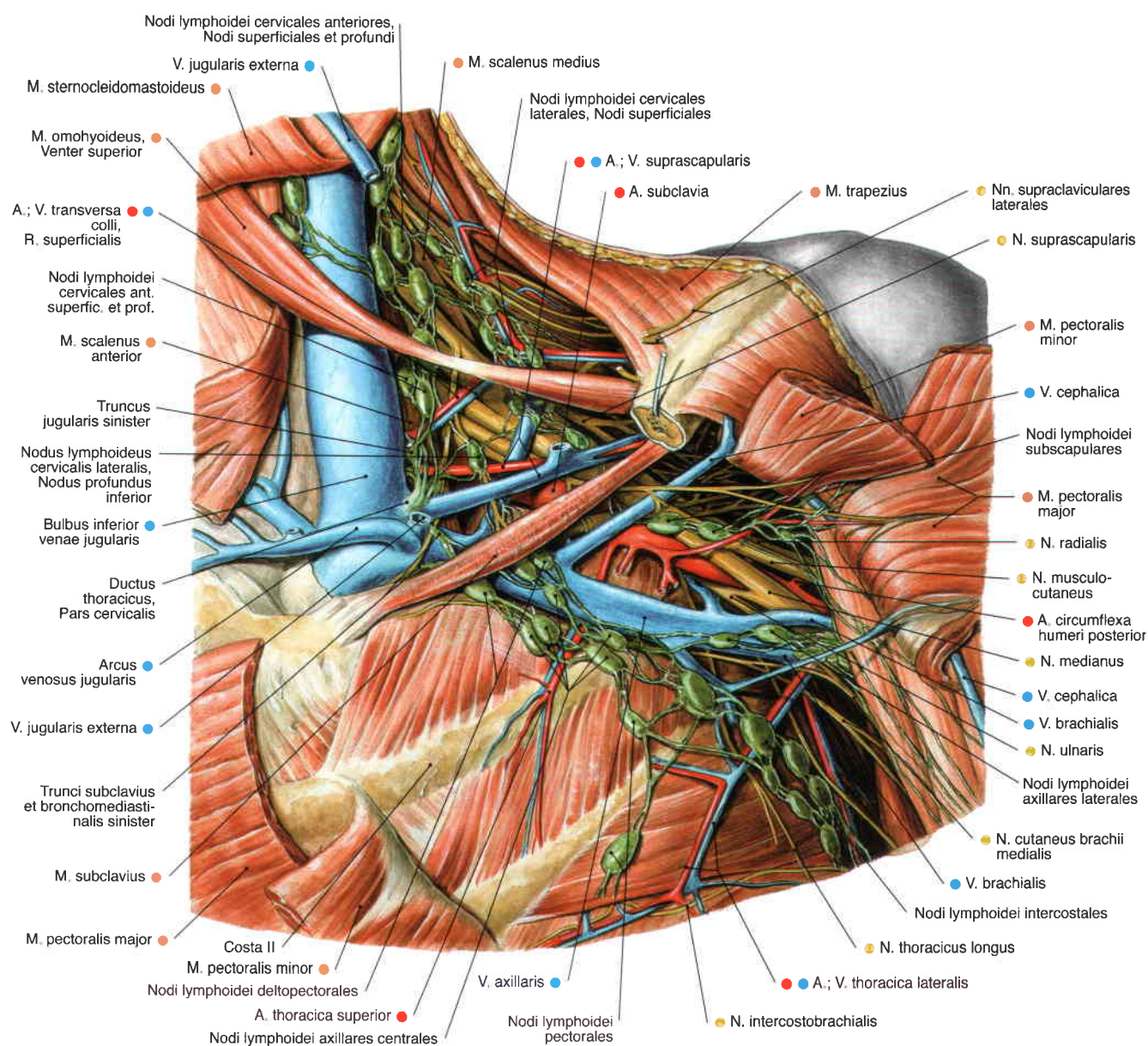
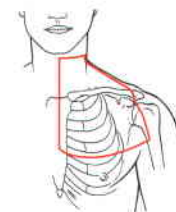
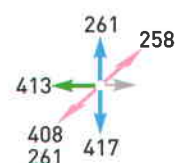


Fig. 414 Axillary fossa, Fossa axillaris, and deep cervical region; exemplary illustration of lymphatics and lymph nodes.



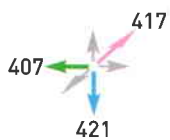
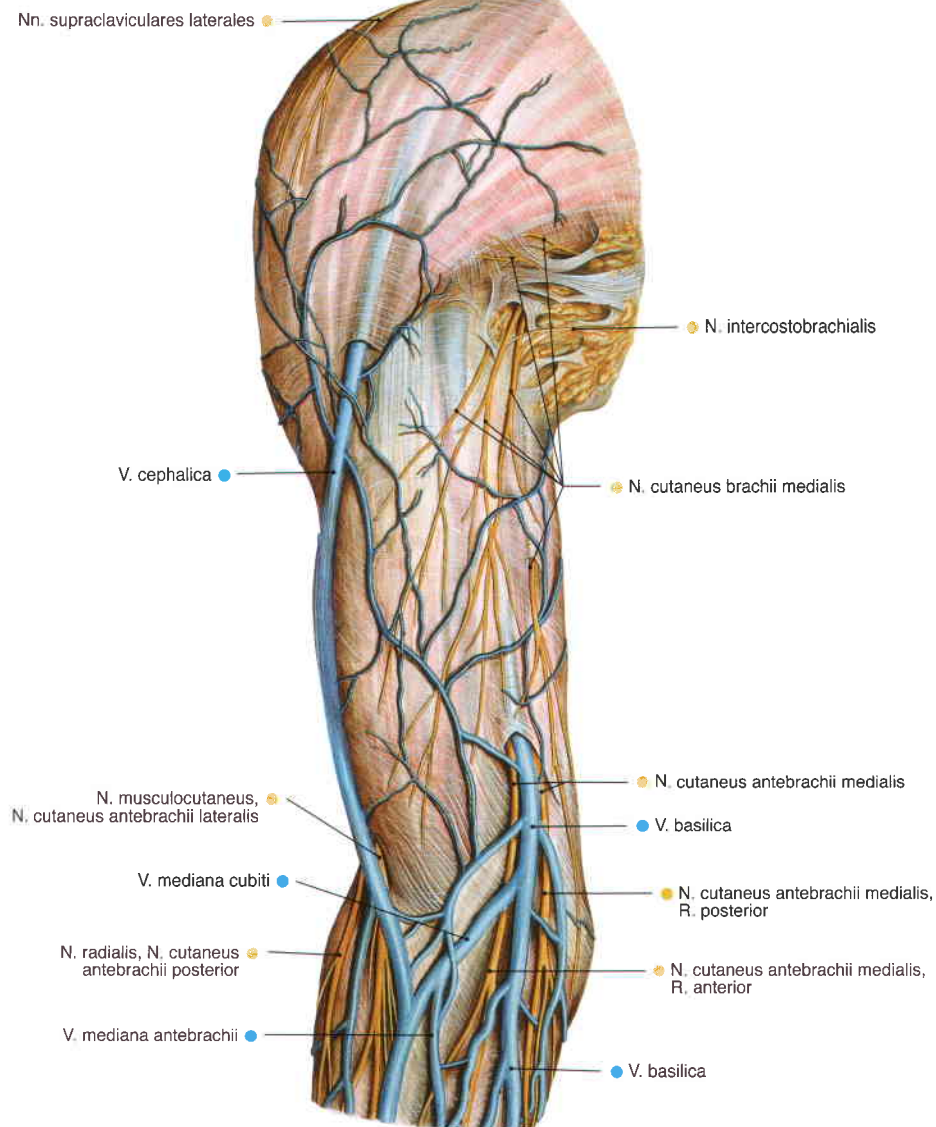
Vessels and nerves of the arm

Fig. 415 Epifascial vessels and nerves of the shoulder, Regio deltoidea, the anterior region of the arm, Regio brachii anterior, and the anterior region of the elbow, Regio cubitalis anterior.

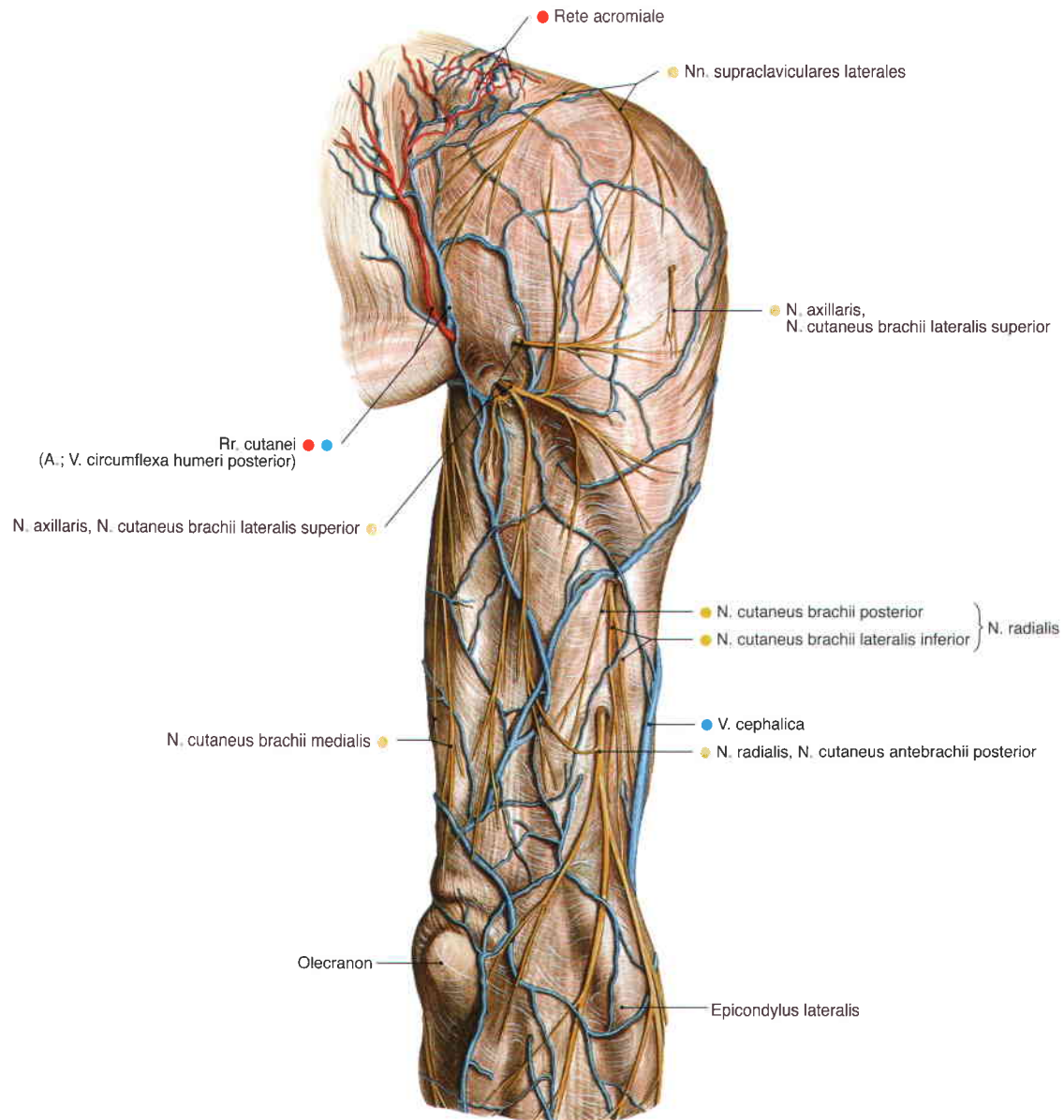


Fig. 416 Epifascial vessels and nerves of the shoulder, Regio deltoidea, the posterior region of the arm, Regio brachii posterior, and the posterior region of the elbow, Regio cubitalis posterior.



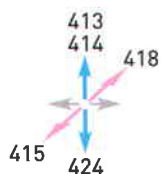
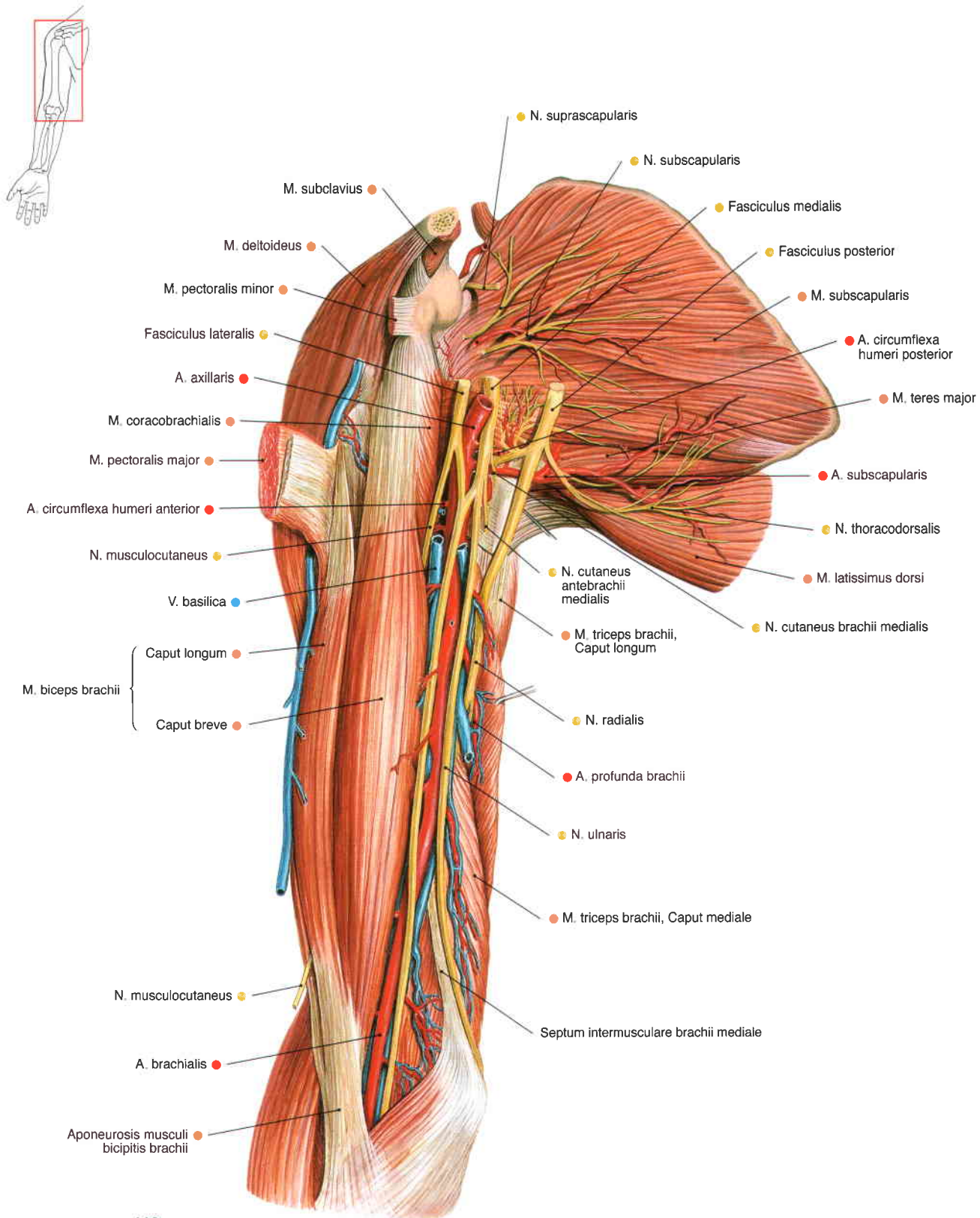
Vessels and nerves of the arm

Fig. 417 Vessels and nerves of the anterior region of the arm, Regio brachii anterior.

Arteries and nerves of the arm

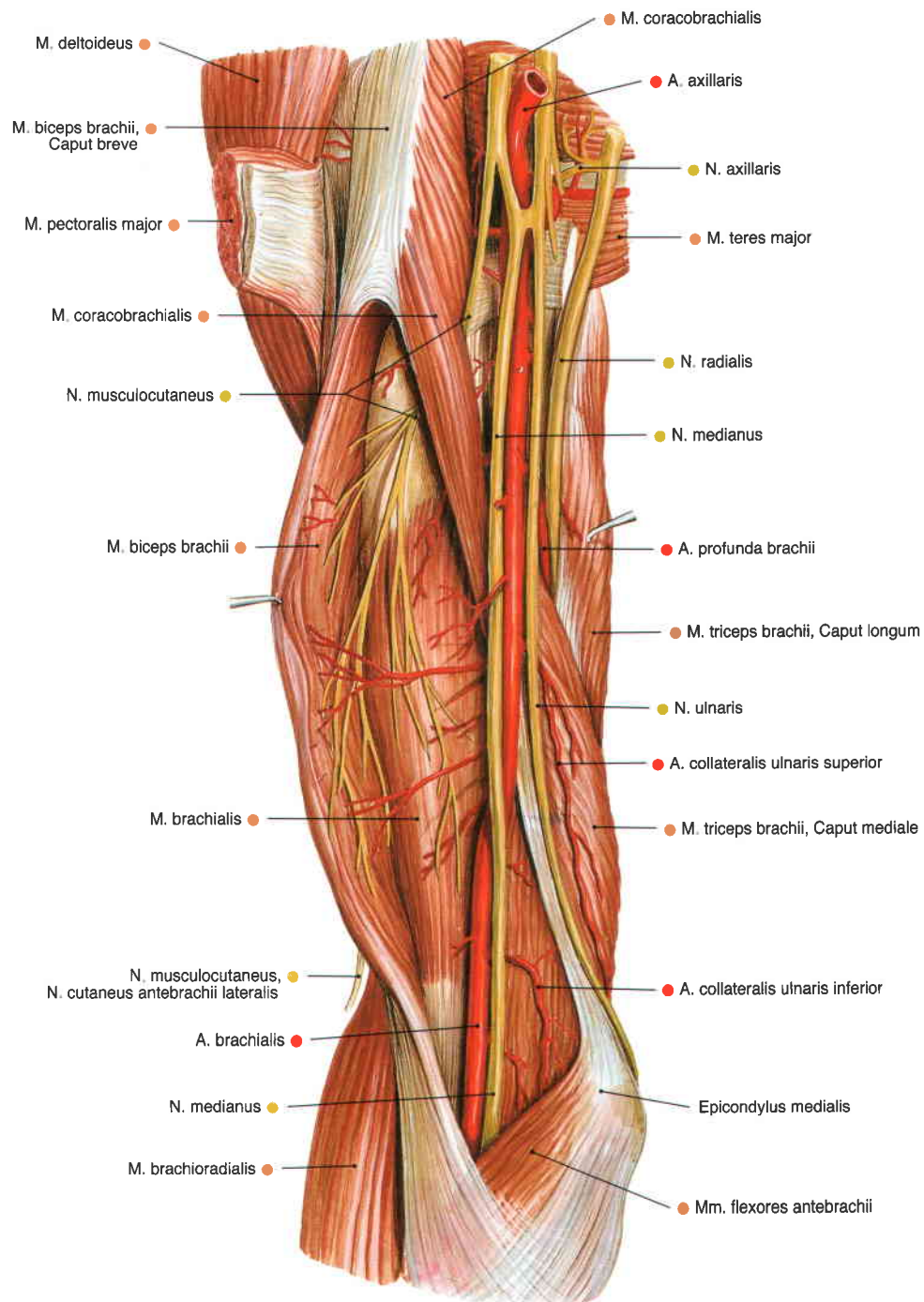


Fig. 418 Arteries and nerves of the anterior region of the arm, Regio brachii anterior.



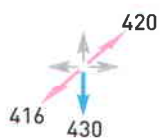
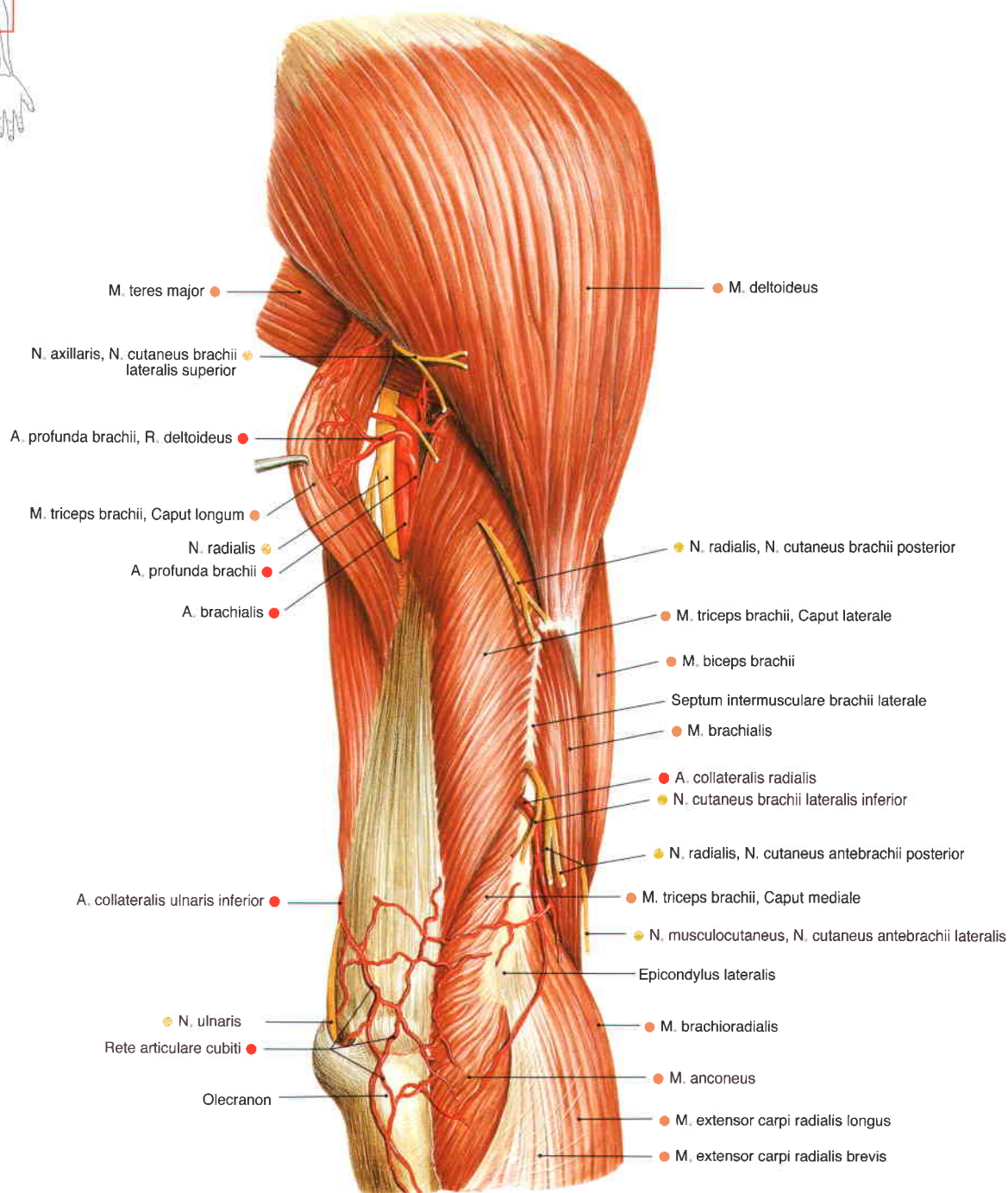
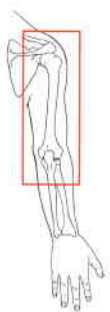
Arteries and nerves of the arm

Fig. 419 Arteries and nerves of the posterior region of the arm, Regio brachii posterior.

Arteries and nerves of the arm

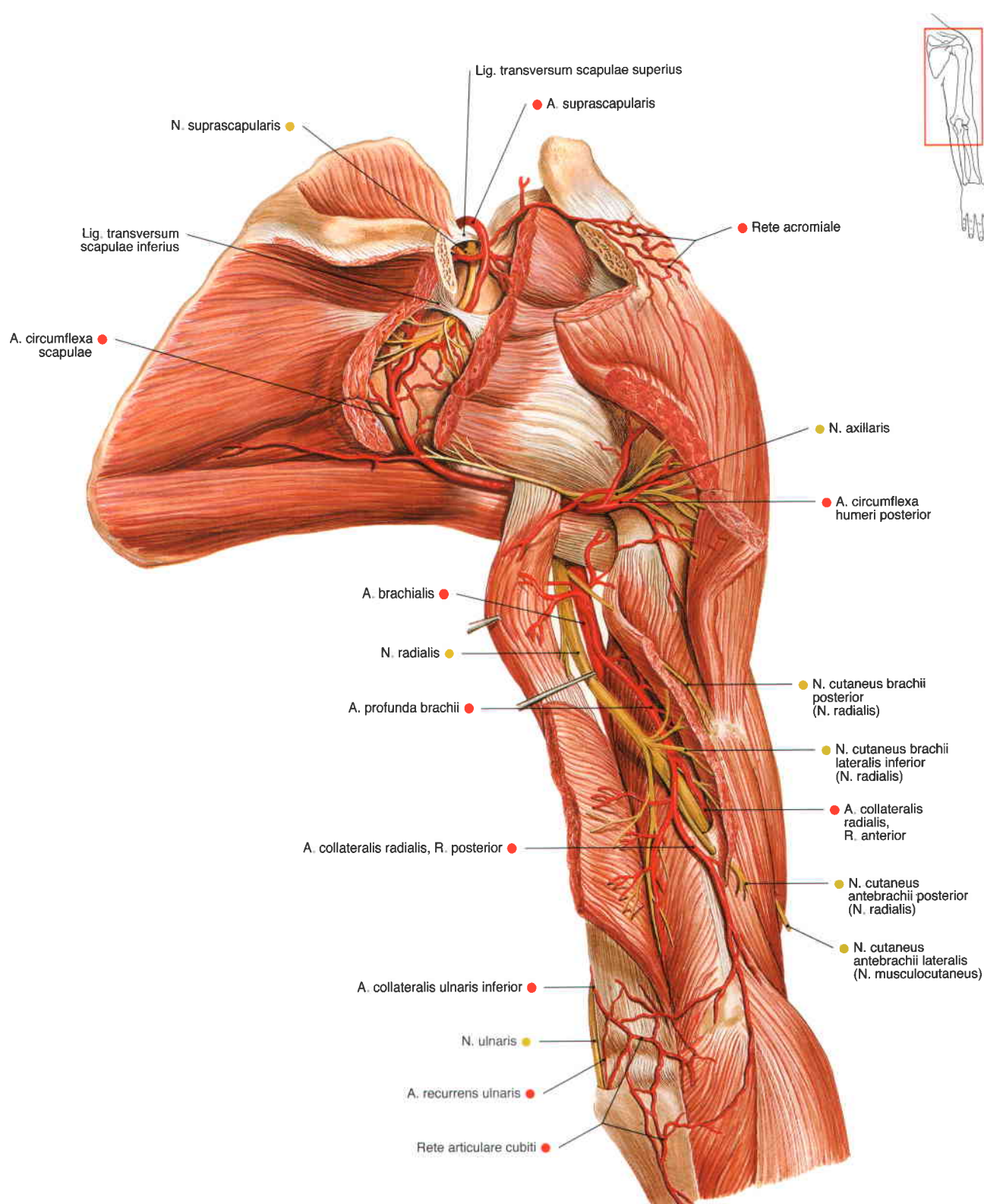


Fig. 420 Arteries and nerves of the scapular region, Regio scapularis, and the posterior region of the arm, Regio brachii posterior.



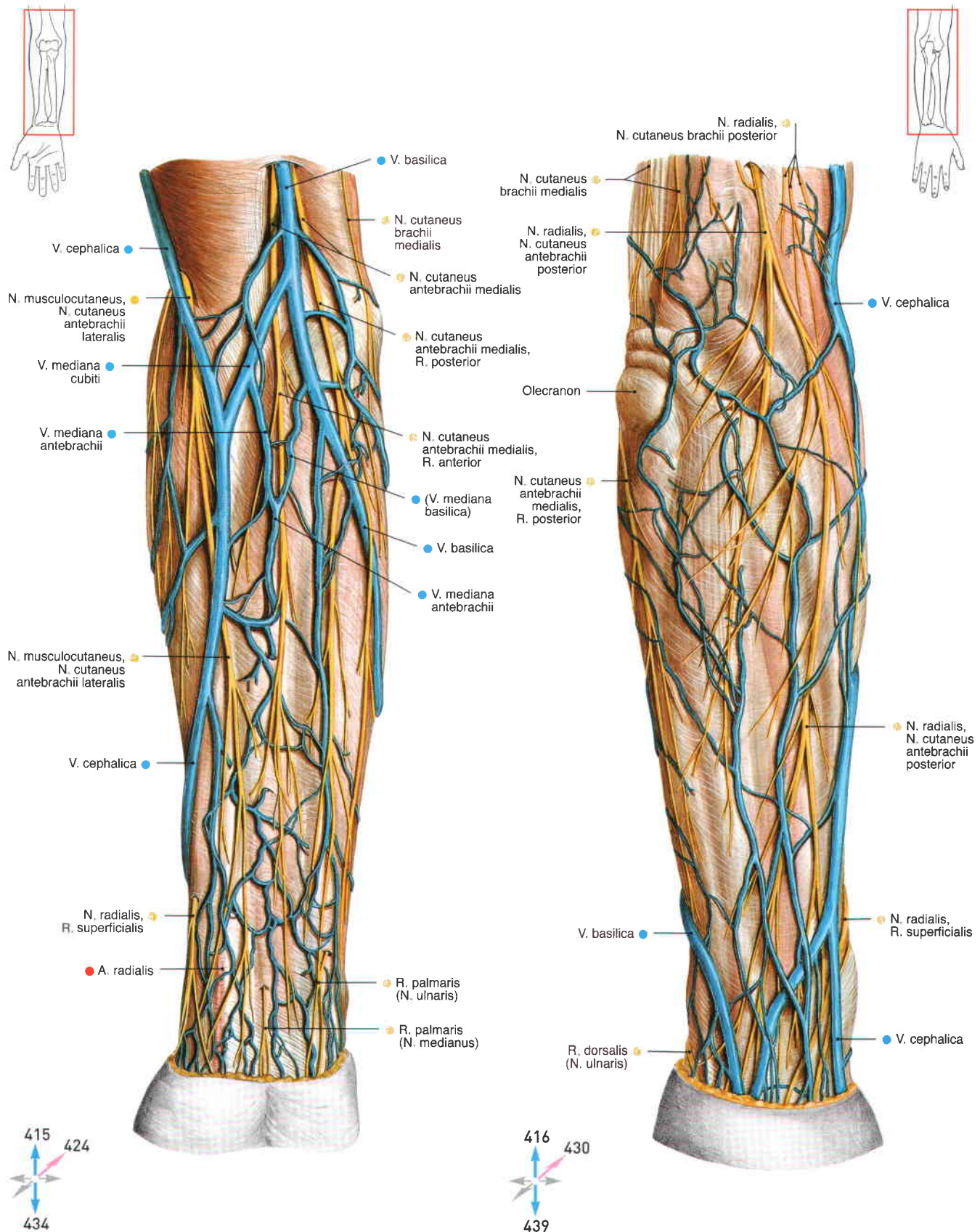
Veins and nerves of the forearm

Fig. 421 Veins and nerves of the anterior region of the forearm, Regio antebrachii anterior; epifascial layer.

Fig. 422 Veins and nerves of the posterior region of the forearm, Regio antebrachii posterior; epifascial layer.

Veins of the cubital fossa

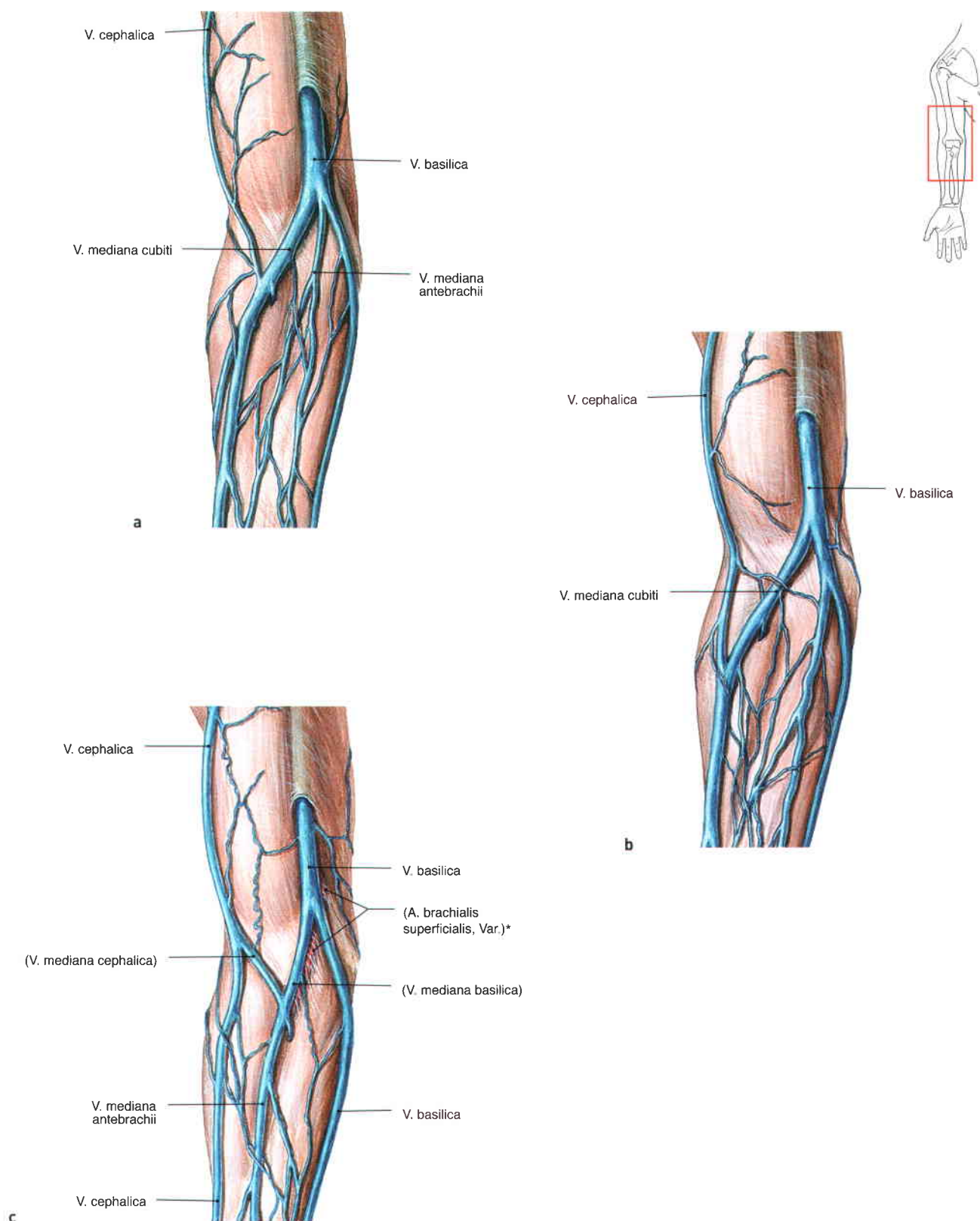


Fig. 423 a–c Variations in the epifascial veins of the cubital fossa.

* With regard to intravenous injections, this rare variation is particularly important, as a supposedly intravenous injection can mistakenly become intra-arterial.

Arteries and nerves of the forearm

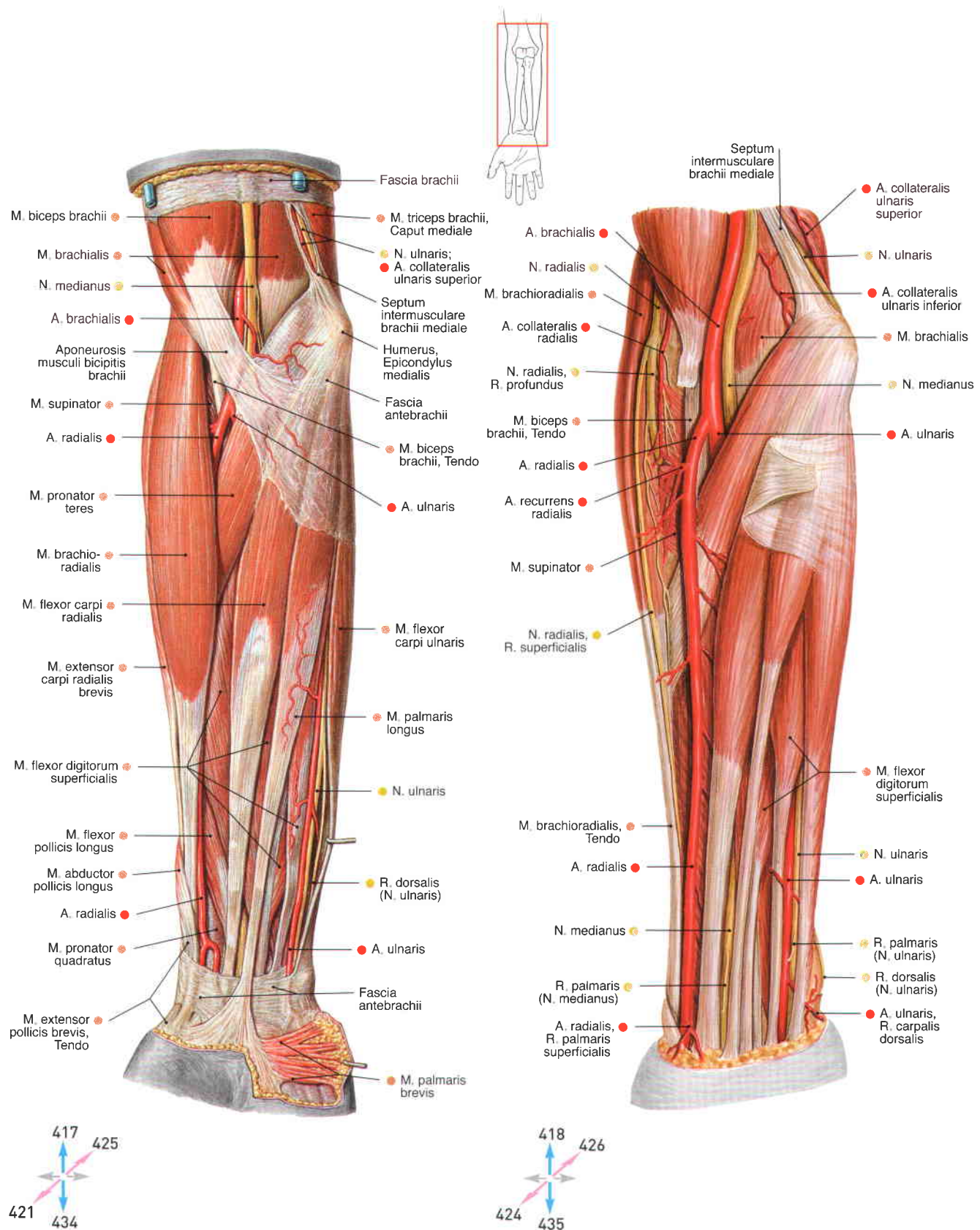
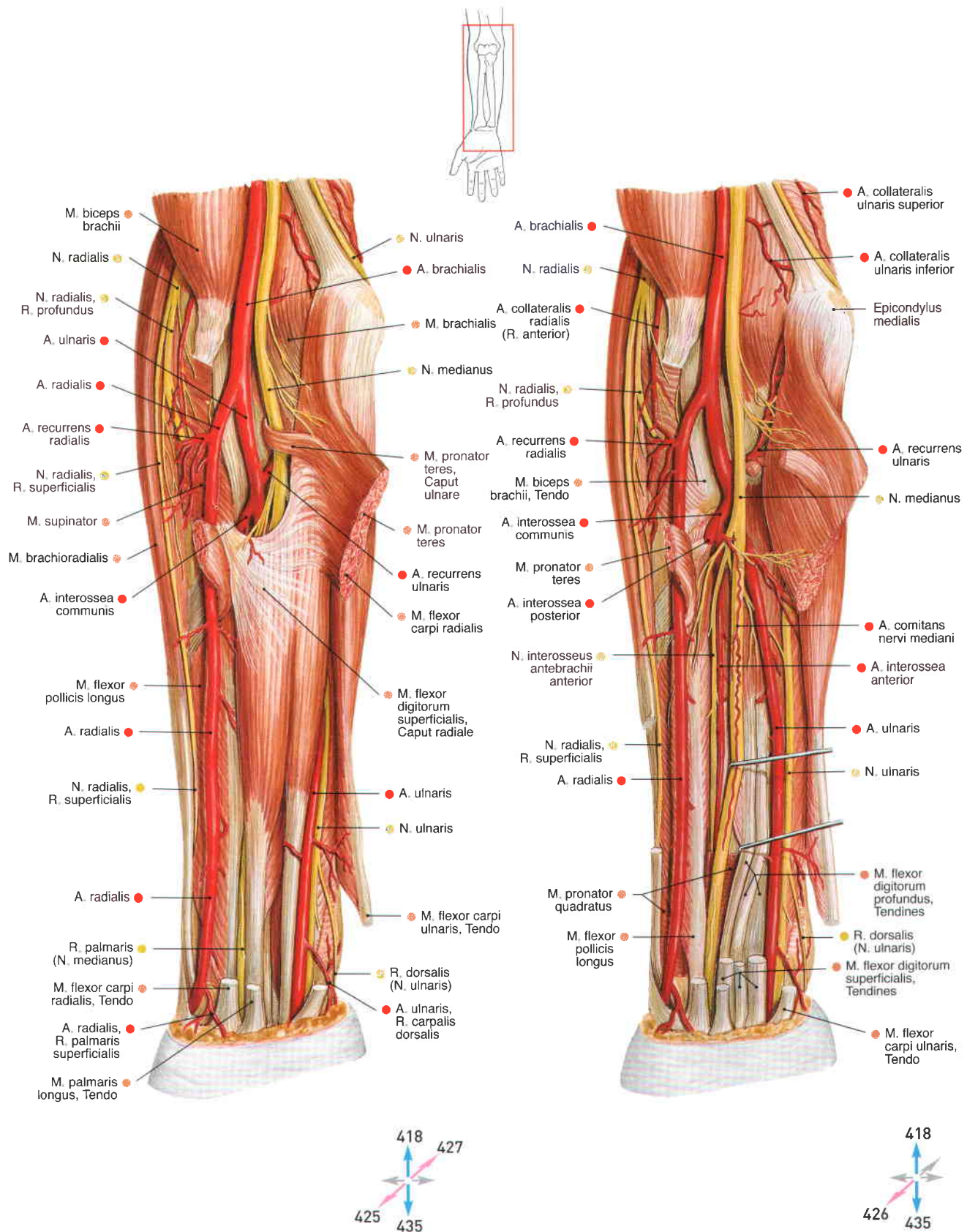


Fig. 424 Arteries and nerves of the anterior region of the forearm, Regio antebrachii anterior; subfascial layer.

Fig. 425 Arteries and nerves of the anterior region of the forearm, Regio antebrachii anterior; course of the radial artery, A. radialis.

Arteries and nerves of the forearm



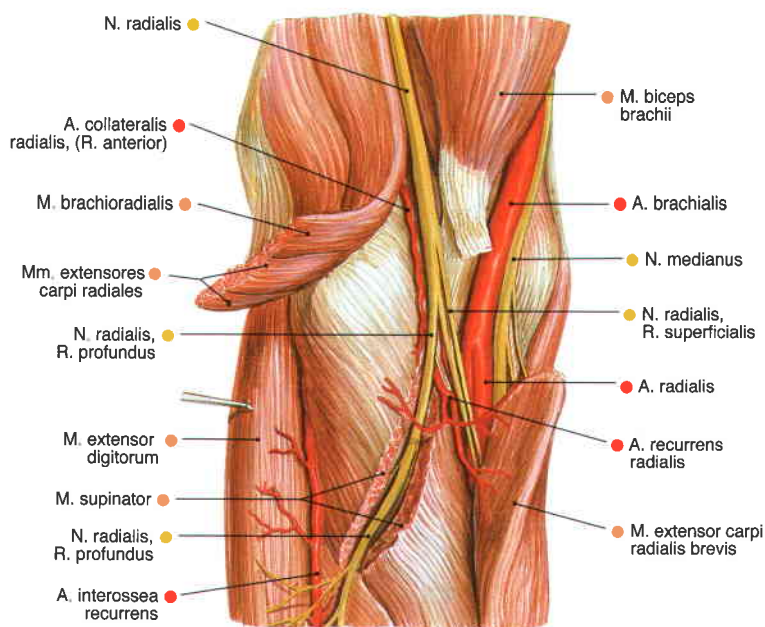
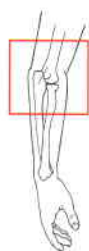
Arteries and nerves of the cubital fossa

Fig. 428 Arteries and nerves of the anterior region of the elbow, Regio cubitalis anterior; after removal of the radial muscles of the forearm; lateral (radial) view.

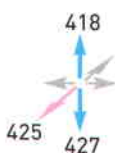
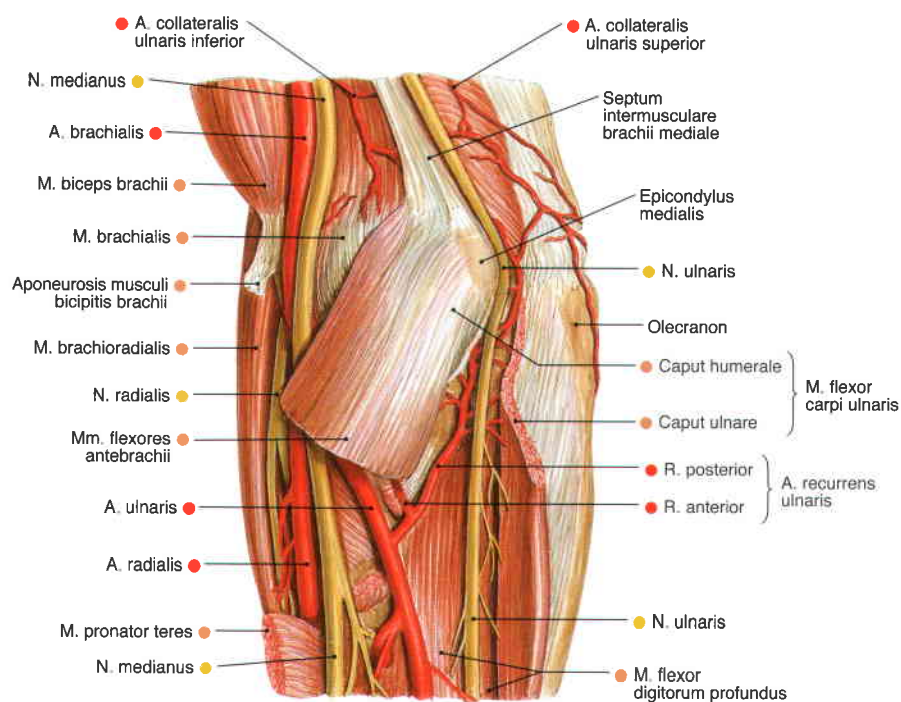
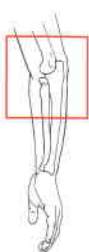


Fig. 429 Arteries and nerves of the anterior region of the elbow, Regio cubitalis anterior; after partial removal of the flexor muscles of the forearm; medial (ulnar) view.

Arteries and nerves of the forearm

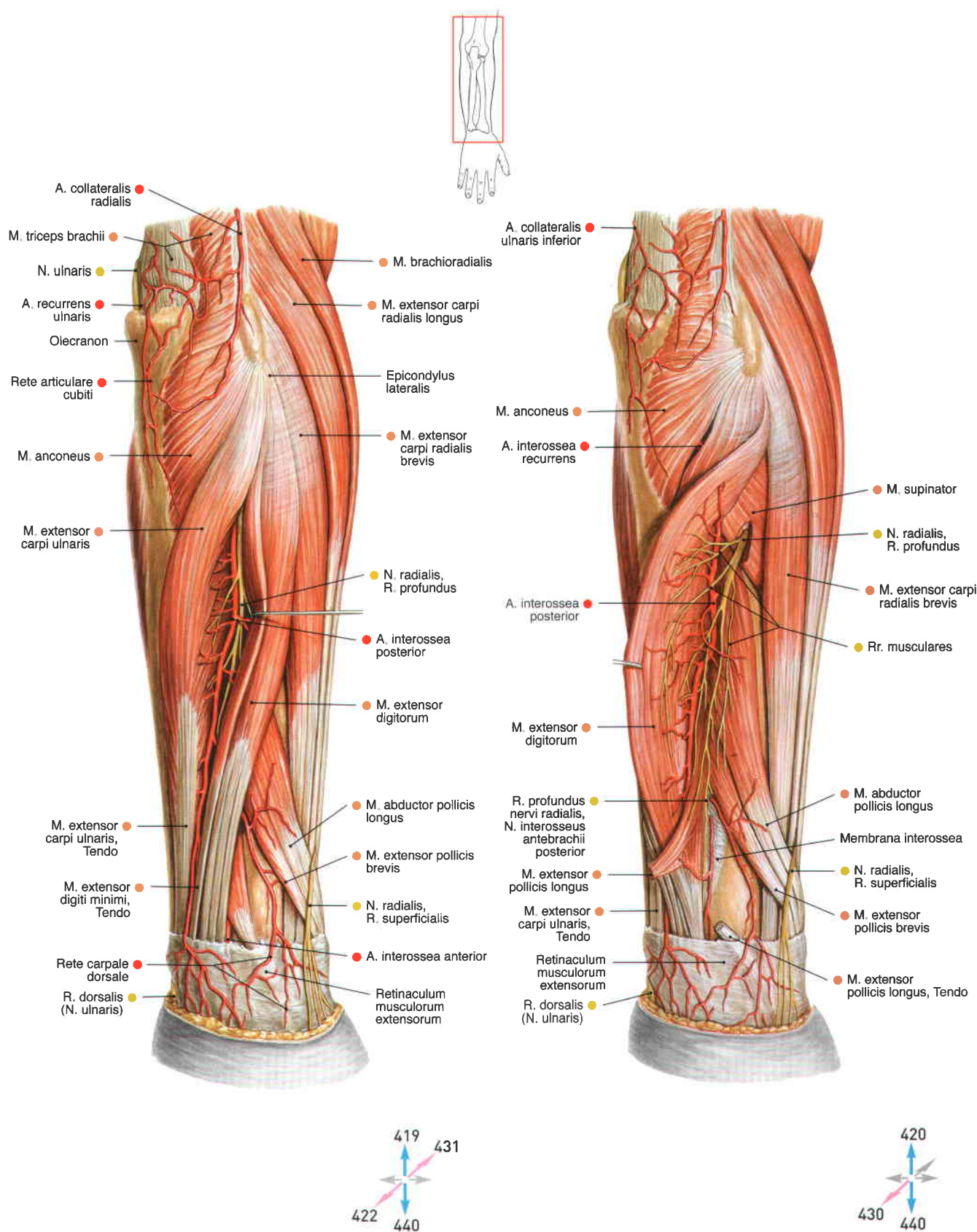


Fig. 430 Arteries and nerves of the posterior region of the forearm, Regio antebrachii posterior; superficial layer.

Fig. 431 Arteries and nerves of the posterior region of the forearm, Regio antebrachii posterior; deep layer.

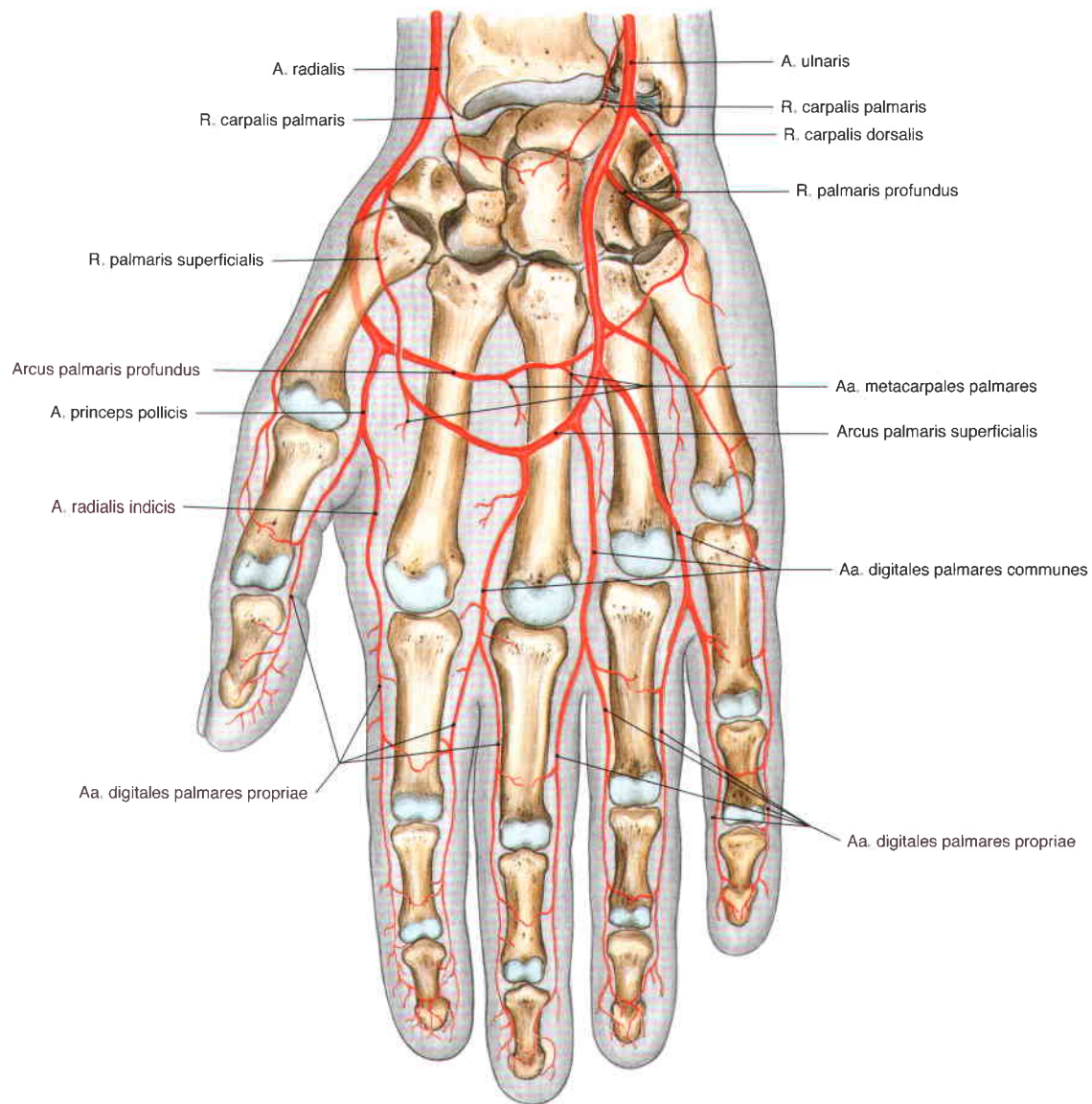
Arteries of the hand

Fig. 432 Arteries of the palm, Palma; overview.

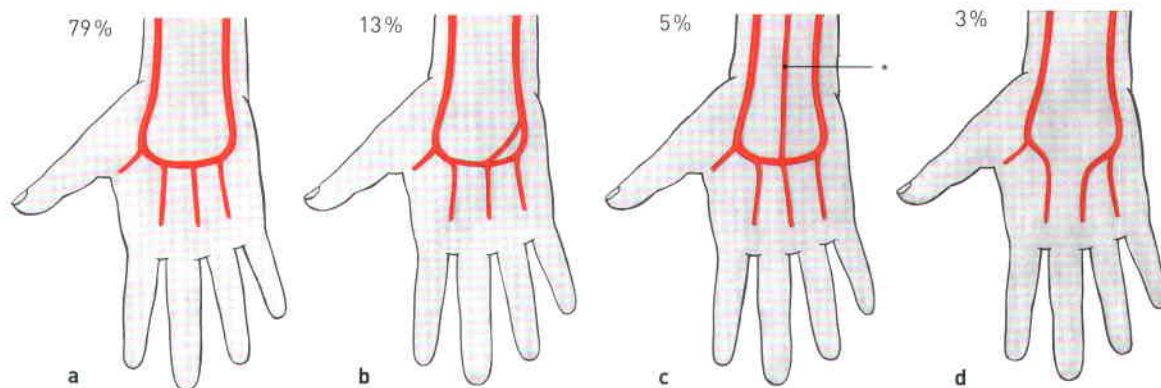


Fig. 433 a–d Variations of the deep palmar arch, Arcus palmaris profundus.

a "Textbook case", simple, closed arch
b Doubling of the ulnar part

c Anastomosis with the anterior interosseous artery, A. interossea anterior (*)
d The radial artery, A. radialis, supplies both radial fingers, whereas the ulnar artery, A. ulnaris, supplies the three ulnar fingers.

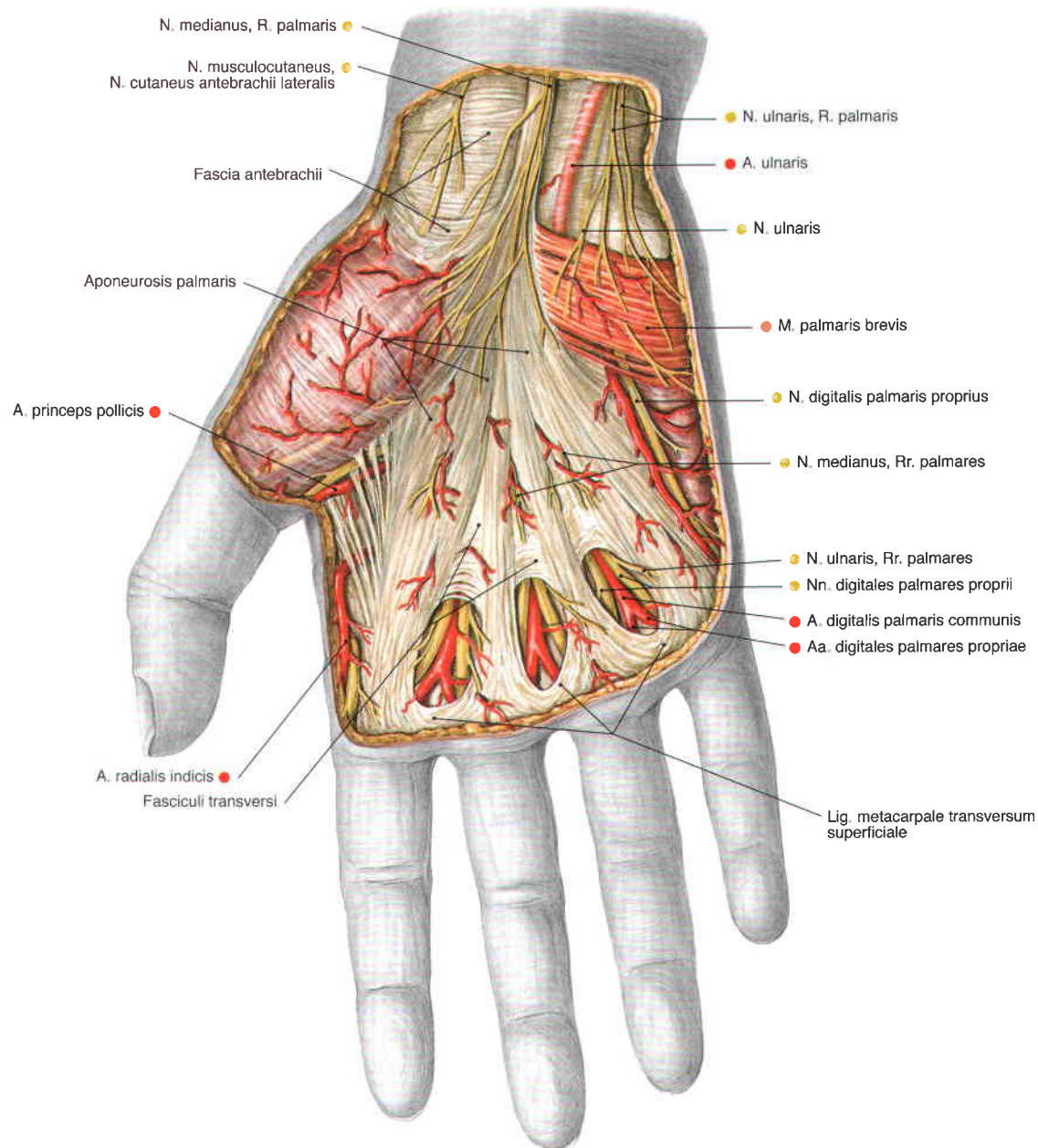


Fig. 434 Arteries and nerves of the palm, Palma; superficial layer.



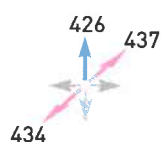
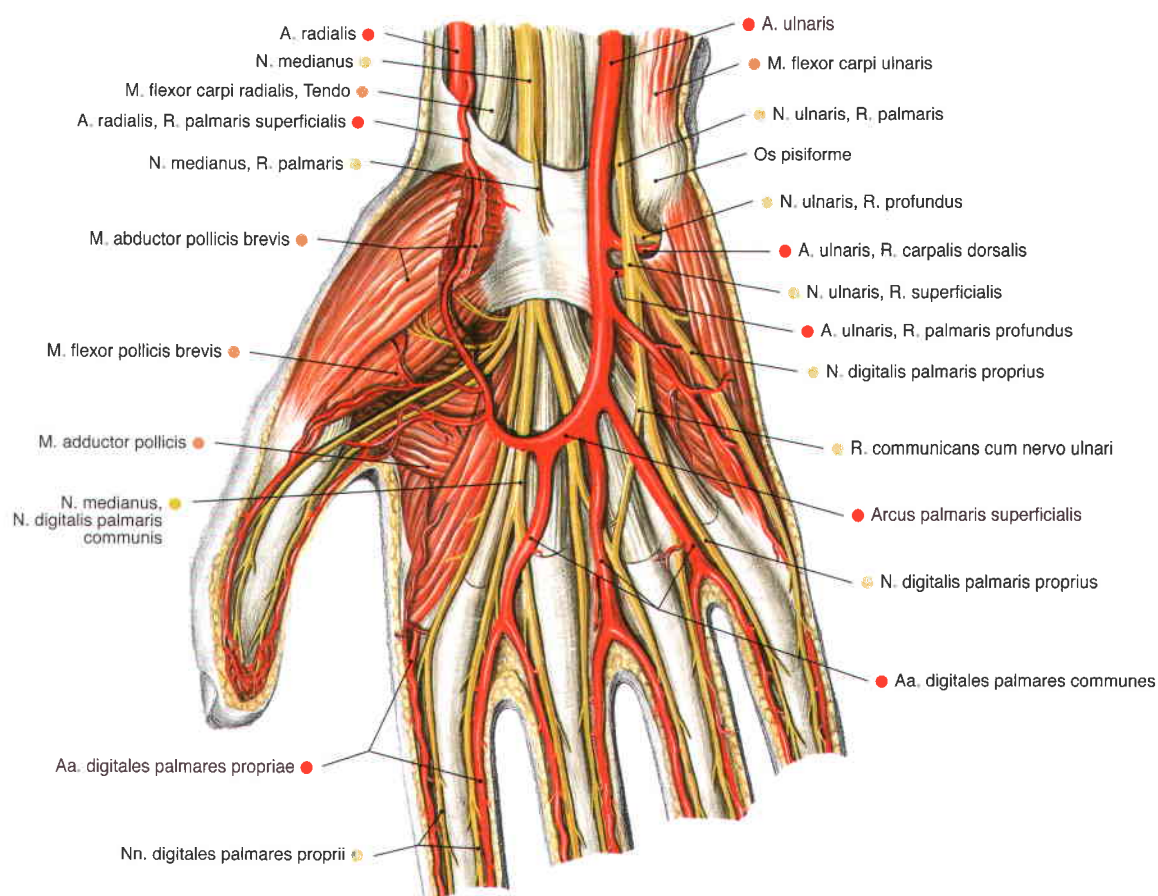
Arteries and nerves of the hand

Fig. 435 Arteries and nerves of the palm, Palma; middle layer.

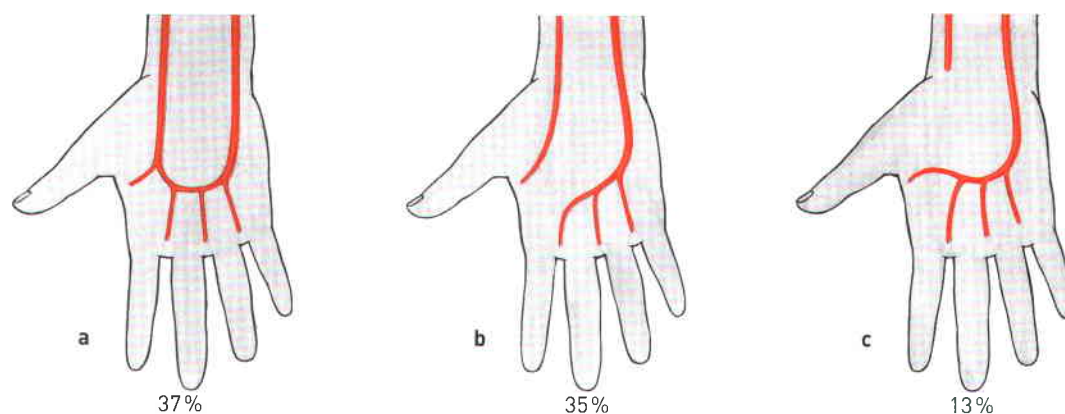


Fig. 436a–c Variations of the superficial palmar arch, Arcus palmaris superficialis.

a "Textbook case", closed arch

b The ulnar artery, A. ulnaris, supplies the three ulnar fingers.

c All fingers are supplied by the ulnar artery, A. ulnaris.

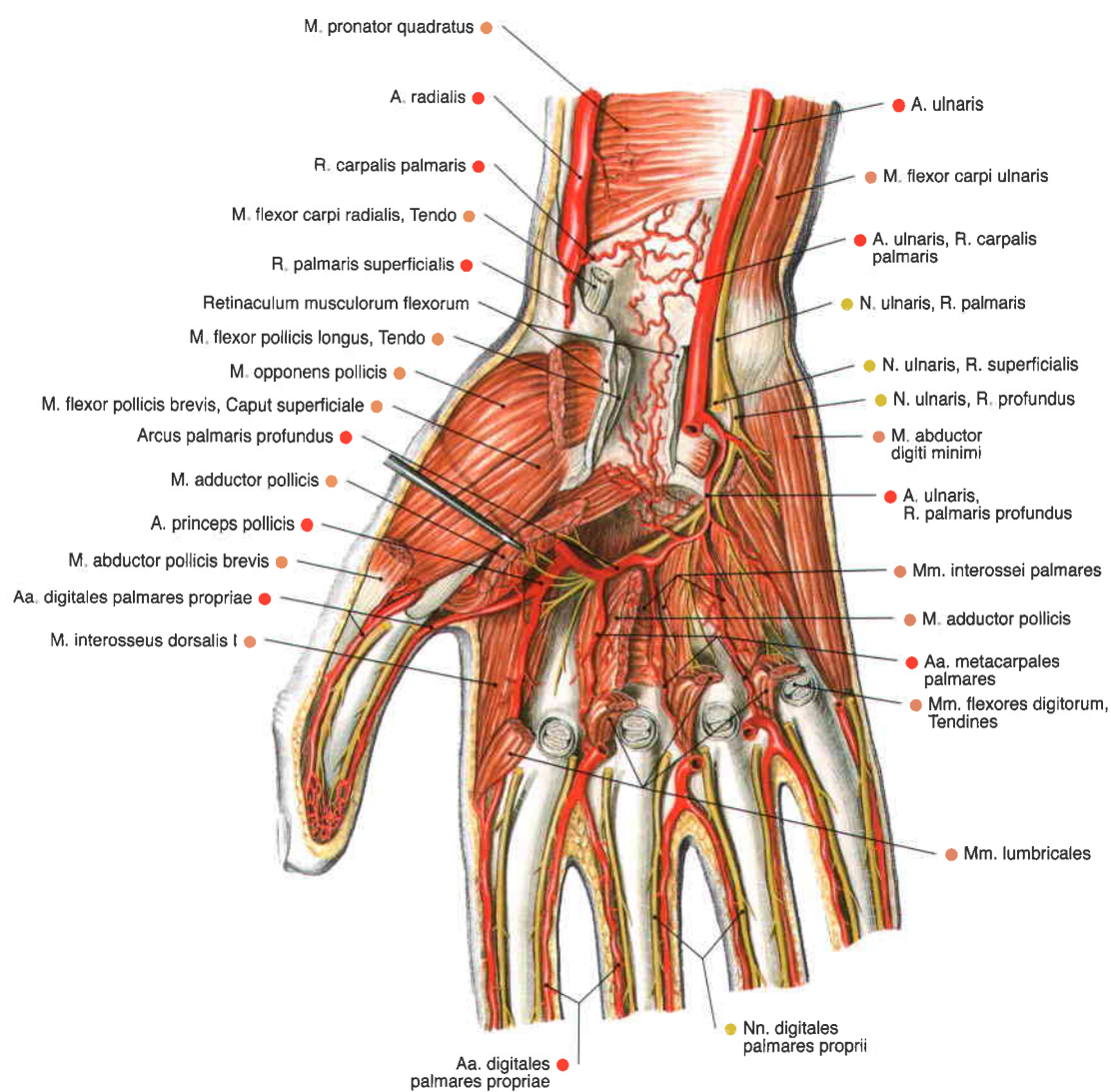
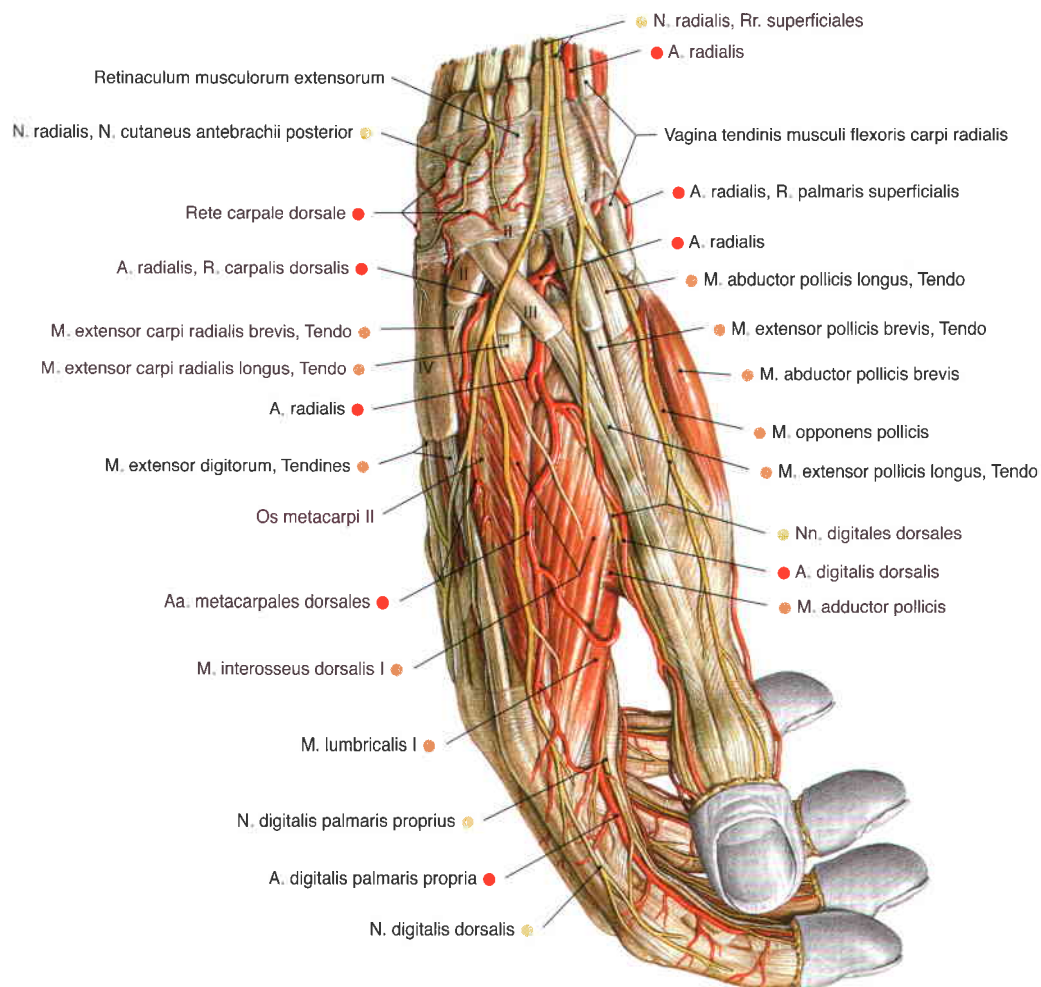
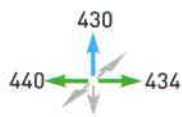


Fig. 437 Arteries and nerves of the palm, Palma; deep layer.



Arteries and nerves of the hand

- I–IV Vaginae tendinum musculorum extensorum:
- I Vagina tendinum musculorum abductoris longi et extensoris pollicis brevis
 - II Vagina tendinum musculorum extensorum carpi radialis
 - III Vagina tendinis musculi extensoris pollicis longi
 - IV Vagina tendinum musculorum extensoris digitorum et extensoris indicis

**Fig. 438** Arteries and nerves of the hand.

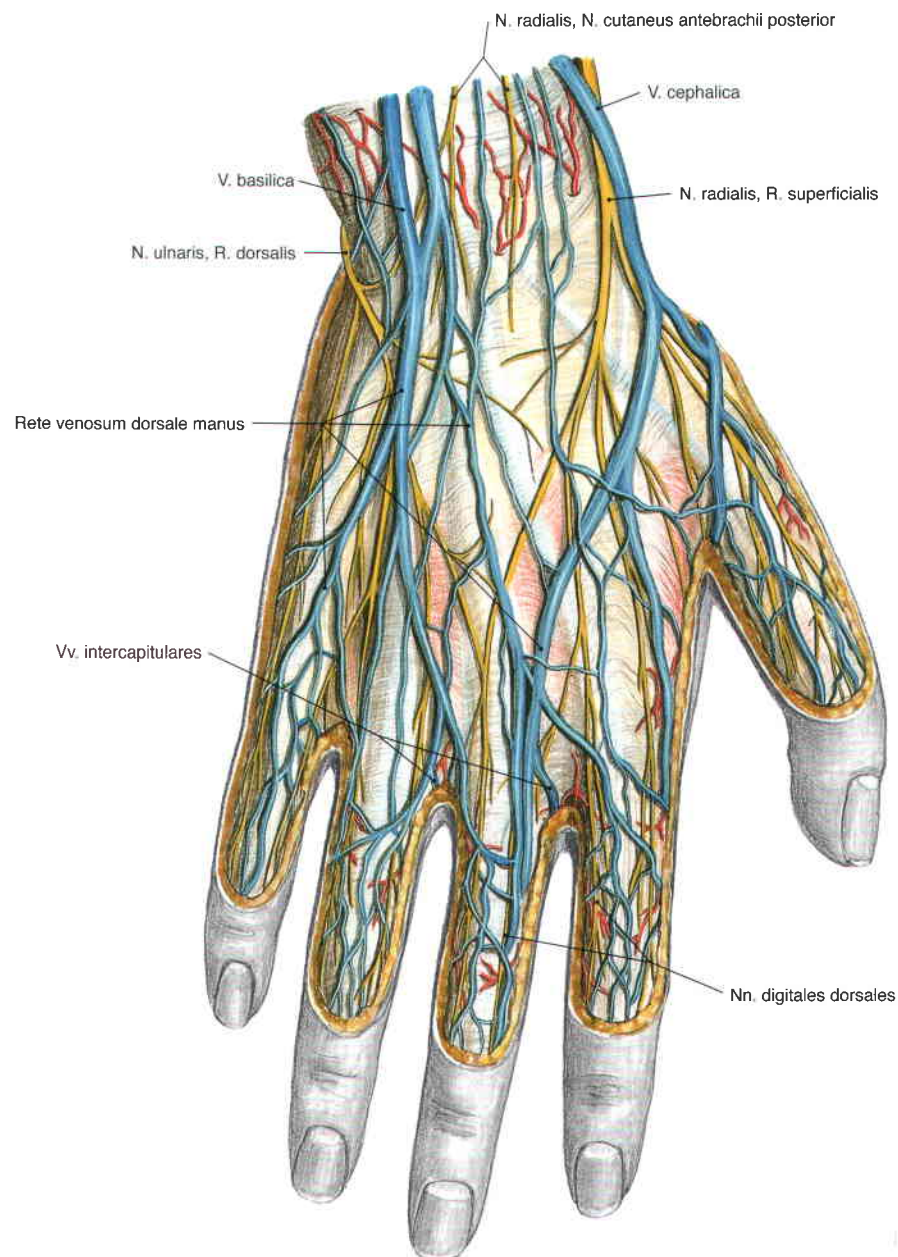


Fig. 439 Vessels and nerves of the dorsum of the hand, Dorsum manus; superficial layer.



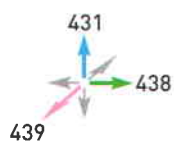
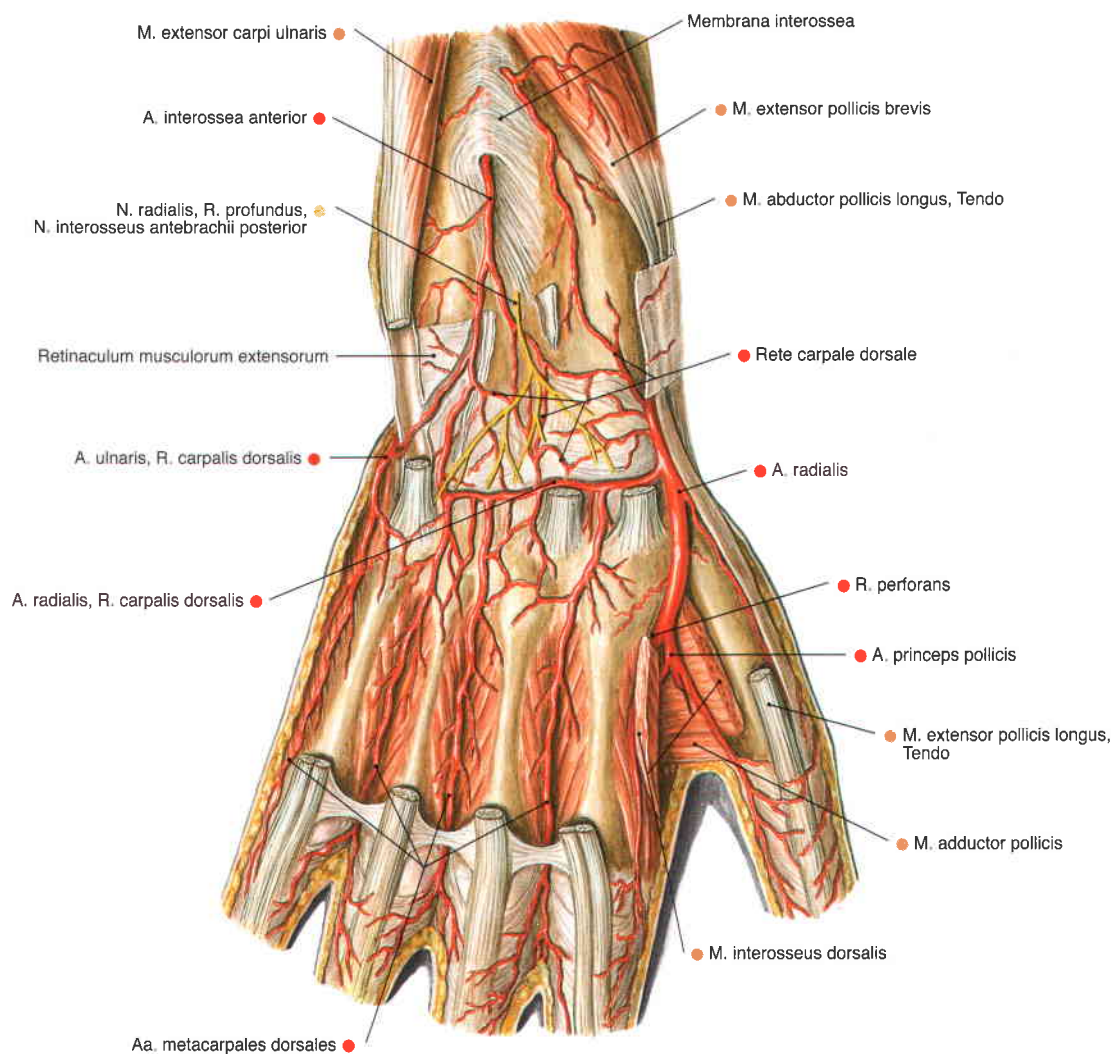
Arteries and nerves of the hand

Fig. 440 Arteries and nerves of the dorsum of the hand, Dorsum manus; deep layer.

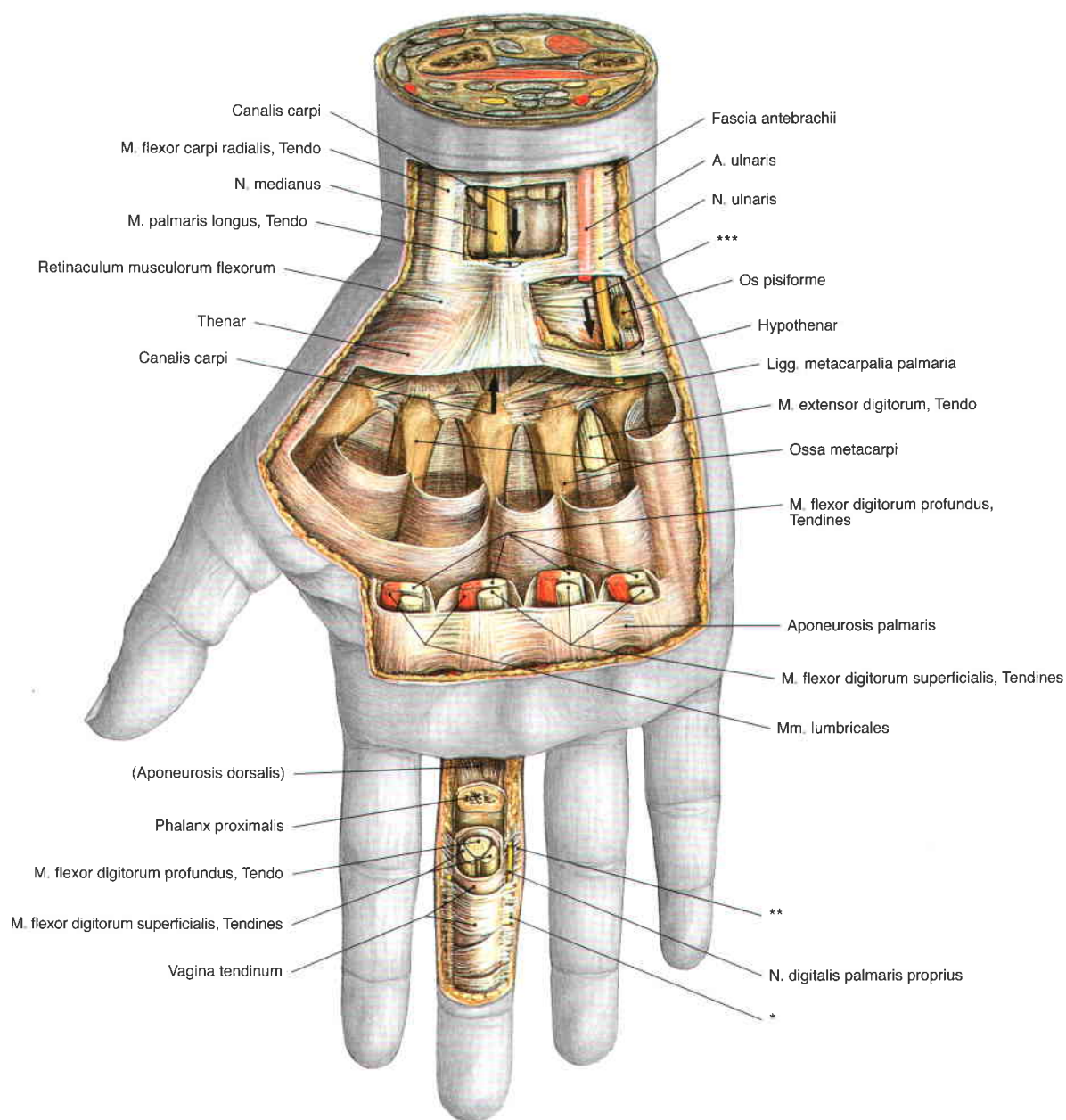


Fig. 441 Fascial compartments of the hand.

* Clinical term: ligament of GRAYSON

** Clinical term: ligament of CLELAND

*** Clinical term: ulnar canal, Canalis ulnocarpalis (loge de GUYON)

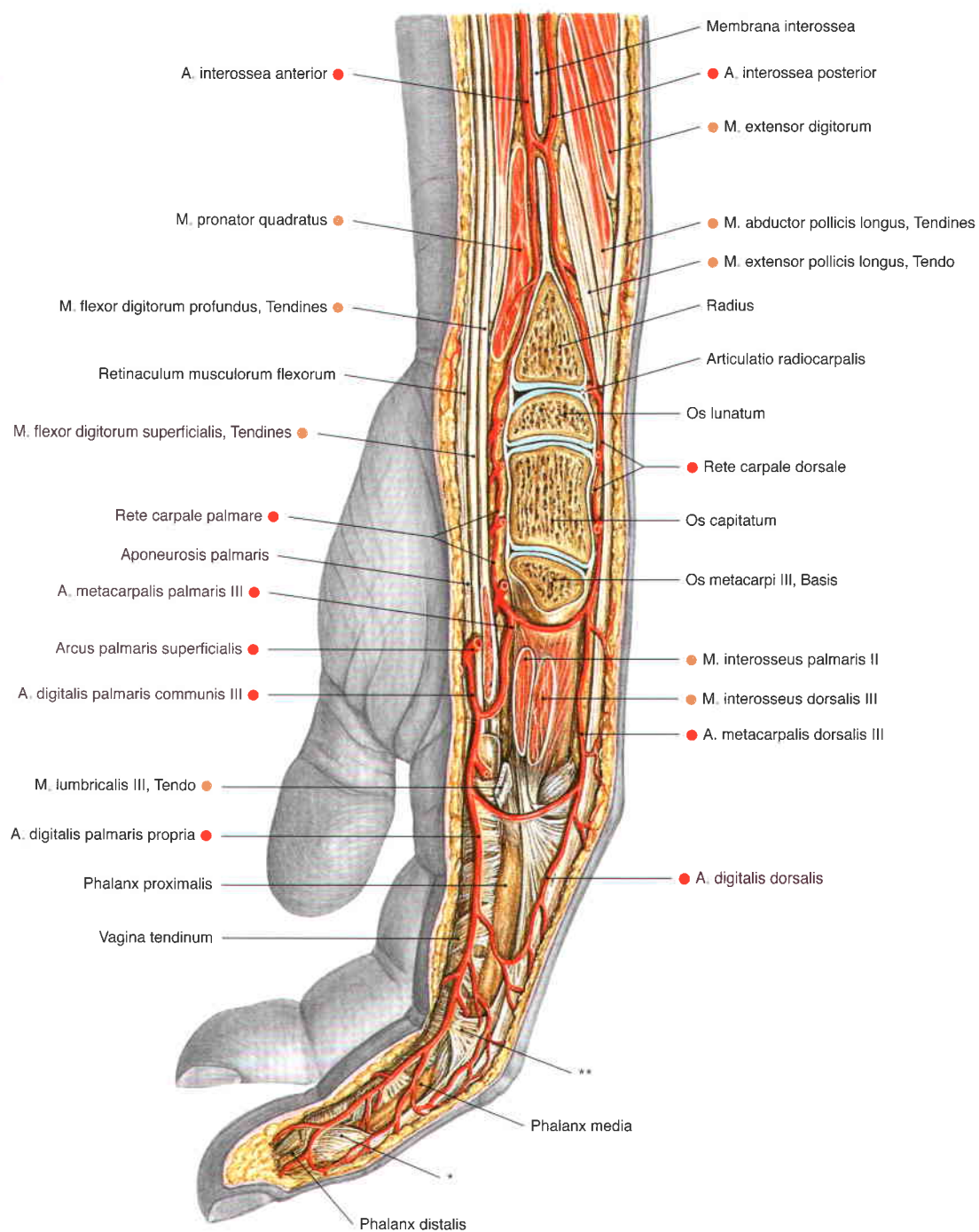
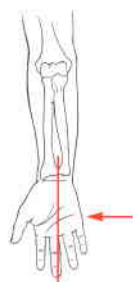
Hand, sagittal section

Fig. 442 Hand, Manus;
sagittal section at the level of the ulnar plane of the middle finger.

* Clinical term: ligament of CLELAND

** Clinical term: ligament of GRAYSON



Fig. 443 Points of injection for regional conduction anaesthesia at the middle finger.

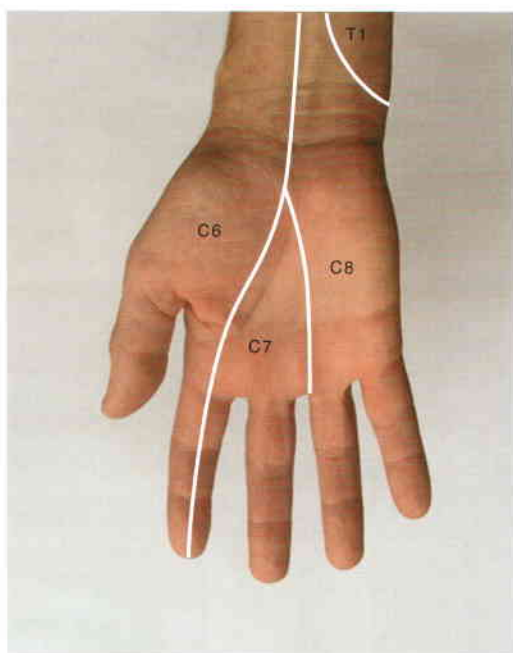


Fig. 444 Palm, Palma; segmental cutaneous innervation.

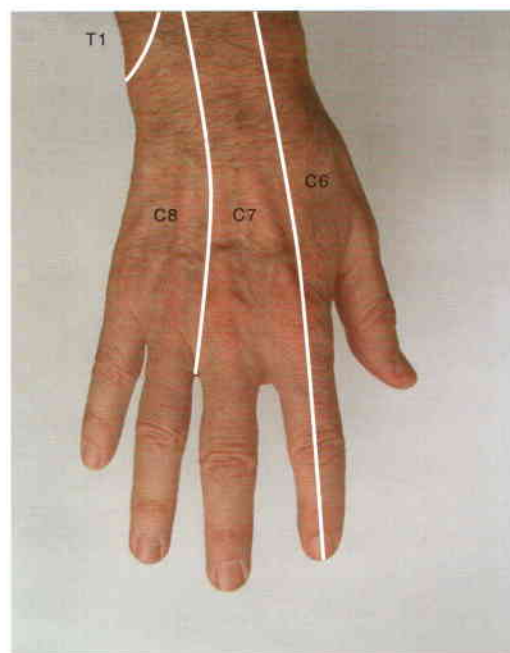


Fig. 445 Dorsum of the hand, Dorsum manus; segmental cutaneous innervation.

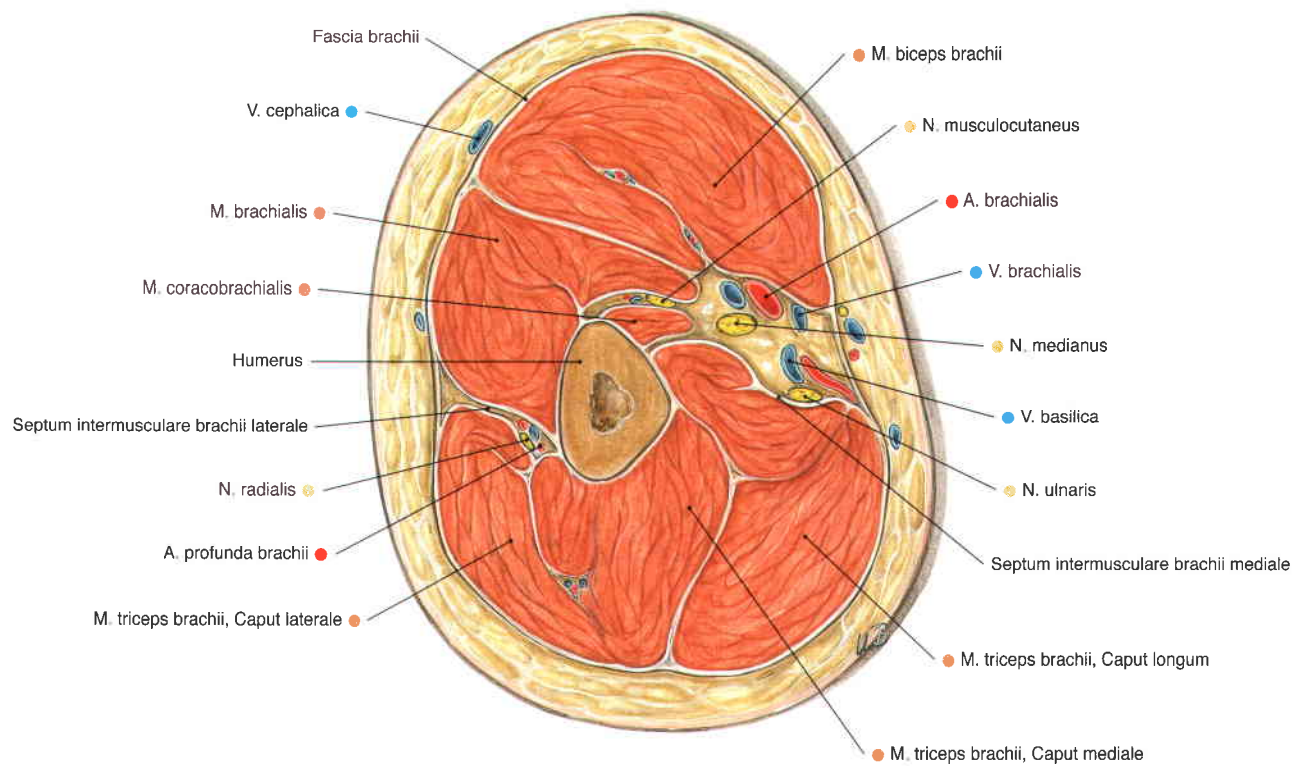
Arm, transverse sections

Fig. 446 Arm, Brachium;
transverse section.

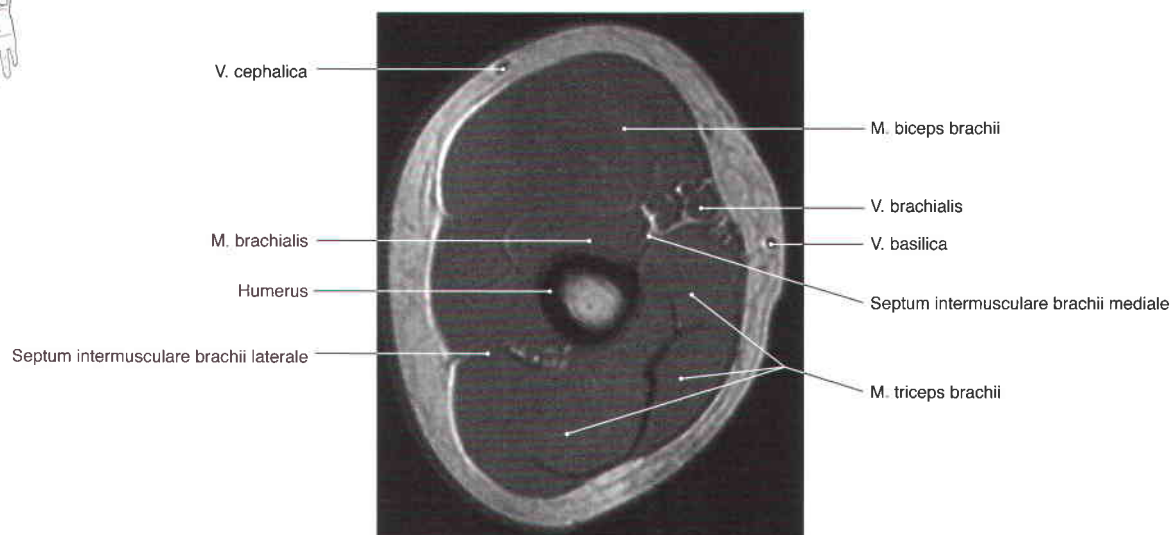
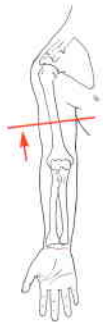


Fig. 447 Arm, Brachium;
magnetic resonance tomographic image (MRI);
cross-section at the level of the middle of the arm;
distal view.

Arm, transverse sections

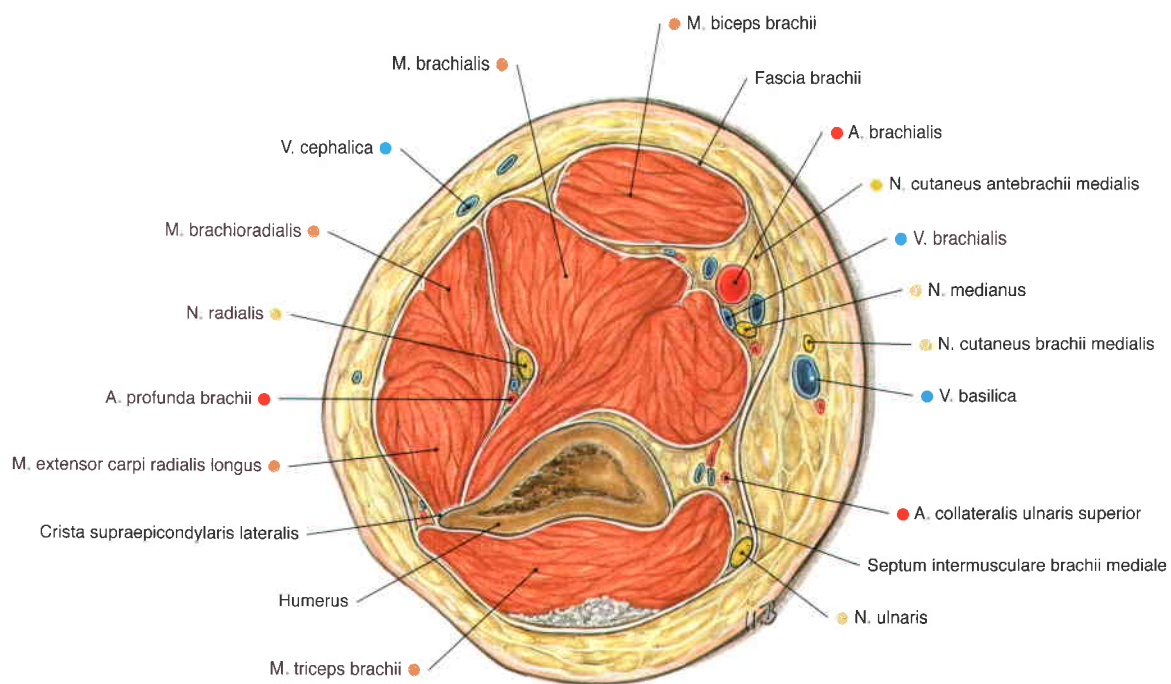


Fig. 448 Arm, Brachium; transverse section through the lower third of the arm.

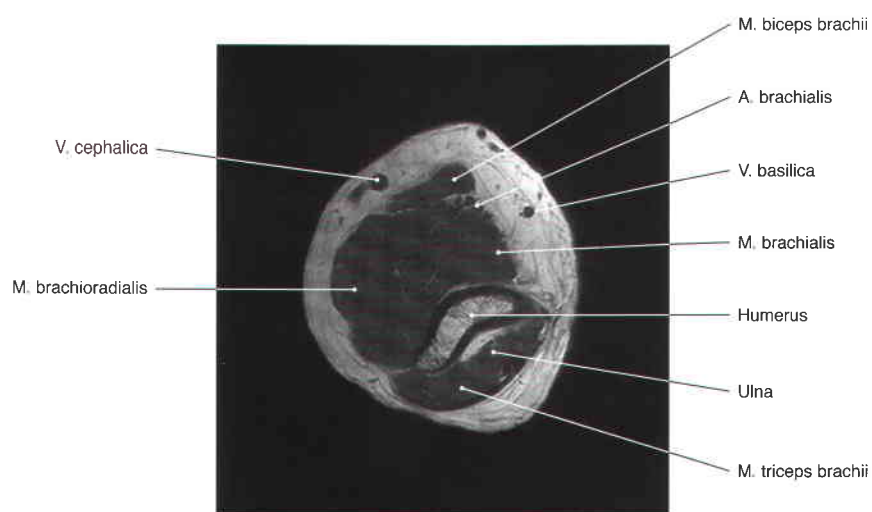


Fig. 449 Arm, Brachium; magnetic resonance tomographic image (MRI); cross-section at the level of the lower third of the arm; distal view.

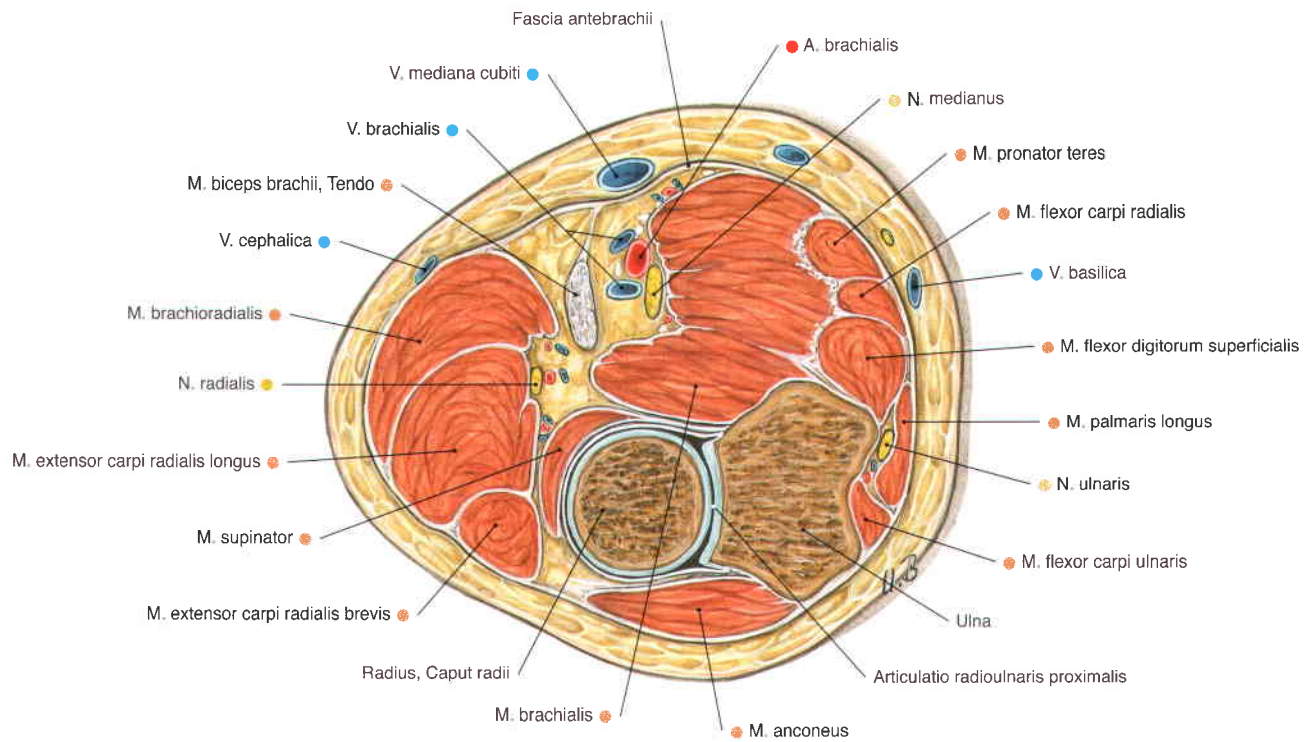
Forearm, transverse sections

Fig. 450 Forearm, Antebrachium; transverse section at the level of the proximal radio-ulnar joint.

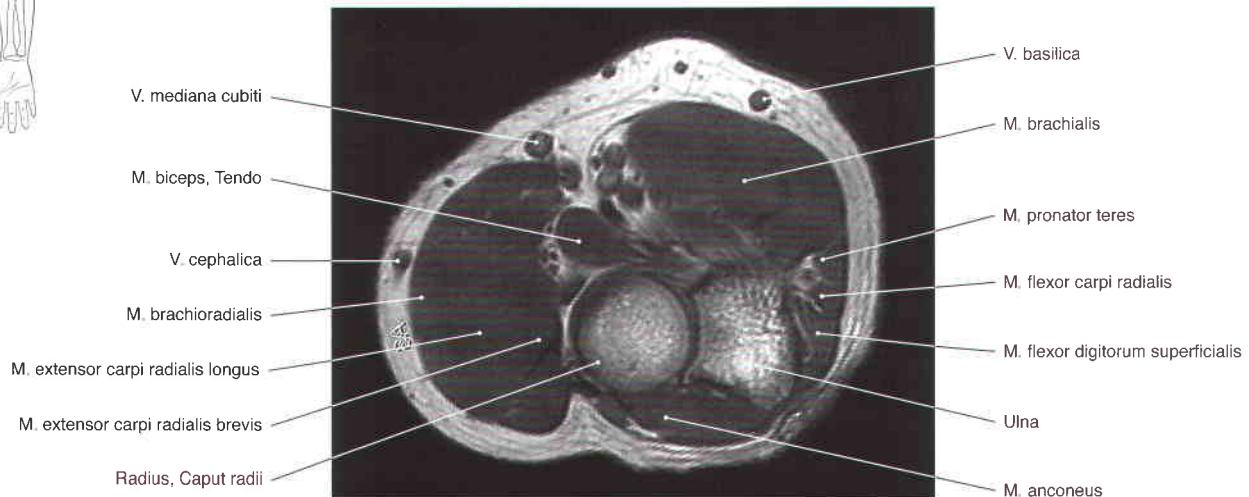


Fig. 451 Forearm, Antebrachium; magnetic resonance tomographic image (MRI); cross-section at the level of the elbow joint; distal view.

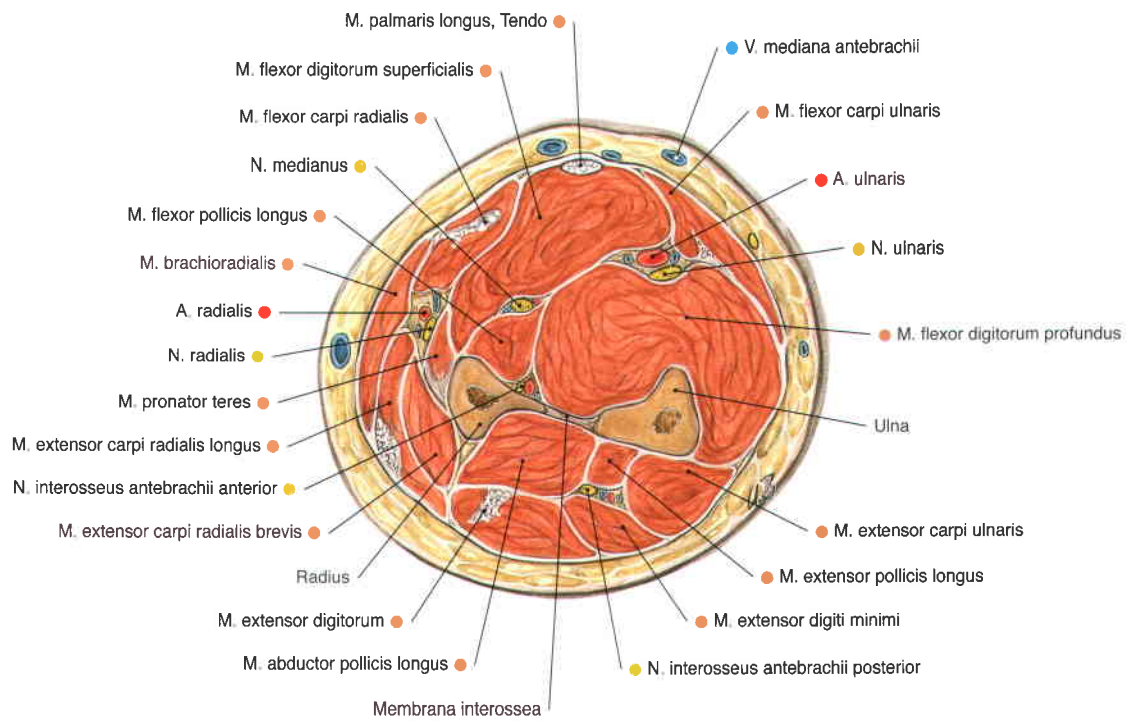


Fig. 452 Forearm, Antebrachium; transverse section through the lower third of the forearm.

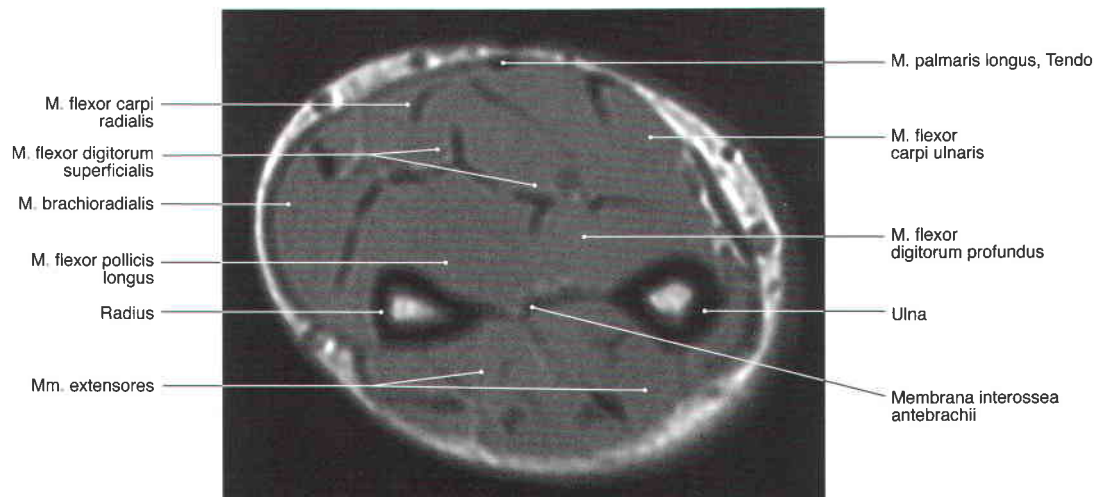


Fig. 453 Forearm, Antebrachium; magnetic resonance tomographic image (MRI); cross-section at the level of the middle of the forearm; distal view.

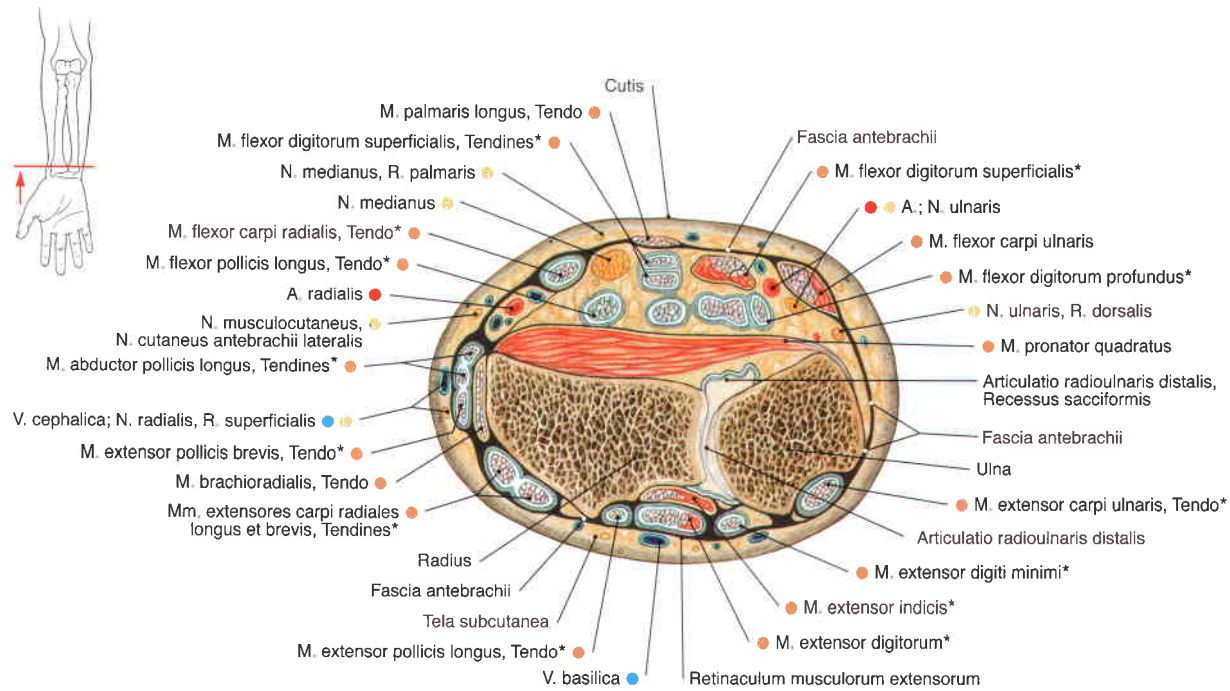
Forearm and hand, transverse sections

Fig. 454 Forearm, Antebrachium; transverse section at the level of the distal radio-ulnar joint. At this level, the muscle tendons marked with * run within tendon sheaths, Vaginae tendinum.

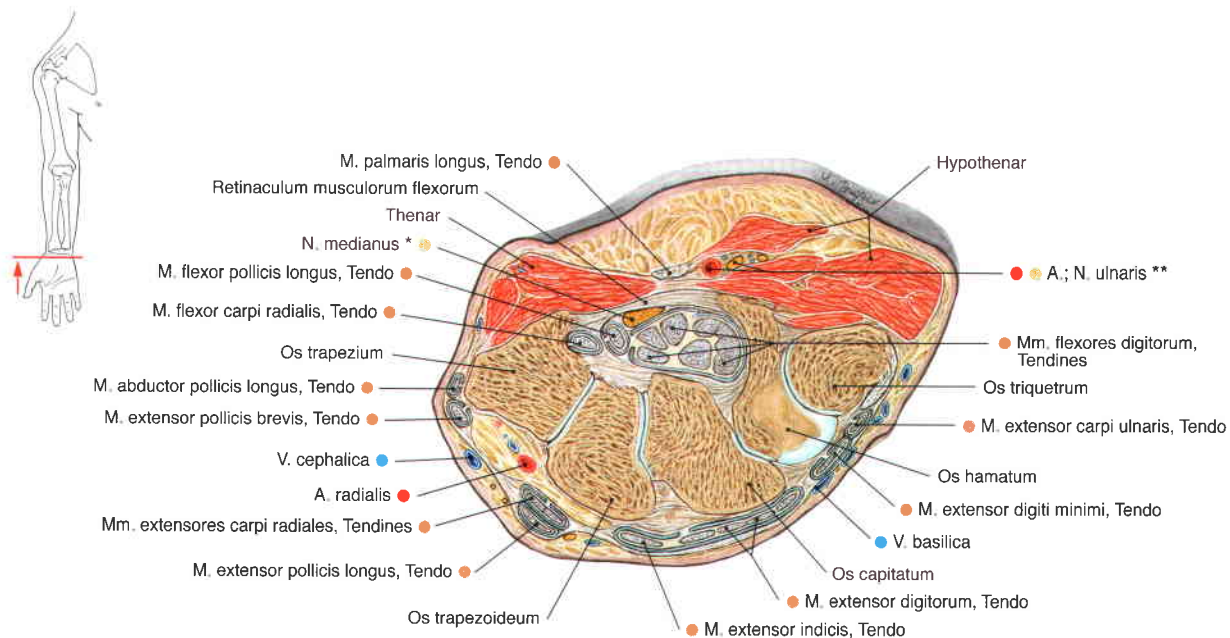


Fig. 455 Wrist, Carpus; transverse section at the level of the hook of the hamate bone, Hamulus ossis hamati.

* Carpal tunnel

** ulnar canal (loge de GUYON)

Hand, transverse sections

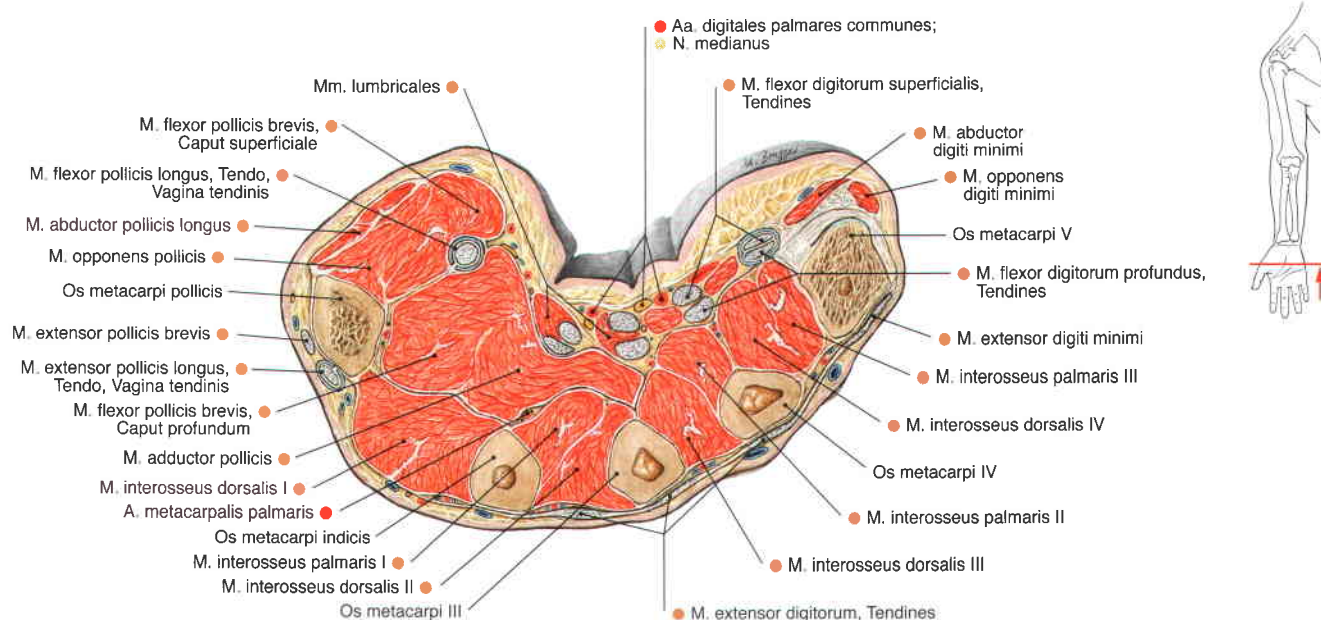


Fig. 456 Metacarpus, Metacarpus; transverse section at the level of the third metacarpal bone.

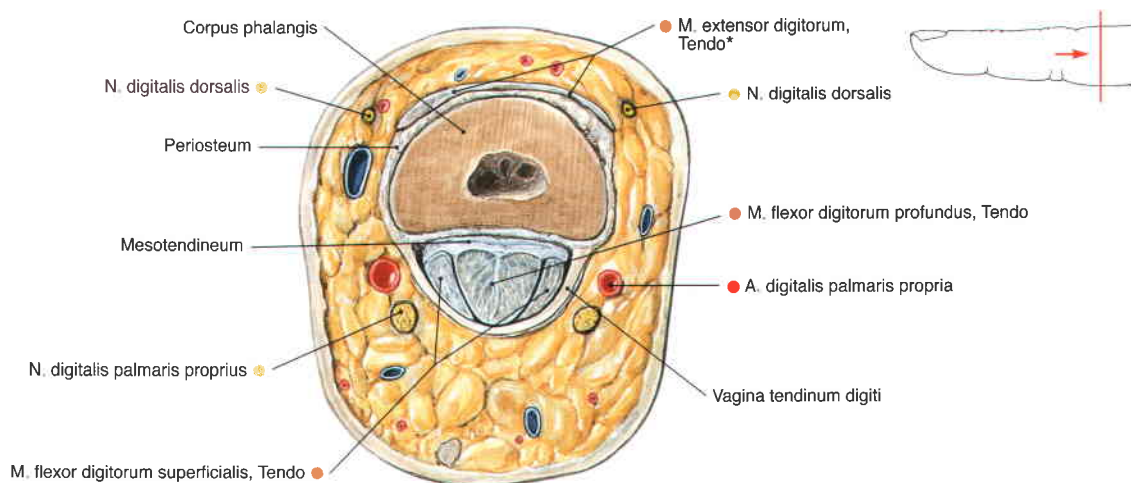


Fig. 457 Middle finger, Digitus medius [III]; transverse section through the shaft of the proximal phalanx.

* So-called dorsal aponeurosis into which the branching tendon of the extensor digitorum muscle, as well as the tendons of the interosseous and lumbrical muscles radiate

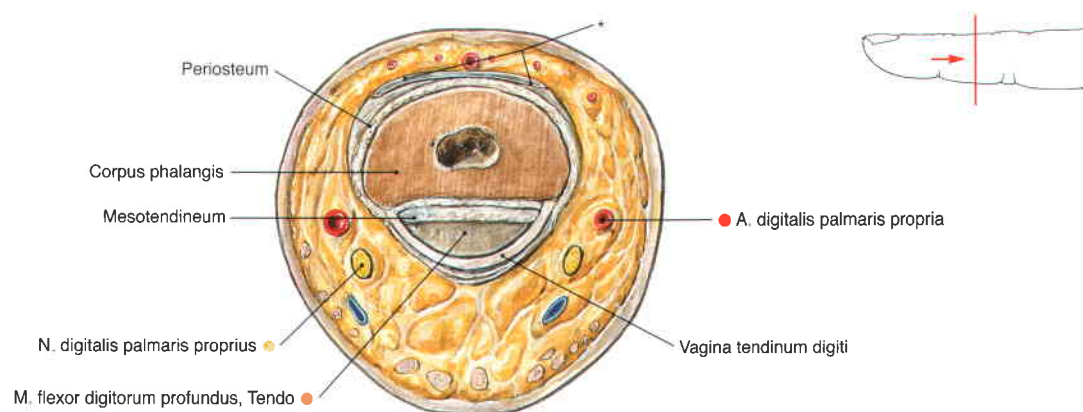
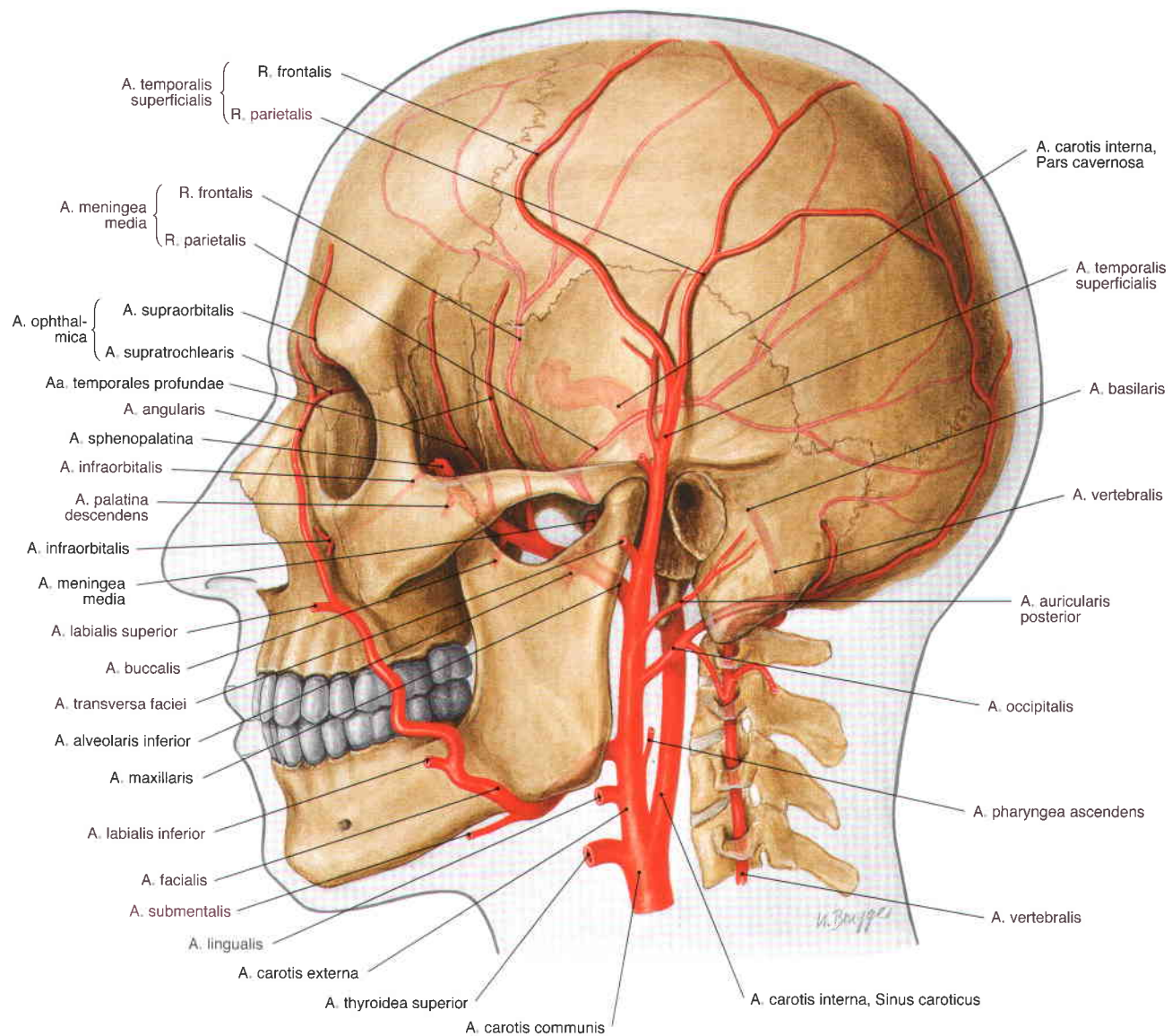


Fig. 458 Middle finger, Digitus medius [III]; transverse section through the shaft of the middle phalanx.

* So-called dorsal aponeurosis

Arteries of the head**Fig. 459** External arteries of the head.

Arteries of the head

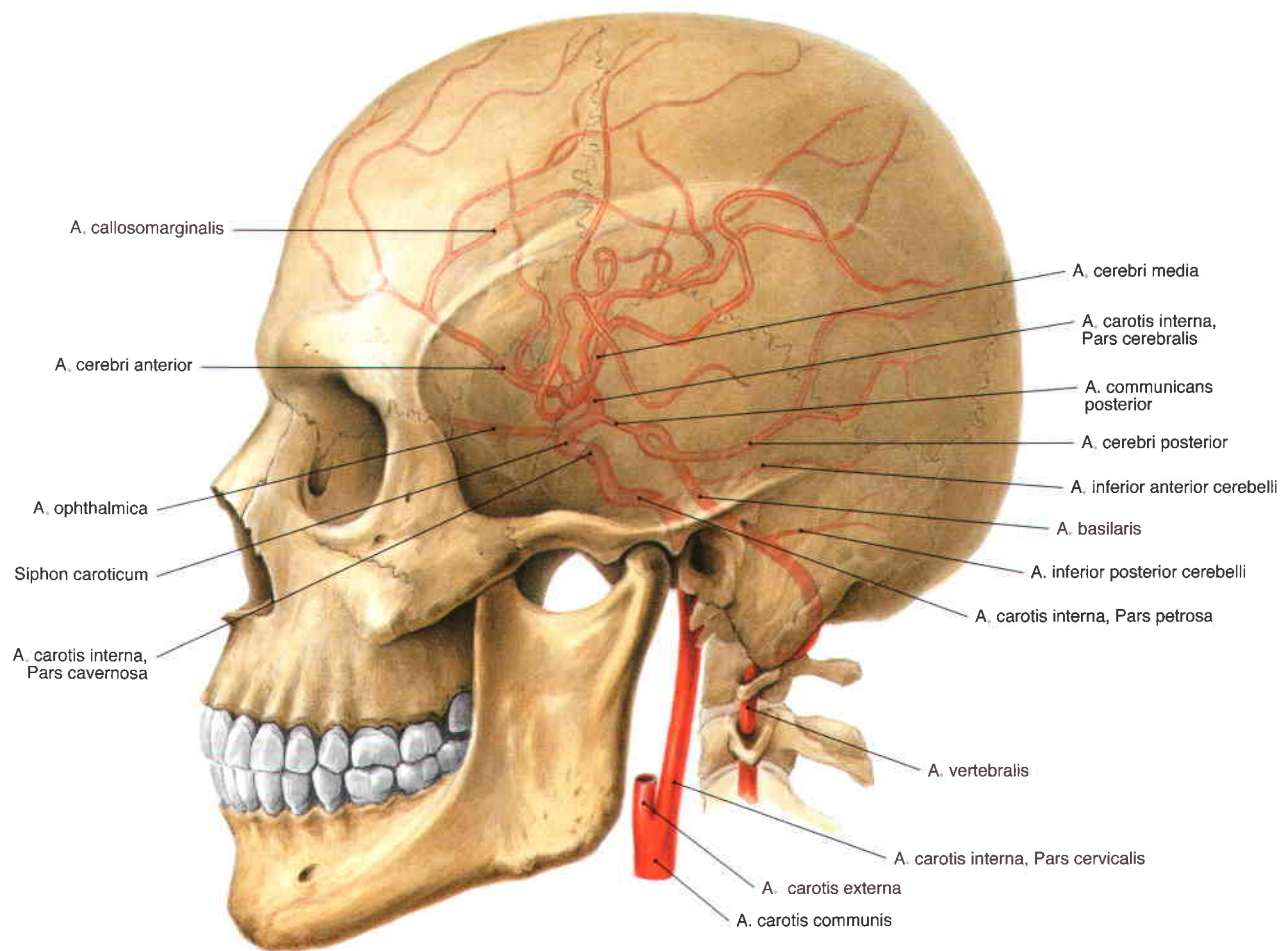


Fig. 460 Internal arteries of the head.



a

Fig. 461 a, b Internal carotid artery, A. carotis interna; radiographs after unilateral injection of a contrast medium (angiograms).

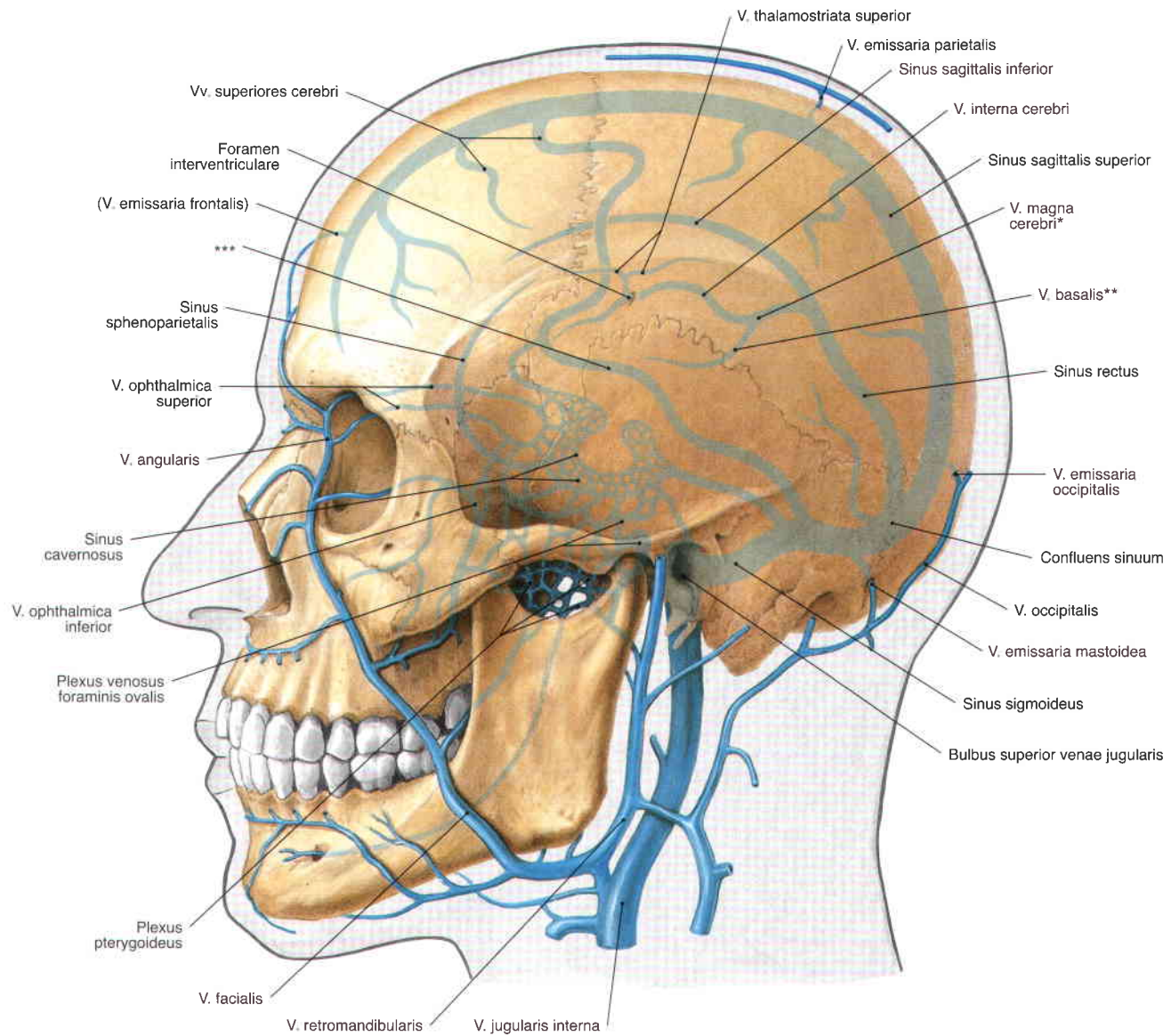


b

The contrast medium also distributes to the vessels of the contralateral side via the arterial circle.

a AP-radiograph, digital subtraction angiography (DSA)

b Lateral radiograph, digital subtraction angiography (DSA)

Veins of the head**Fig. 462** Internal and external veins of the head.

* Vein of GALEN

** ROSENTHAL's vein

*** Vein of LABBÉ

Emissary veins, Vv. emissariae – Passages through the skull

V. emissaria parietalis – Foramen parietale
 V. emissaria mastoidea – Foramen mastoideum
 V. emissaria occipitalis – Passage in the region of the
 Protuberantia occipitalis externa
 V. emissaria condylaris – Canalis condylaris

Plexus venosus canalis nervi hypoglossi – Canalis nervi
 hypoglossi
 Plexus venosus foraminis ovalis – Foramen ovale
 Plexus venosus caroticus internus – Canalis caroticus

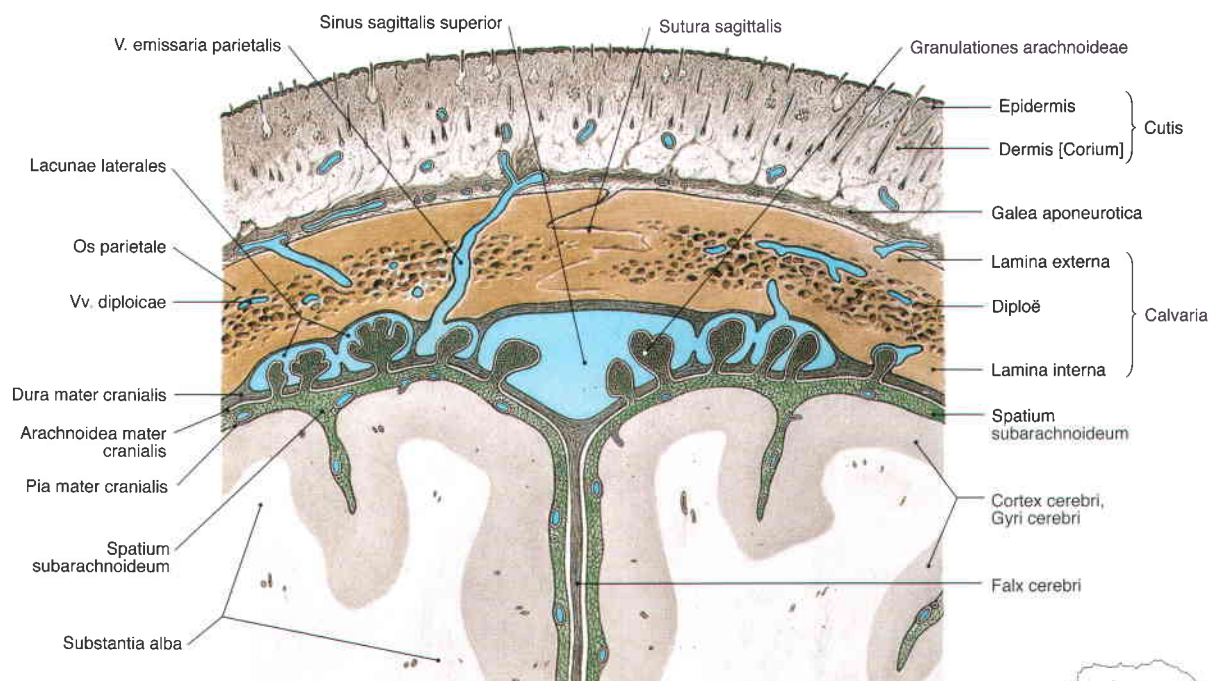


Fig. 463 Calvaria, Calvaria; meninges, Meninges, and dural venous sinuses, Sinus durae matris.

In the adult, the cerebrospinal fluid is mainly reabsorbed into the venous system through the arachnoid granulations. Additionally, reabsorption occurs through the lymphatic sheaths of small vessels of the cranial pia mater and through the perineural sheaths of the cranial and the spinal nerves.

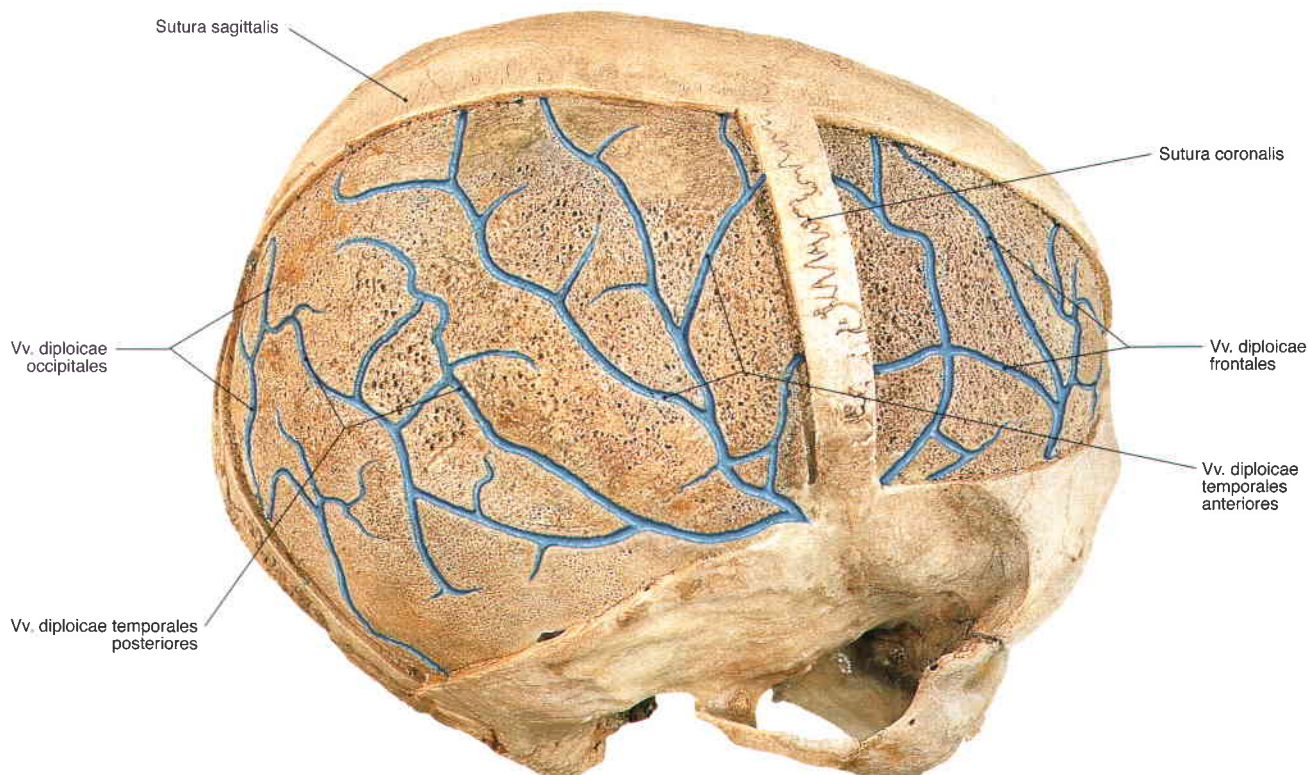
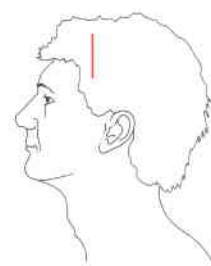


Fig. 464 Diploic canals, Canales diploici, and diploic veins, Vv. diploicae, of the calvaria;

the external table of compact bone has been removed from the calvaria.

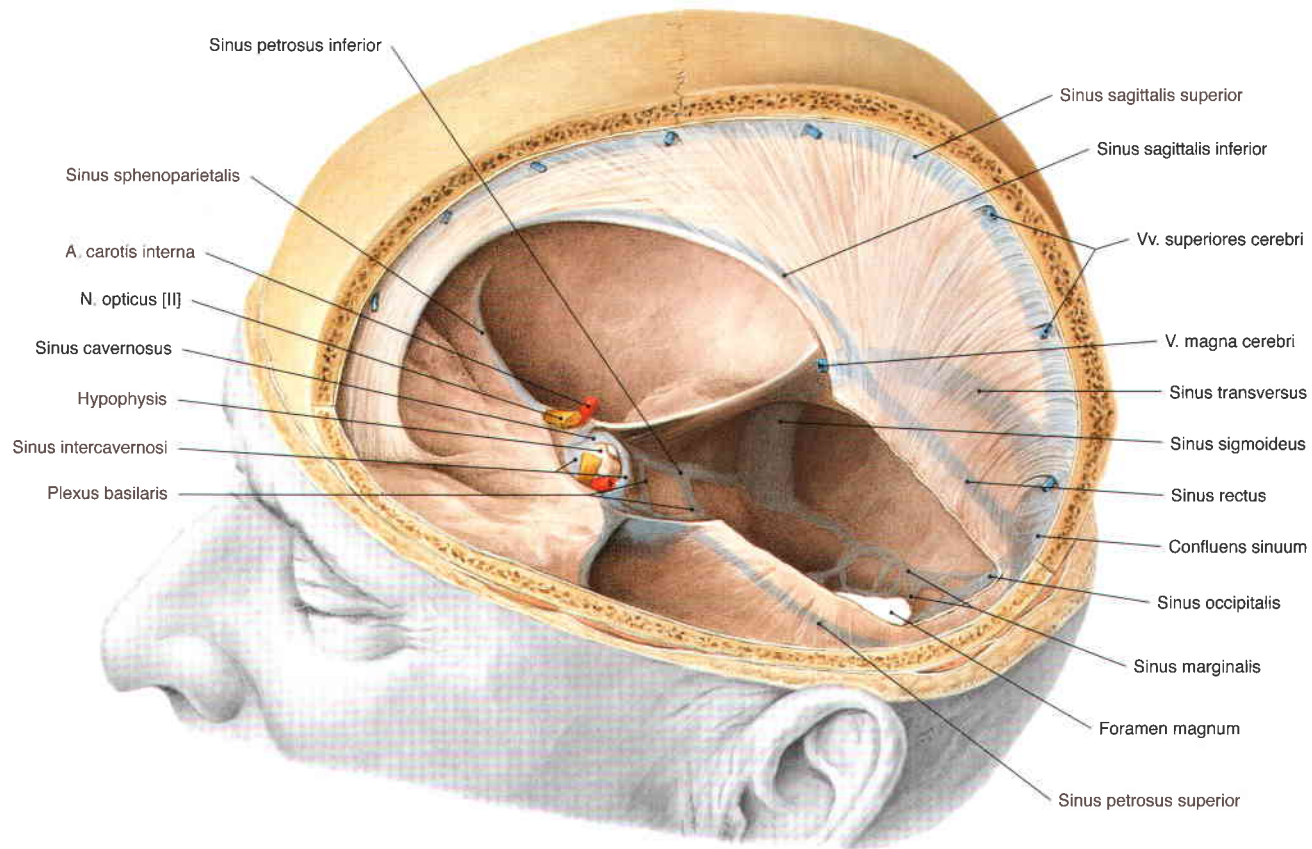
Dural venous sinuses

Fig. 465 Cranial dura mater, Dura mater cranialis, and dural venous sinuses, Sinus durae matris; after partial removal of the tentorium cerebelli.

Cranial dura mater, Dura mater cranialis

The cranial dura mater lines the cranial cavity completely and tightly adheres to the skull bone. The cerebral falx protrudes in the sagittal plane in a sickle-like shape and stretches from the crista galli to the ridge of the tentorium cerebelli, which, in turn, overstretches the posterior cranial fossa and is attached along the transverse sinus and the

pyramidal edge. The margins of the tentorial notch envelop the midbrain and taper off into the anterior and posterior clinoid process. The cerebral falx and the tentorium cerebelli divide the cranial cavity into three spaces that are incompletely separated from one another, containing the two cerebral hemispheres and the cerebellum.

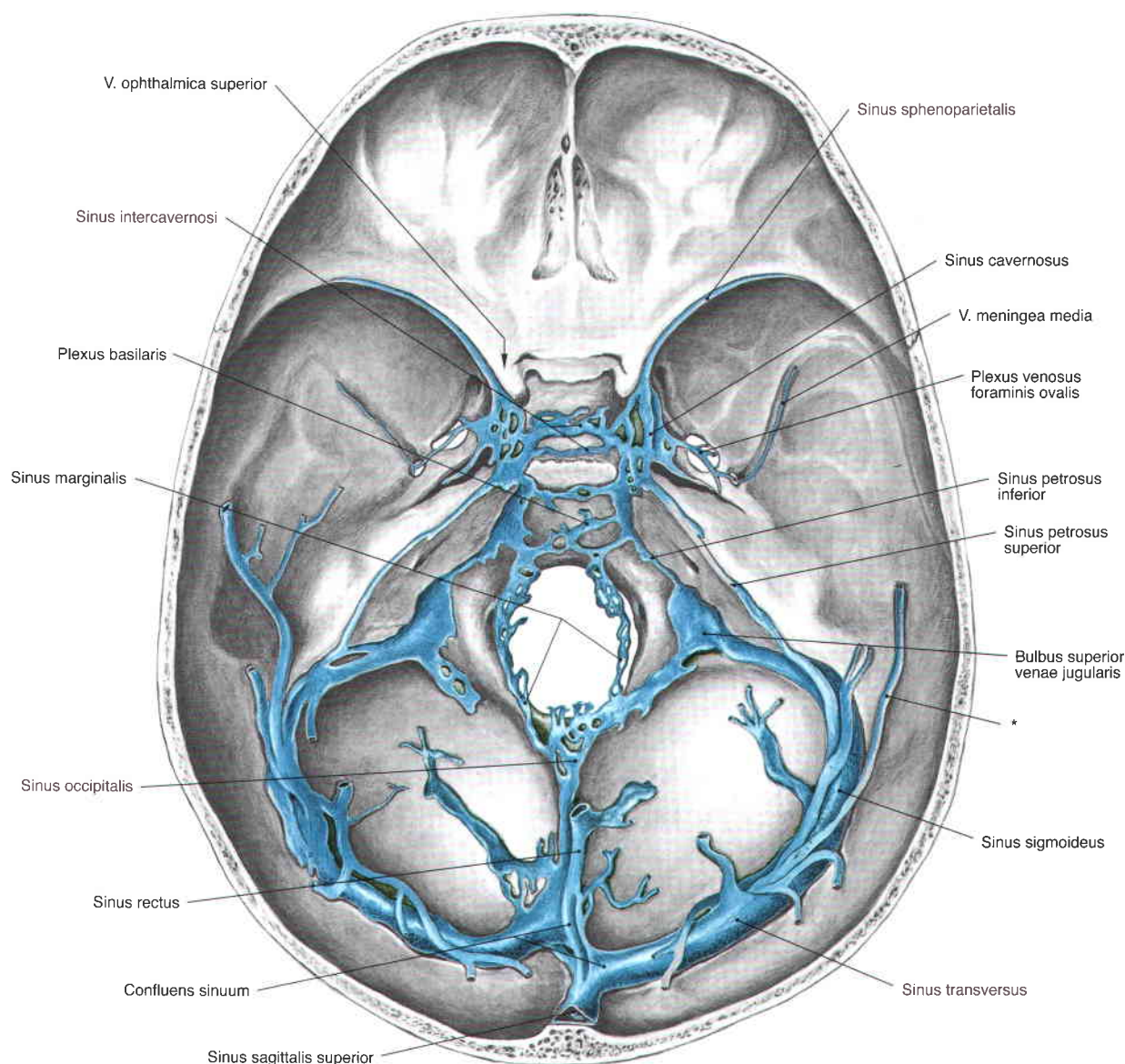


Fig. 466 Dural venous sinuses, Sinus durae matris; corrosion cast.

The sinuses contain no valves and feature rigid walls.

* Vein of LABBÉ to the superficial middle cerebral veins

Dural venous sinuses, Sinus durae matris

The dural venous sinuses are rigid venous channels without valves draining the venous blood from the brain via so-called bridging veins.

The main drainage from within the skull occurs via the sigmoid sinuses into the internal jugular veins. Additionally, the superior ophthalmic veins and the highly variable emissary veins form a series of smaller, likewise valveless, venous connections between the intra- and extracranial regions.

The two cavernous sinuses assume a central position by being situated in the middle cranial fossa to the right and the left of the sella turcica. They communicate with each other through the intercavernous sinuses and either directly or indirectly with most other sinuses and with the veins of the orbit and the infratemporal fossa.

External surface of the cranial base

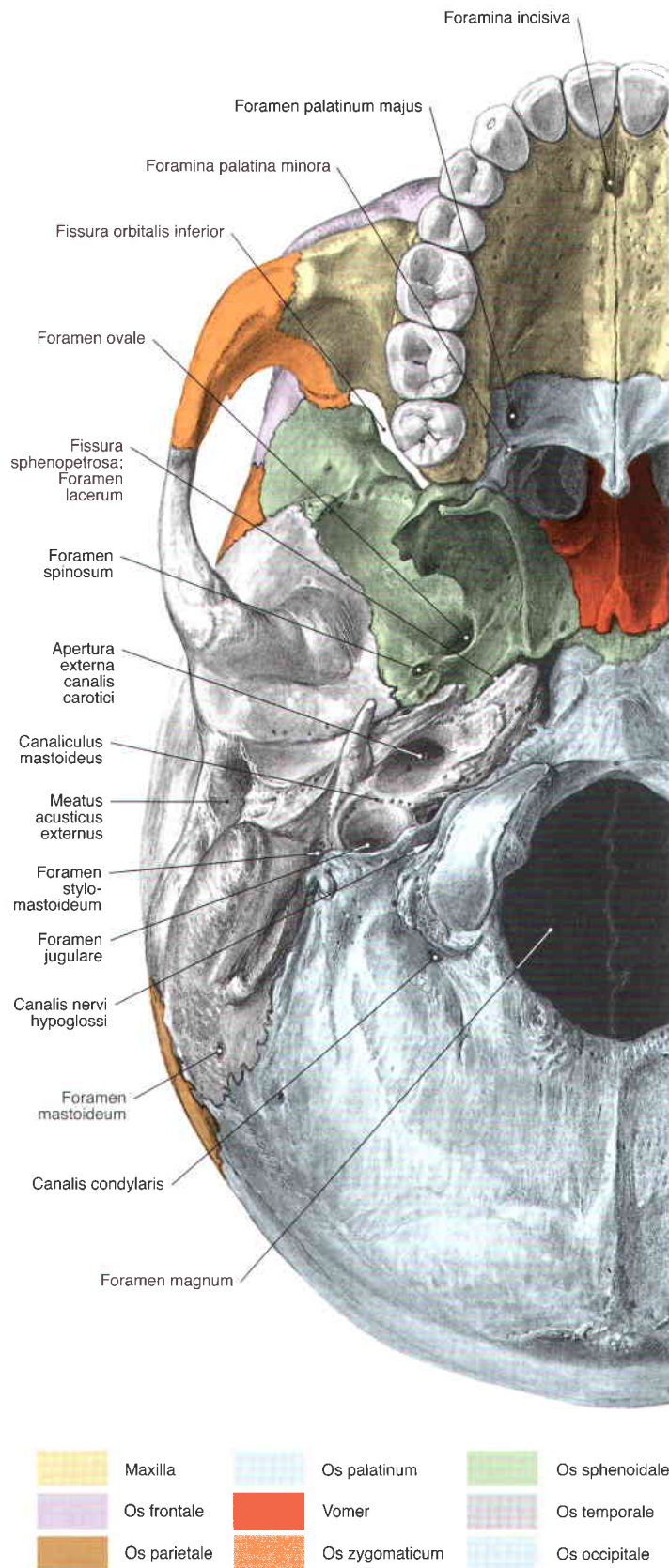


Fig. 467 External surface of the cranial base, Basis cranii externa, and foramina.

Contents of the foramina of the external surface of the cranial base

Foramina incisiva

N. nasopalatinus (N. maxillaris [V/2])

Foramen palatinum majus

N. palatinus major (N. maxillaris [V/2])

A. palatina major (A. palatina descendens)

Foramina palatina minora

Nn. palatini minores (N. maxillaris [V/2])

Aa. palatinae minores (A. palatina descendens)

Fissura orbitalis inferior

A. infraorbitalis (A. maxillaris)

V. ophthalmica inferior

N. infraorbitalis (N. maxillaris [V/2])

N. zygomaticus (N. maxillaris [V/2])

Foramen rotundum (see Fig. 91, 93)

N. maxillaris [V/2]

Foramen ovale

N. mandibularis [V/3]

Plexus venosus foraminis ovalis

Foramen spinosum

R. meningeus (N. mandibularis [V/3])

A. meningea media (A. maxillaris)

Fissura sphenopetrosa et Foramen lacerum

N. petrosus minor (N. glossopharyngeus [IX])

N. petrosus major (N. facialis [VII])

N. petrosus profundus (Plexus caroticus internus)

Apertura externa canalis carotici → Canalis caroticus

A. carotis interna, Pars petrosa

Plexus venosus caroticus internus

Plexus caroticus internus (Truncus sympathicus, Ganglion cervicale superius)

Foramen stylomastoideum

N. facialis [VII]

Foramen jugulare

Anterior part:

Sinus petrosus inferior

N. glossopharyngeus [IX]

Posterior part:

A. meningea posterior (A. pharyngea ascendens)

Sinus sigmoideus (Bulbus superior venae jugularis)

N. vagus [X]

R. meningeus (N. vagus [X])

N. accessorius [XI]

Canaliculus mastoideus

R. auricularis nervi vagi (N. vagus [X])

Canalis nervi hypoglossi

N. hypoglossus [XII]

Plexus venosus canalis nervi hypoglossi

Canalis condylaris

V. emissaria condylaris

Foramen magnum

Meninges

Plexus venosus vertebralis internus (Sinus marginalis)

Aa. vertebrales (Aa. subclaviae)

A. spinalis anterior (Aa. vertebrales)

Medulla oblongata/Medulla spinalis

Radices spinales (N. accessorius [XI])

Contents of the foramina of the internal surface of the cranial base

Lamina cribrosa

Nn. olfactorii [I]
A. ethmoidalis anterior (A. ophthalmica)

Canalis opticus

N. opticus [II]
A. ophthalmica (A. carotis interna)
Meninges; Vaginae nervi optici

Fissura orbitalis superior

Medial part:
N. nasociliaris (N. ophthalmicus [V/1])
N. oculomotorius [III]
N. abducens [VI]
Lateral part:
N. trochlearis [IV]
Common trunk of the:
– N. frontalis (N. ophthalmicus [V/1])
– N. lacrimalis (N. ophthalmicus [V/1])
R. orbitalis (A. meningea media)
V. ophthalmica superior

Foramen rotundum

N. maxillaris [V/2]

Foramen ovale

N. mandibularis [V/3]
Plexus venosus foraminis ovalis

Foramen spinosum

R. meningeus (N. mandibularis [V/3])
A. meningea media (A. maxillaris)

Fissura sphenopetrosa et Foramen lacerum

N. petrosus minor (N. glossopharyngeus [IX])
N. petrosus major (N. facialis [VII])
N. petrosus profundus (Plexus caroticus internus)

Apertura interna canalis carotici → Canalis caroticus

A. carotis interna, Pars petrosa
Plexus venosus caroticus internus
Plexus caroticus internus (Truncus sympathicus, Ganglion cervicale superius)

Porus → Meatus acusticus internus

N. facialis [VII]
N. vestibulocochlearis [VIII]
A. labyrinthi (A. basilaris)
Vv. labyrinthi

Foramen jugulare

Anterior part:
Sinus petrosus inferior
N. glossopharyngeus [IX]
Posterior part:
A. meningea posterior (A. pharyngea ascendens)
Sinus sigmoideus (Bulbus superior venae jugularis)
N. vagus [X]
N. accessorius [XI]
R. meningeus (N. vagus [X])

Canalis nervi hypoglossi

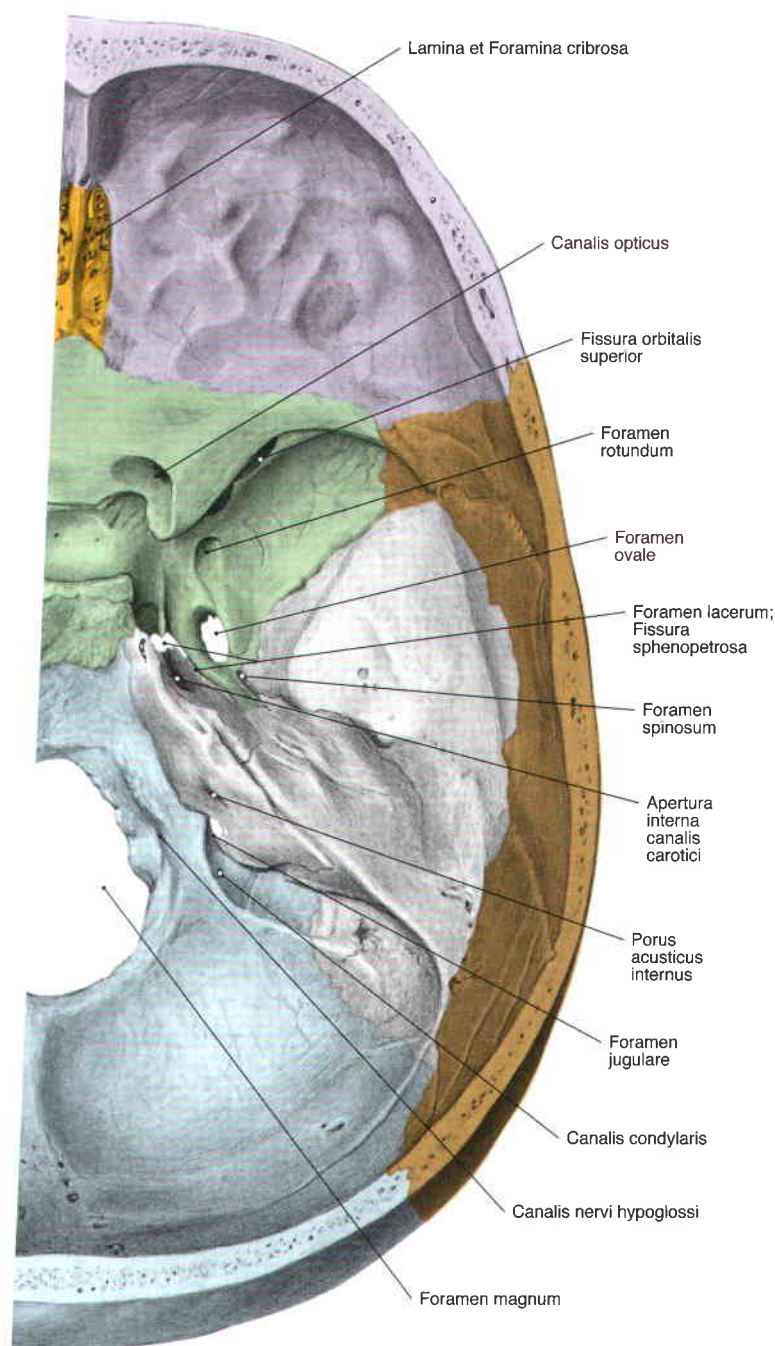
N. hypoglossus [XII]
Plexus venosus canalis nervi hypoglossi

Canalis condylaris

V. emissaria condylaris

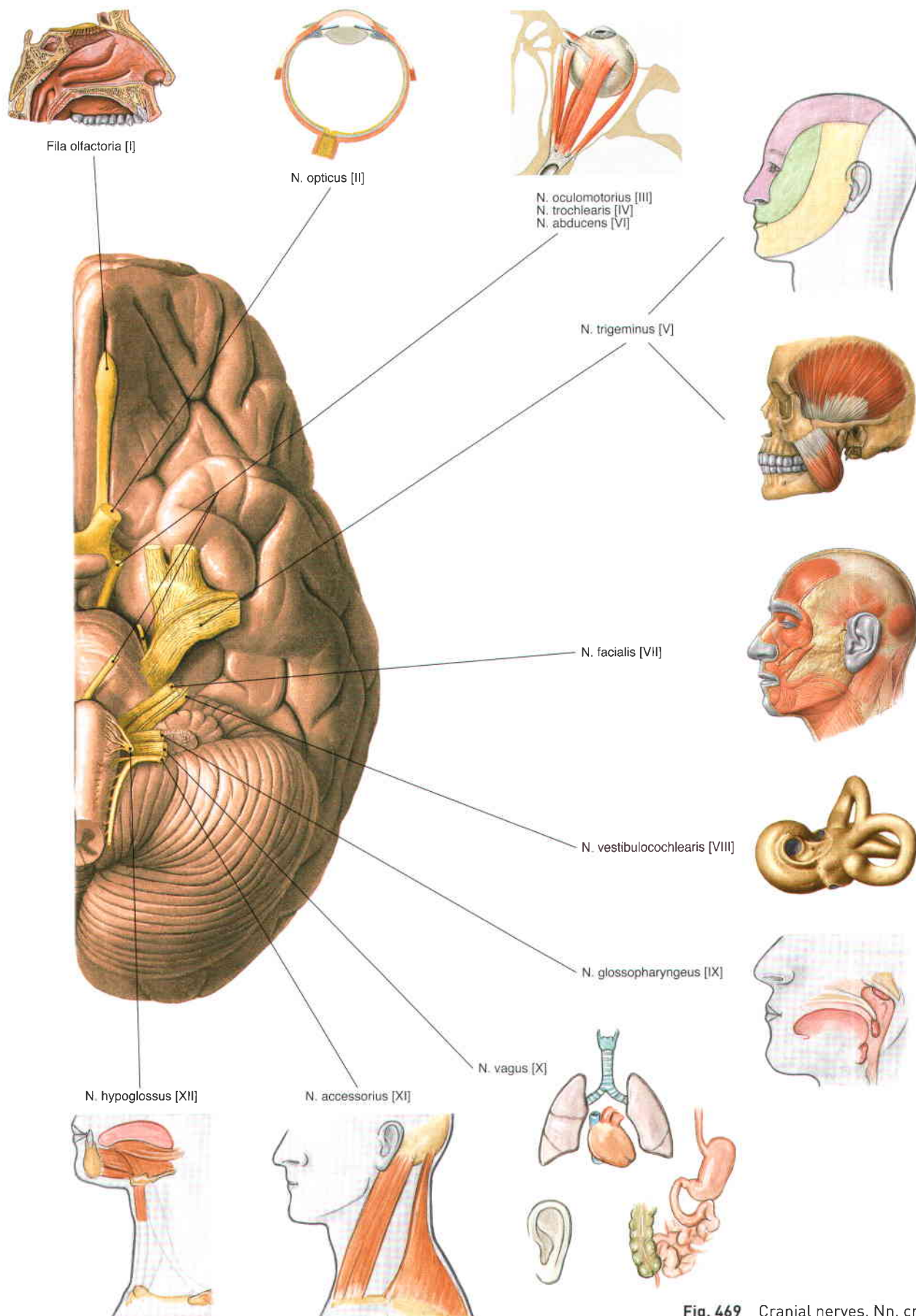
Foramen magnum

Meninges
Plexus venosus vertebralis internus (Sinus marginalis)
Aa. vertebrales (Aa. subclaviae)
A. spinalis anterior (Aa. vertebrales)
Medulla oblongata/Medulla spinalis
Radices spinales (N. accessorius [XI])



Os frontale	Os sphenoidale
Os parietale	Os temporale
Os ethmoidale	Os occipitale

Fig. 468 Internal surface of the cranial base, Basis cranii interna, and foramina.

Cranial nerves, overview**Fig. 469** Cranial nerves, Nn. craniales.

→ T 55, T 57

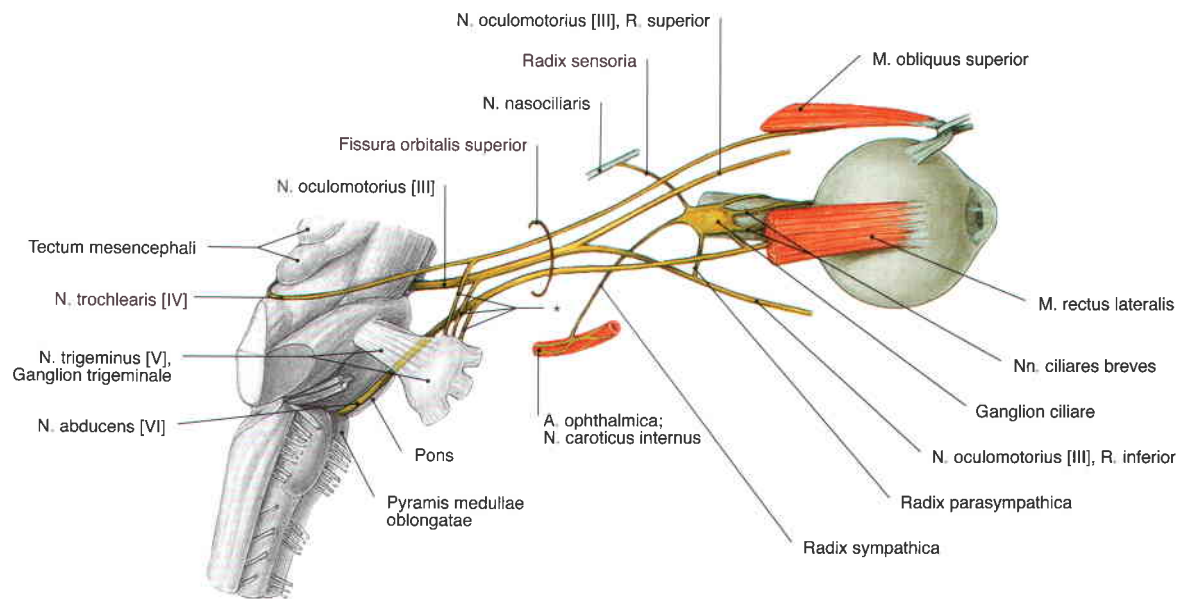


Fig. 470 Oculomotor nerve, N. oculomotorius [III], trochlear nerve, N. trochlearis [IV], and abducens nerve, N. abducens [VI]; viewed from the right.

* Connections to the trigeminal ganglion

→ T 57c, d, f

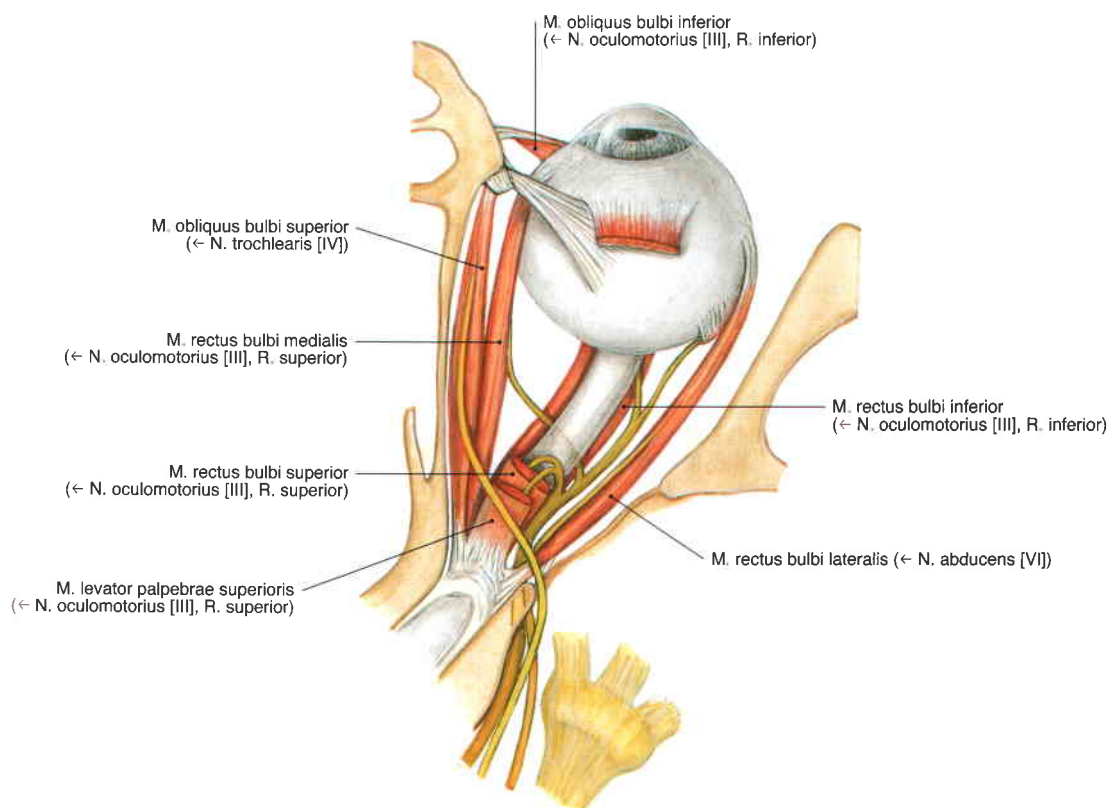
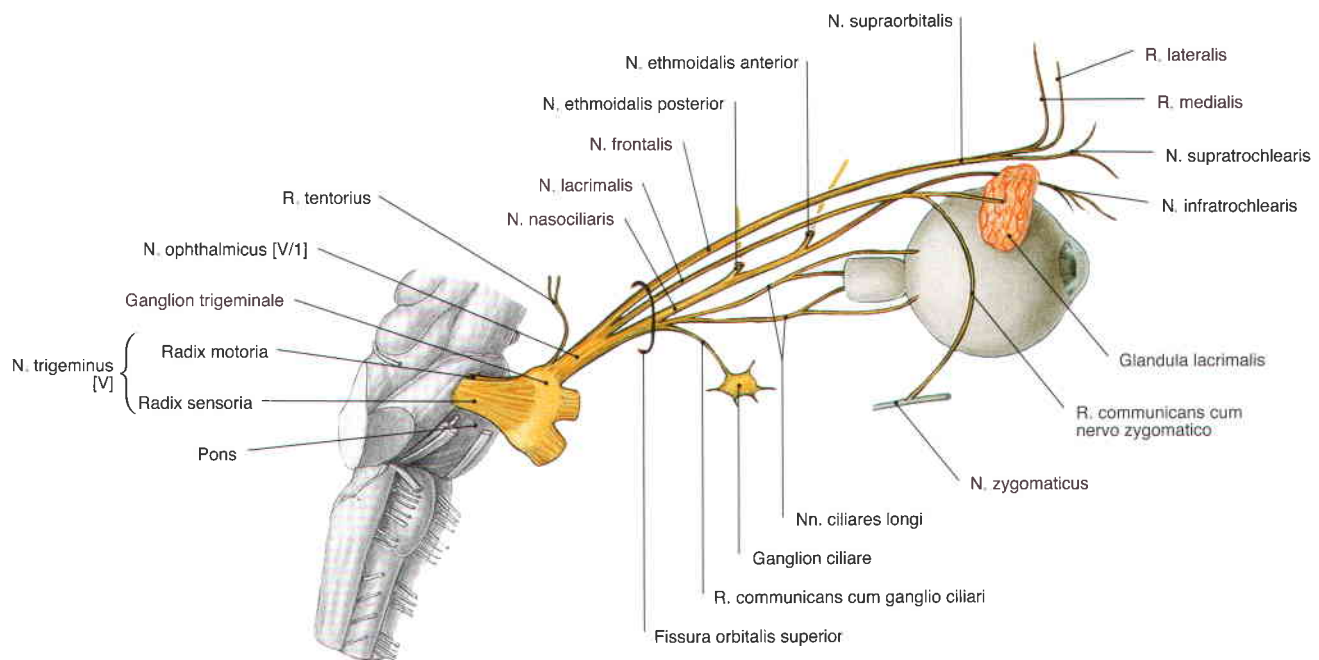
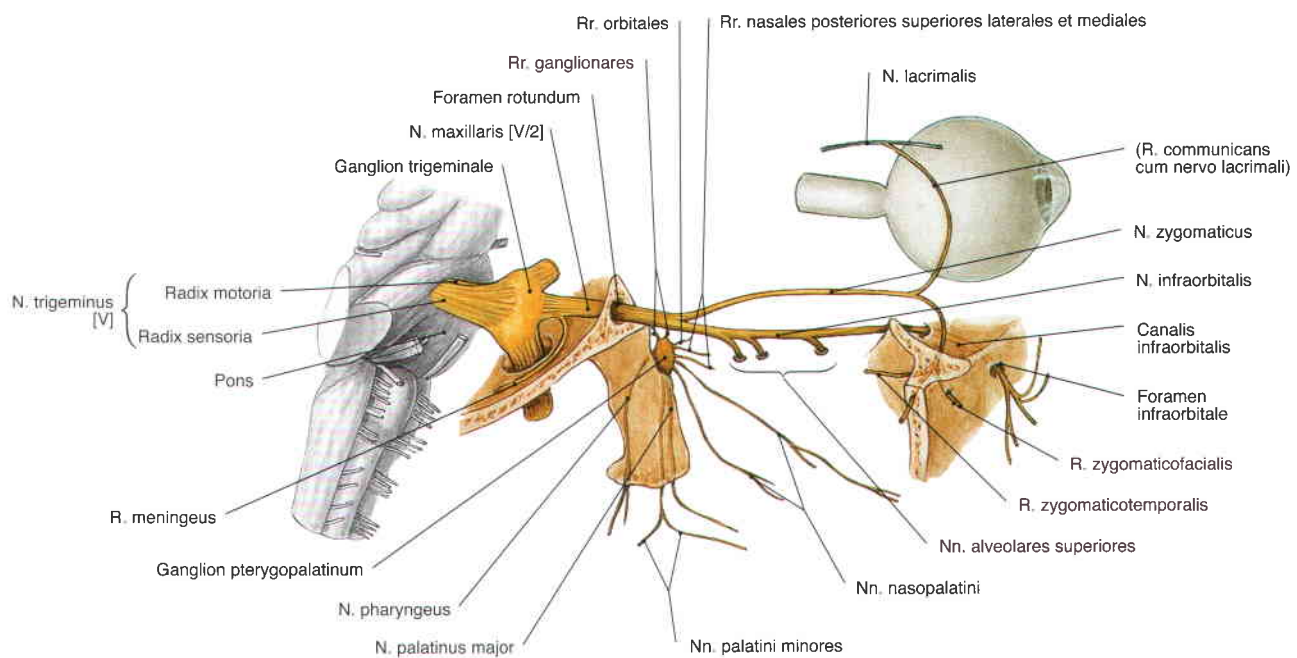


Fig. 471 Innervation of the ocular muscles; superior view.

Cranial nerves

→ T 57e

Fig. 472 Ophthalmic nerve, N. ophthalmicus [V/1]; viewed from the right.



→ T 57e

Fig. 473 Maxillary nerve, N. maxillaris [V/2]; viewed from the right.

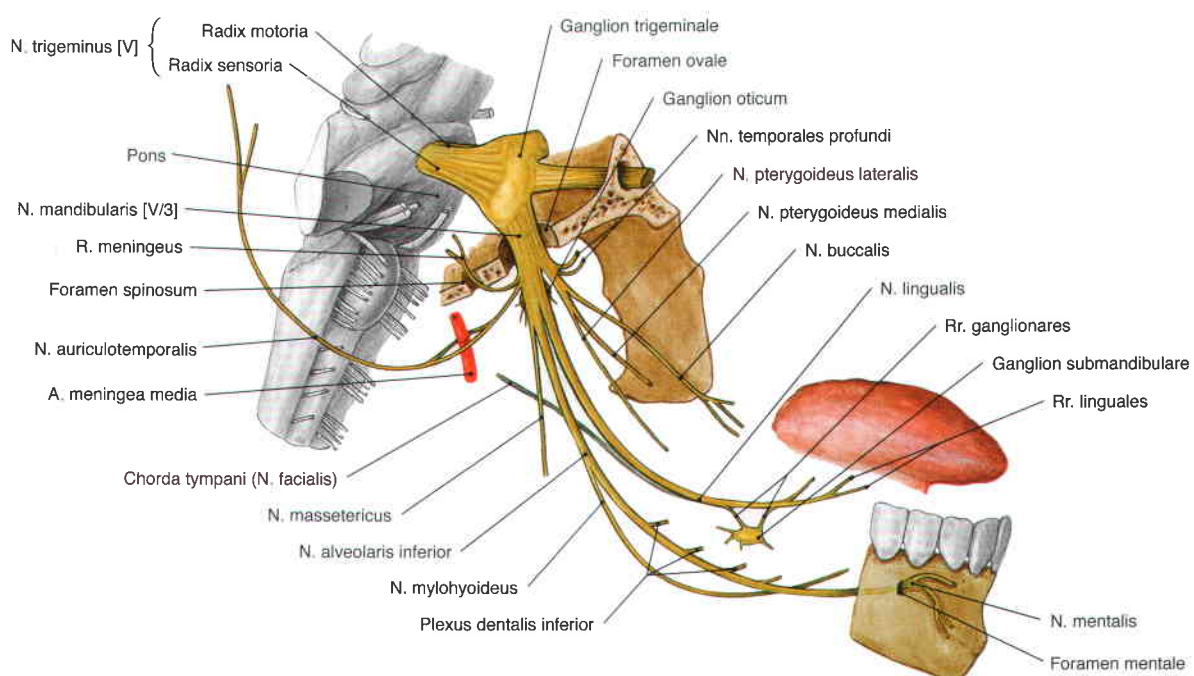


Fig. 474 Mandibular nerve, N. mandibularis [V/3]; viewed from the right.

→ T 57e

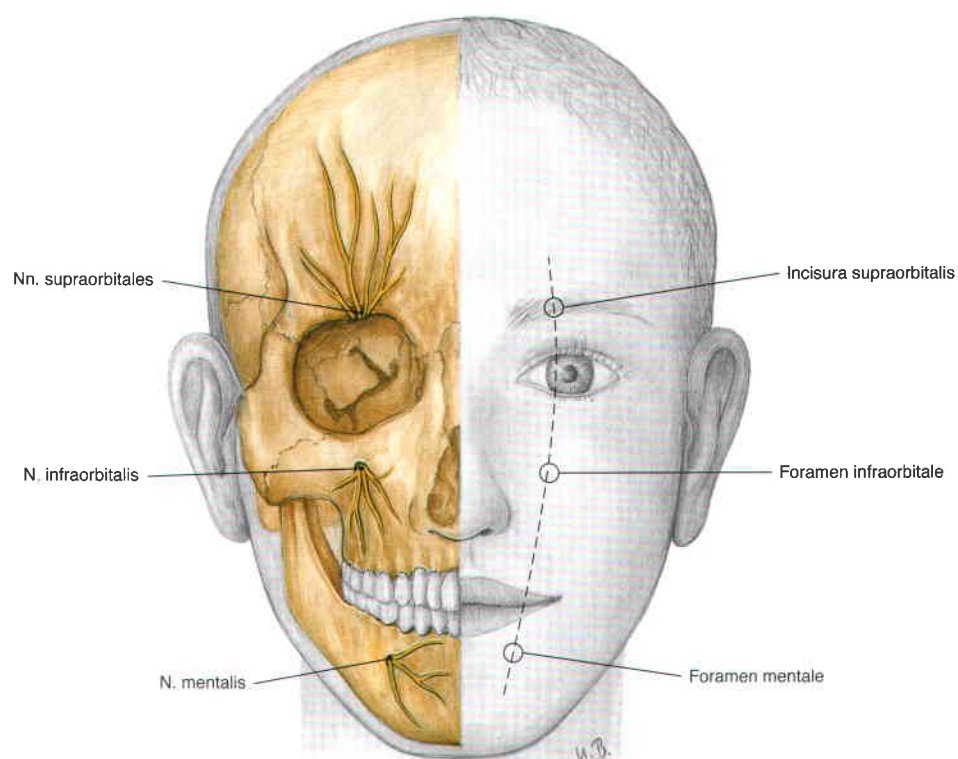
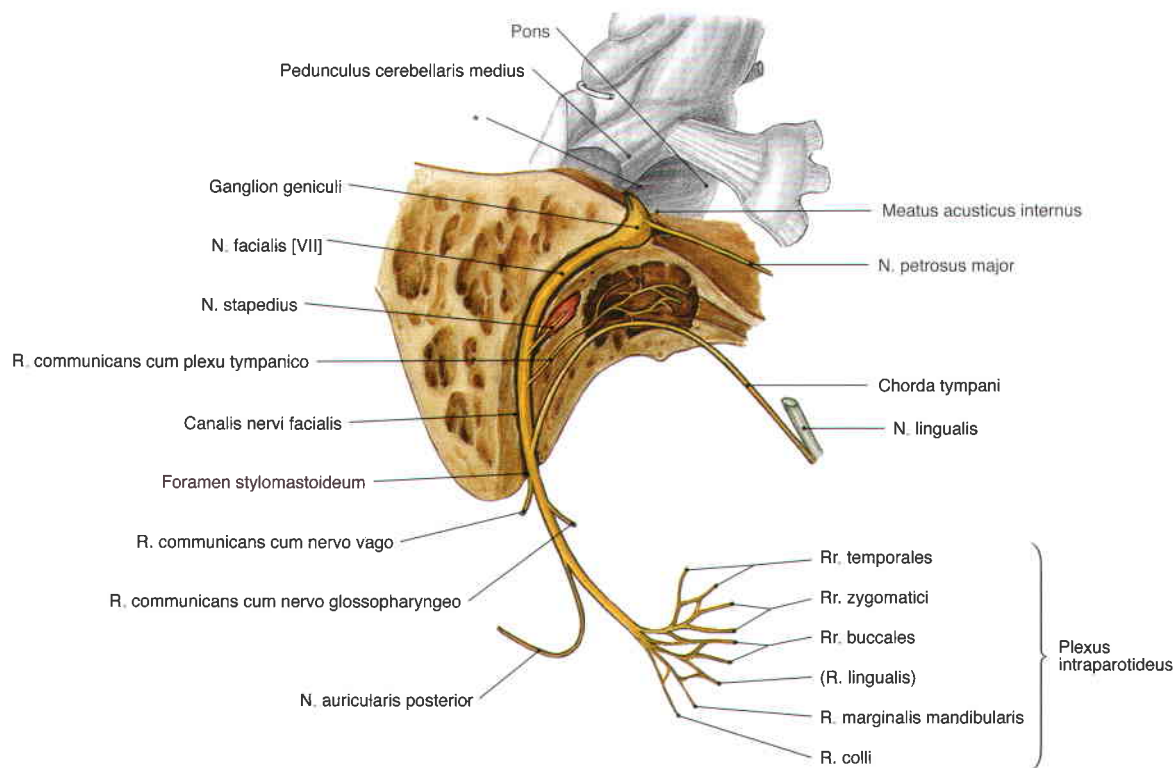


Fig. 475 Exit points of the cutaneous branches of the trigeminal nerve, N. trigeminus [V]. Clinically, they are referred to as nerve exit points.

Cranial nerves



→ T 57g

Fig. 476 Facial nerve, N. facialis [VII]; the facial canal and the tympanic cavity have been opened; viewed from the right.

* Clinical term: cerebellopontine angle

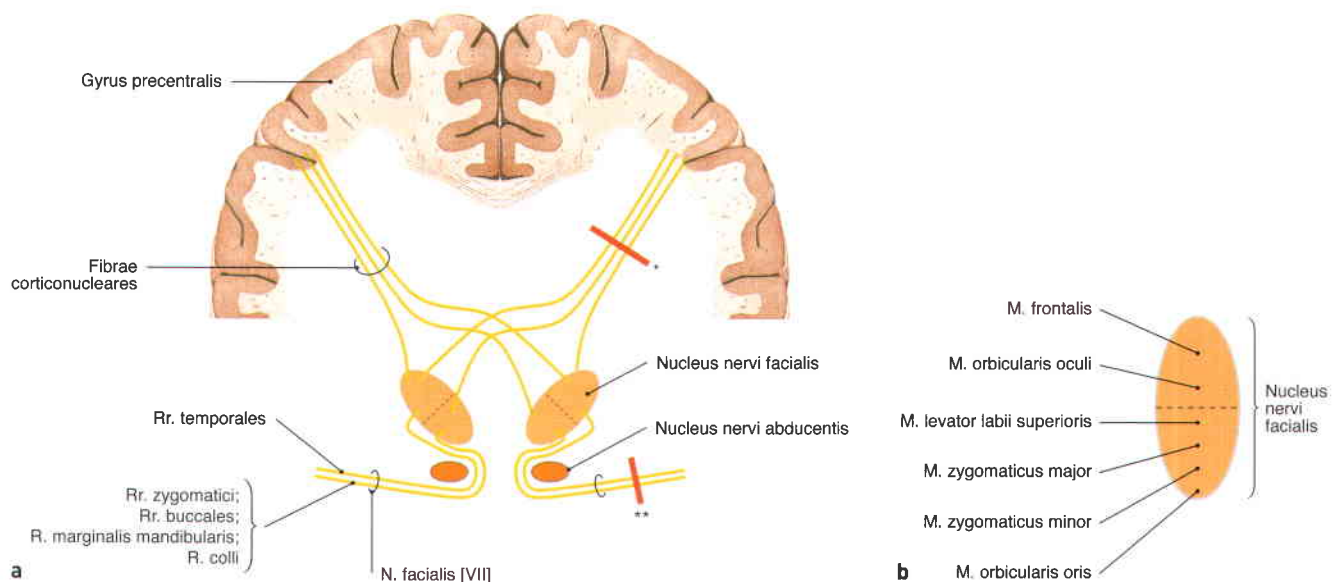


Fig. 477 a, b Neuronal structure of the motor part of the facial nerve, N. facialis [VII].

a Overview

b Representation of the facial muscles in the motor nucleus of the facial nerve

Though the nuclei of the upper facial muscles receive

innervation from both hemispheres, those of the lower facial muscles are only innervated from the contralateral side. Therefore, patients with central palsy (*) are still able to frown the brow and to close the eyelids just sufficiently. However, in patients with peripheral palsy (**) all facial muscles are paralyzed.

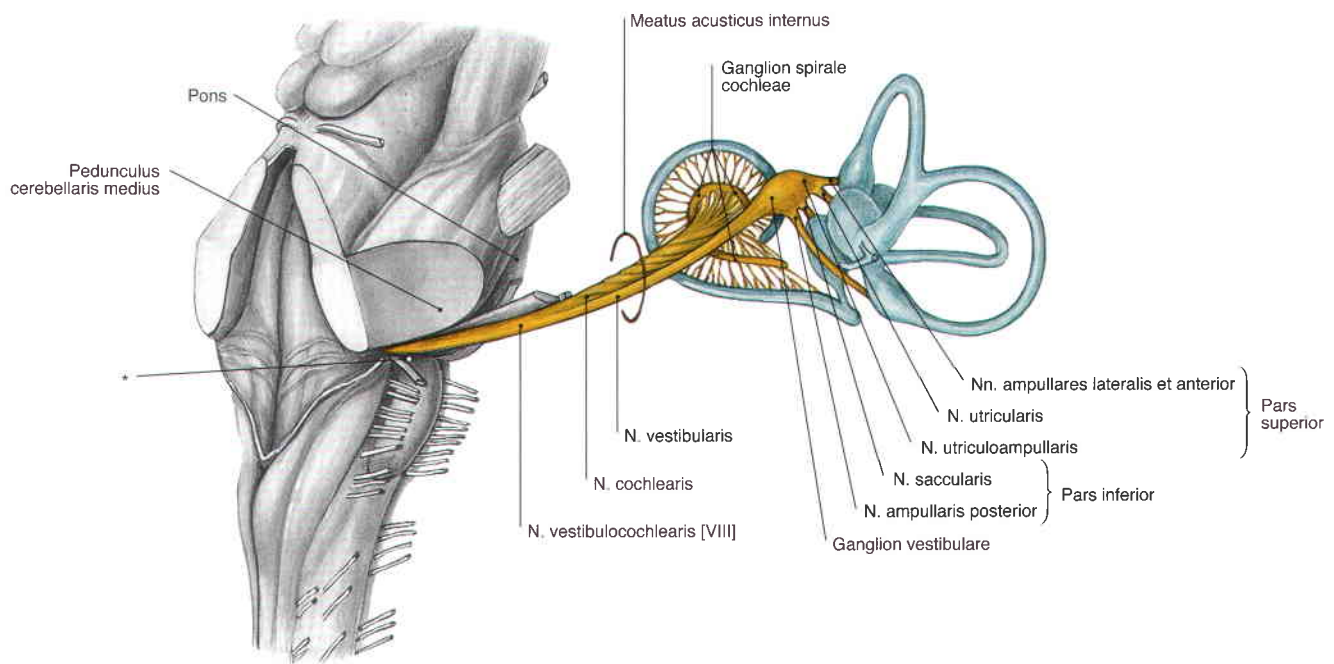


Fig. 478 Vestibulocochlear nerve, N. vestibulocochlearis [VIII]; the membranous labyrinth is greatly enlarged; posterior view from the right.
* Clinical term: cerebellopontine angle

→ T 57h

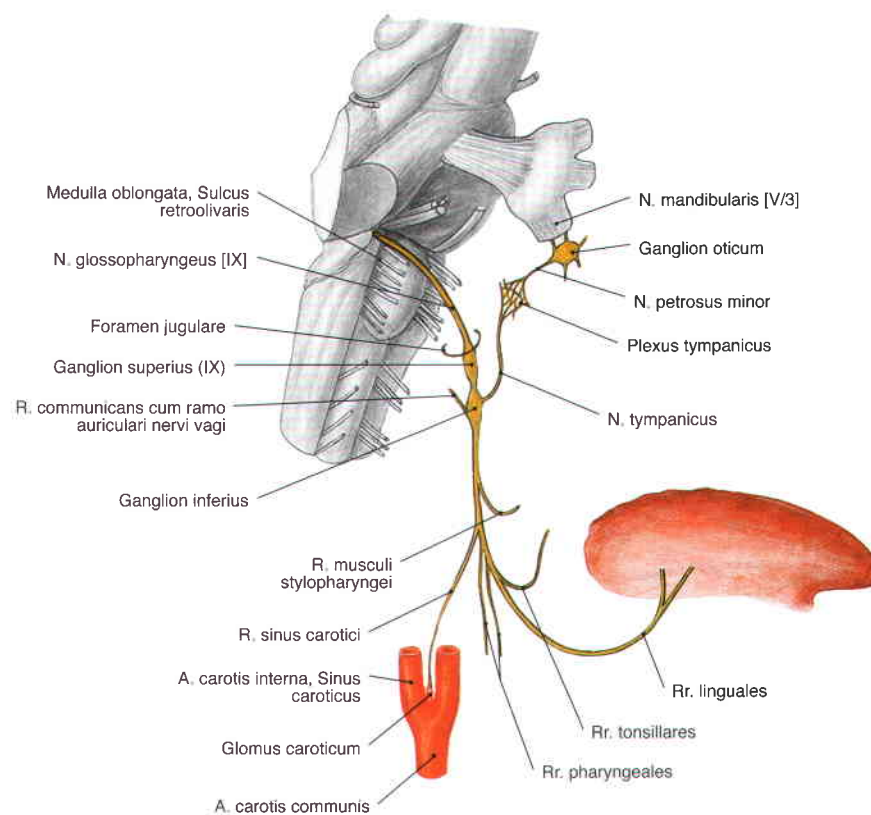
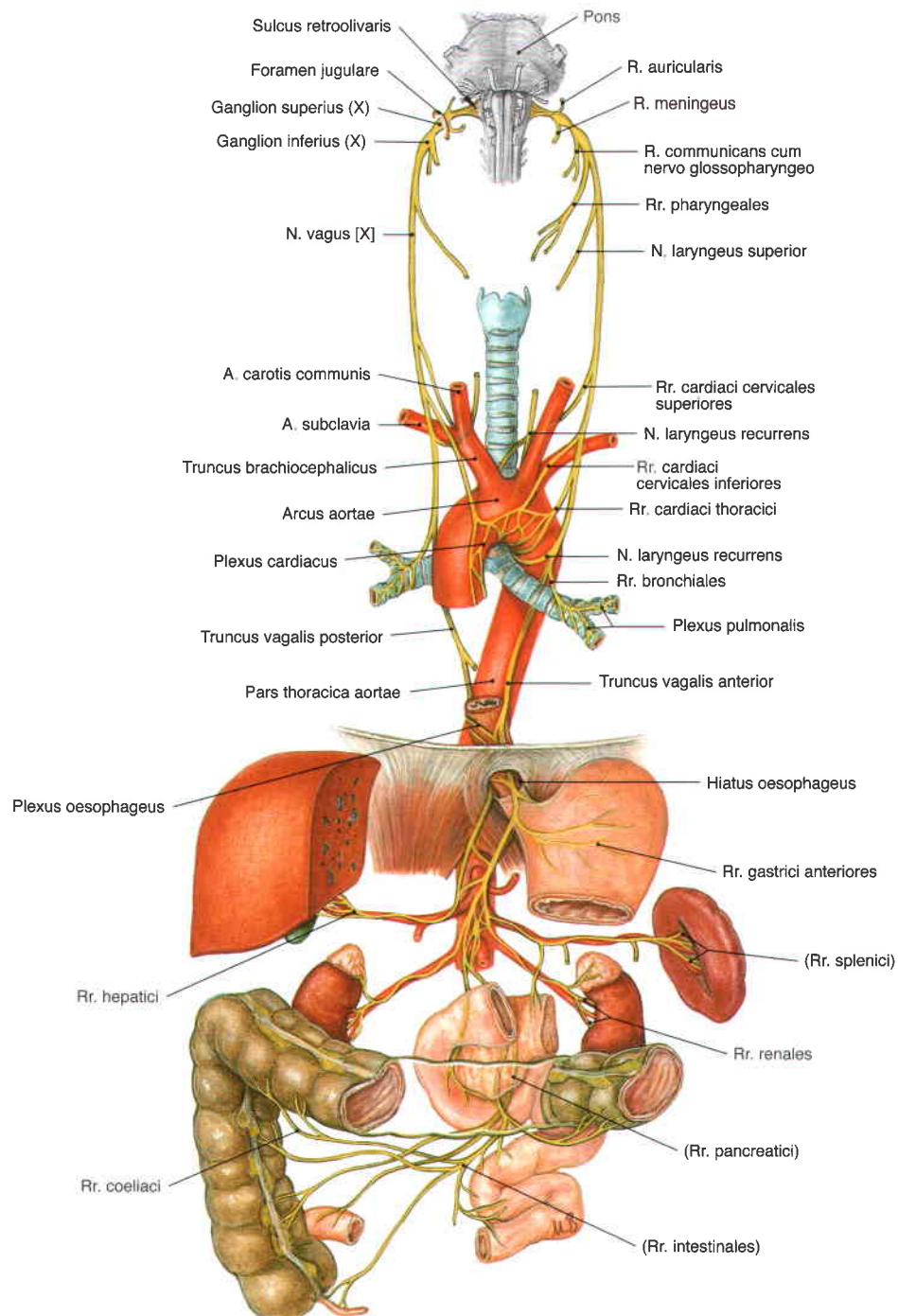


Fig. 479 Glossopharyngeal nerve, N. glossopharyngeus [IX]; viewed from the right.

→ T 57i

Cranial nerves

→ T57j

Fig. 480 Vagus nerve, N. vagus [X]; both nerves; semi-schematic; anterior view.

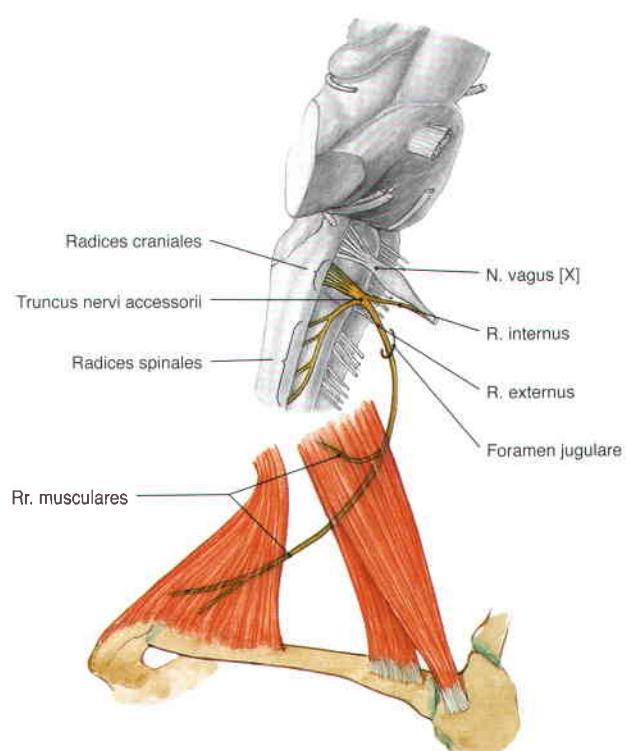


Fig. 481 Accessory nerve, N. accessorius [XI]; viewed from the right.

→ T 57k

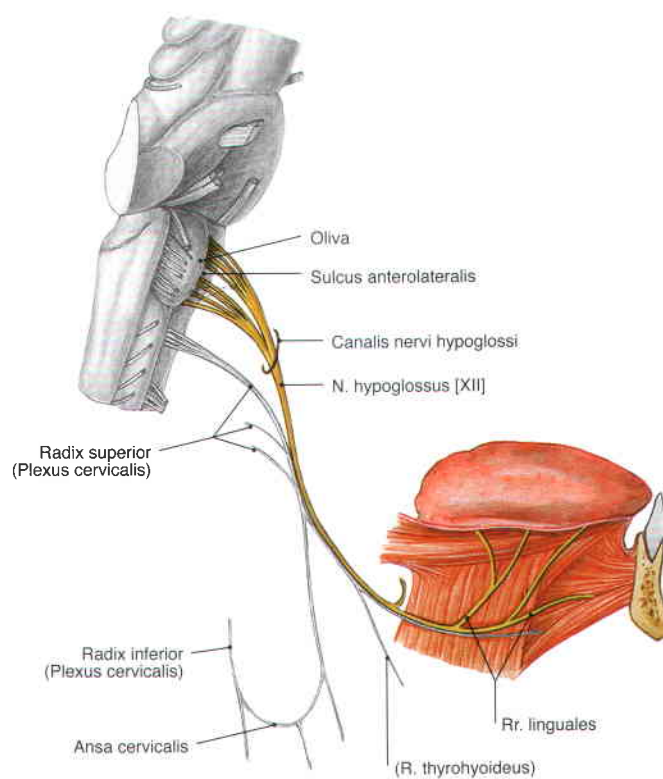


Fig. 482 Hypoglossal nerve, N. hypoglossus [XII]; viewed from the right.

→ T 57l

Cranial nerves

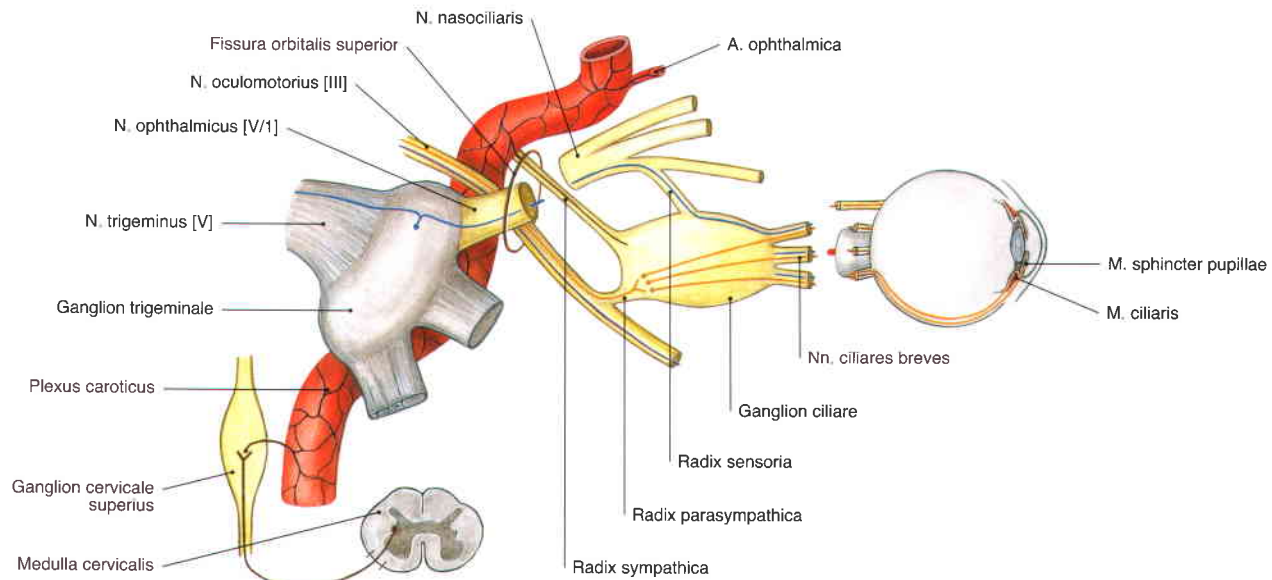


Fig. 483 Ciliary ganglion, Ganglion ciliare; overview.

Nuclear region:
Accessory nucleus of the oculomotor nerve,
Nucleus accessorius nervi oculomotorii

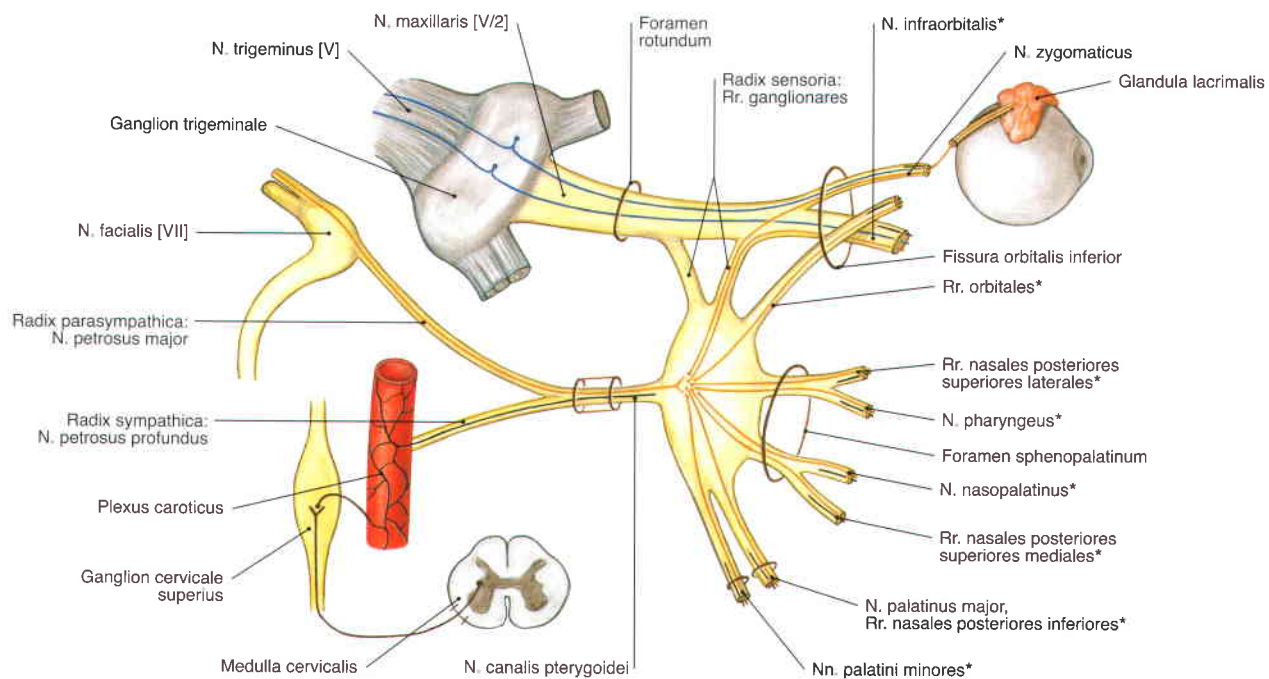
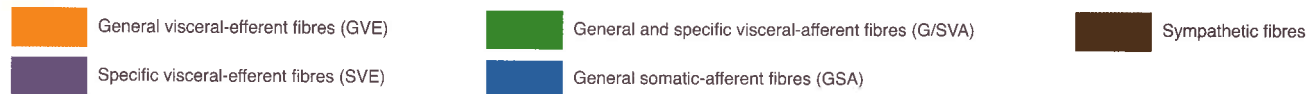


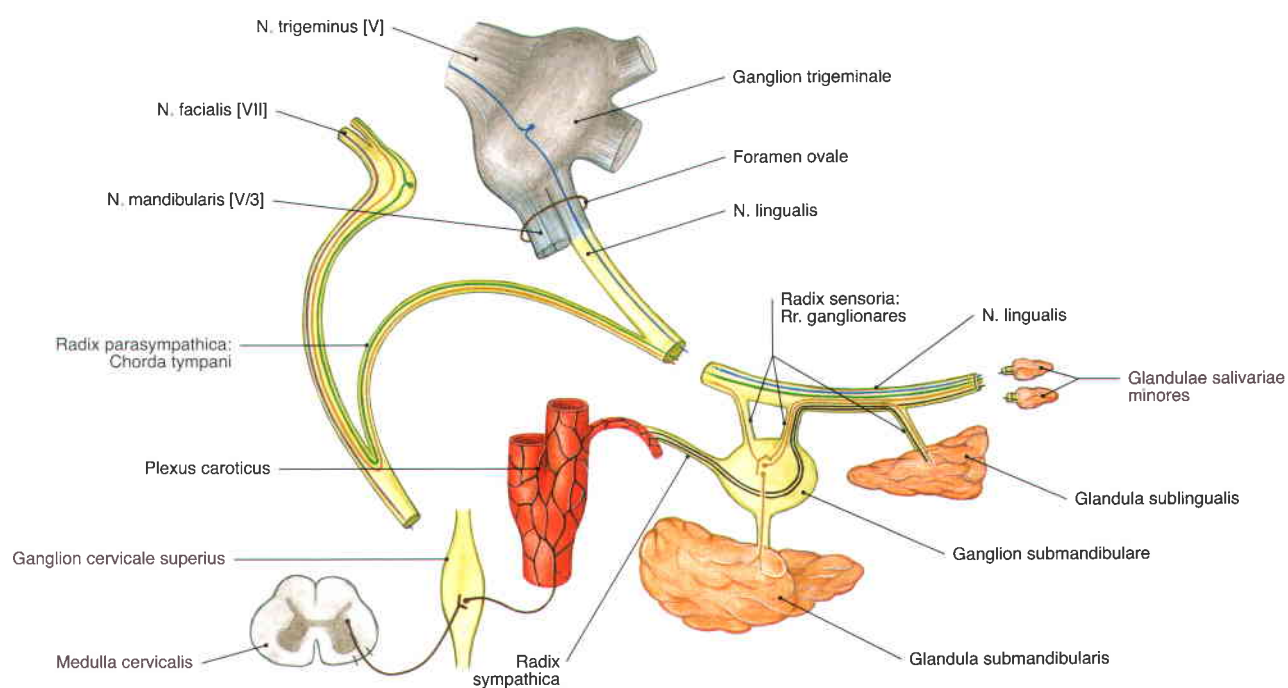
Fig. 484 Pterygopalatine ganglion, Ganglion pterygopalatinum; overview.

* Innervation of the glands of the nose and the palate

Nuclear region:
Superior salivatory nucleus,
Nucleus salivatorius superior

Nuclear region:
Inferior salivatory nucleus,
Nucleus salivatorius inferior

General somatic-afferent fibres (GSA)



Nuclear region:
Superior salivatory nucleus,
Nucleus salivatorius superior

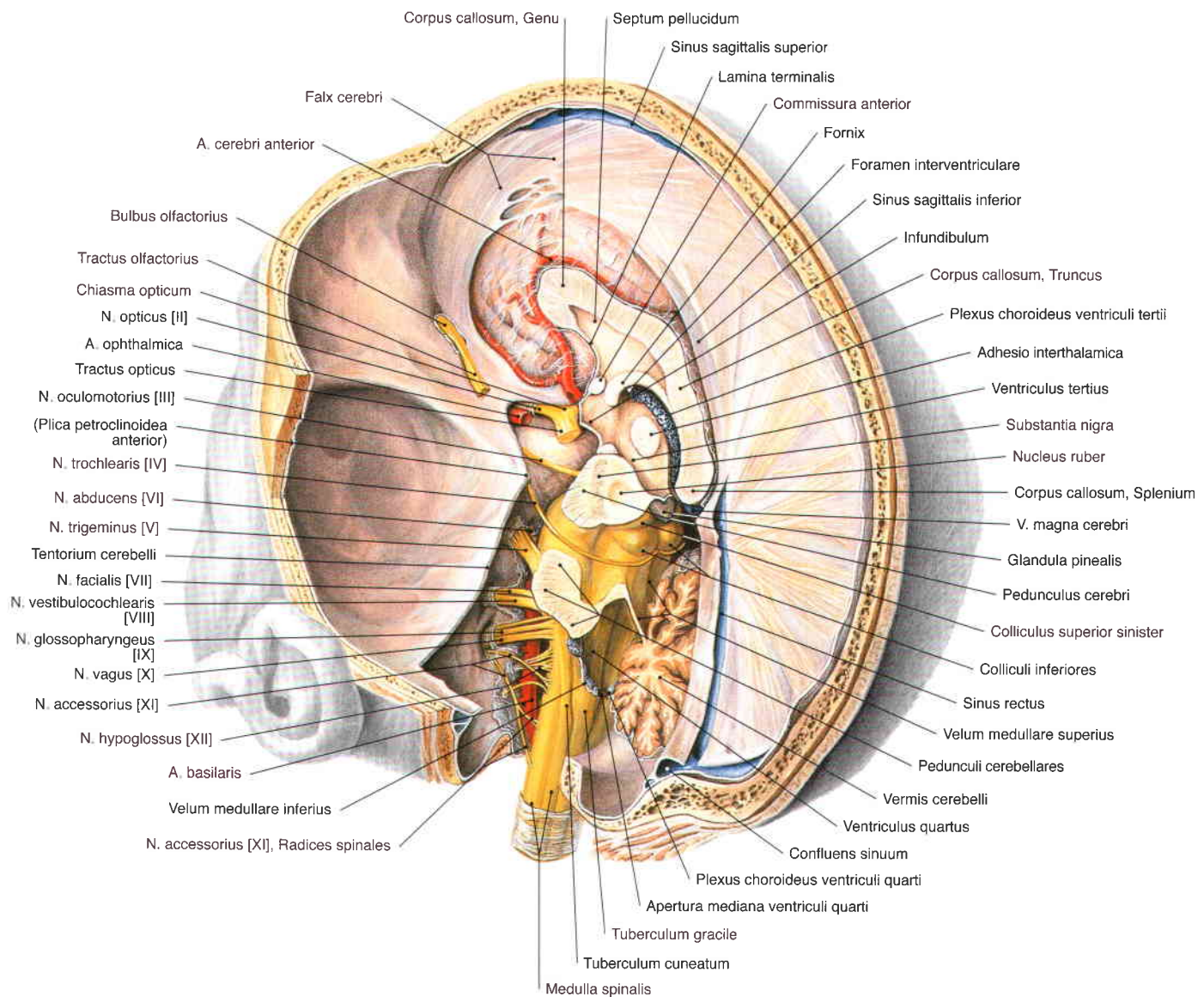
Cranial nerves, topography

Fig. 487 Course of the cranial nerves, Nn. craniales, in the subarachnoid space; the left hemisphere of the cerebrum and the cerebellum as well as the tentorium cerebelli have been removed.

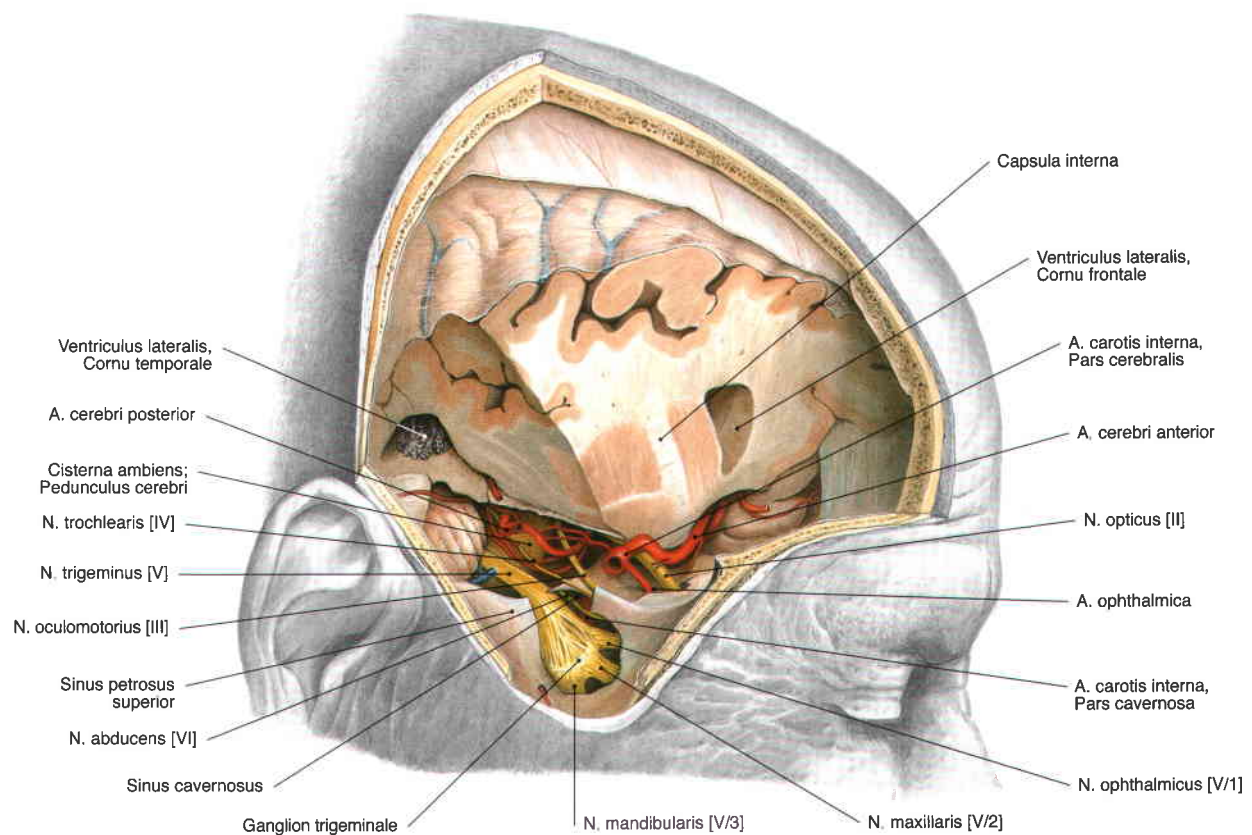


Fig. 488 Course of the cranial nerves, Nn. craniales, in the middle cranial fossa, Fossa cranii media.

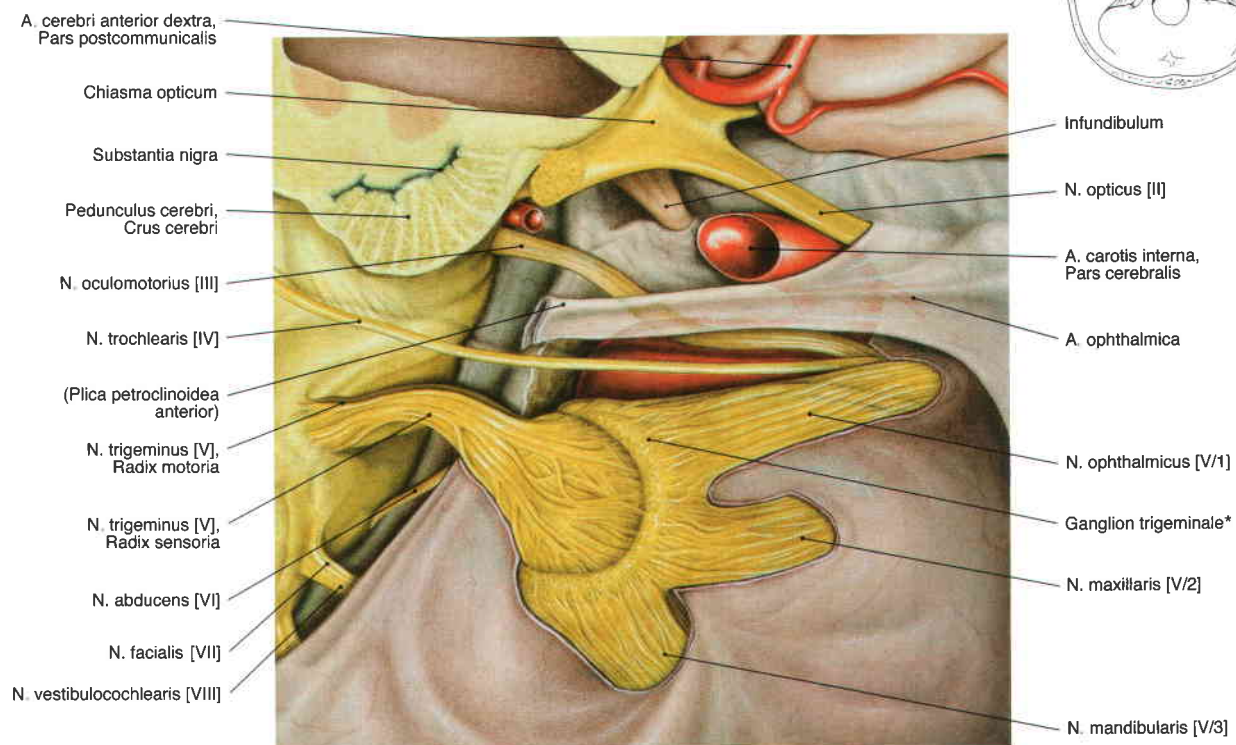
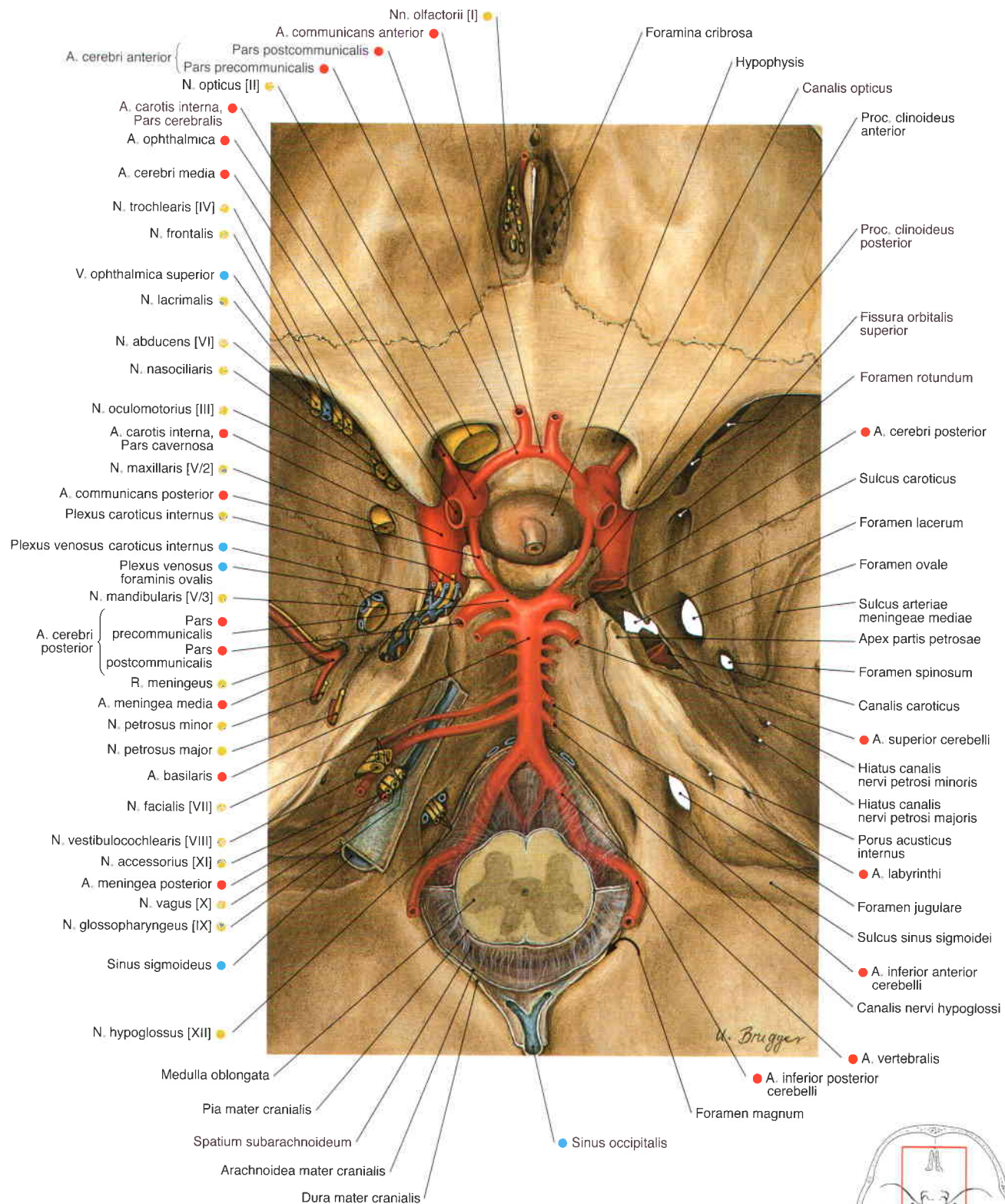


Fig. 489 Arteries and nerves in the region of the sella turcica, Sella turcica, and the cavernous sinus, Sinus cavernosus.

* Clinical term: GASSERian ganglion

Vessels and nerves of the cranial base

→ 467, 468, 563

Fig. 490 Passage of vessels and nerves through the internal surface of cranial base, Basis cranii interna, and the cerebral arterial circle, Circulus arteriosus cerebri [WILLIS]; superior view.

Cavernous sinus and pituitary gland

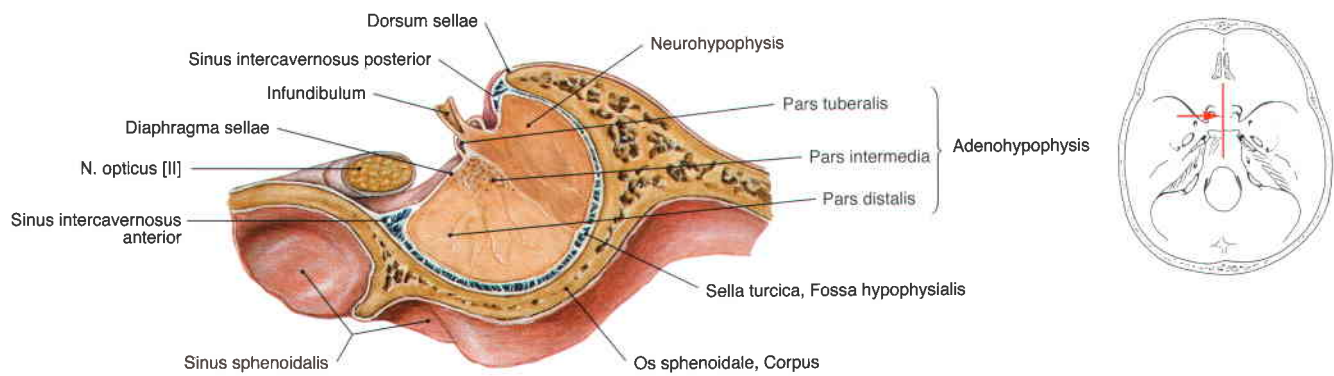


Fig. 491 Pituitary gland, Hypophysis [Glandula pituitaria].

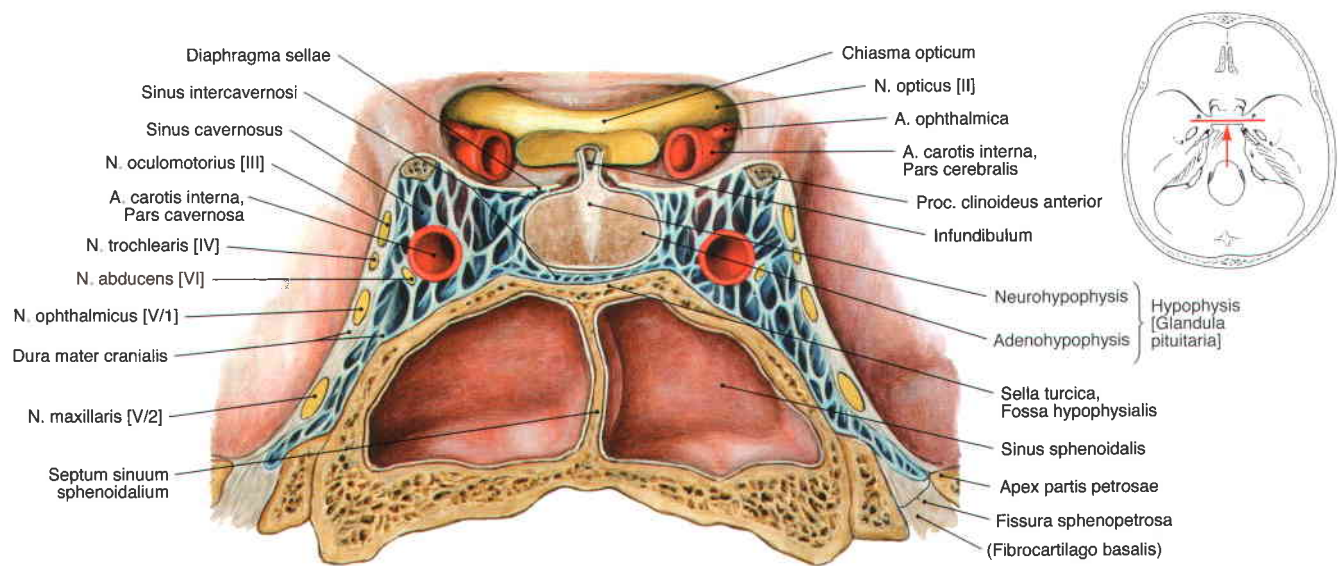


Fig. 492 Pituitary gland, Hypophysis [Glandula pituitaria], and cavernous sinus, Sinus cavernosus.

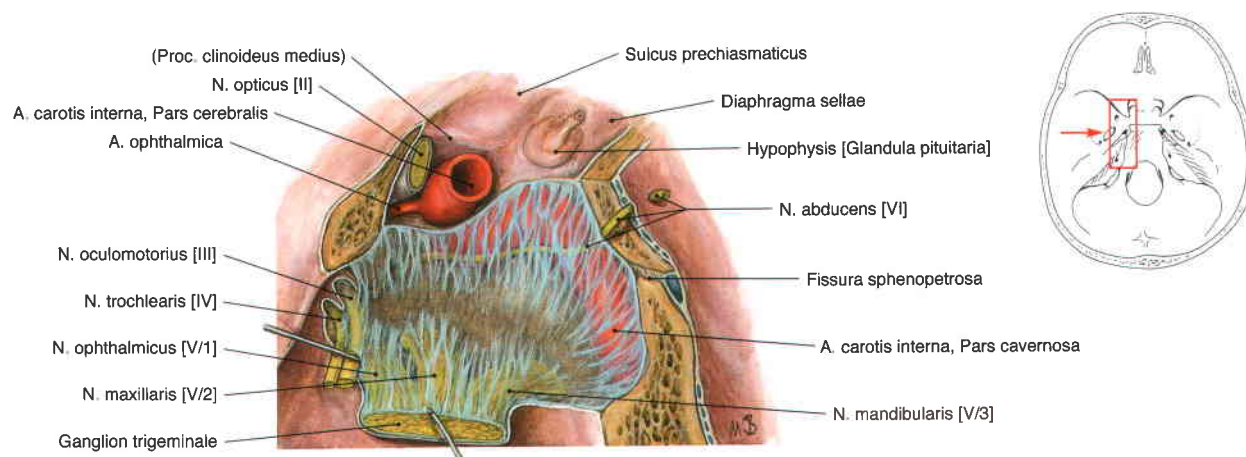


Fig. 493 Cavernous sinus, Sinus cavernosus; the part of the cranial dura mater forming the lateral wall of the cavernous sinus has been removed; the trigeminal ganglion has been reflected to the side.

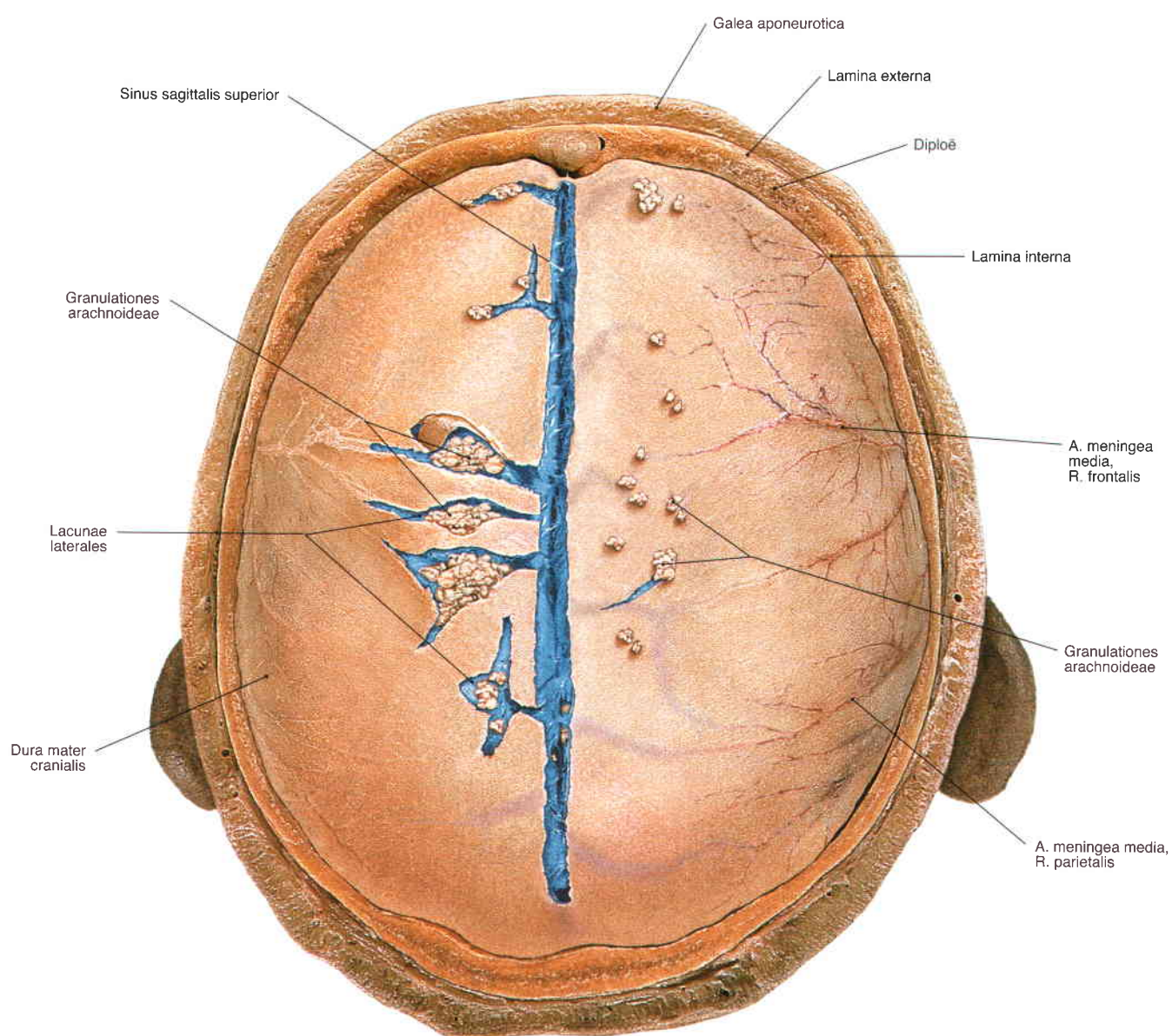
Cranial dura mater and superior sagittal sinus

Fig. 494 Cranial dura mater, Dura mater cranialis, and superior sagittal sinus, Sinus sagittalis superior, with some lateral lacunae, Lacunae laterales.

Superficial vessels of the brain

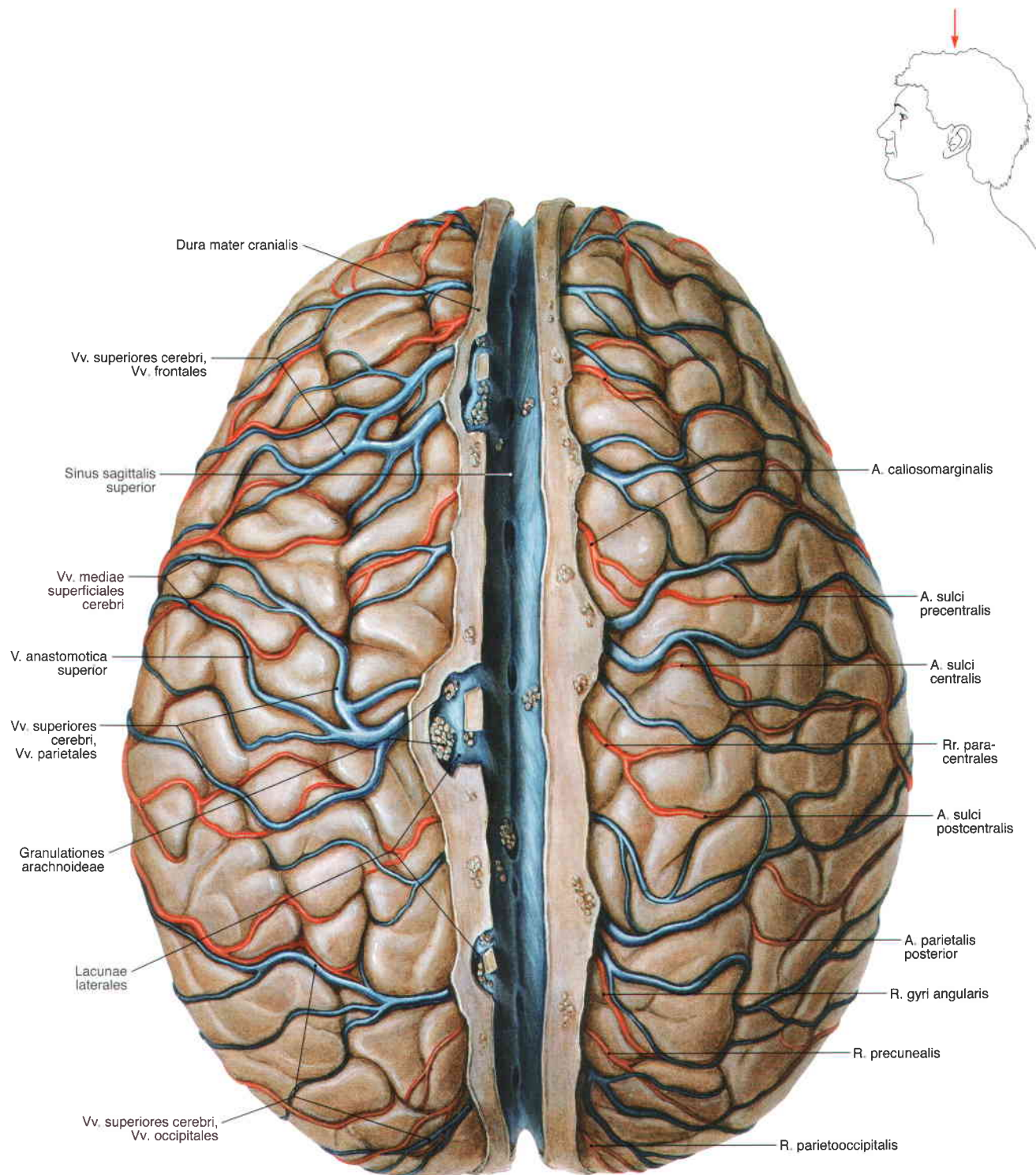


Fig. 495 Superficial arteries and veins of the brain; the cranial dura mater has been removed and the superior sagittal sinus has been sectioned; after removal of the cranial arachnoid mater.

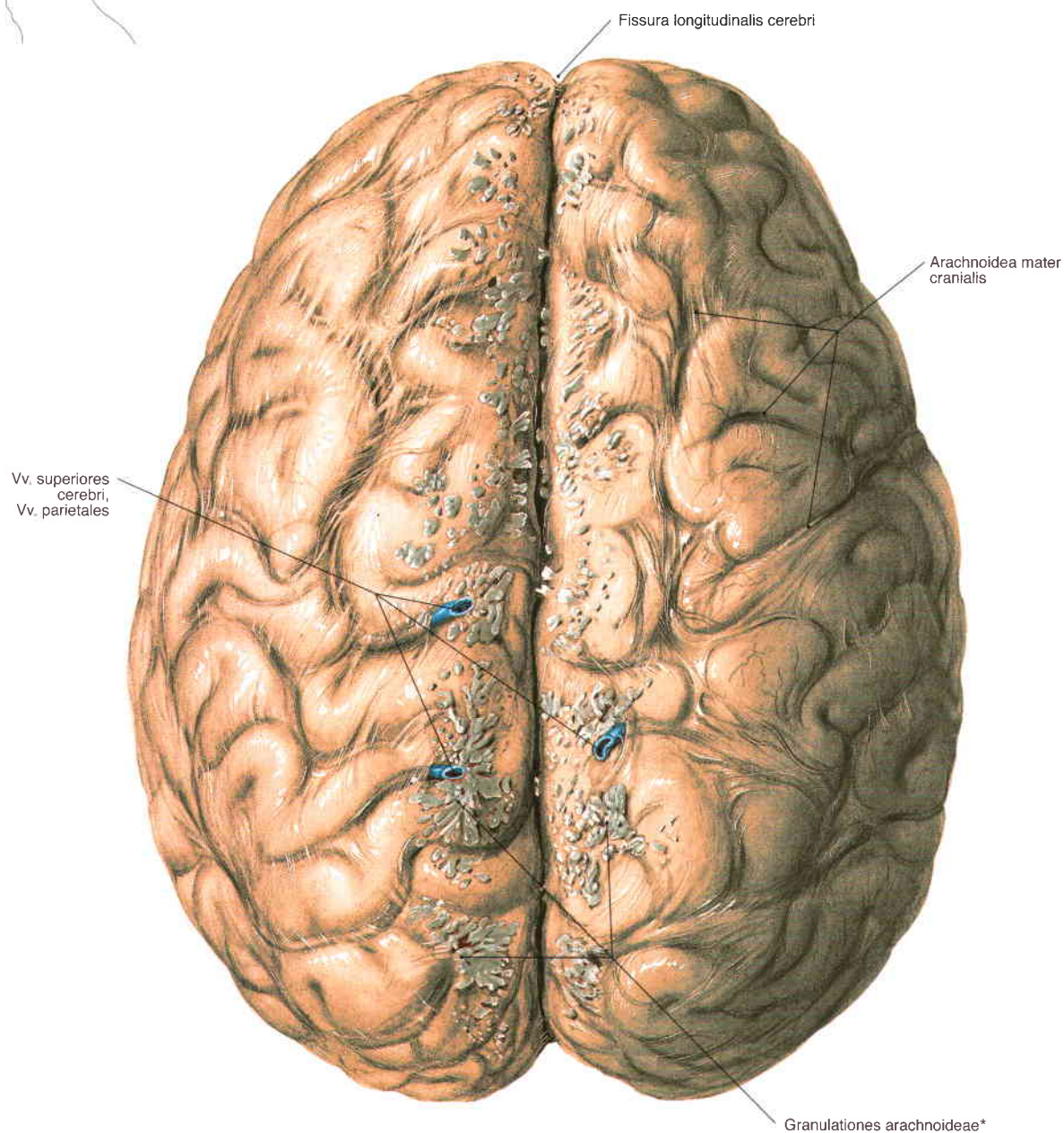
Cranial arachnoid mater

Fig. 496 Brain, Encephalon, with cranial arachnoid mater, Arachnoidea mater cranialis; superior view.

* Also: PACCHIONIAN granulations

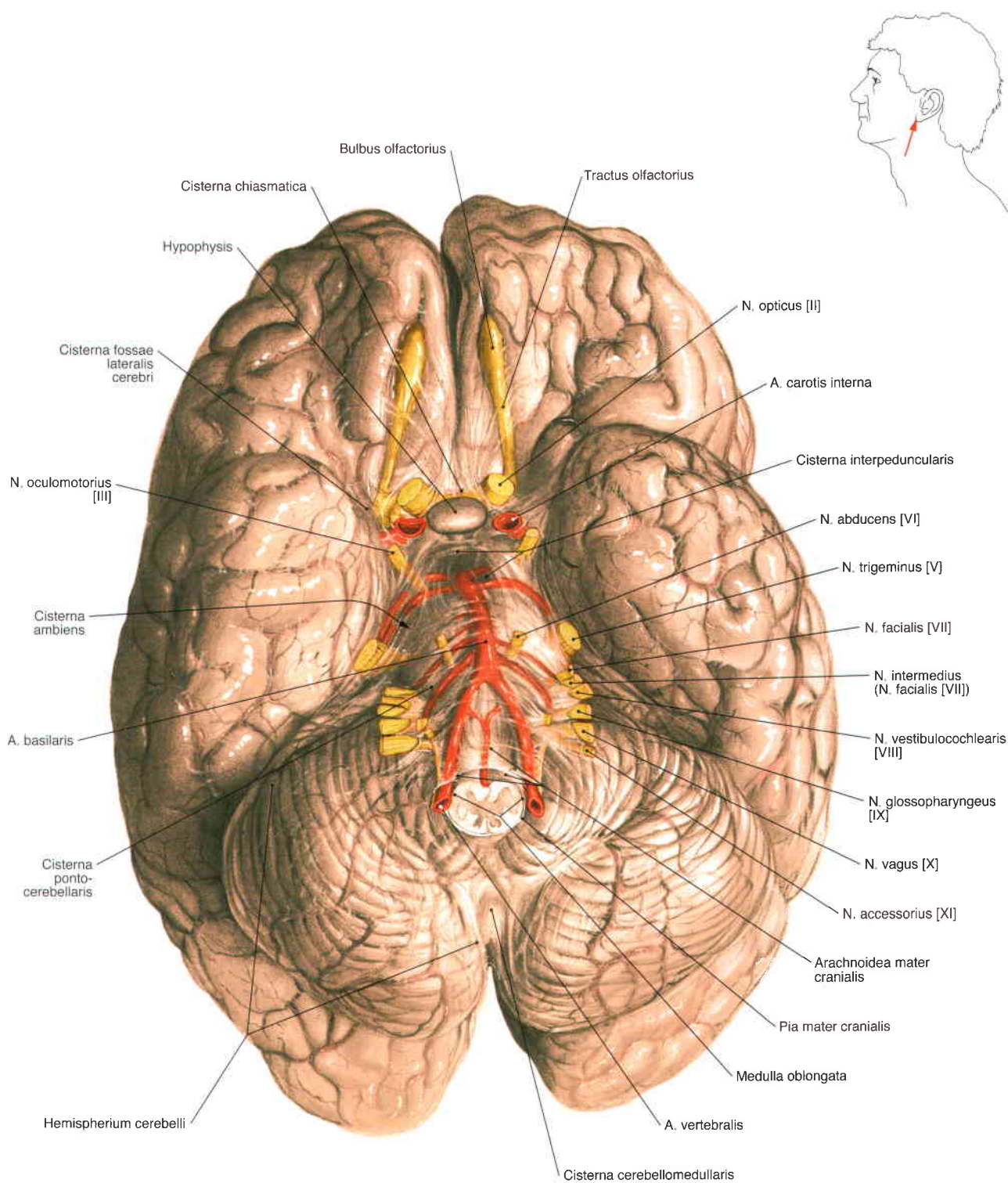


Fig. 497 Brain, Encephalon, with cranial arachnoid mater, Arachnoidea mater cranialis.

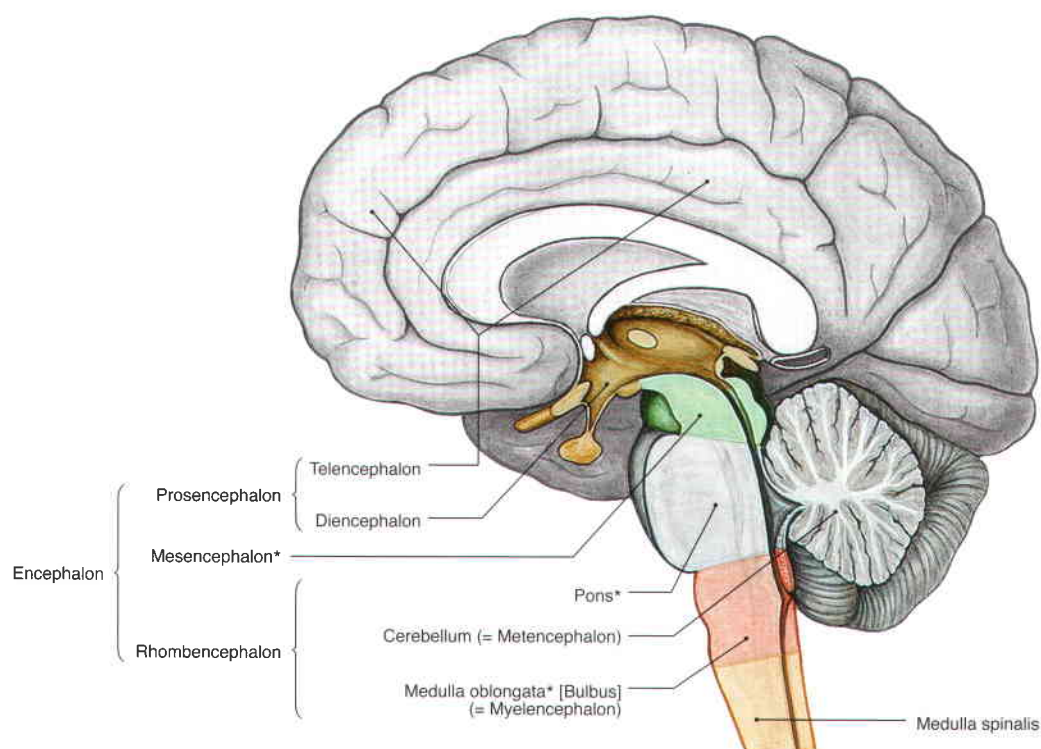
Organisation of the brain

Fig. 498 Organisation of the central nervous system; median section; schema. Parts marked with * together form the brainstem, Truncus encephali.

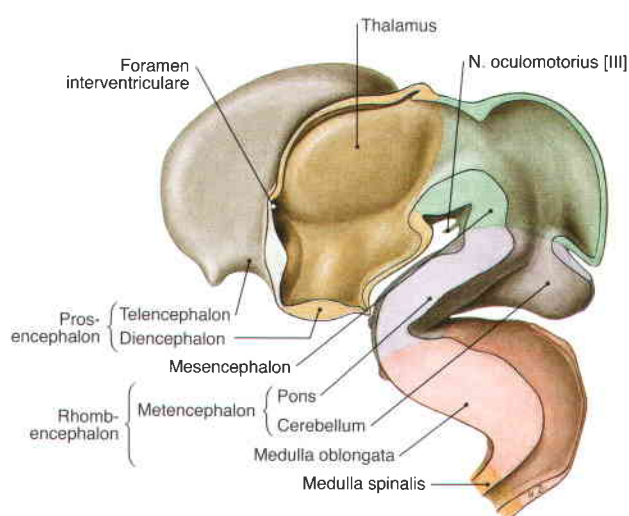


Fig. 499 Development of the brain; model of the brain of an approx. 2-month-old embryo; median section.

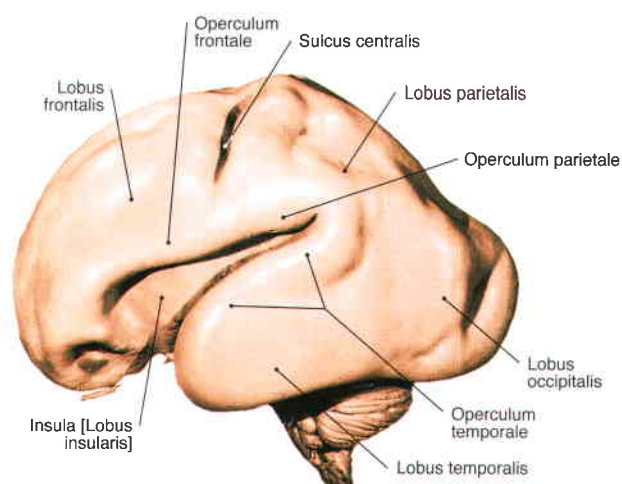


Fig. 500 Development of the brain; brain of an approx. 4-month-old foetus (crown-rump length 20 cm); viewed from the left.

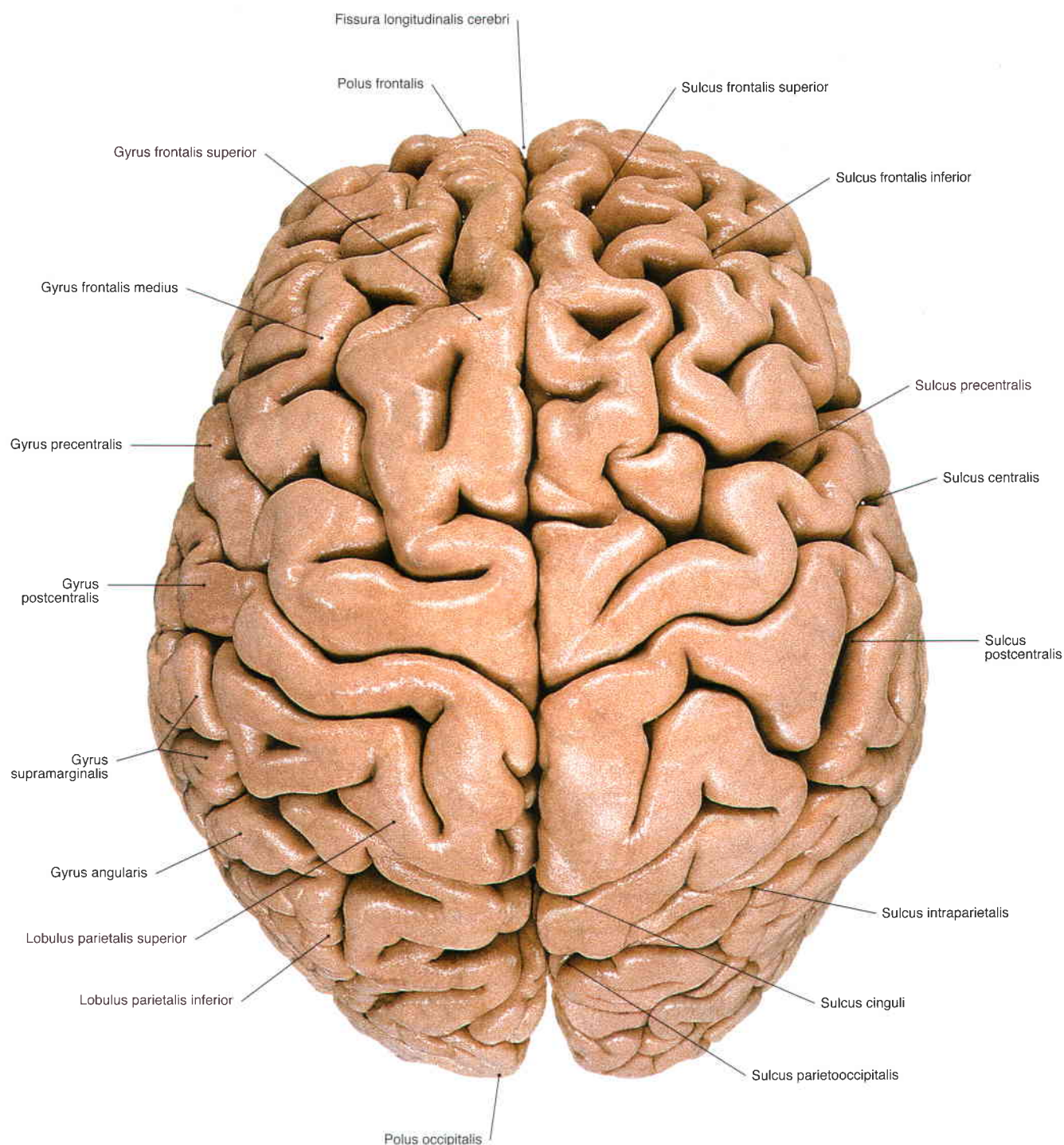


Fig. 501 Cerebrum, Cerebrum; after removal of the cranial arachnoid mater; superior view. Formation of the gyri varies considerably.

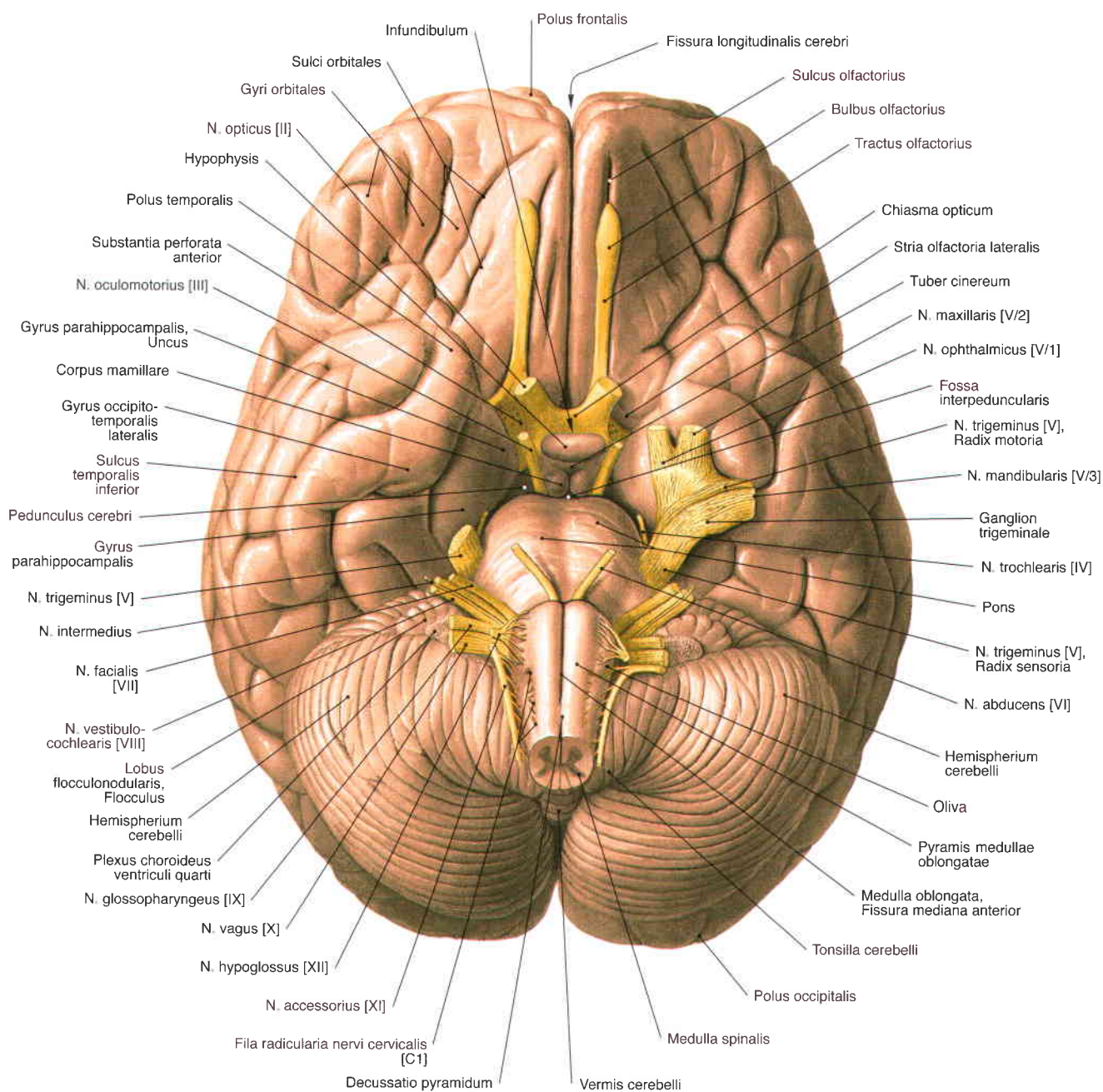
Base of the brain

Fig. 502 Cerebrum, Cerebrum;
brainstem, Truncus encephali, with cerebellum,
Cerebellum, as well as cranial nerves, Nn. craniales;
inferior view.

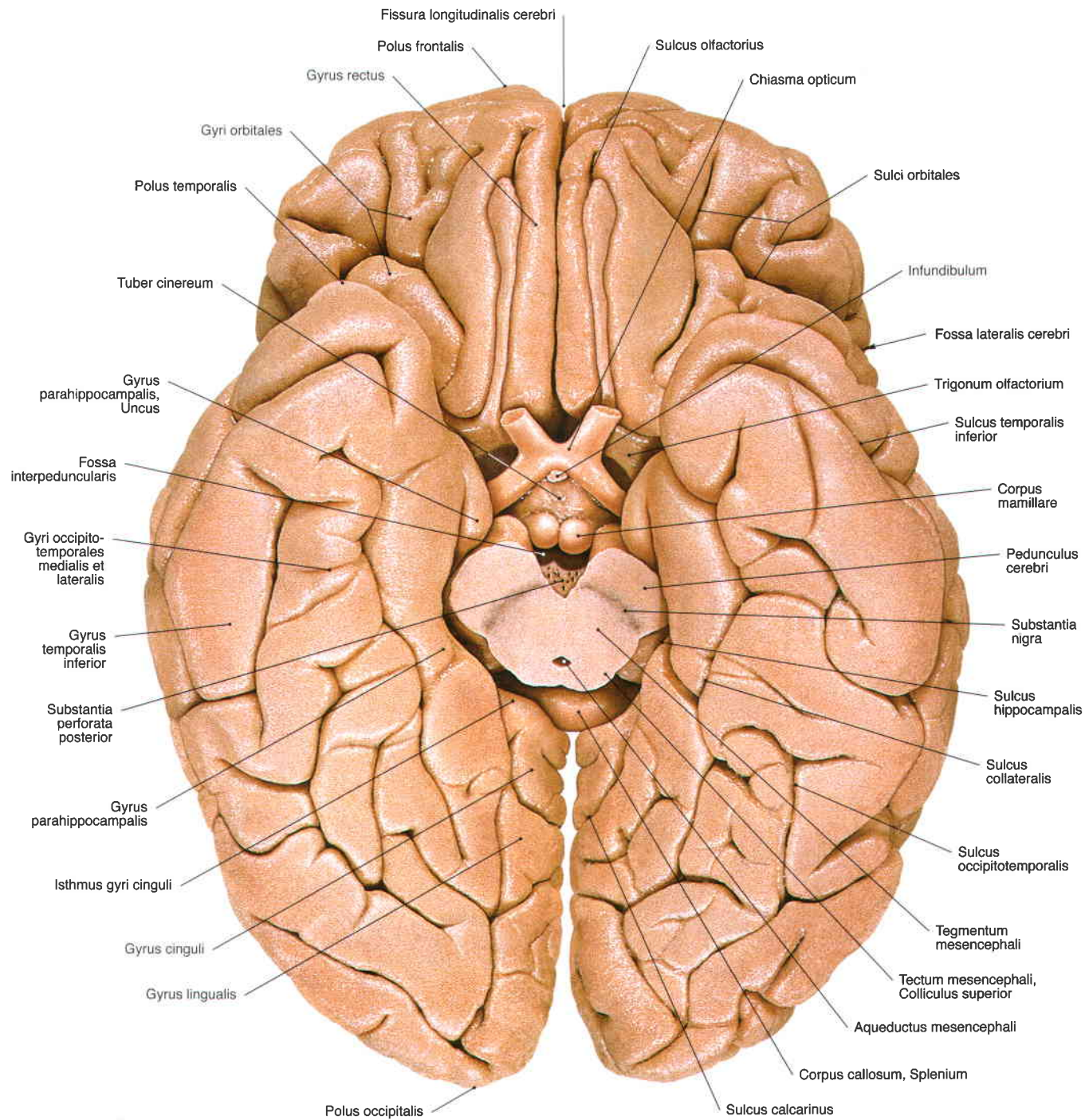


Fig. 503 Gyri, Gyri, and grooves, Sulci, of the cerebral hemispheres; the midbrain has been sectioned.

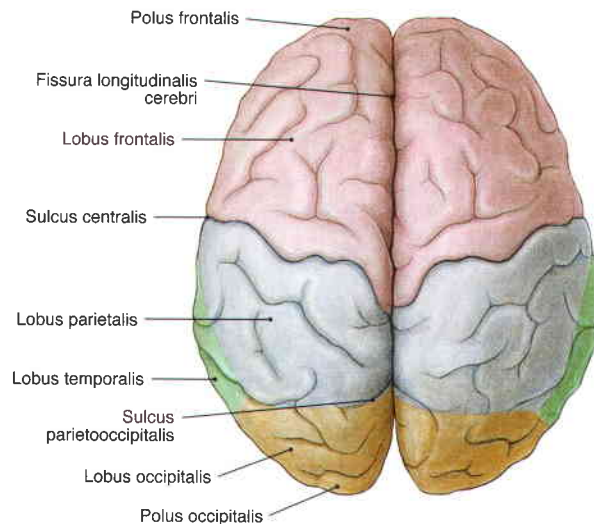
Lobes of the telencephalon

Fig. 504 Lobes of the cerebrum, Lobi cerebri; superior view.

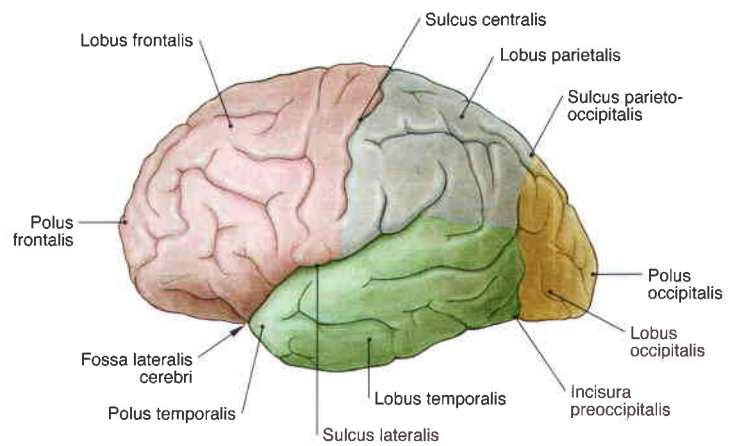


Fig. 505 Lobes of the cerebrum, Lobi cerebri; viewed from the left.

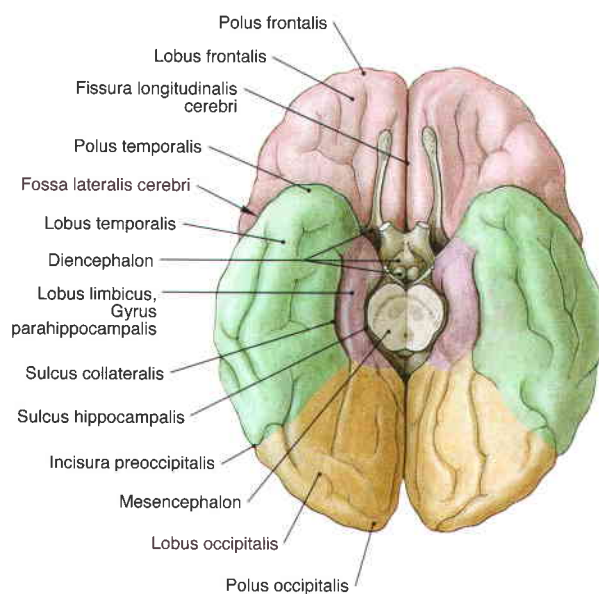


Fig. 506 Lobes of the cerebrum, Lobi cerebri; inferior view.

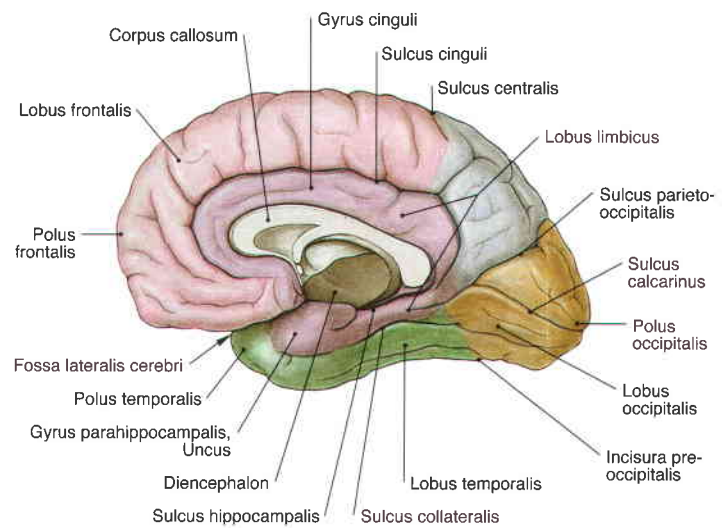


Fig. 507 Lobes of the cerebrum, Lobi cerebri; medial view.

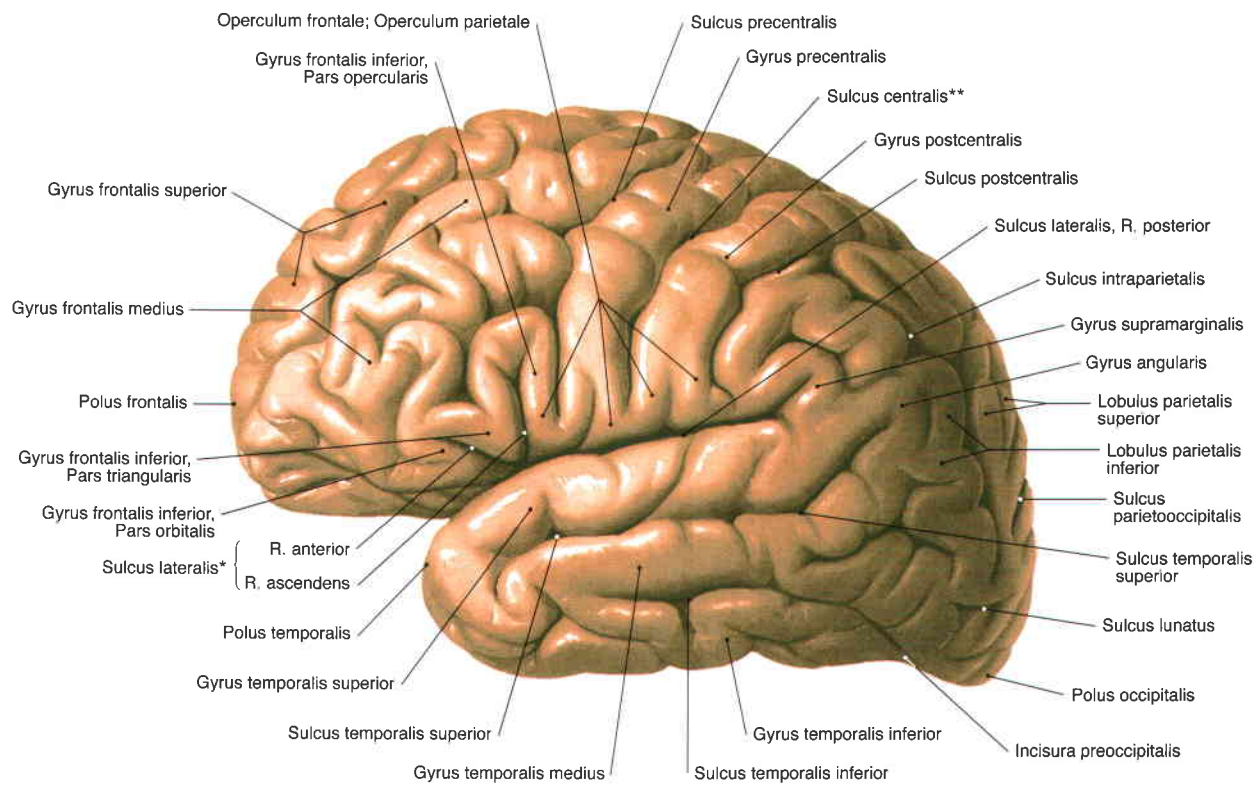


Fig. 508 Gyri, Gyri, and grooves, Sulci, of the cerebral hemispheres; viewed from the left.

* Sulcus of SYLVIVUS

** Sulcus of ROLANDO

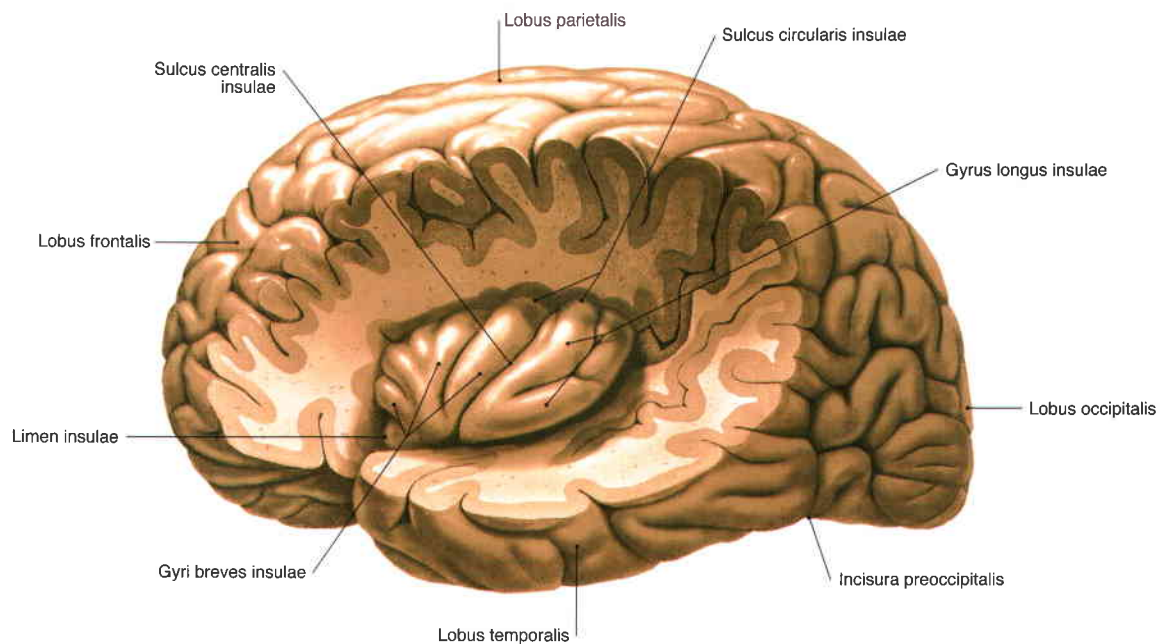


Fig. 509 Gyri, Gyri, and grooves, Sulci, of the cerebral hemispheres; exposure of the insula after removal of the frontal, parietal and temporal opercula; viewed from the left.

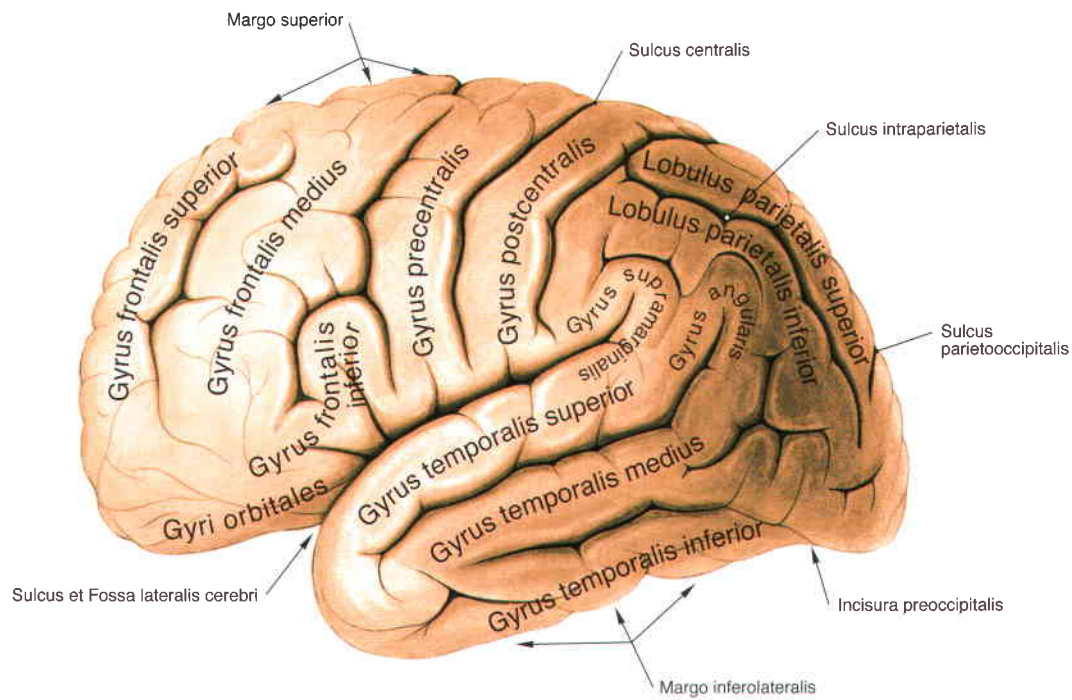
Gyri of the cerebral hemispheres

Fig. 510 Gyri, Gyri, of the cerebral hemispheres; viewed from the left.

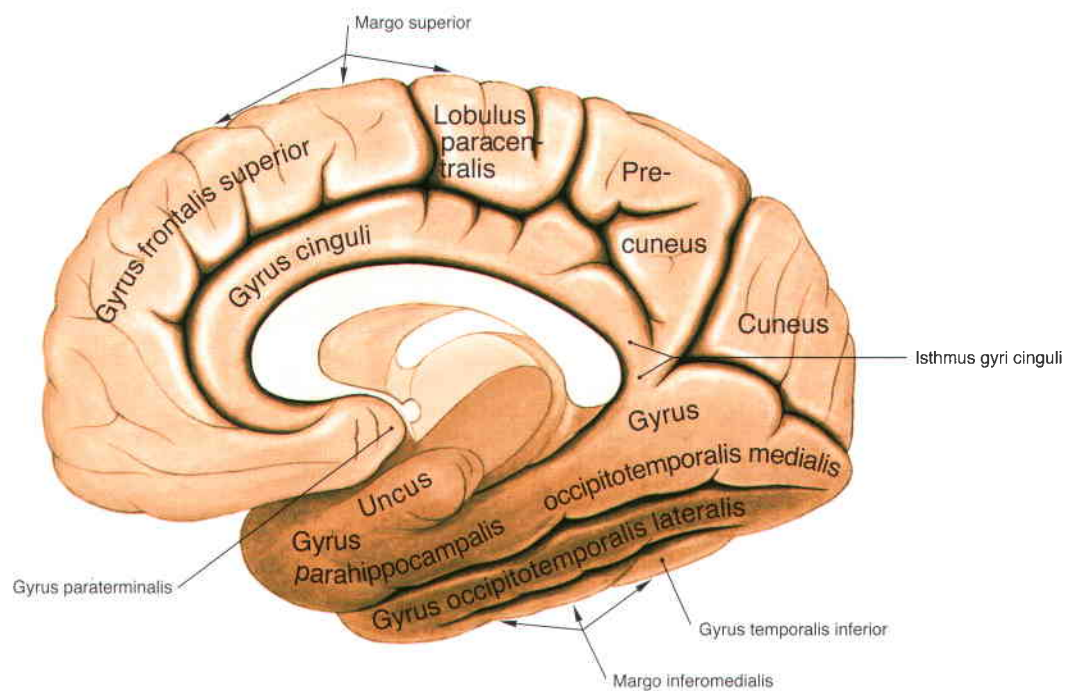


Fig. 511 Gyri, Gyri, of the cerebral hemispheres; medial view.

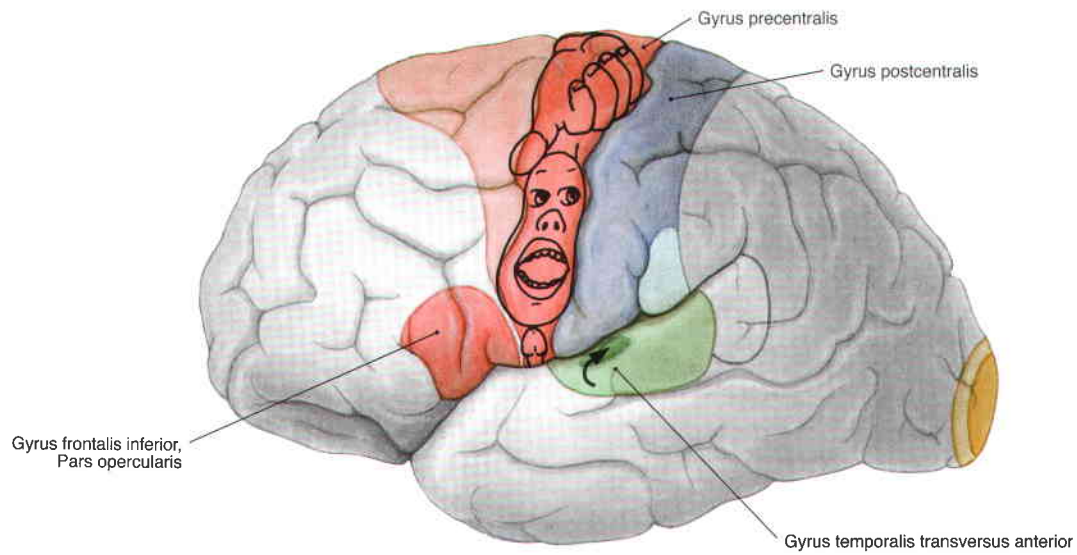


Fig. 512 Functional cortical areas of the cerebral hemispheres according to FOERSTER; viewed from the left.

The somatotopic organisation is illustrated schematically. The primary receiving area for auditory impulses (A) extends over the upper edge of the temporal lobe onto its inner surface.

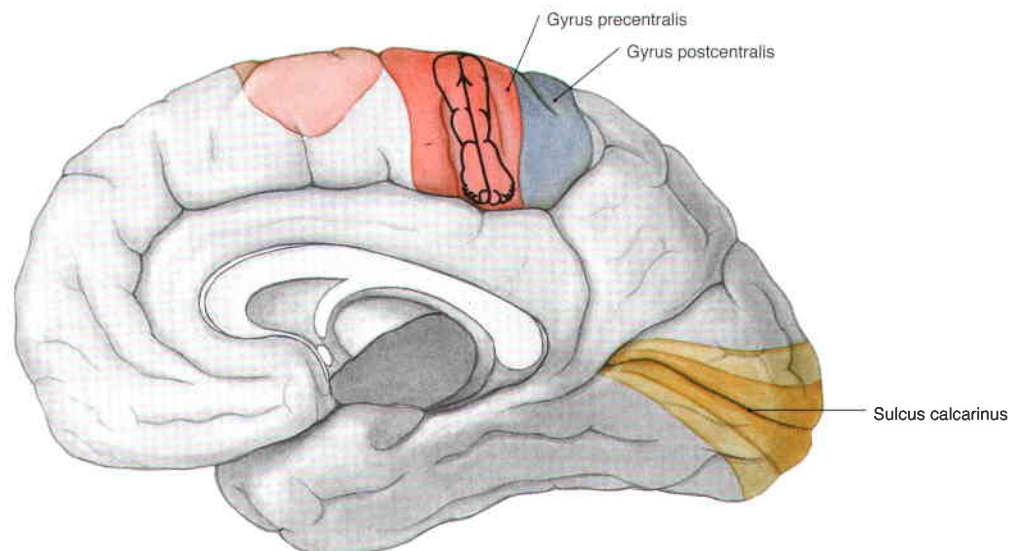


Fig. 513 Functional cortical areas of the cerebral hemispheres according to FOERSTER; medial view.

The somatotopic organisation is illustrated schematically.

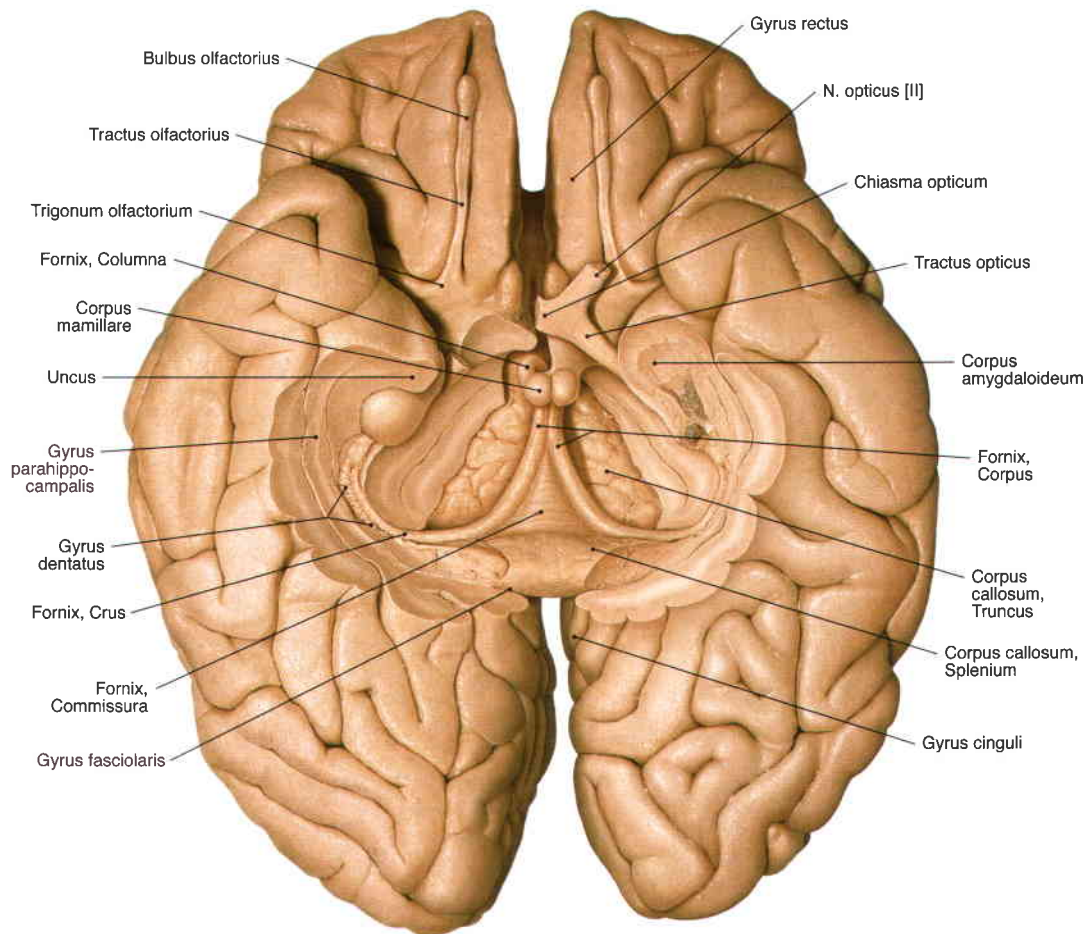
Fornix

Fig. 514 Fornix, Fornix;
after removal of the basal parts of the brain;
inferior view.

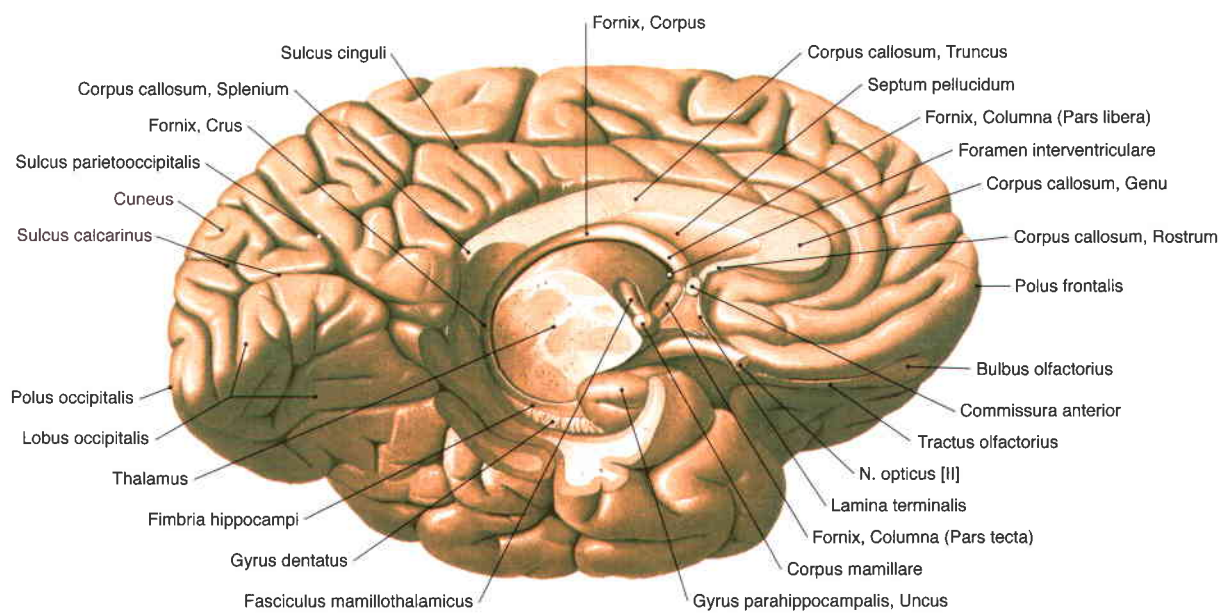


Fig. 515 Fornix, Fornix;
inferomedial view.

Fornix and anterior commissure

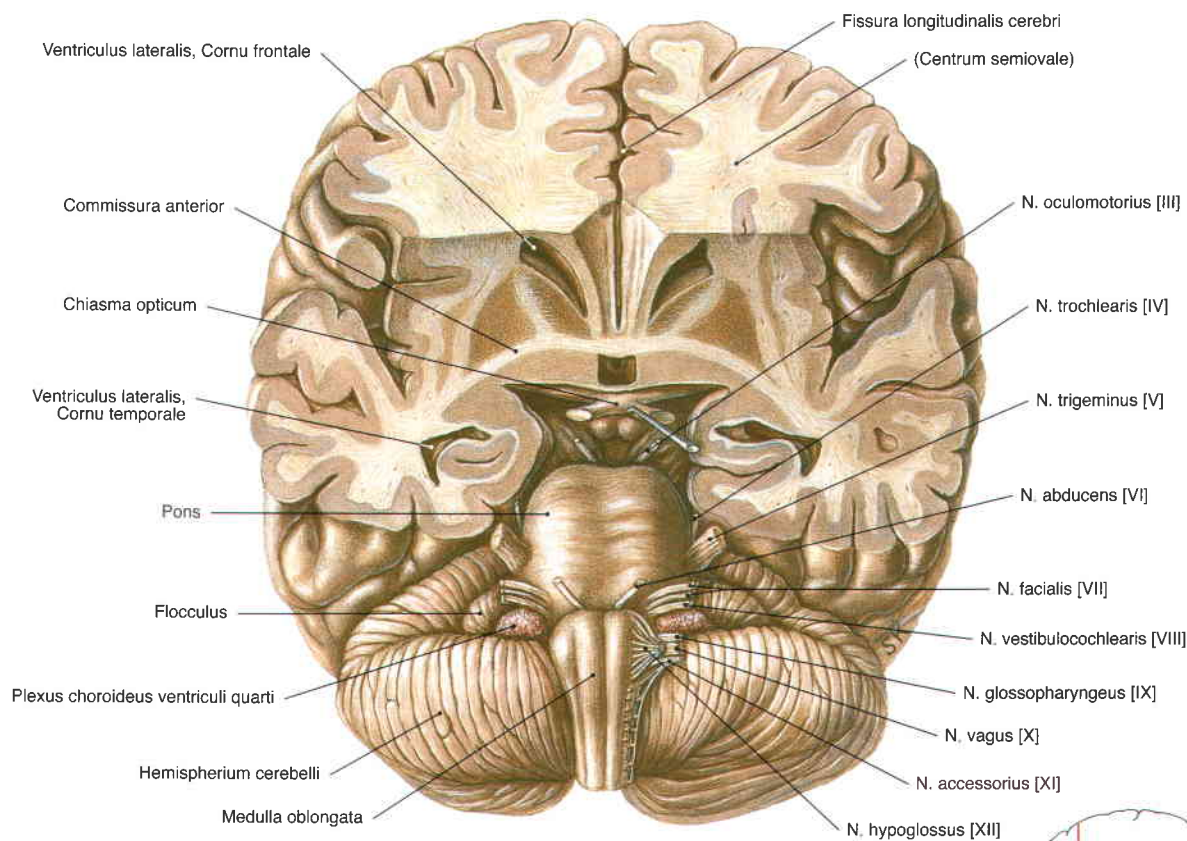


Fig. 516 Anterior commissure, Commissura anterior, and brainstem, Truncus encephali; after partial removal of the basal parts of the cerebrum; anterior-inferior view.

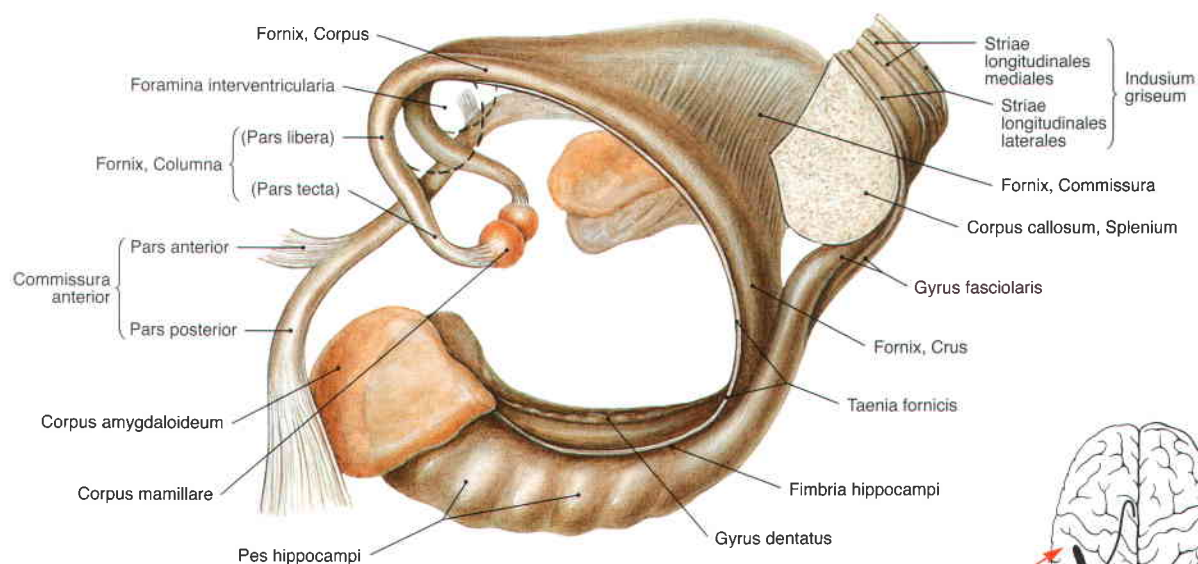


Fig. 517 Both fornices, Fornices, and anterior commissure, Commissura anterior; viewed from the left.

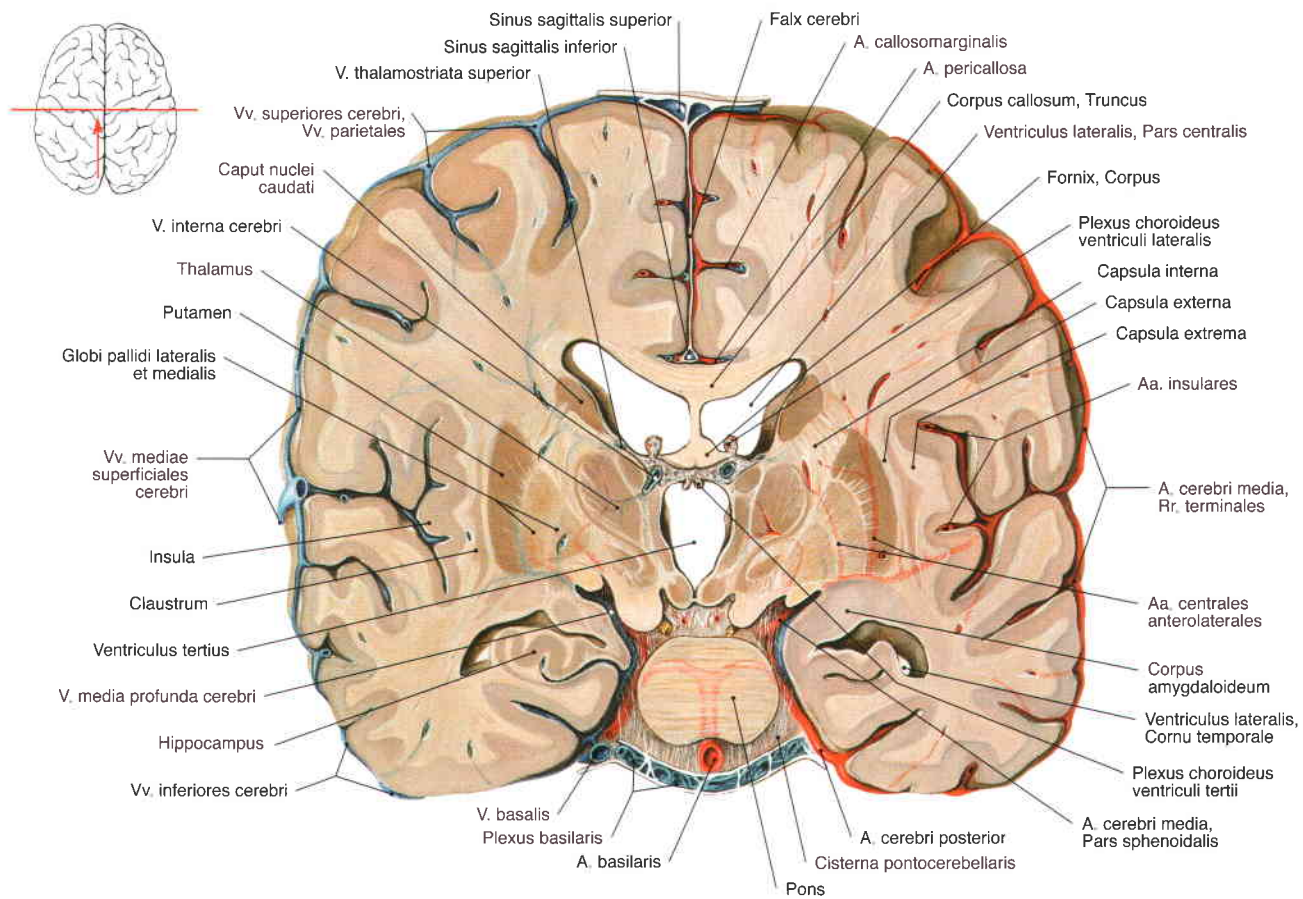
Basal ganglia

Fig. 518 Blood supply of the basal ganglia; frontal section; the arteries are shown on the right and the veins on the left; posterior view.

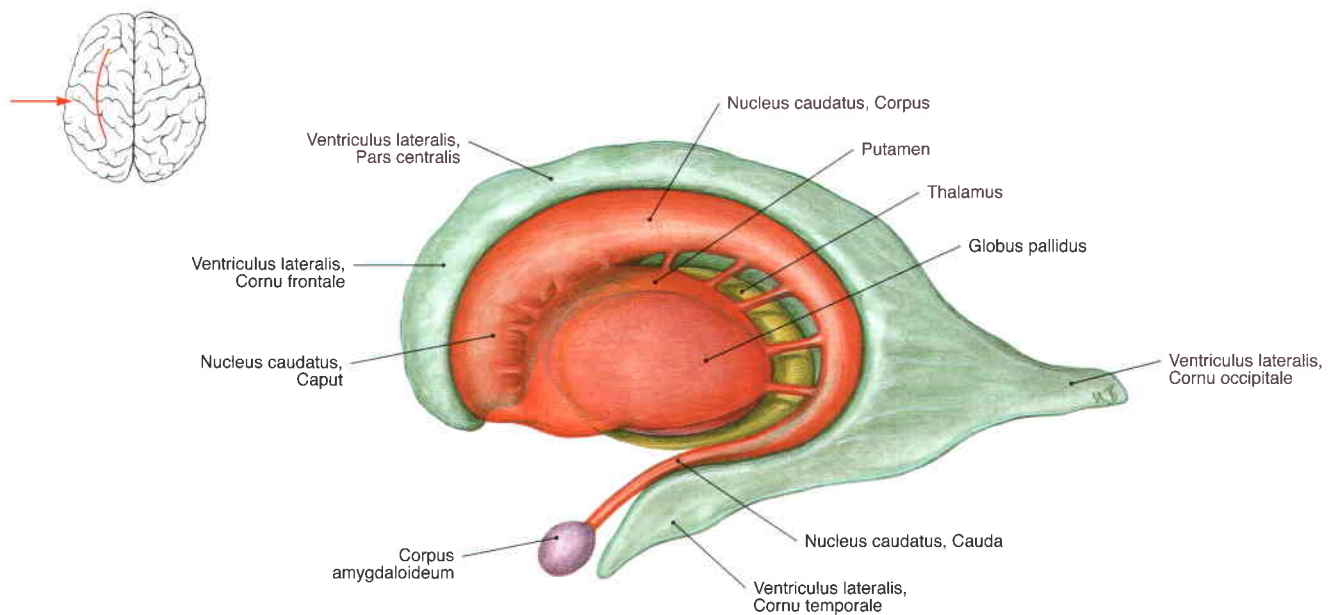


Fig. 519 Basal ganglia and thalamus, Thalamus; viewed from the left.

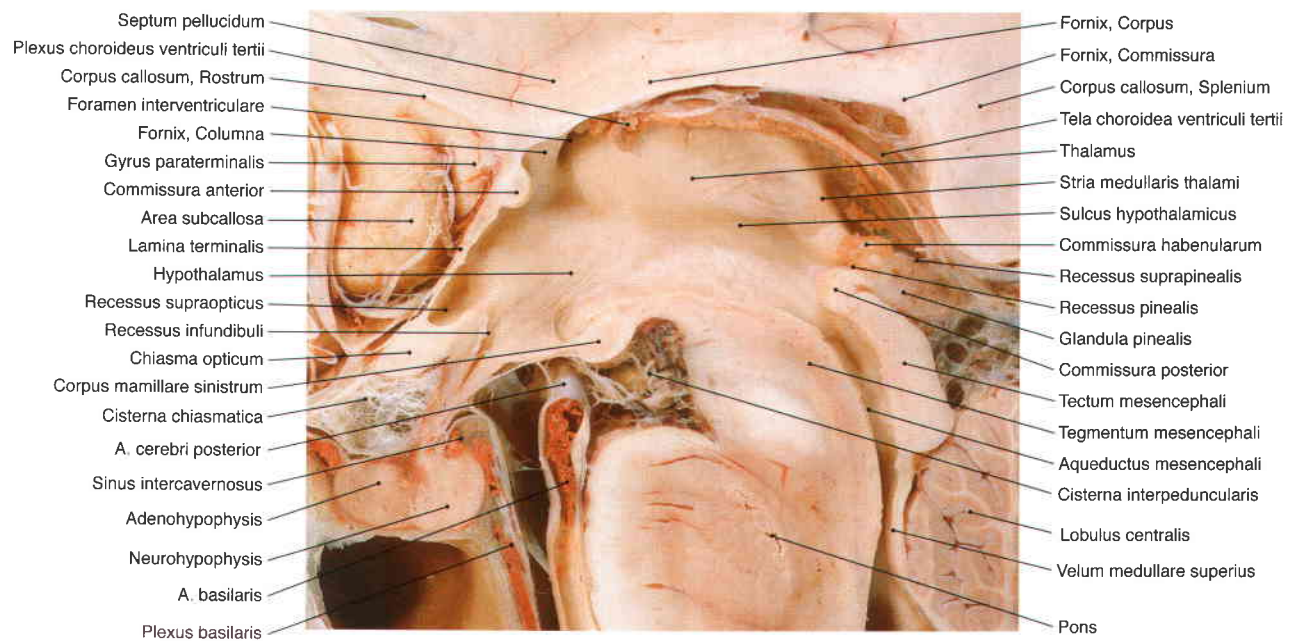


Fig. 520 Third ventricle, Ventriculus tertius; median section.

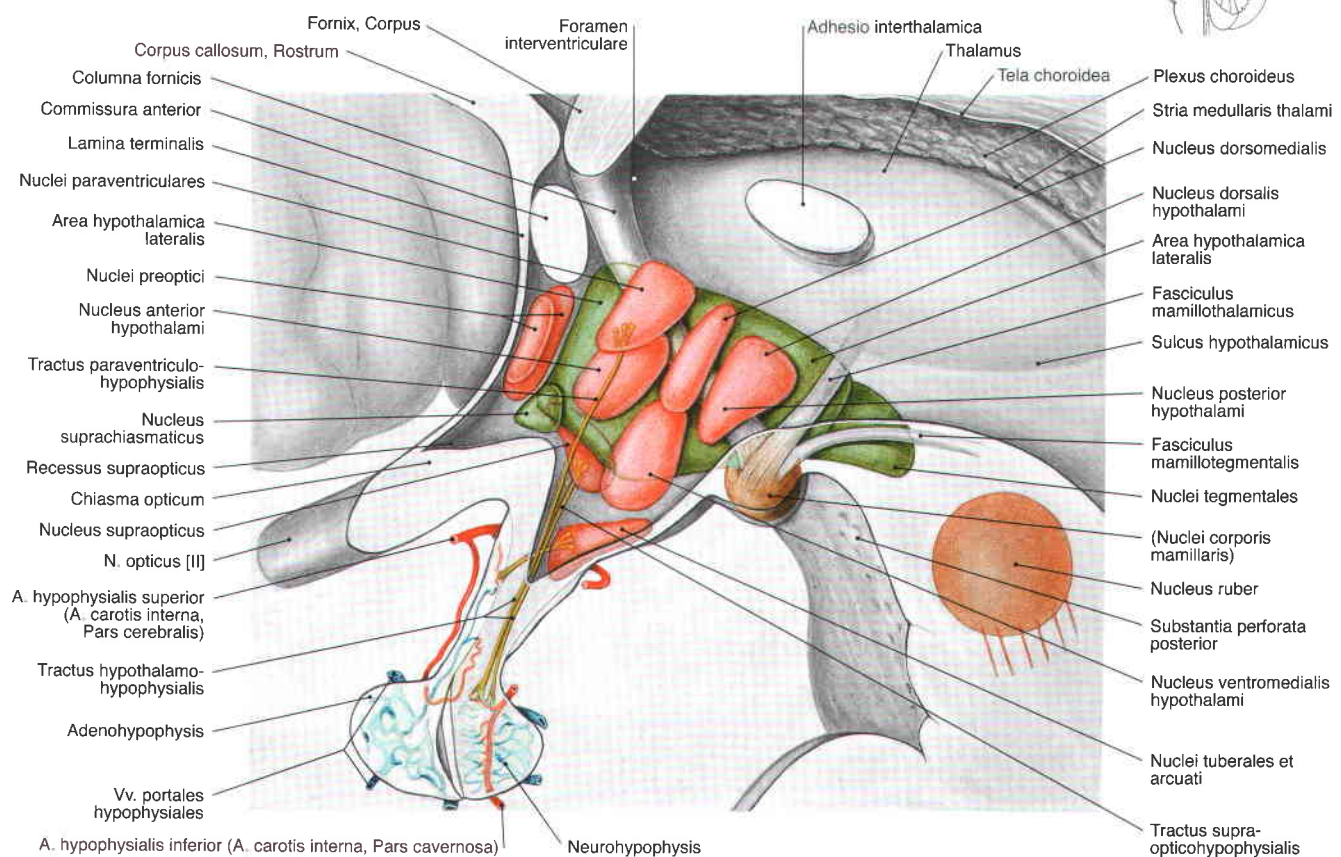


Fig. 521 Hypothalamus, Hypothalamus; overview; nuclei are illustrated translucently; medial view.

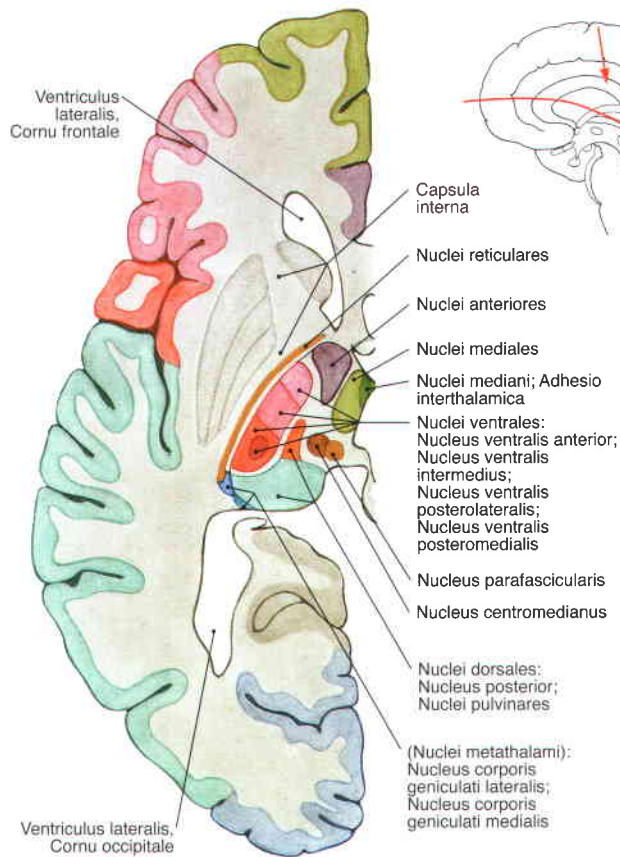
Thalamic nuclei**a** Horizontal section through the left cerebral hemisphere

Fig. 522 a–c Nuclei and cortical projections of the thalamus, Thalamus. Corresponding nuclei and cortical projections are indicated by the same colour.

**b** Left cerebral hemisphere; viewed from the left**c** Right cerebral hemisphere; medial view

Fig. 523 Thalamic nuclei; oblique view from posterior. For colour coding see Fig. 522.

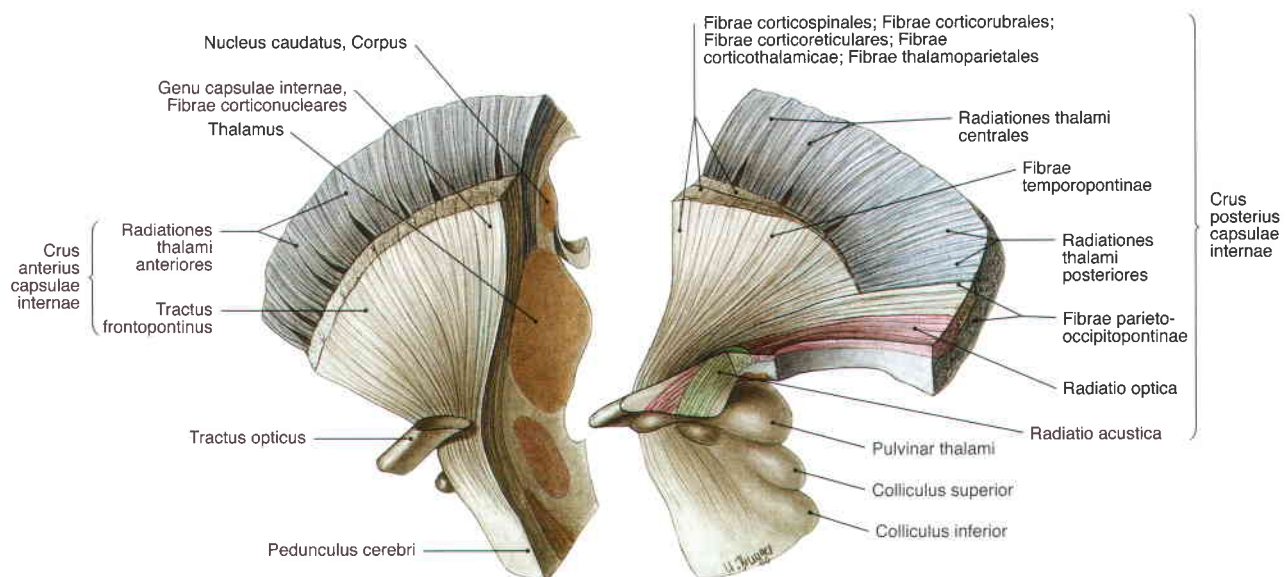


Fig. 524 Thalamic radiation, Radiationes thalami, and internal capsule, Capsula interna, have been divided by a frontal section; viewed from the left.

Midbrain

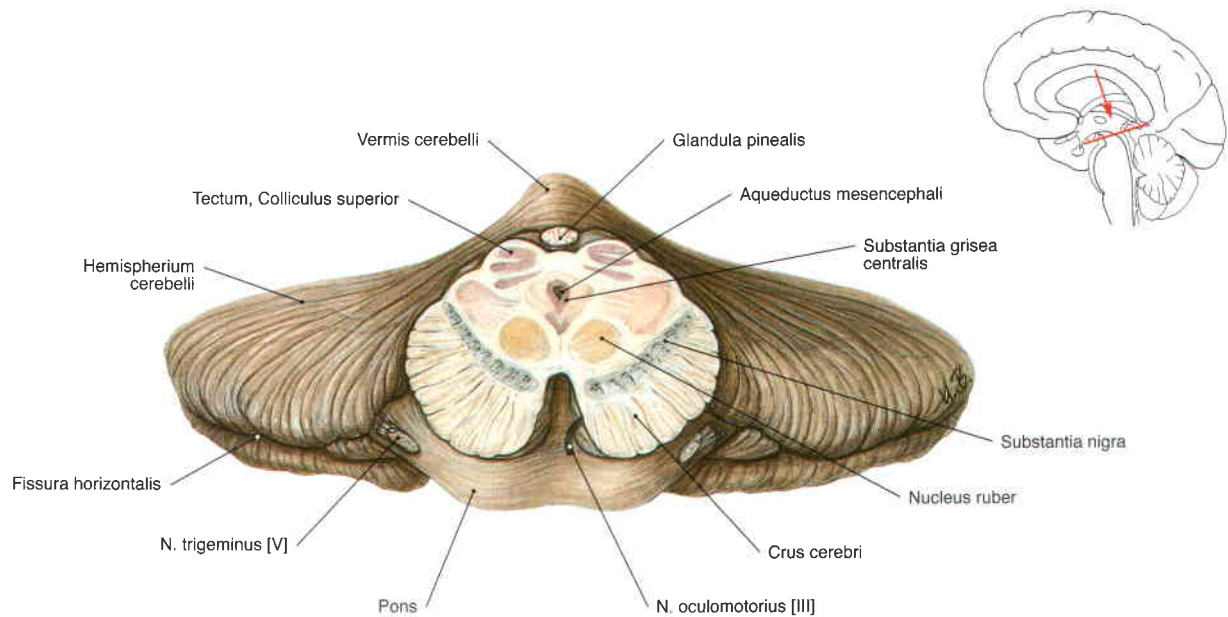


Fig. 525 Midbrain, Mesencephalon; cross-section at the level of the superior colliculi; anterior view.

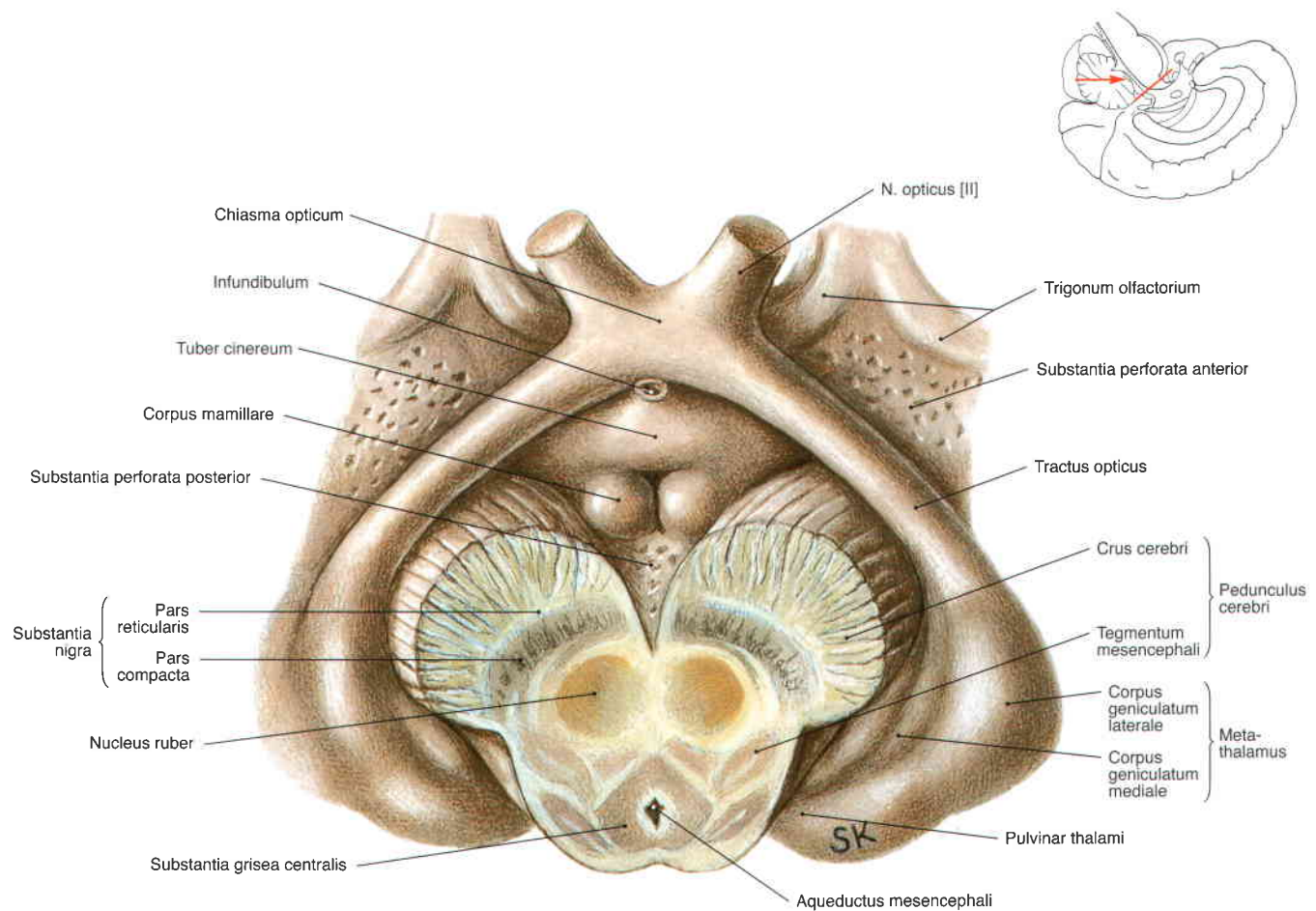


Fig. 526 Midbrain, Mesencephalon, and diencephalon, Diencephalon; after oblique section of the midbrain; inferior view.

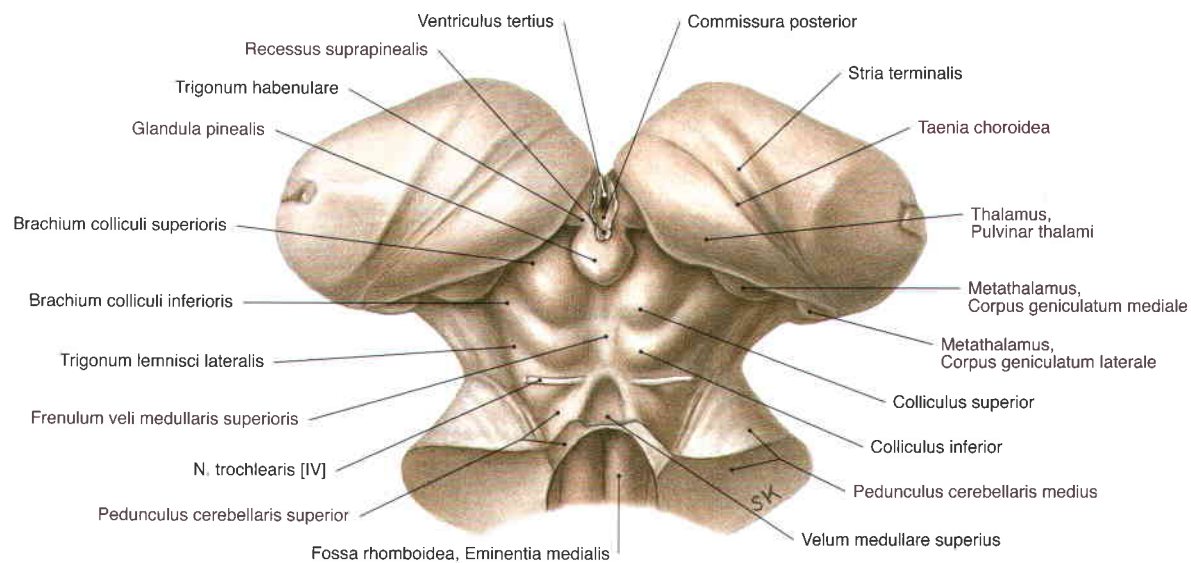
Midbrain and medulla oblongata

Fig. 527 Midbrain, Mesencephalon, and pineal gland, Glandula pinealis; posterior-superior view.

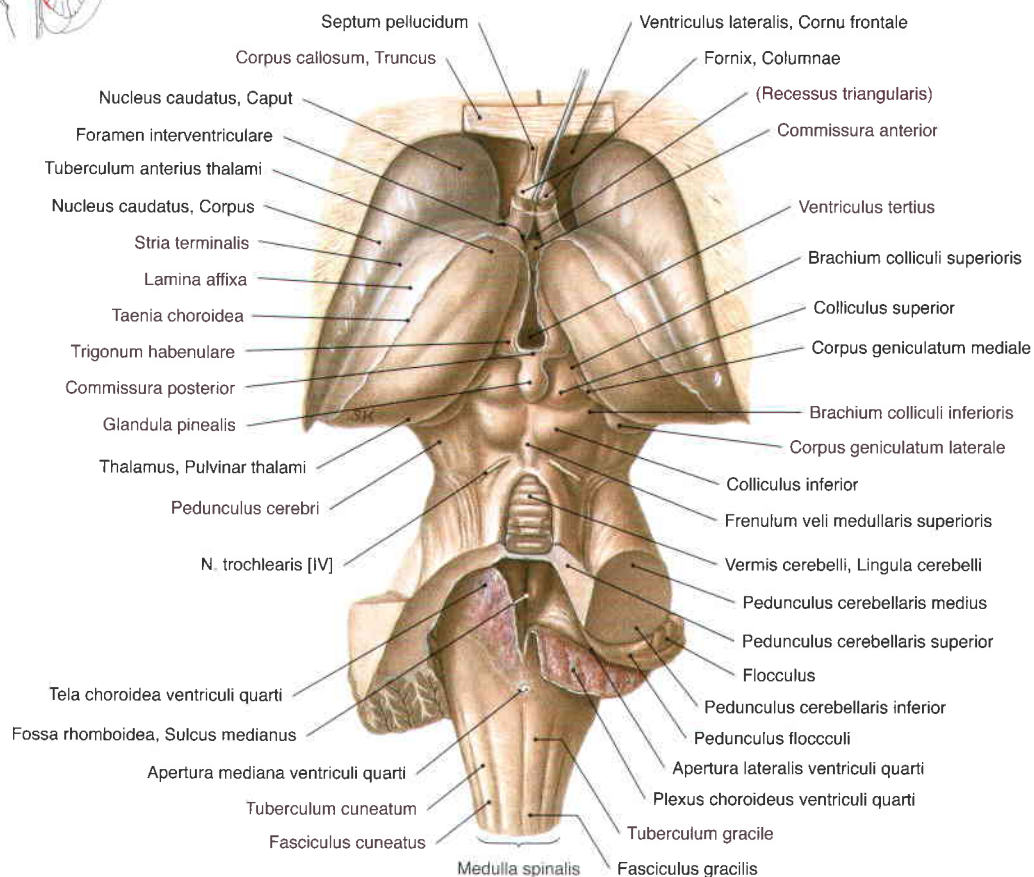
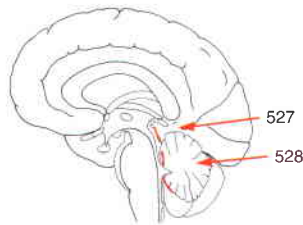


Fig. 528 Brainstem, Truncus encephali; the pons and major parts of the cerebellum have been removed; the tela choroidea of the fourth ventricle has been sectioned in the median plane and reflected to the right; posterior-superior view.

Midbrain and medulla oblongata

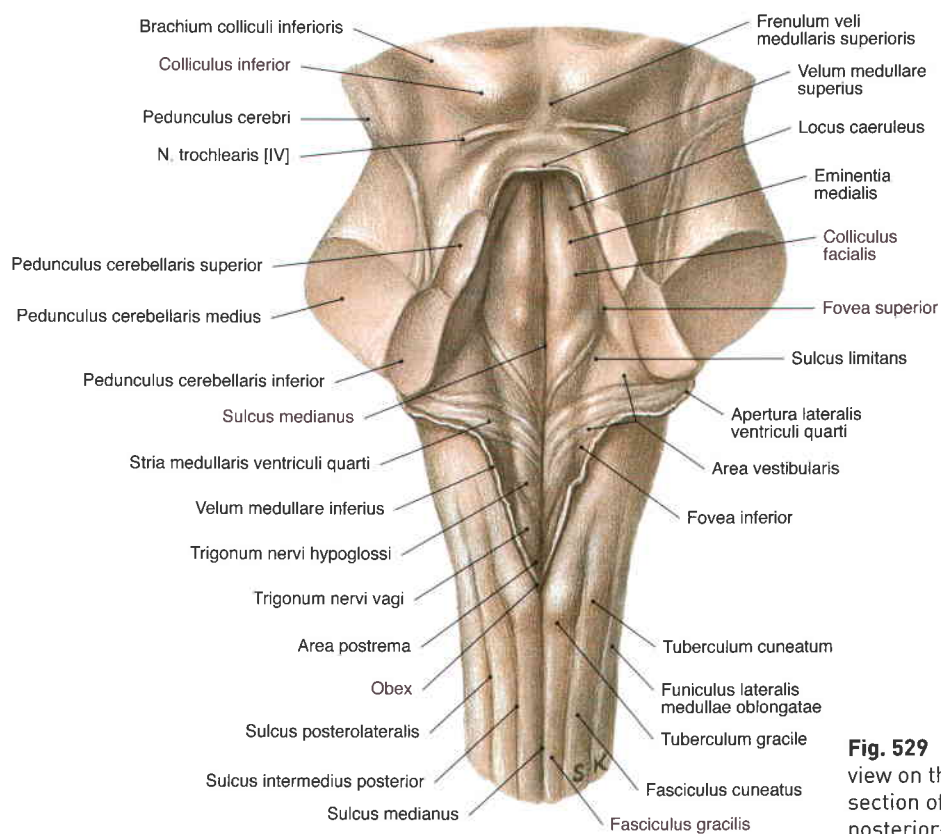


Fig. 529 Rhomboid fossa, Fossa rhomboidea; view on the floor of the fourth ventricle after section of the cerebellar peduncles; posterior-superior view.

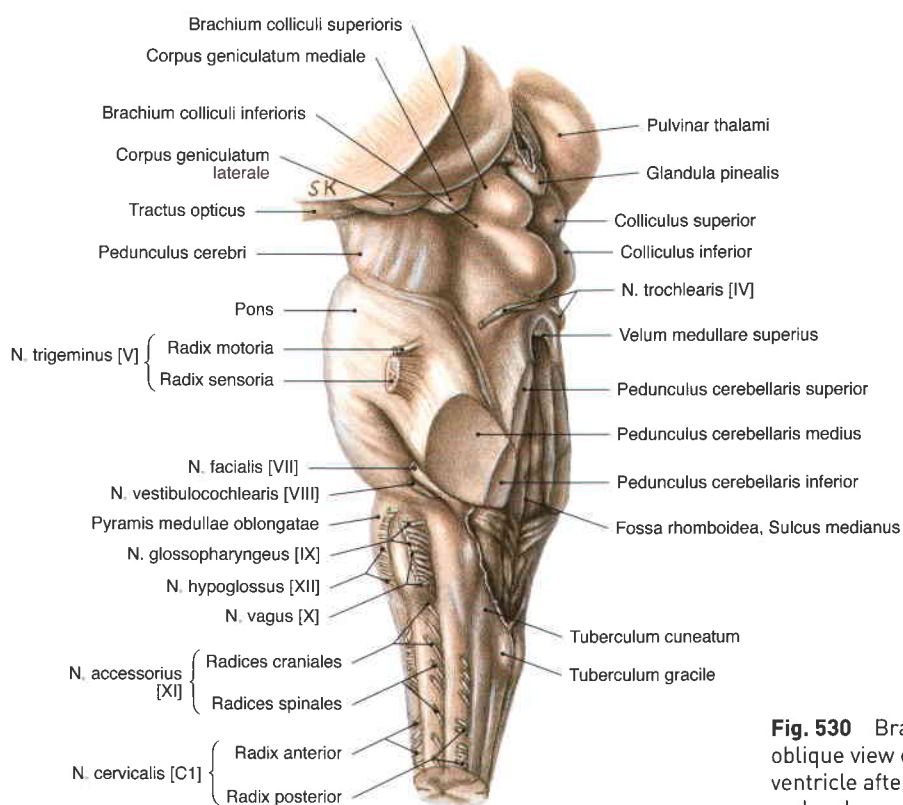


Fig. 530 Brainstem, Truncus encephali; oblique view on the floor of the fourth ventricle after section of the cerebellar peduncles; lateral view.

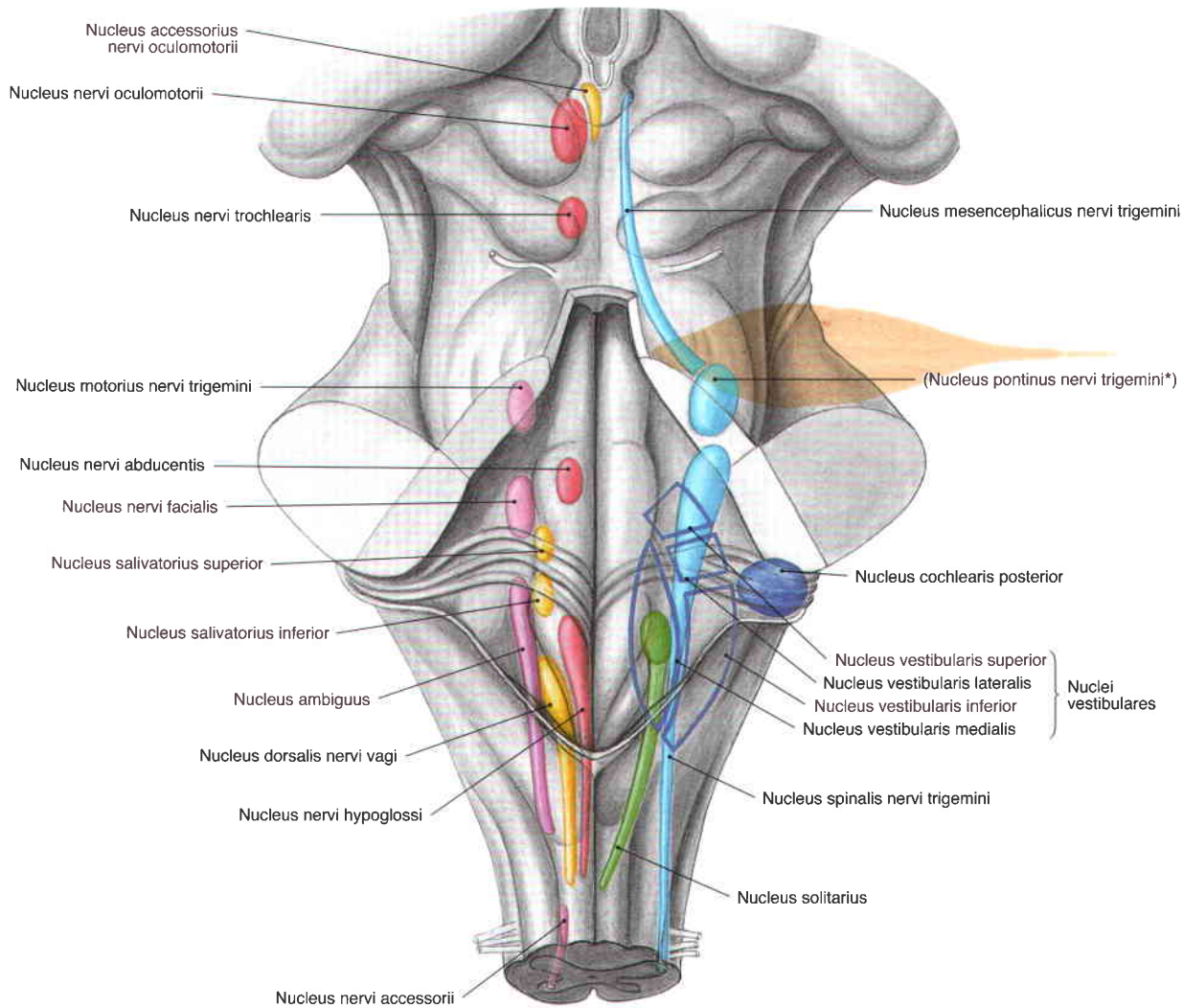
Nuclei of the cranial nerves

Fig. 531 Cranial nerves, Nn. craniales; topographic overview of the nuclei; posterior view.

On the left the motor nuclei and on the right the sensory nuclei are shown.

* Clinical term: principal sensory nucleus of the trigeminal nerve

- General somatic-efferent nuclei (GSE)
- General visceral-efferent nuclei (GVE)
- Specific visceral-efferent nuclei (SVE)

- General and specific visceral-afferent nuclei (G/SVA)
- General somatic-afferent nuclei (GSA)
- Specific somatic-afferent nuclei (SSA)

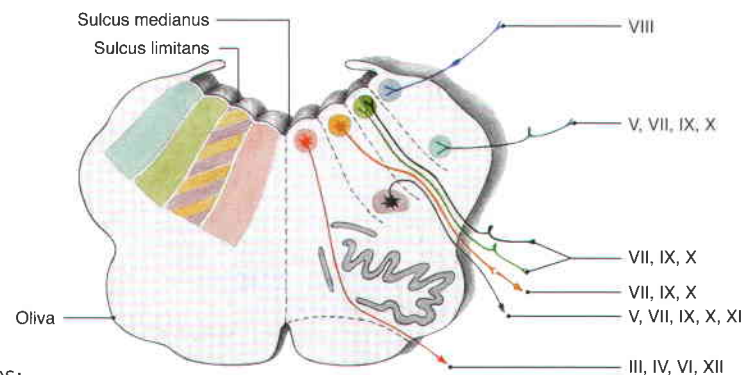


Fig. 532 Cranial nerves, Nn. craniales; schematic cross-section through the rhomboid fossa demonstrating the nuclei.

Nuclei of the cranial nerves

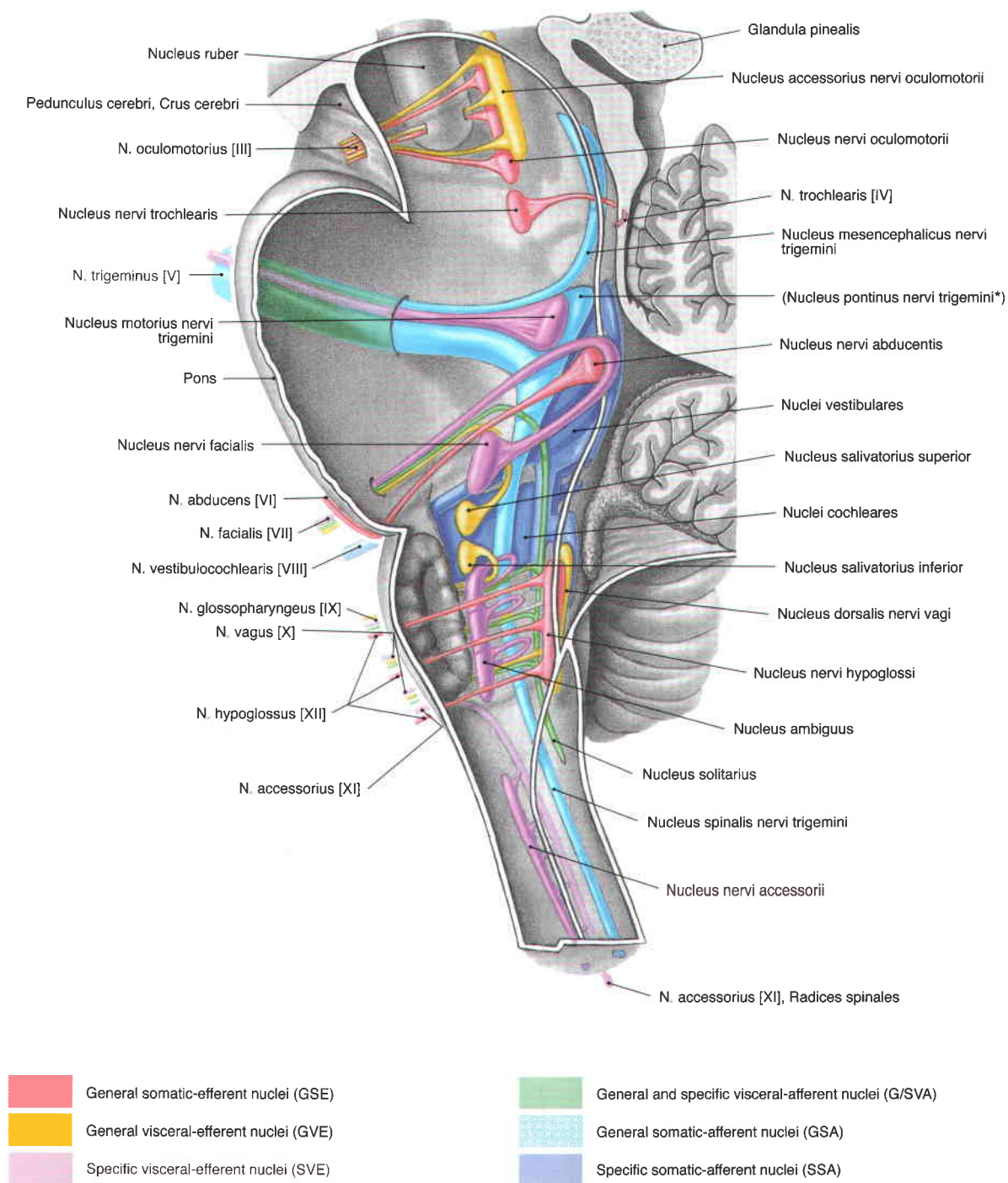


Fig. 533 Cranial nerves, Nn. craniales; topographic overview of the nuclei in the median plane.
* Clinical term: principal sensory nucleus of the trigeminal nerve

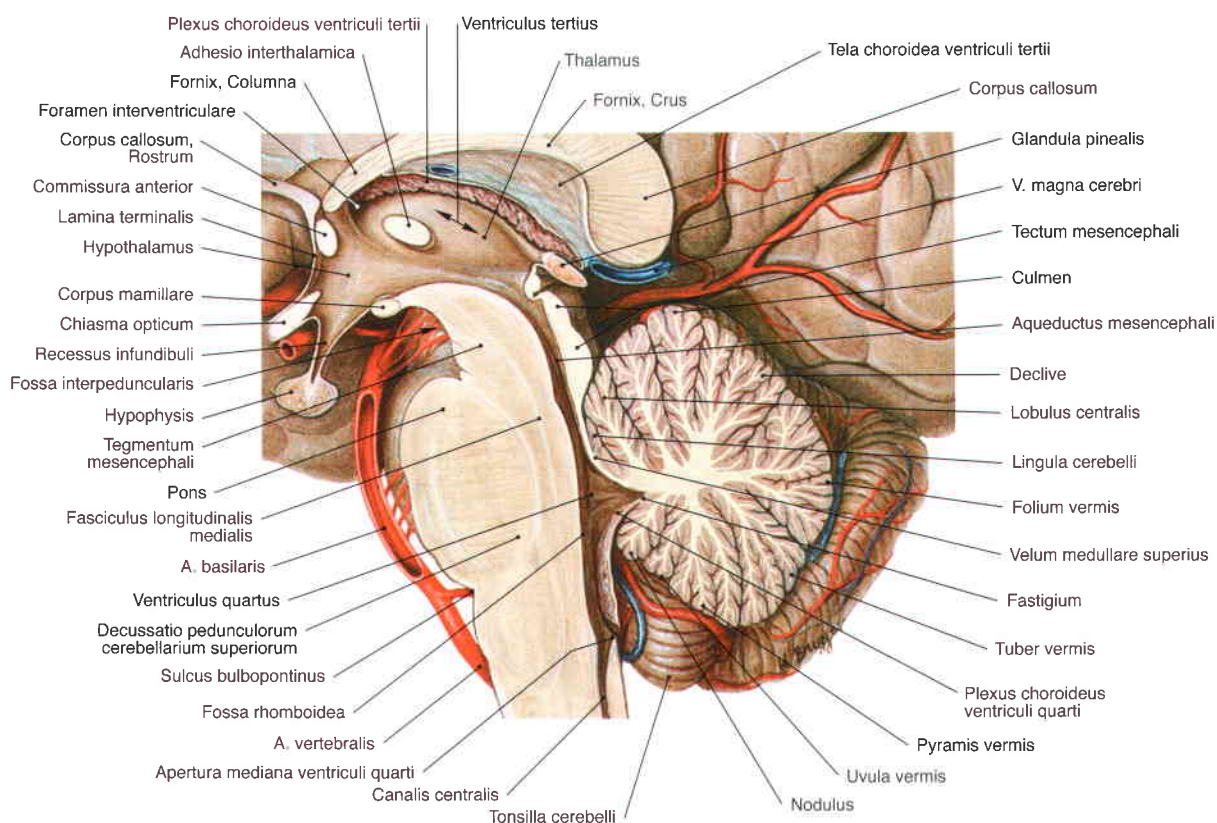
Cerebellum

Fig. 534 Brainstem, Truncus cerebri, with the cerebellum, Cerebellum, and the fourth ventricle, Ventriculus quartus; median section.

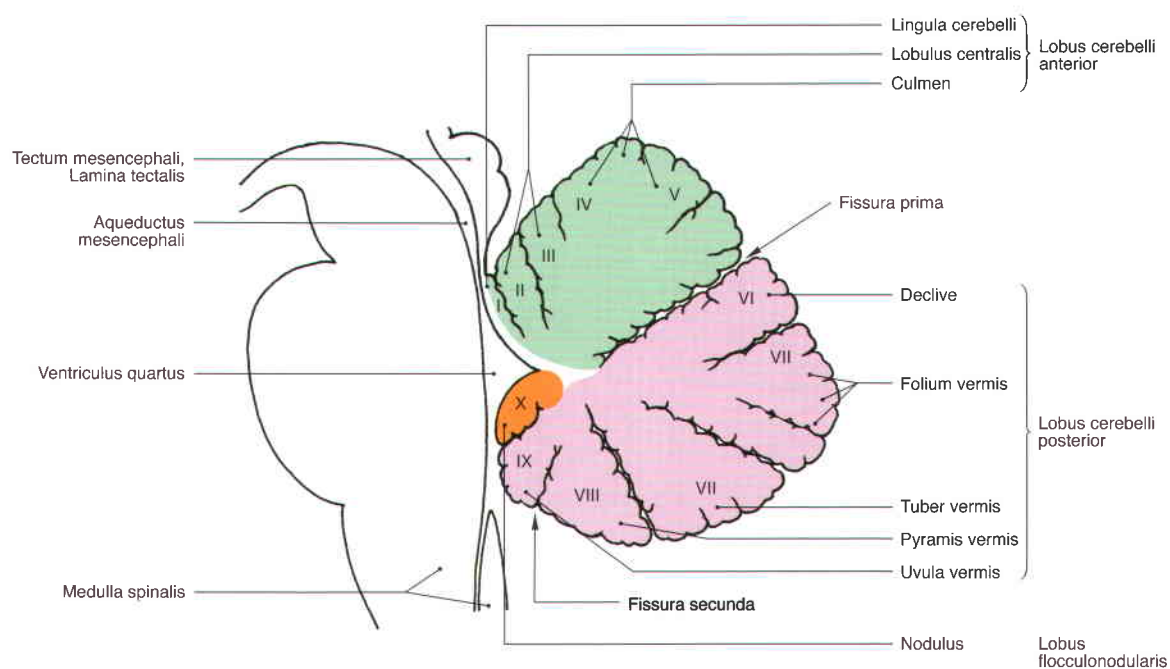


Fig. 535 Parts of the cerebellar vermis, Vermis cerebelli; median section; overview.

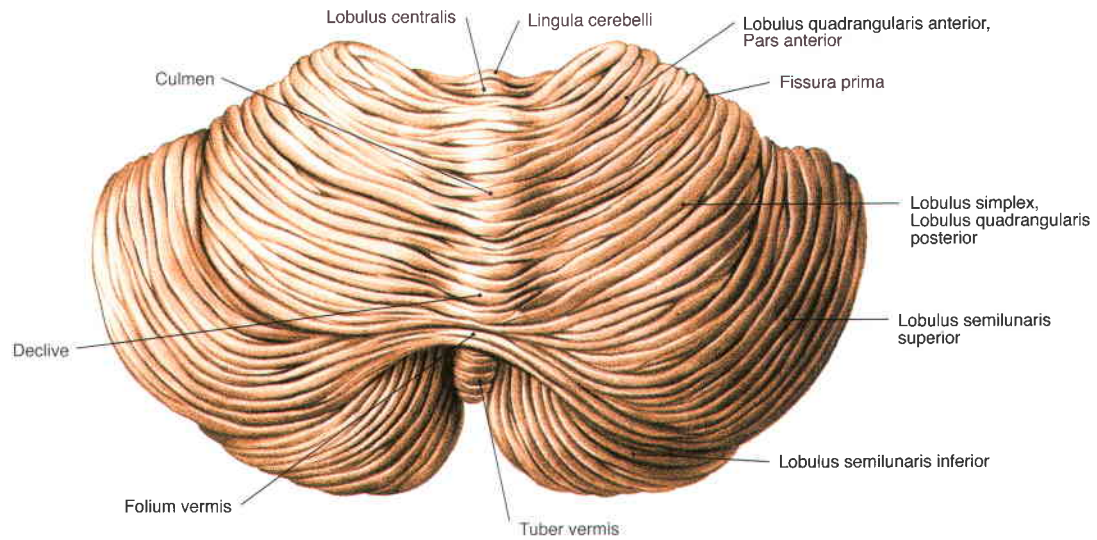


Fig. 536 Cerebellum, Cerebellum; posterior-superior view.

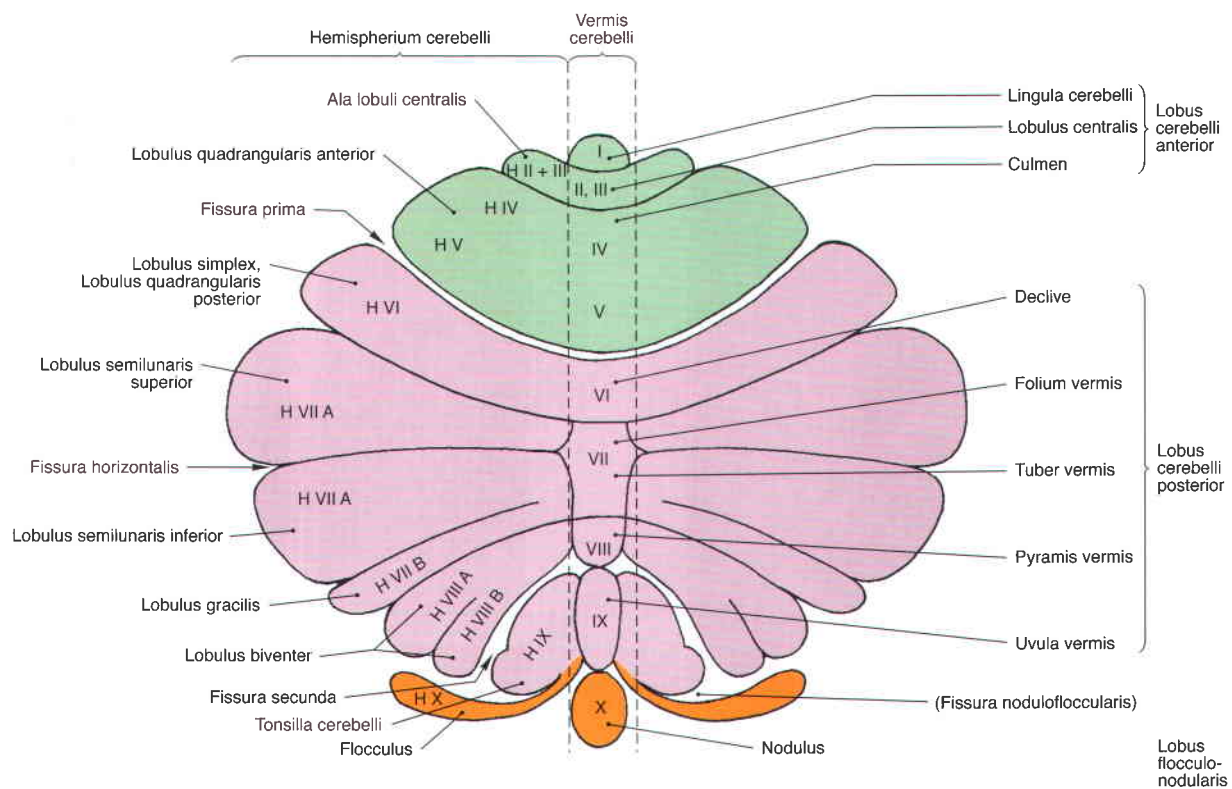


Fig. 537 Cerebellum, Cerebellum; diagram of the cerebellar cortex outstretched; overview.

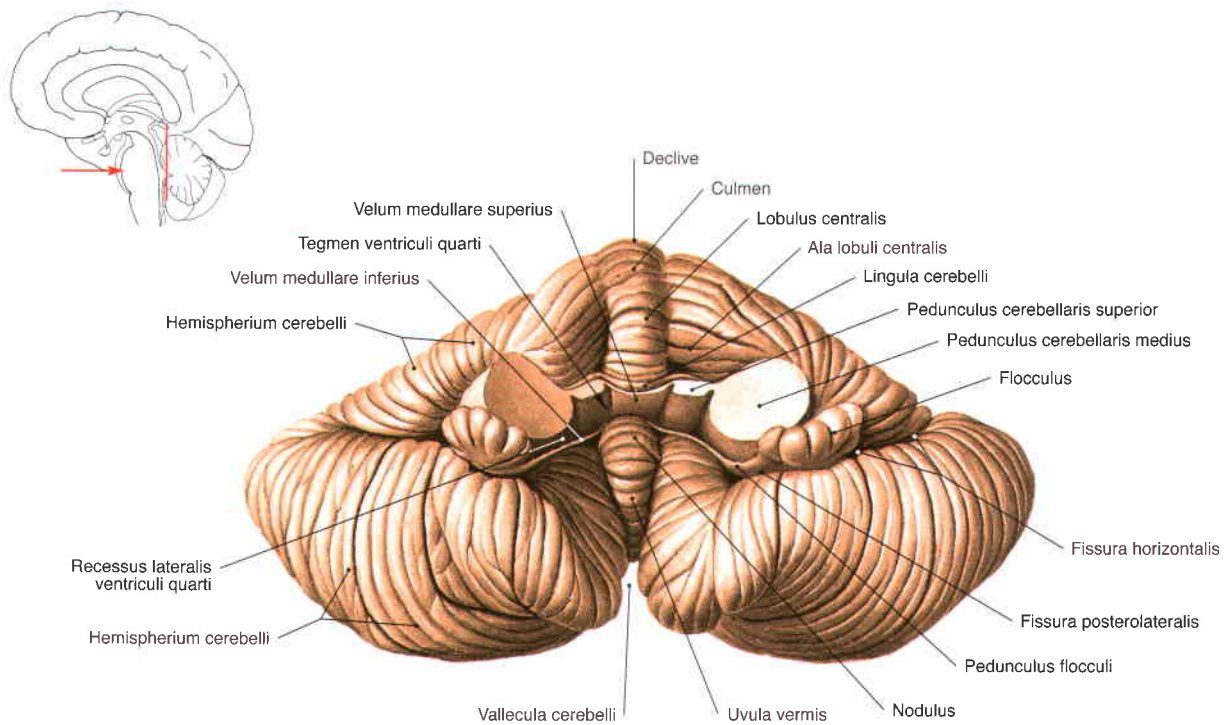
Cerebellum

Fig. 538 Cerebellum, Cerebellum;
after section of the cerebellar peduncles;
anterior view.

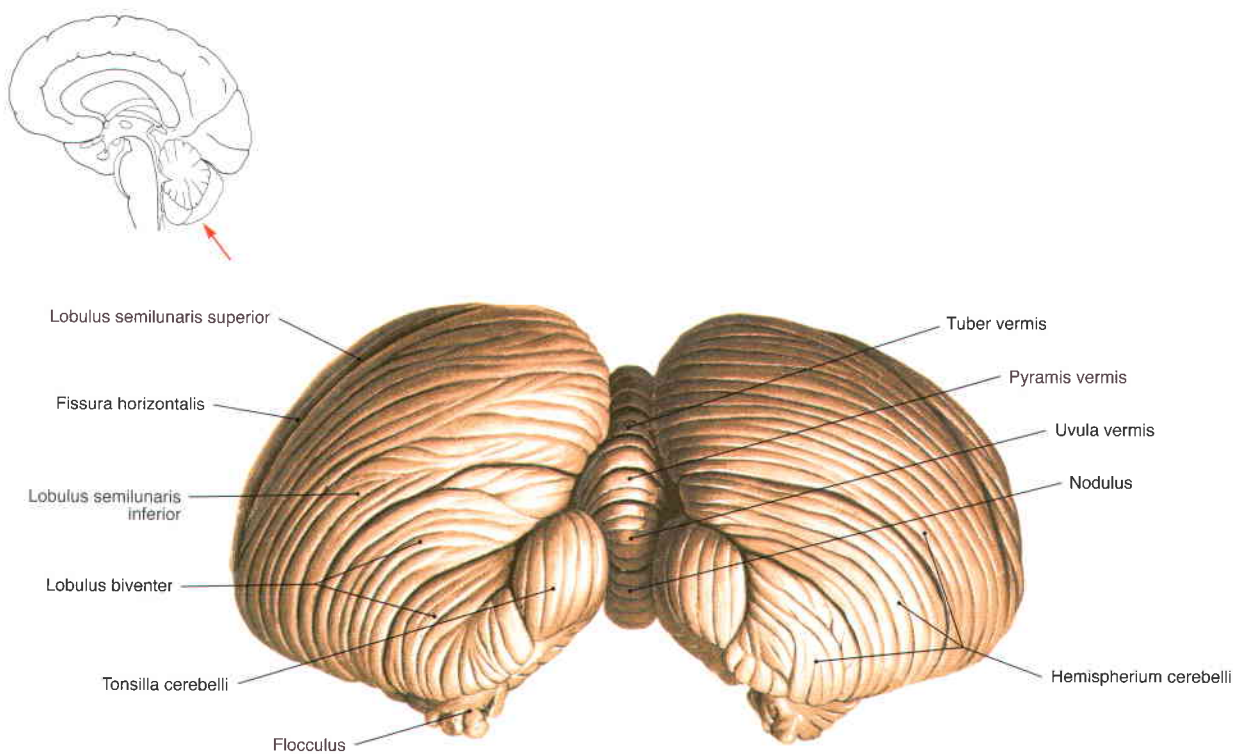


Fig. 539 Cerebellum, Cerebellum;
posterior-inferior view.

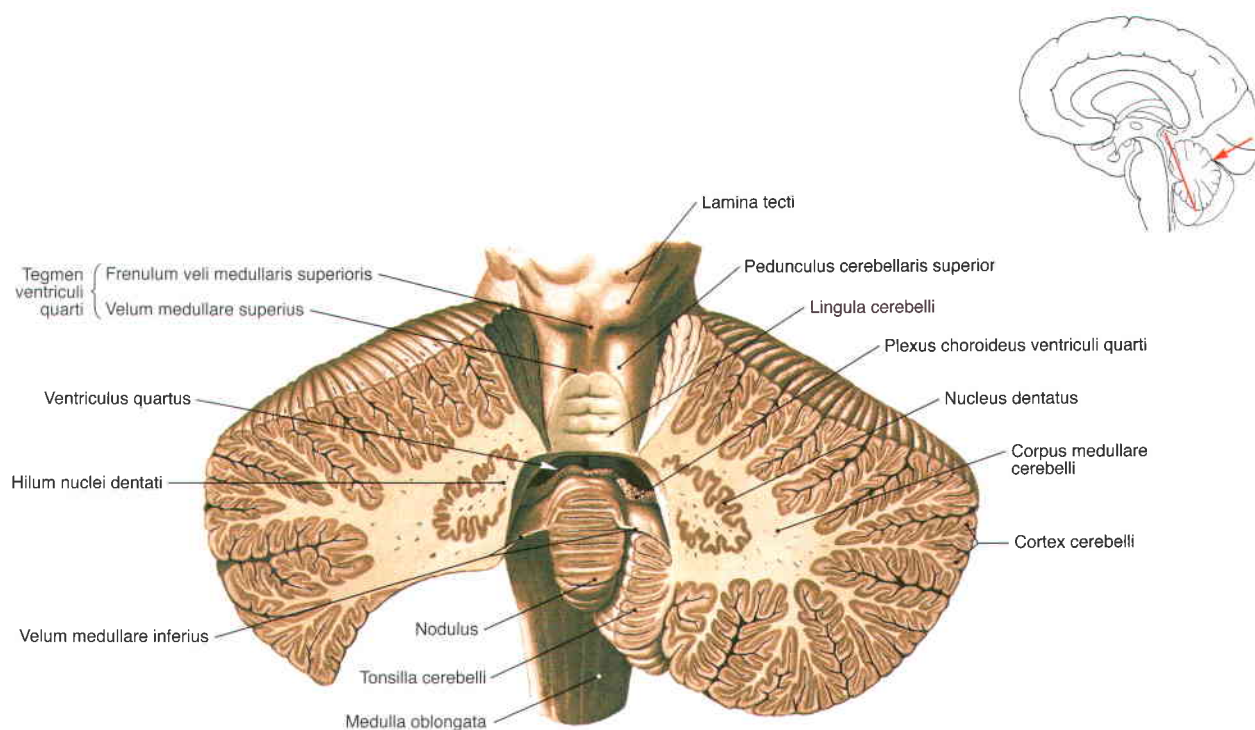
Cerebellar nuclei

Fig. 540 Cerebellum, Cerebellum;
oblique section;
posterior view.

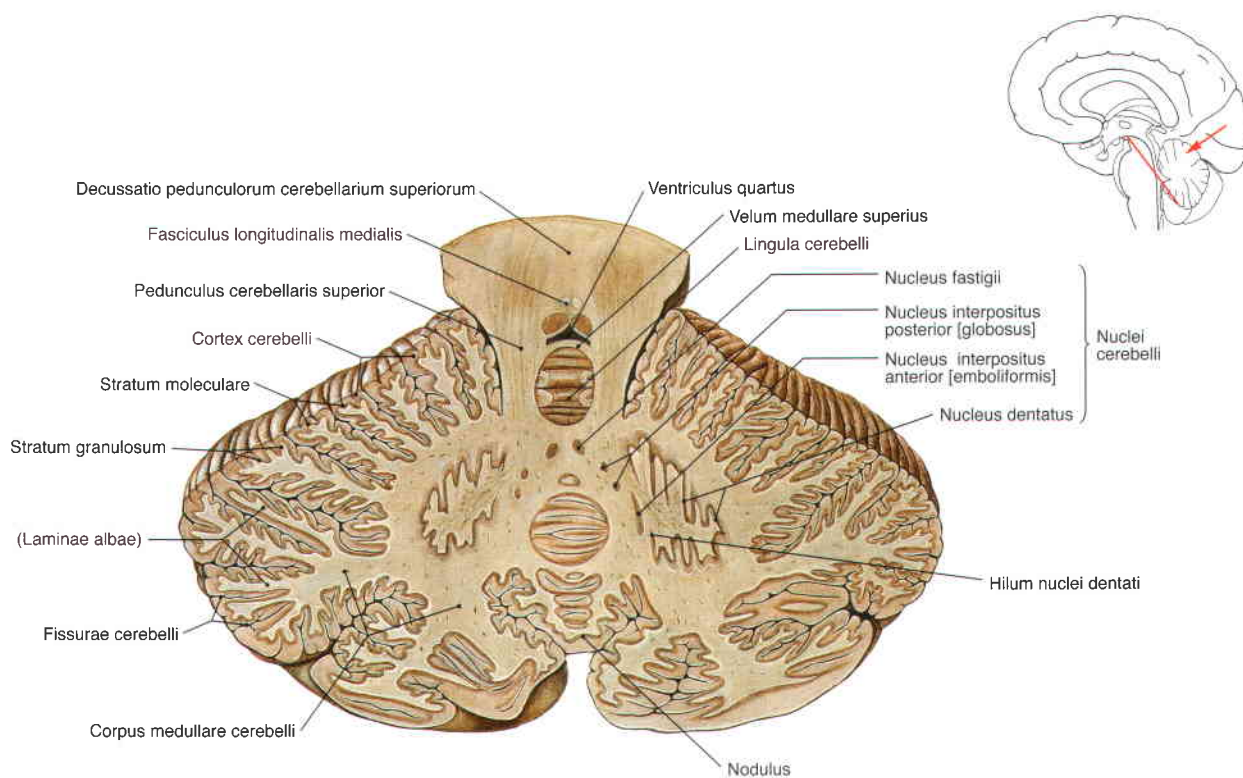


Fig. 541 Cerebellum, Cerebellum;
oblique section through the upper cerebellar peduncles;
posterior view.

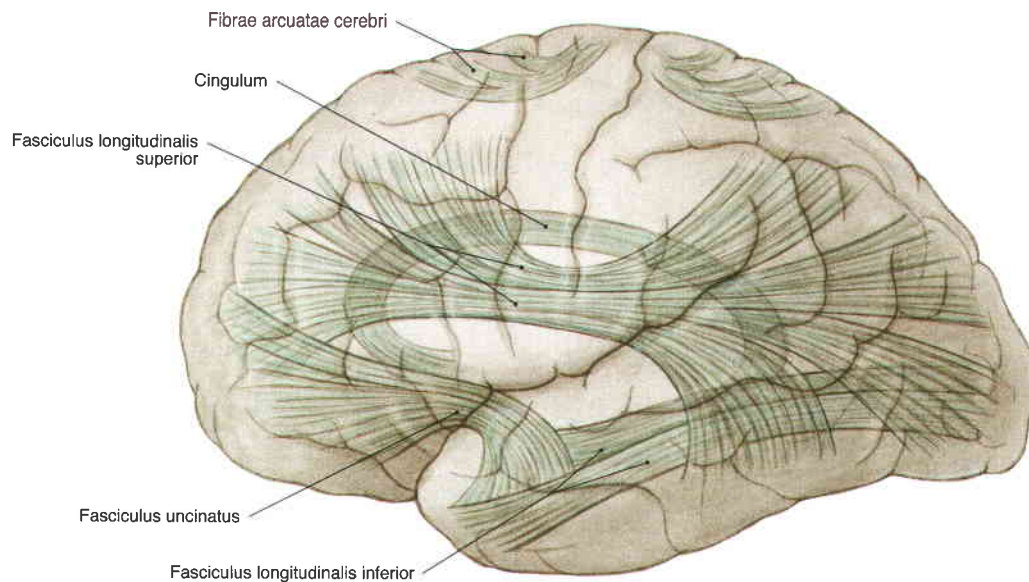
Association and commissural tracts

Fig. 542 Association tracts, Neurofibrae associationis; projection onto the cerebral hemisphere; overview; viewed from the left.

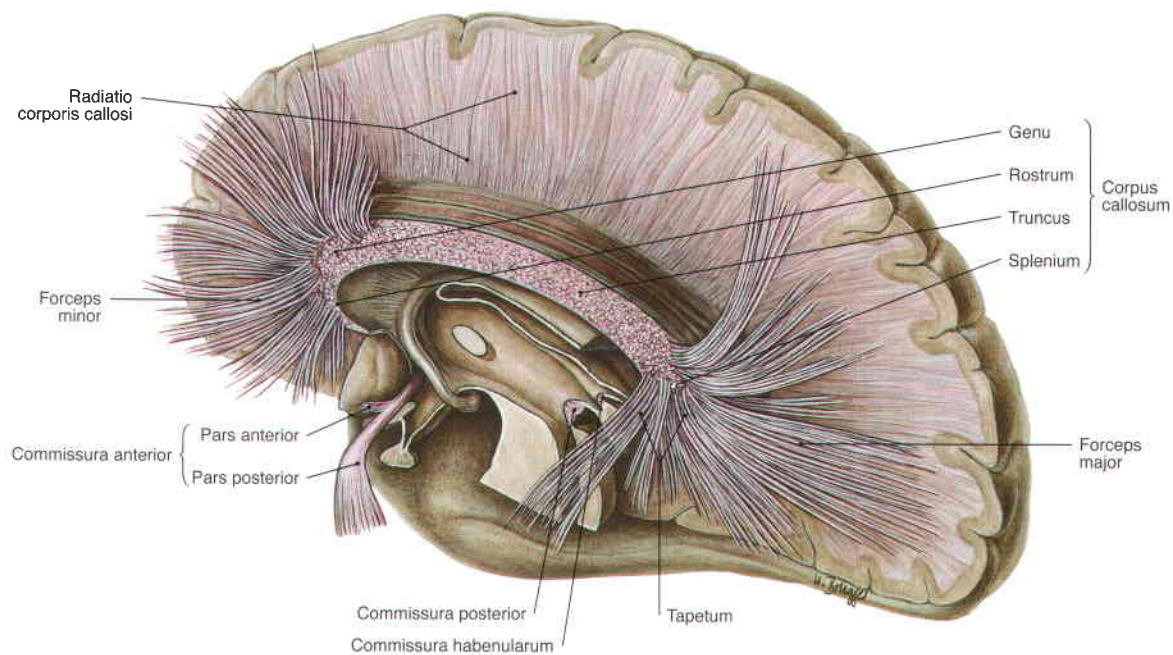


Fig. 543 Commissural tracts, Neurofibrae commissurales; topographic overview after extensive removal of the corpus callosum in the paramedian plane; single fibres of the corpus callosum are shown; viewed from the left.

Projection tracts

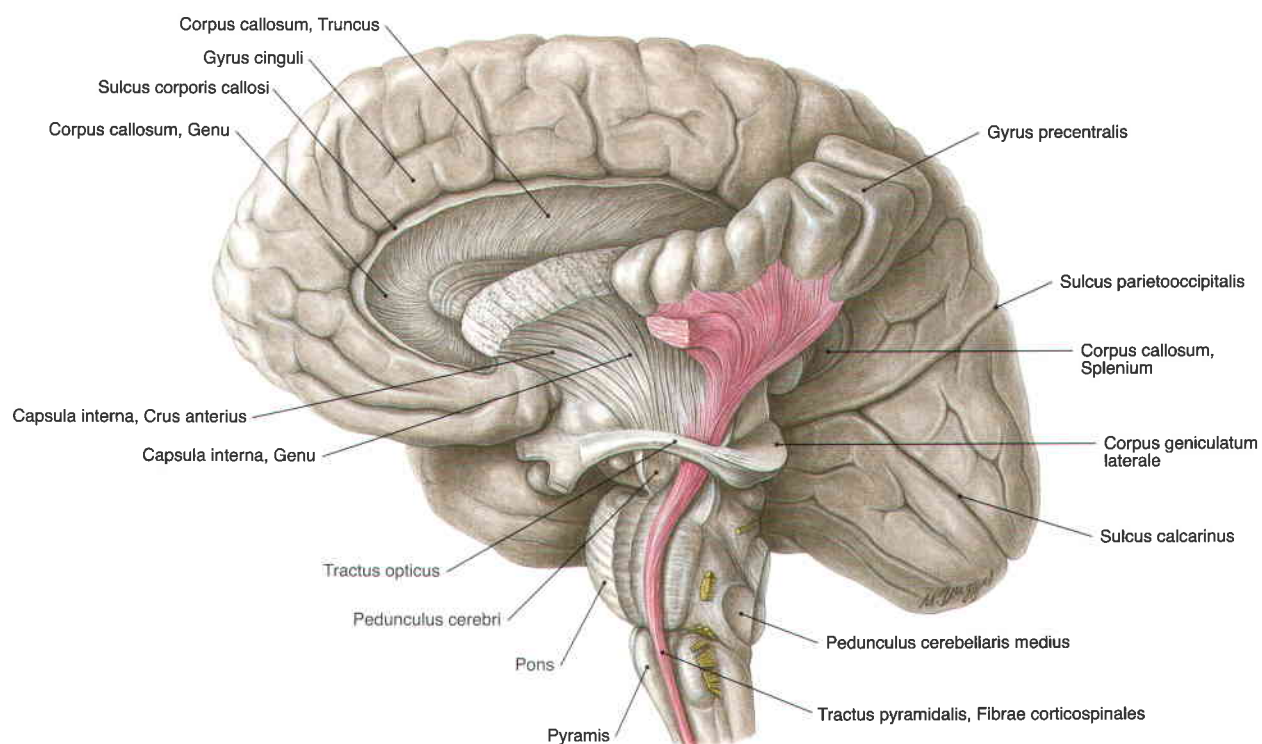


Fig. 544 Projection tracts, Neurofibrae projectionis; the internal capsule and the pyramidal tract have been exposed; viewed from the left.

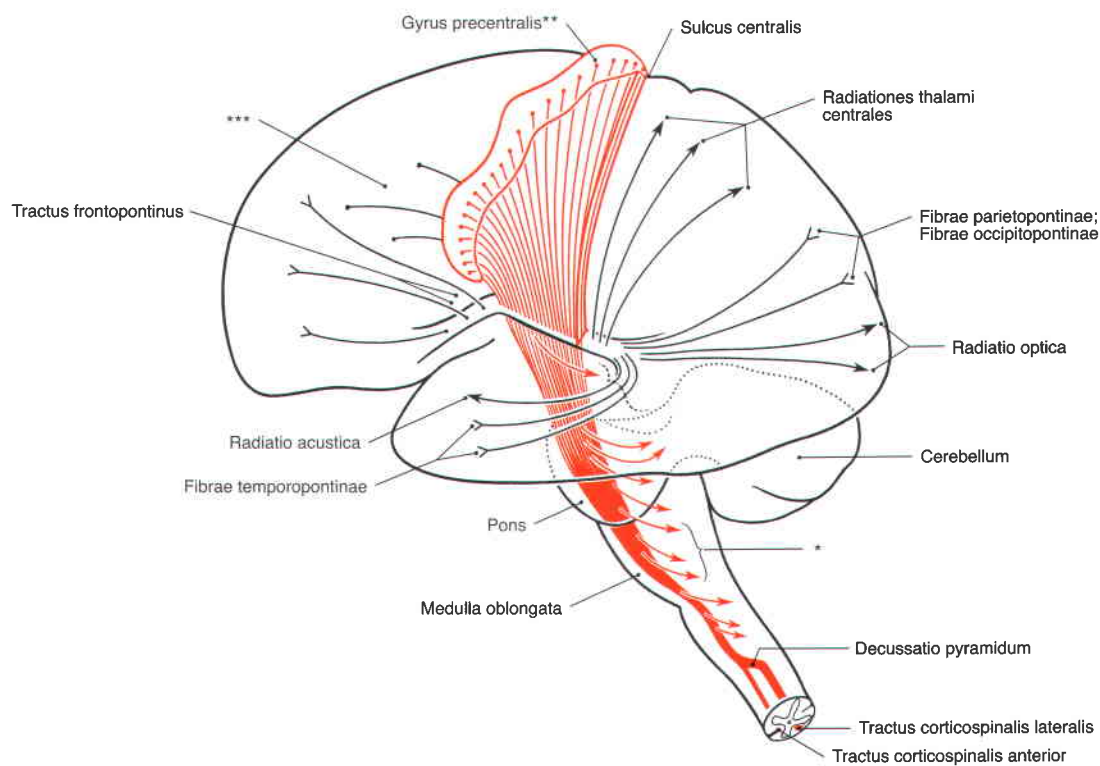


Fig. 545 Internal capsule, Capsula interna, and pyramidal tract, Tractus pyramidalis; functional overview; viewed from the left.

* Fibres to the tectal plate and the nuclei of the hindbrain

** Perikarya of the pyramidal tract

*** Perikarya of areas 6 and 8 (premotor cortex)

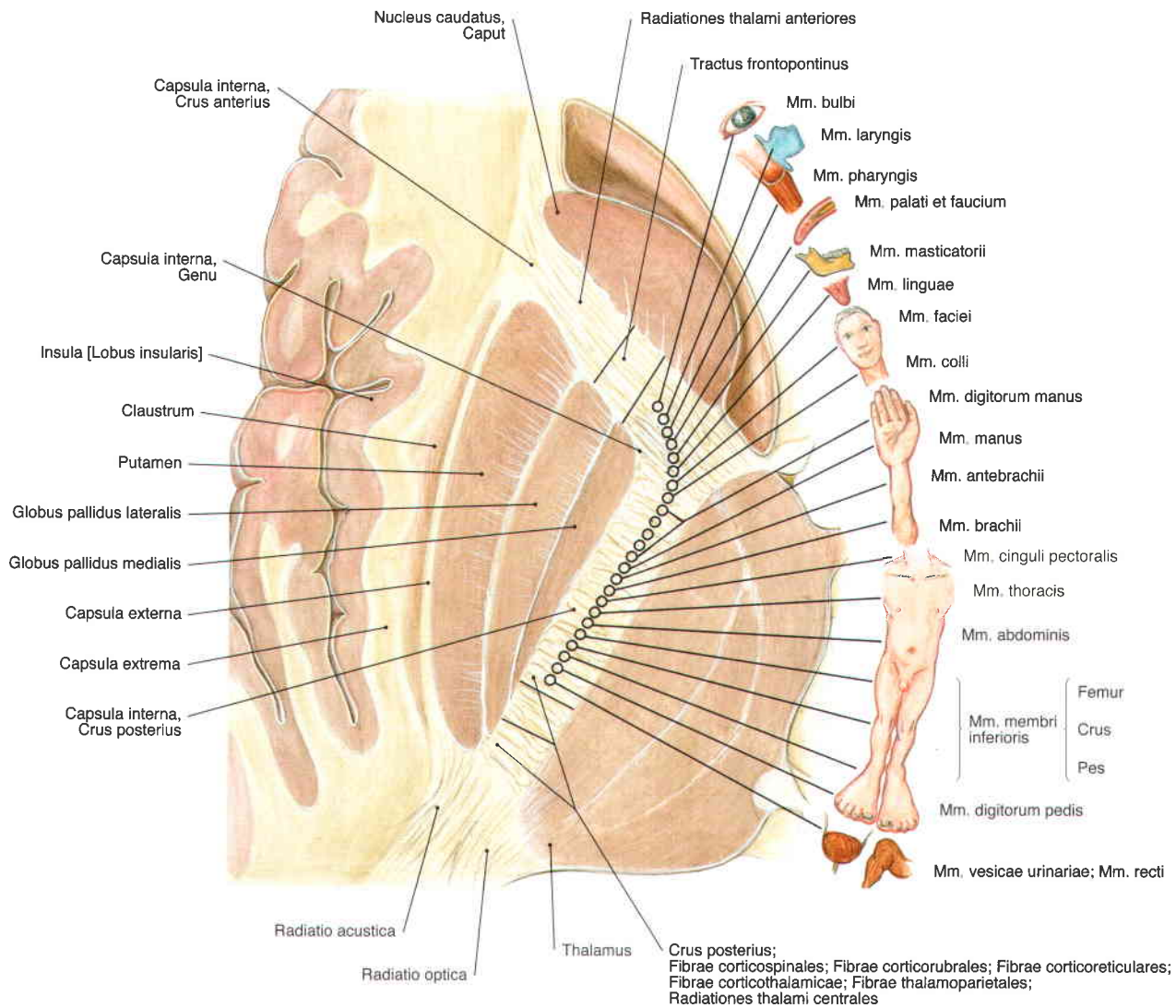
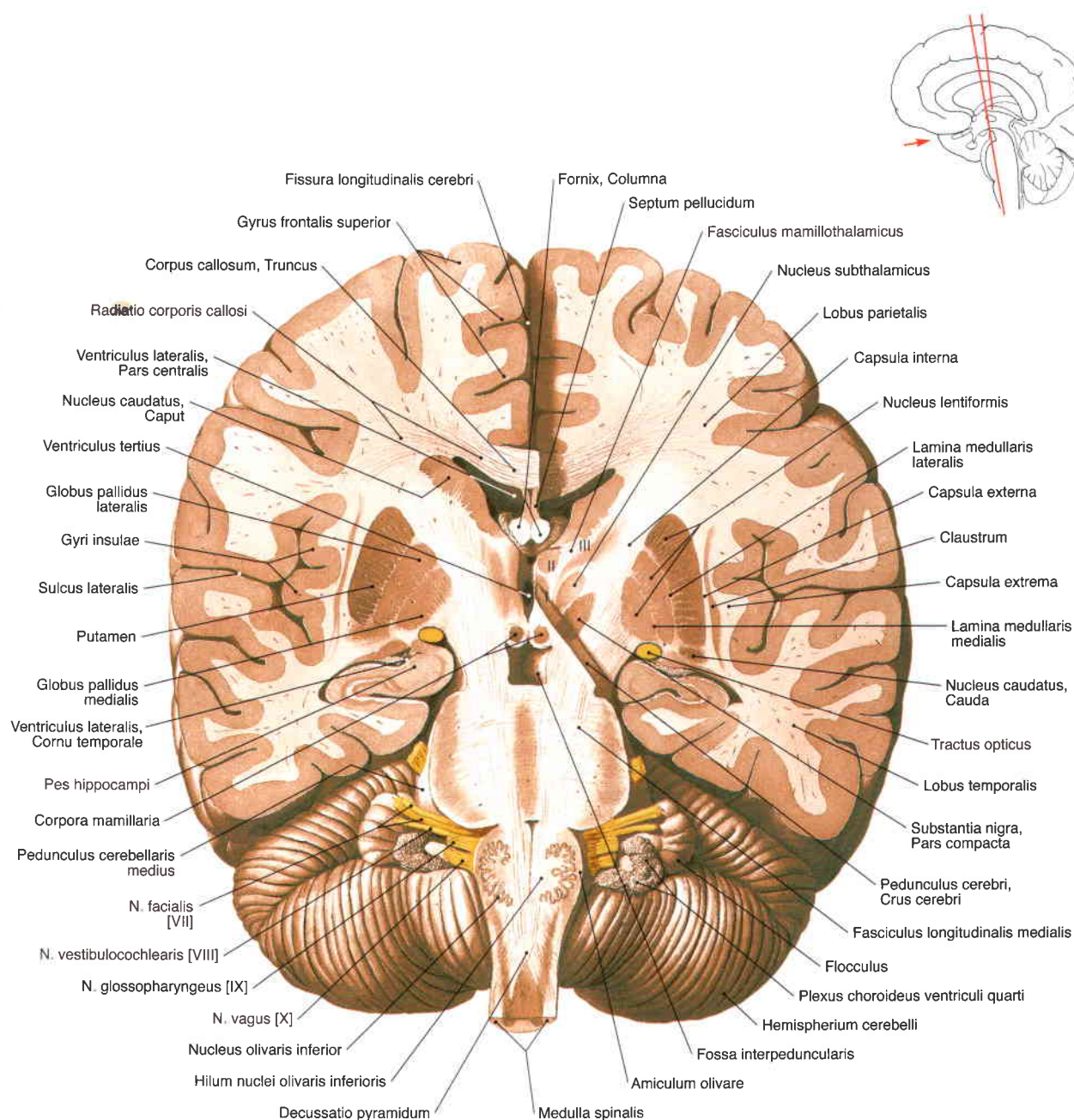
Internal capsule

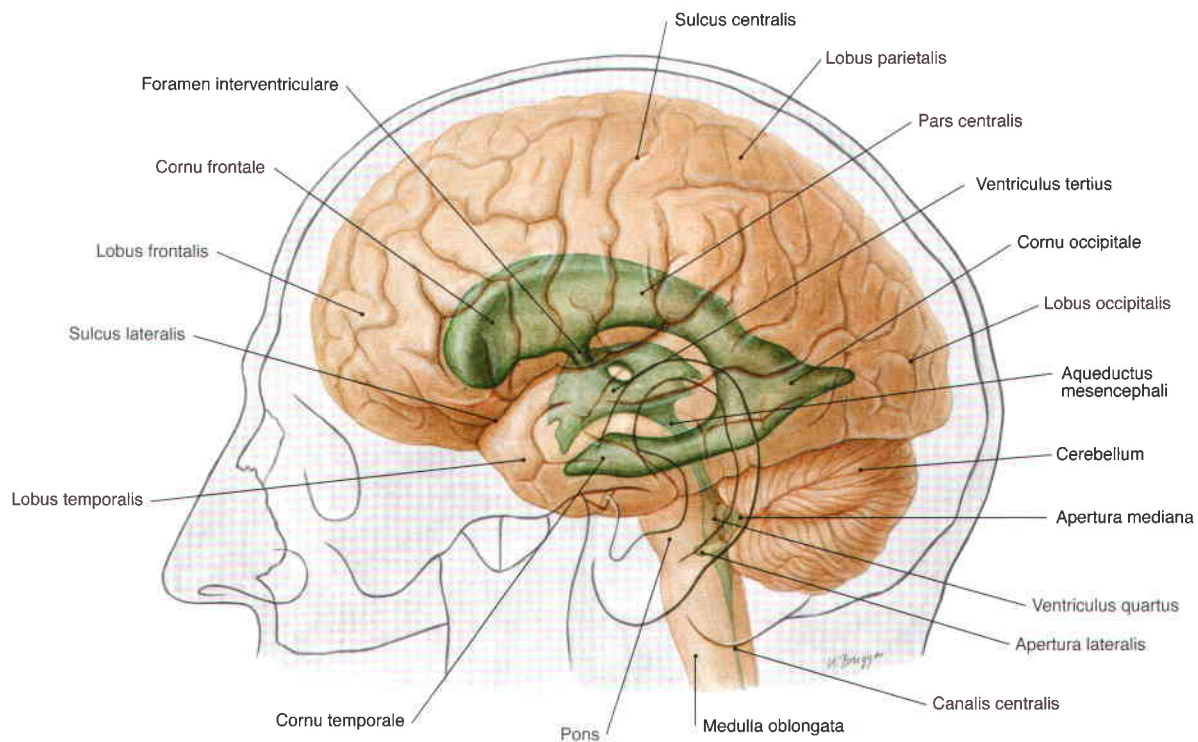
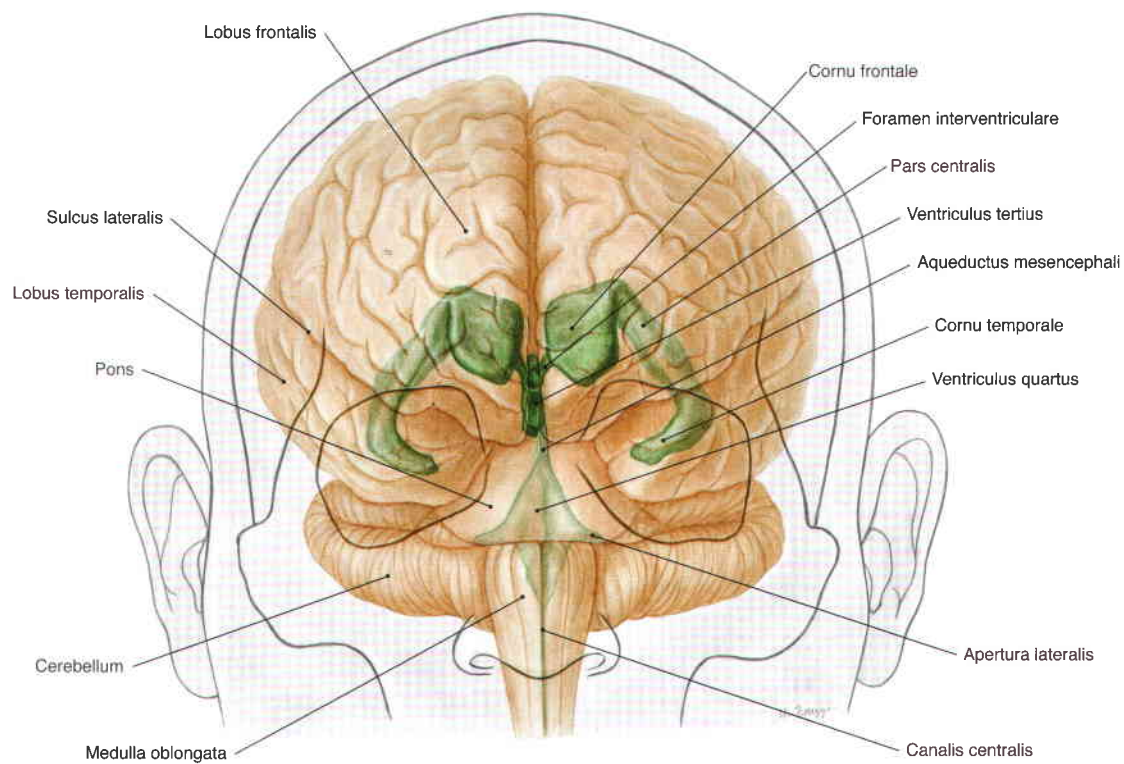
Fig. 546 Internal capsule, Capsula interna; functional organisation.

Pyramidal tract



I–III = Thalamic nuclei, Nuclei thalami:
 I = Median nuclei, Nuclei mediani
 II = Anterior nuclei, Nuclei anteriores
 III = Ventral nuclei, Nuclei ventrales

Fig. 547 Pyramidal tract, Tractus pyramidalis, and basal ganglia, Nuclei basales; obliquely staggered section through the posterior limb of the internal capsule, the cerebral peduncles, and the medulla oblongata.

Ventricles, projection**Fig. 548** Ventricles of the brain, Ventriculi encephali.**Fig. 549** Ventricles of the brain, Ventriculi encephali; anterior view.

Inner and outer liquor spaces

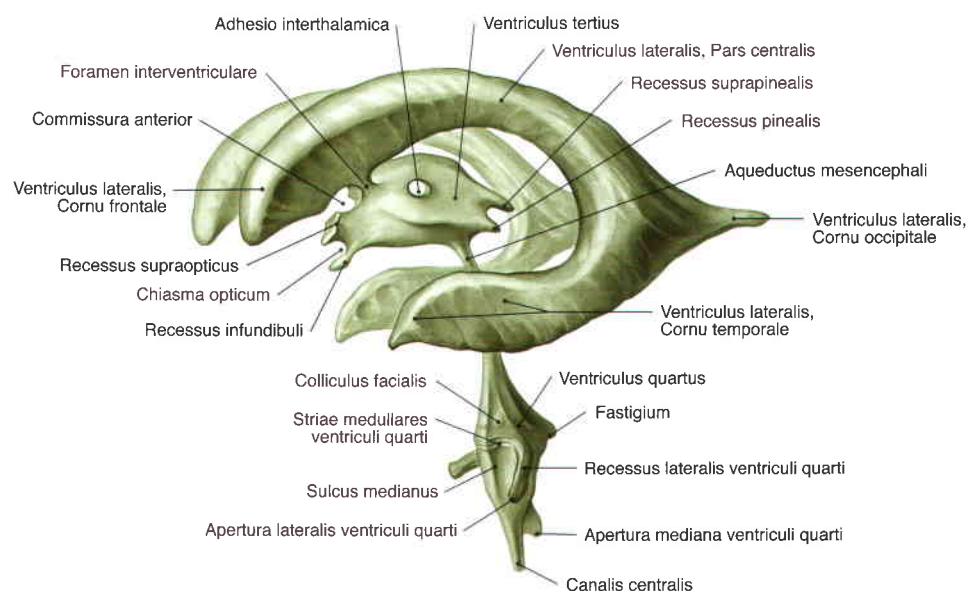


Fig. 550 Inner liquor spaces, Ventriculi encephali; corrosion cast specimen; oblique view from the left.

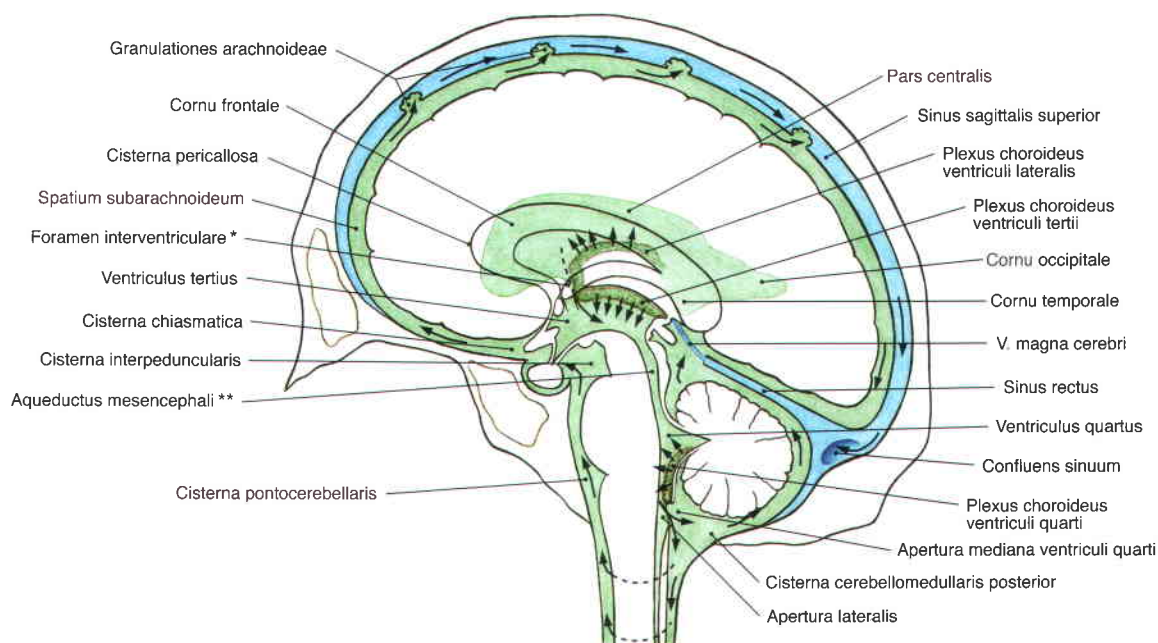
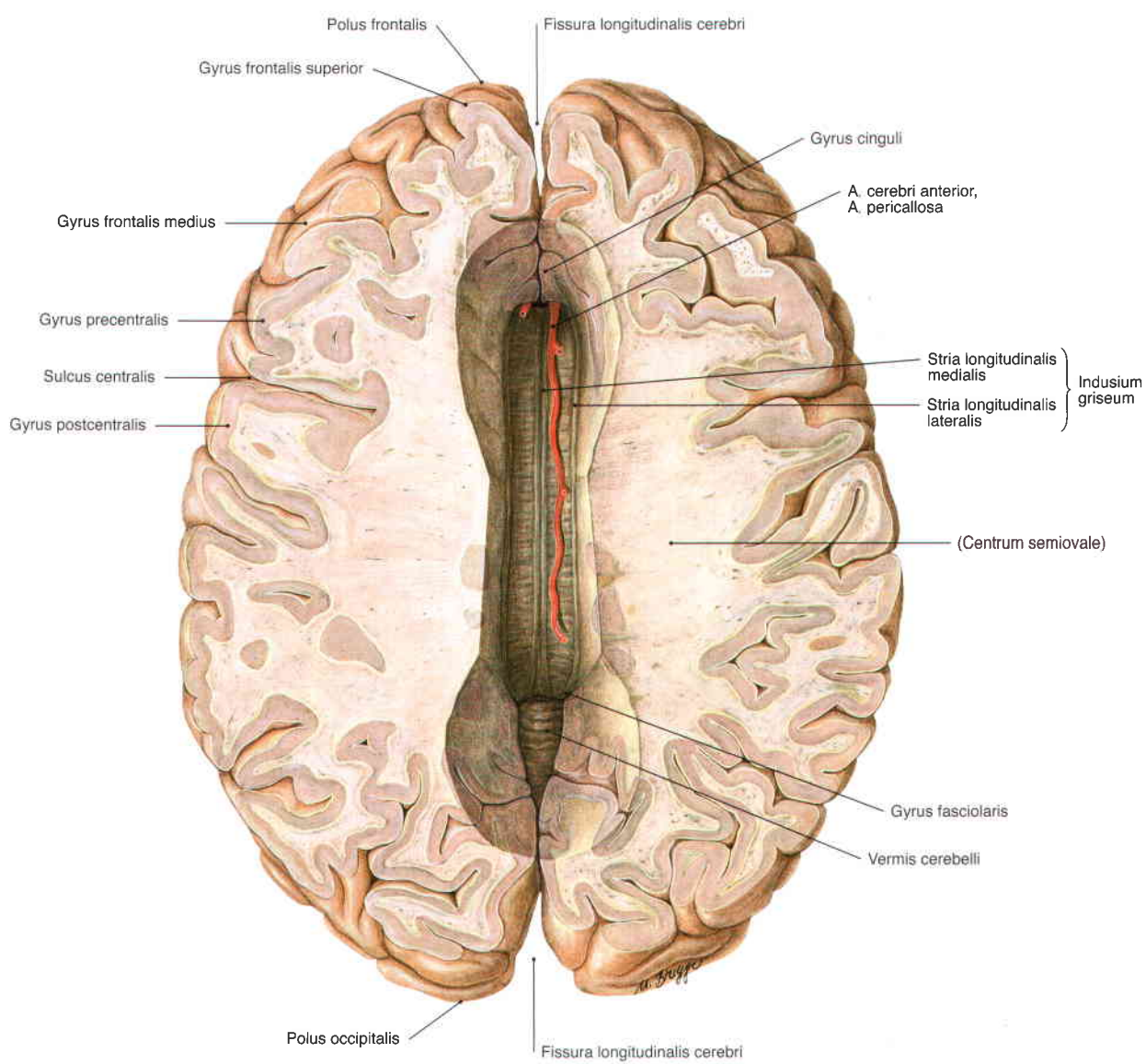


Fig. 551 Ventricles of the brain, Ventriculi encephali, and subarachnoid space, Spatium subarachnoideum; schema of the circulation [arrows] of the cerebrospinal fluid, Liquor cerebrospinalis, from the inner to the outer liquor spaces.

* Clinical term: foramen of MONRO

** Clinical term: cerebral aqueduct of SYLVIVS

Brain, topography

553



Fig. 552 Corpus callosum, Corpus callosum; after removal of the upper parts of the cerebral hemispheres; superior view.

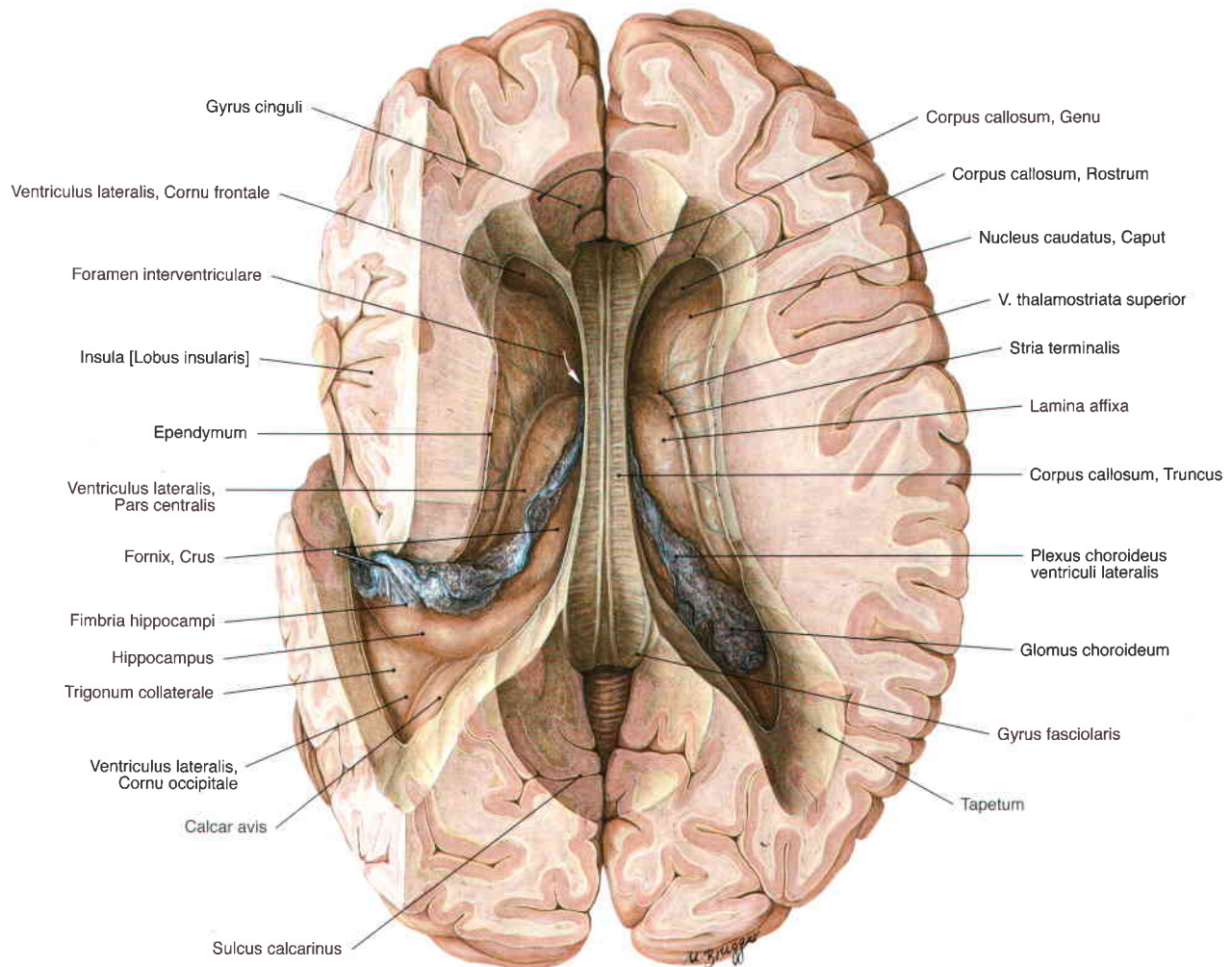


Fig. 553 Lateral ventricles, Ventriculi laterales; after removal of the upper parts of the cerebral hemispheres; superior view.



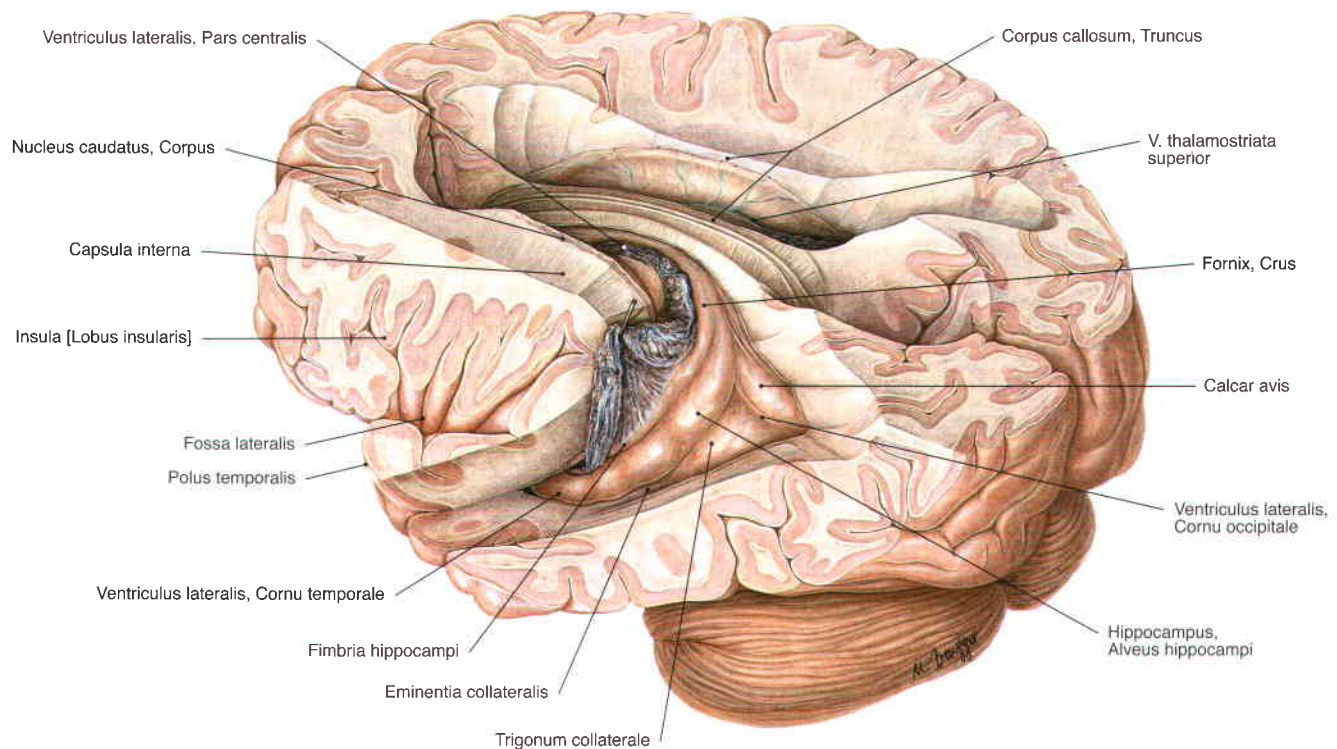
Brain, topography

Fig. 554 Lateral ventricles, Ventriculi laterales; after removal of the upper parts of the cerebral hemispheres; posterior view from the left.

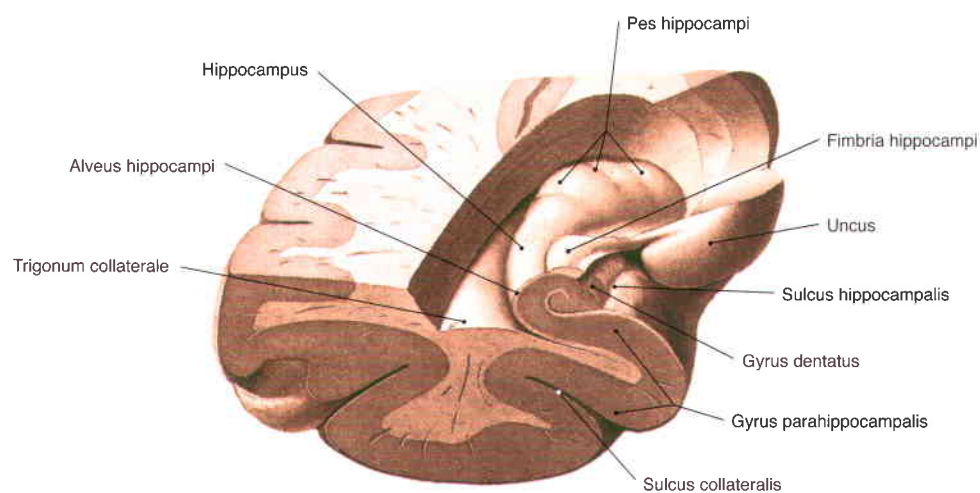


Fig. 555 Left temporal horn, Cornu temporale, of the lateral ventricle, Ventriculus lateralis; frontal section after removal of the temporal wall; posterior-superior view.

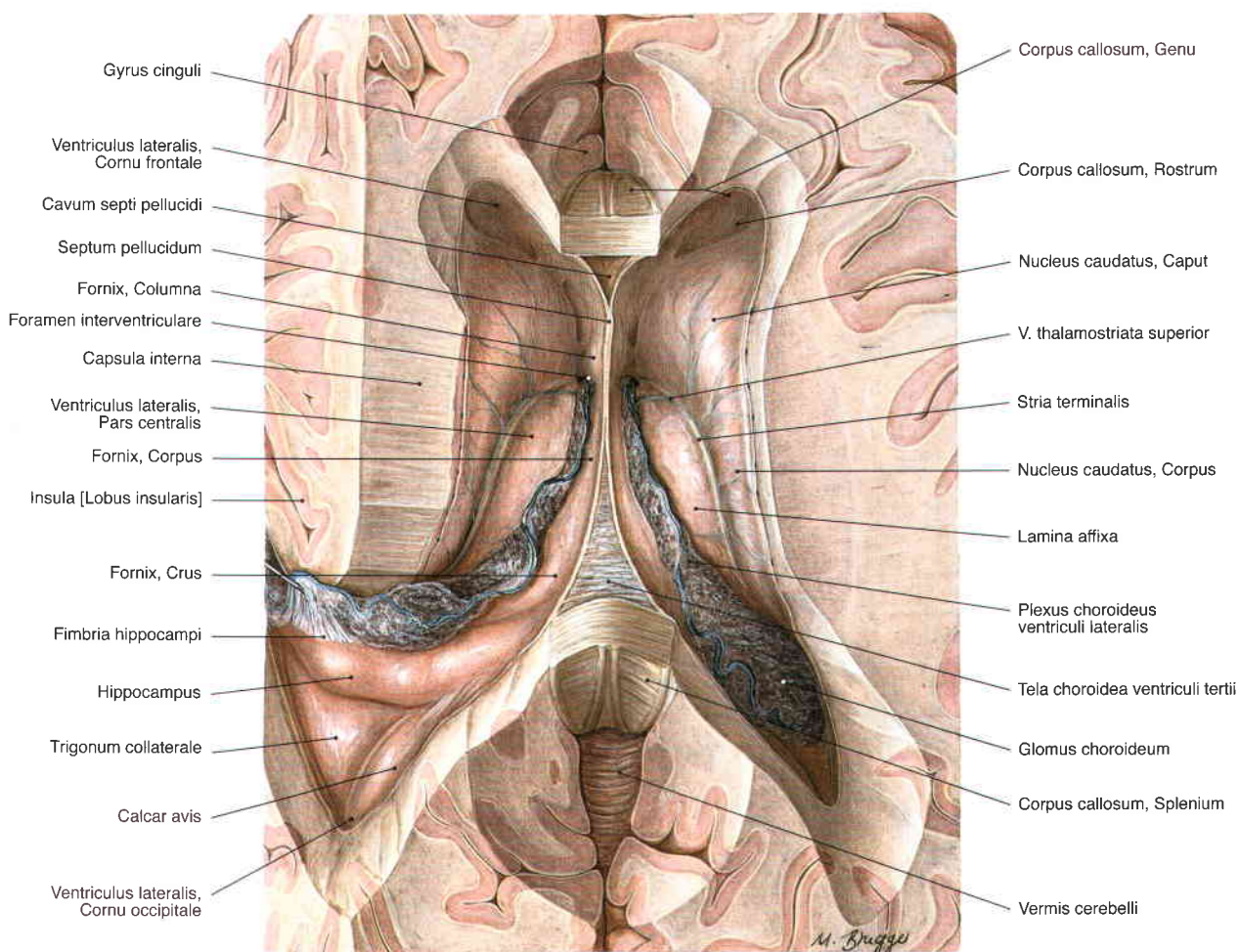


Fig. 556 Lateral ventricles, Ventriculi laterales; after removal of the upper parts of the cerebral hemispheres and the central part of the corpus callosum; superior view.

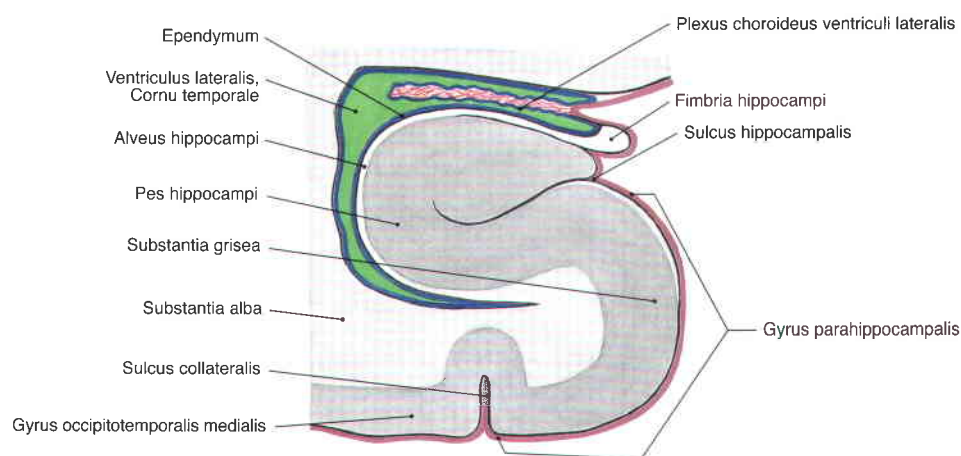


Fig. 557 Temporal horn, Cornu temporale, of the lateral ventricle, Ventriculus lateralis; schematic frontal section.

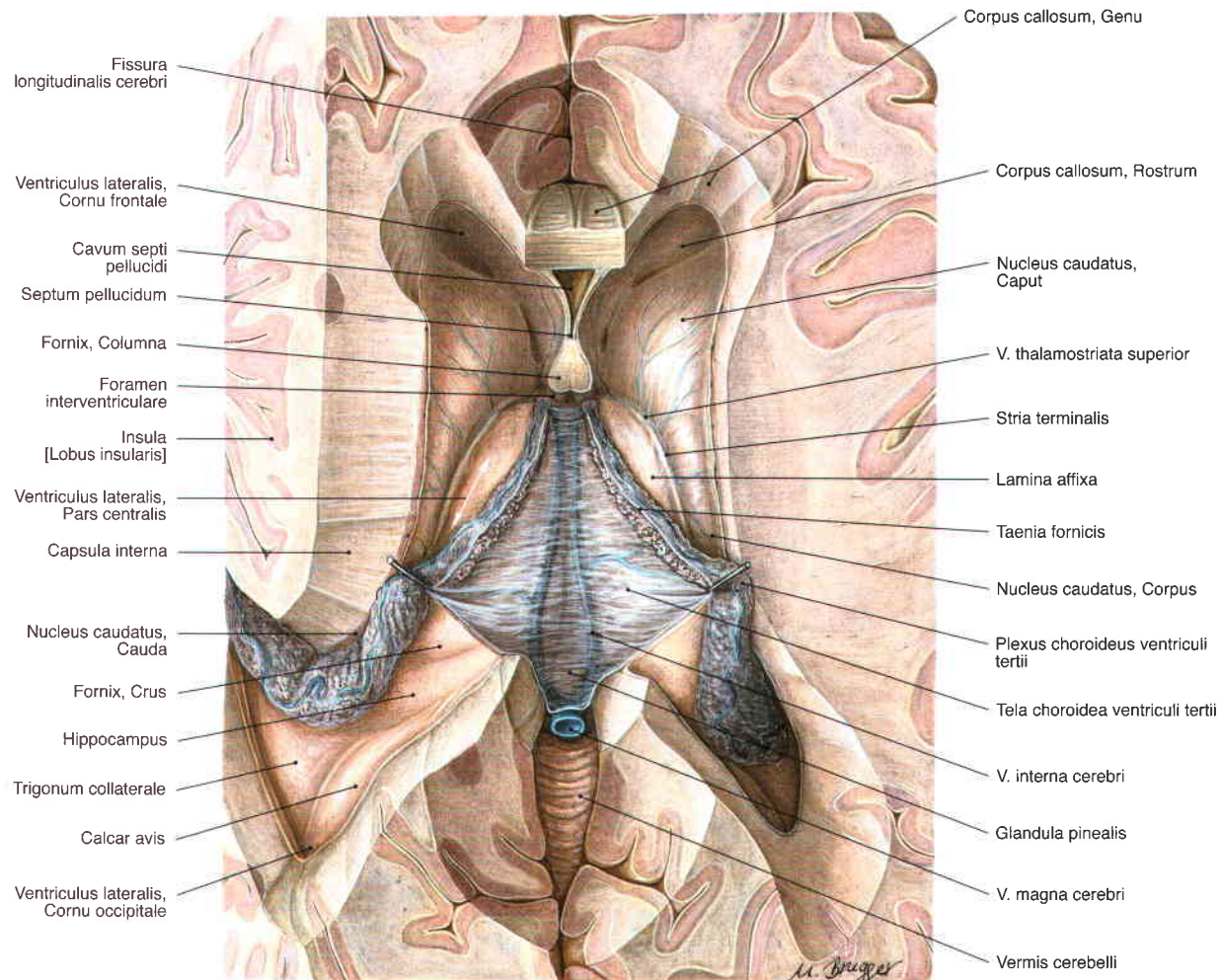
Brain, topography

Fig. 558 Lateral ventricles, Ventriculi laterales; after removal of the central part of the corpus callosum and the columns of the fornix; superior view.

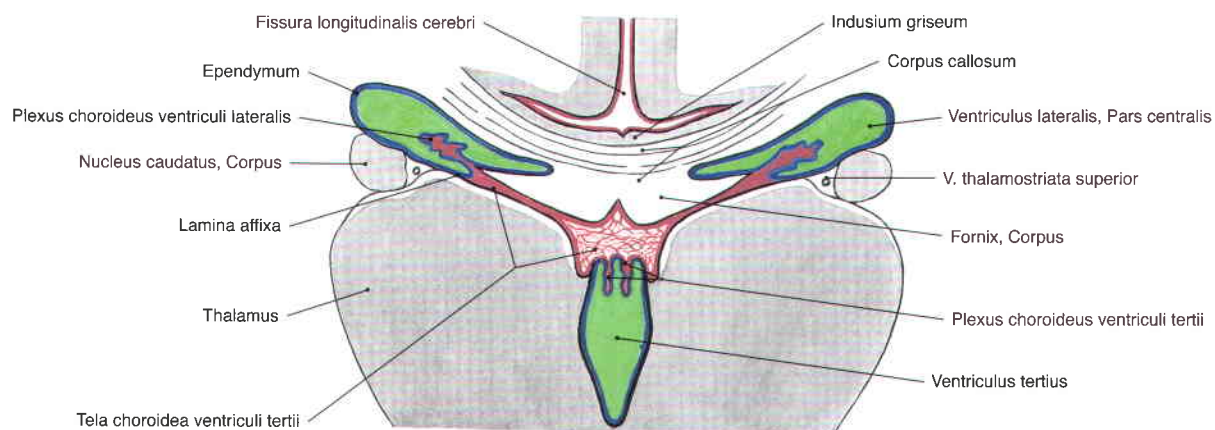


Fig. 559 Central parts, Partes centrales, of the lateral ventricles and third ventricle, Ventriculus tertius; schematic frontal section.

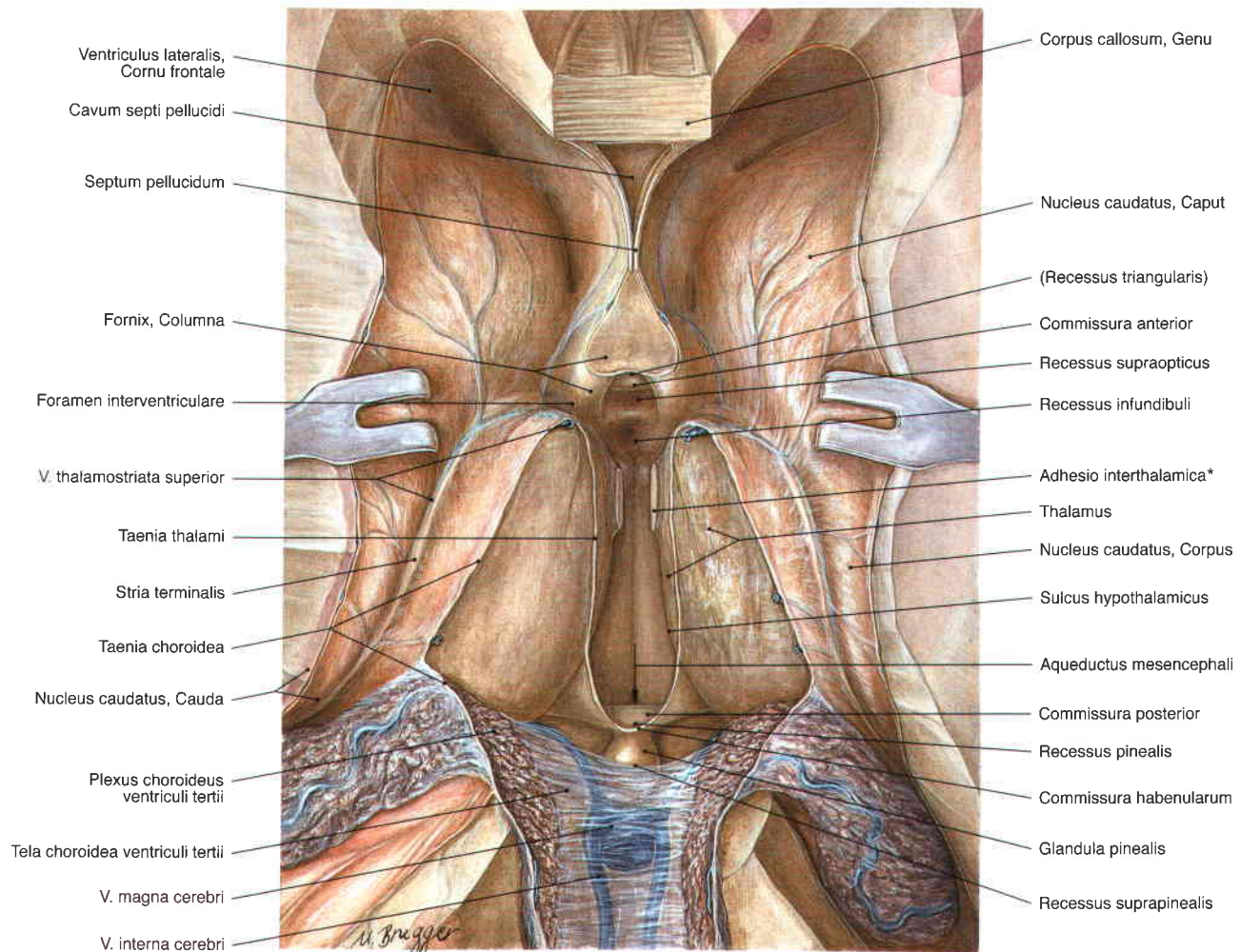


Fig. 560 Lateral ventricles, Ventriculi laterales, and third ventricle, Ventriculus tertius; parts of the cerebral hemispheres, the central part of the corpus callosum as well as the fornix and the choroid plexus have been removed, the tela choroidea of the third ventricle has been reflected; superior view.

* The interthalamic adhesion has been sectioned in the median plane.

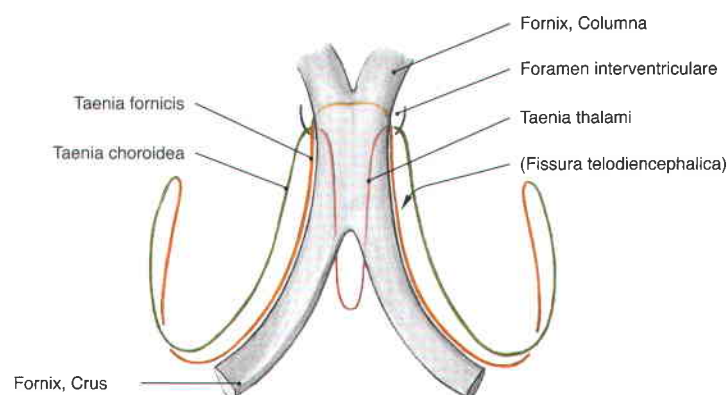
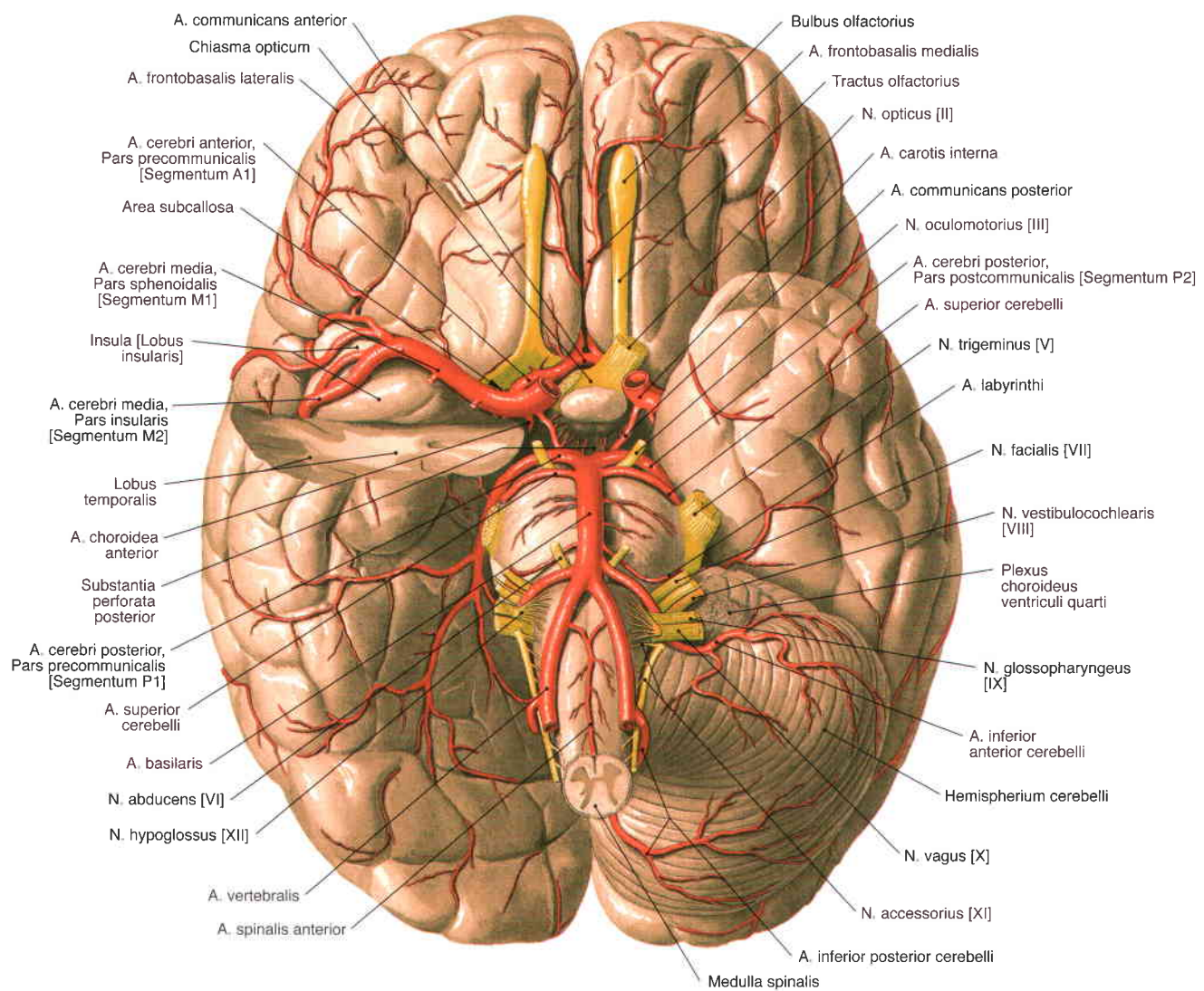


Fig. 561 Taeniae, Taeniae, of the choroid plexus, Plexus choroideus of the cerebrum; superior view.

Arteries of the base of the brain

→ 566, 567

490

Fig. 562 Arteries of the brain.

Arterial circle

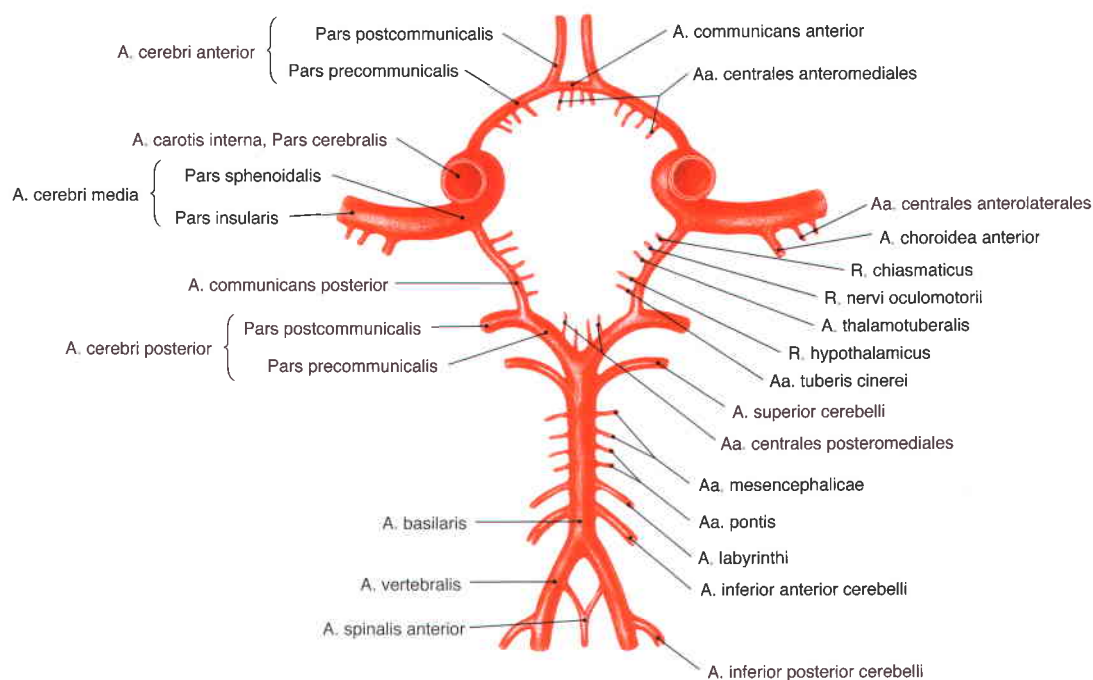


Fig. 563 Arterial circle of the brain, Circulus arteriosus cerebri [WILLIS].

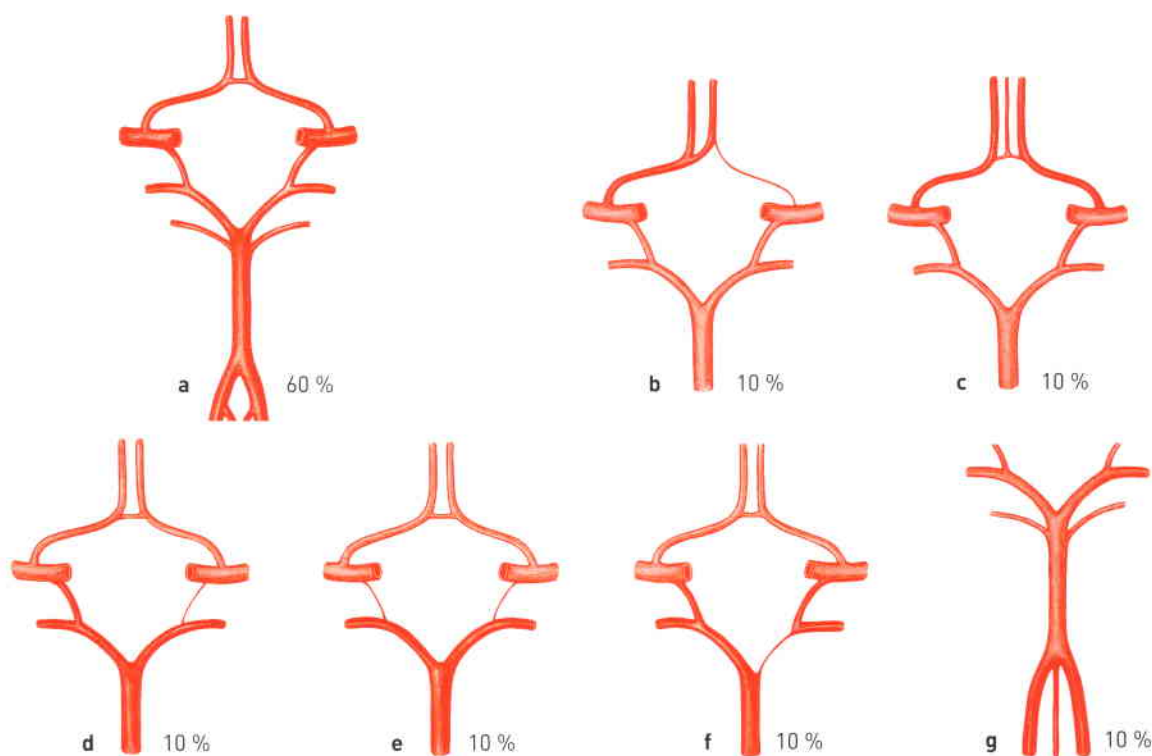


Fig. 564 a-g Arterial circle of the brain, Circulus arteriosus cerebri.
a-c Variations of the anterior portion
d-f Variations of the posterior portion
g Very far inferior union of the vertebral arteries

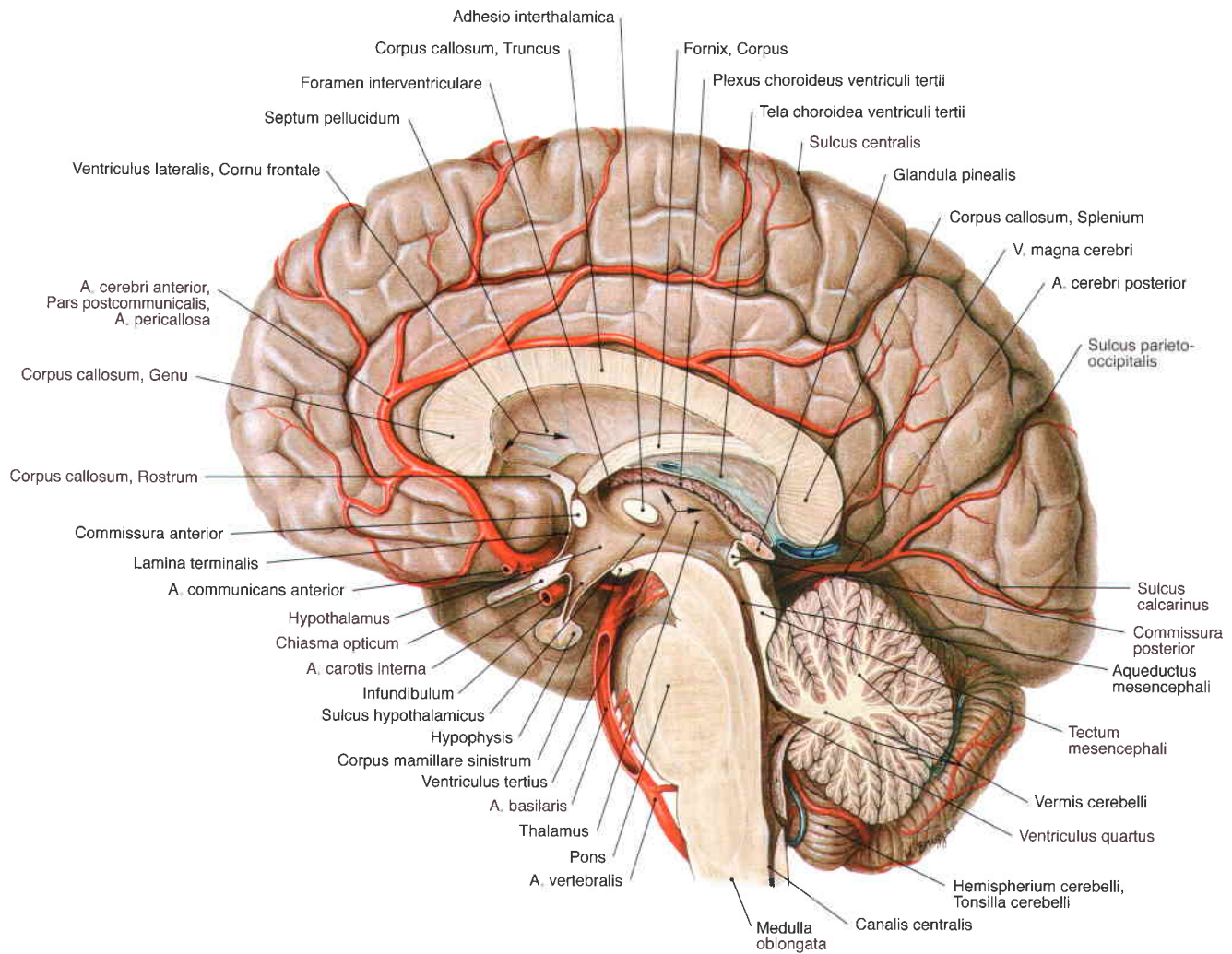
Arteries of the brain

Fig. 565 Medial surface of the brain, *Facies medialis hemispherii cerebri*; diencephalon, Diencephalon, and brainstem, *Truncus encephali*; staggered median section; viewed from the left.

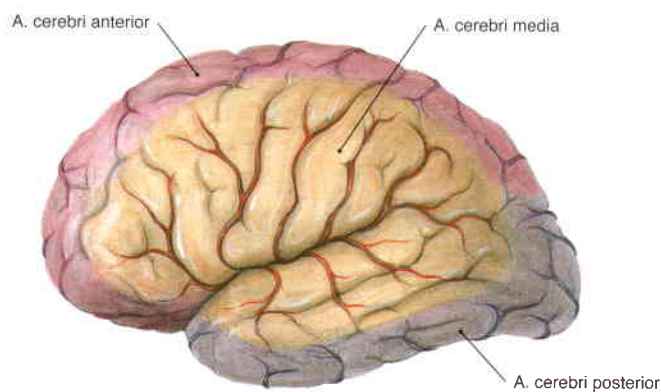


Fig. 566 Arterial supply of the brain; viewed from the left.

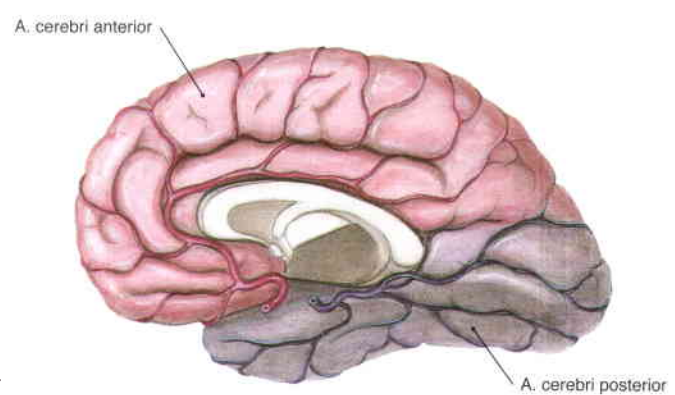


Fig. 567 Arterial supply of the brain; medial view.

Arteries and veins of the brain

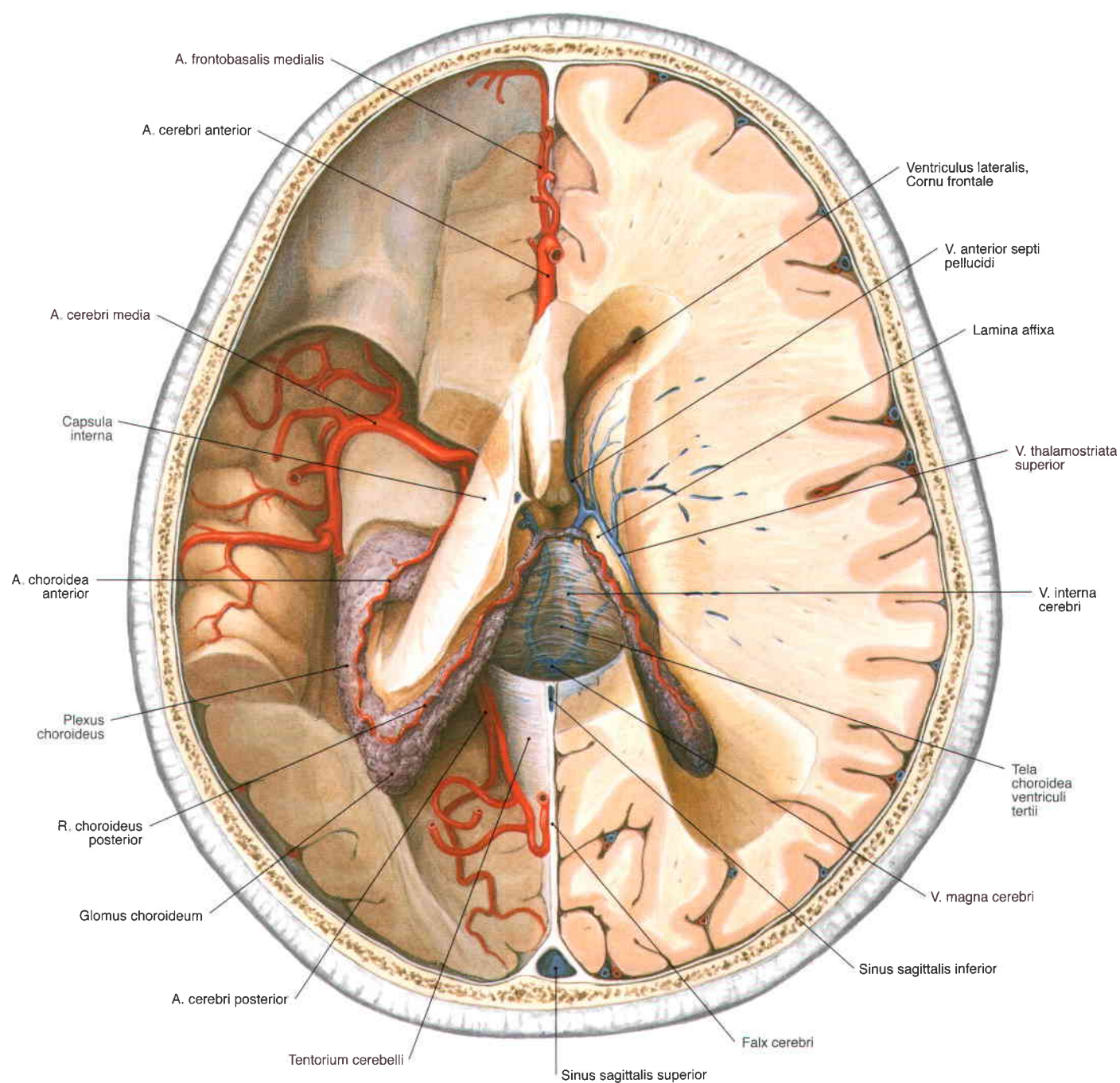


Fig. 568 Arteries and veins of the brain, Arteriae et Venae cerebri.

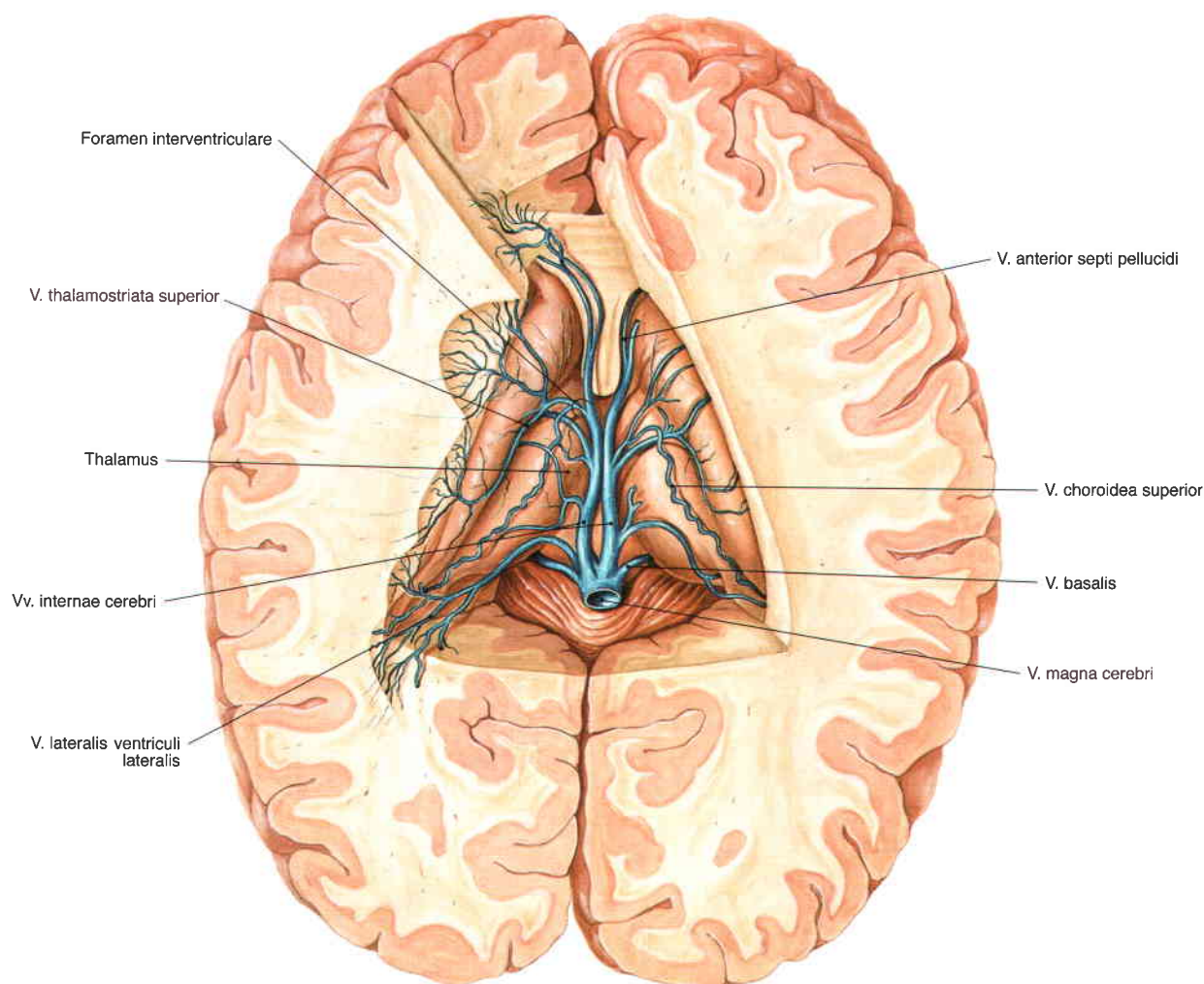
Veins of the brain

Fig. 569 Deep veins of the brain, Vv. profundae cerebri. The internal cerebral veins run within the tela choroidea of the third ventricle.

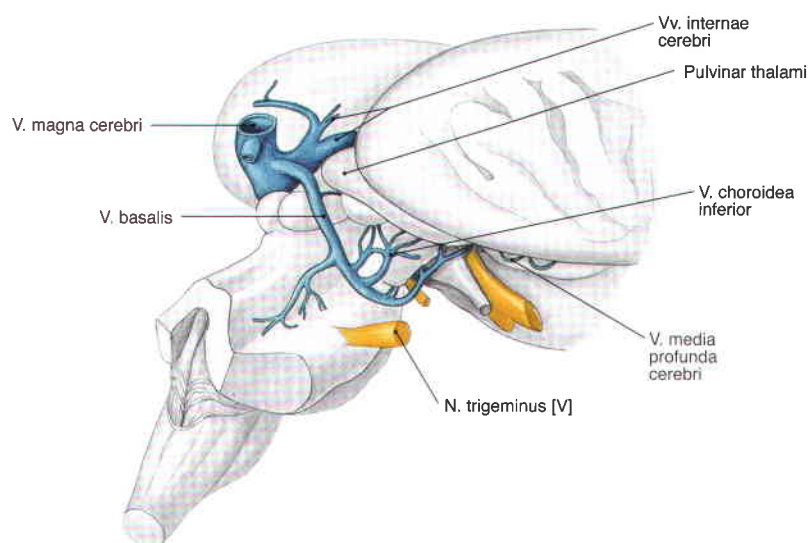


Fig. 570 Deep veins of the brain, Vv. profundae cerebri; posterior view from the right.

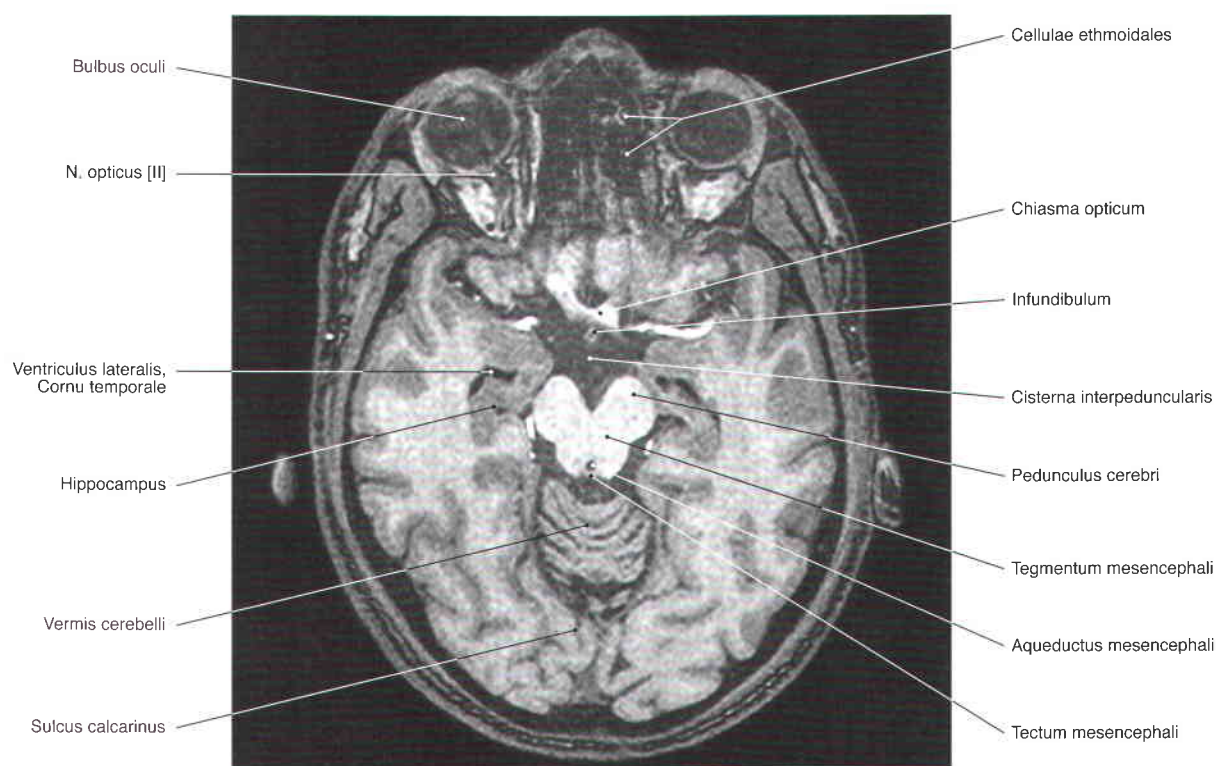


Fig. 571 Brain, Encephalon; magnetic resonance tomographic image (MRI); horizontal section at the level of the midbrain and the temporal horns of the lateral ventricles; superior view.

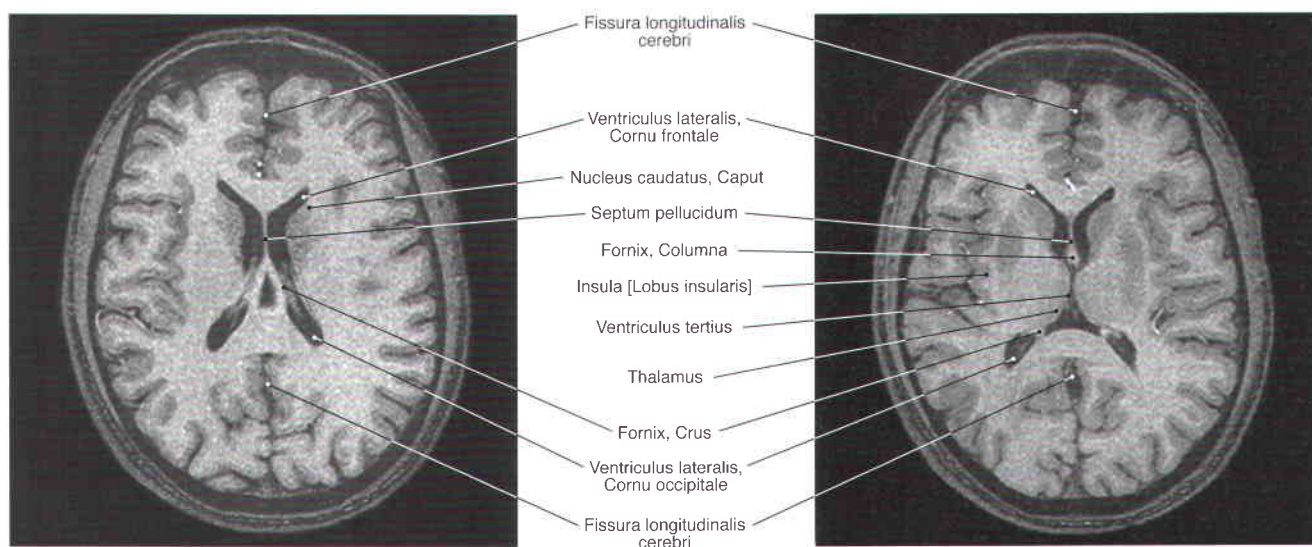
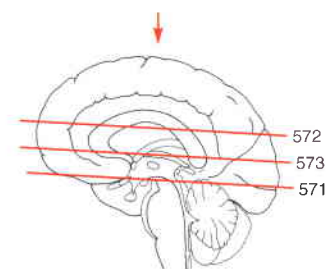


Fig. 572 Brain, Encephalon; magnetic resonance tomographic image (MRI); horizontal section at the level of the central parts of the lateral ventricles; superior view.

Fig. 573 Brain, Encephalon; magnetic resonance tomographic image (MRI); horizontal section at the level of the third ventricle and the opening of the temporal horns of the lateral ventricles; superior view.

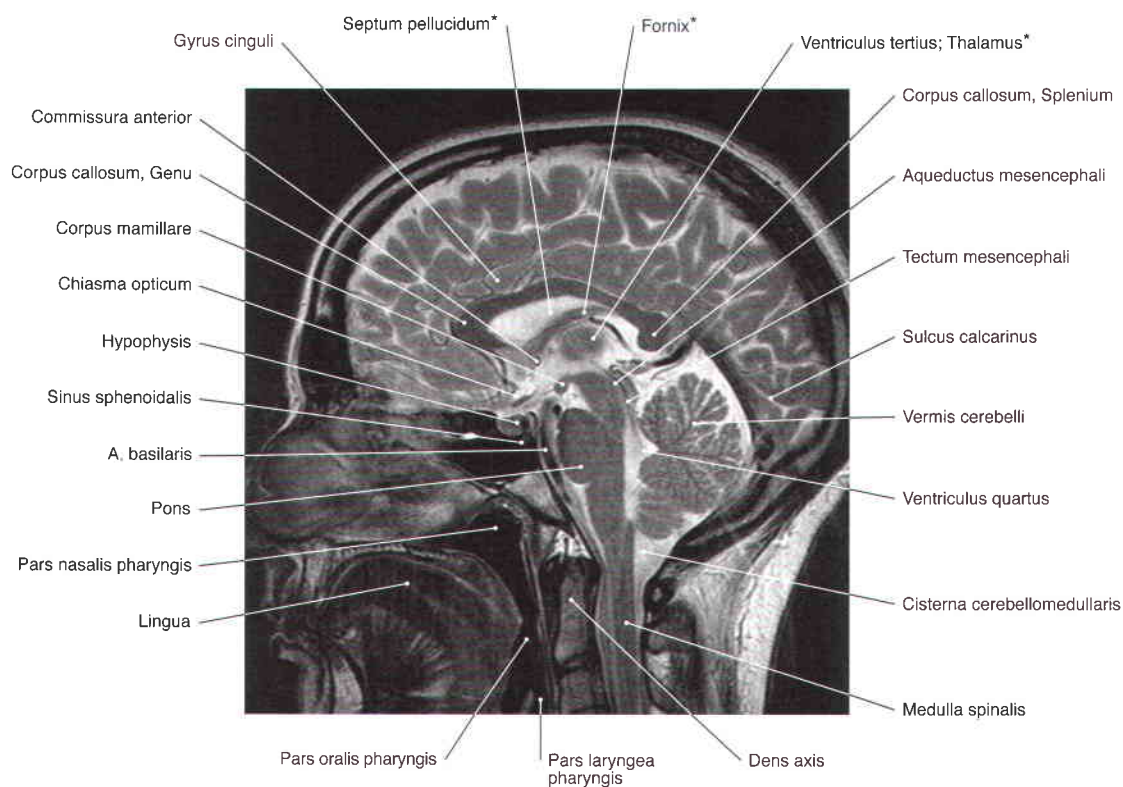
Brain, sections

Fig. 574 Brain, Encephalon; magnetic resonance tomographic image (MRI); median section. The structures marked with * appear partly falsified as a consequence of the "partial-volume-effect".

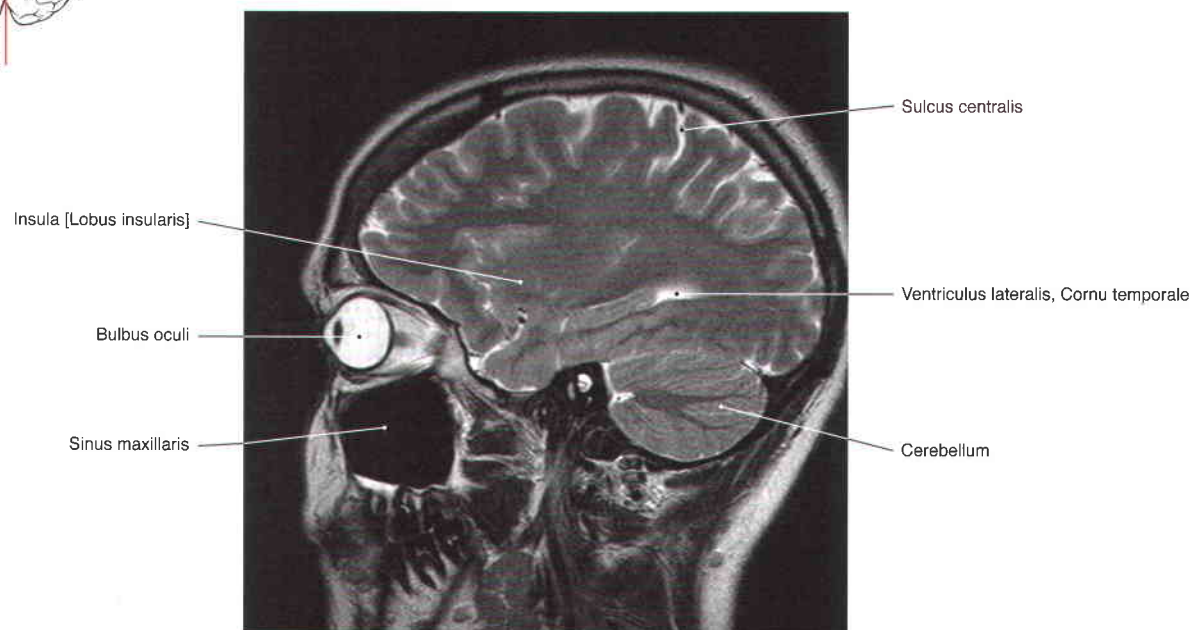
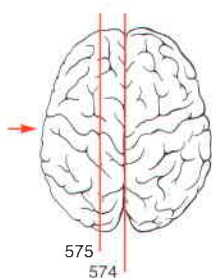


Fig. 575 Brain, Encephalon; magnetic resonance tomographic image (MRI); sagittal section.

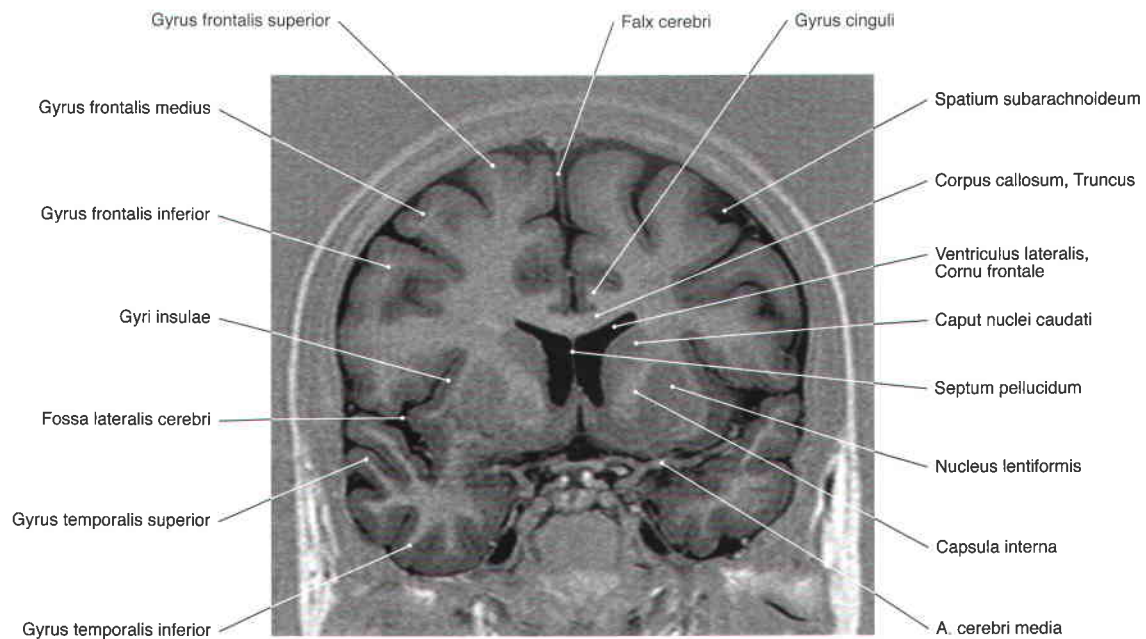


Fig. 576 Brain, Encephalon; magnetic resonance tomographic image (MRI); frontal section.

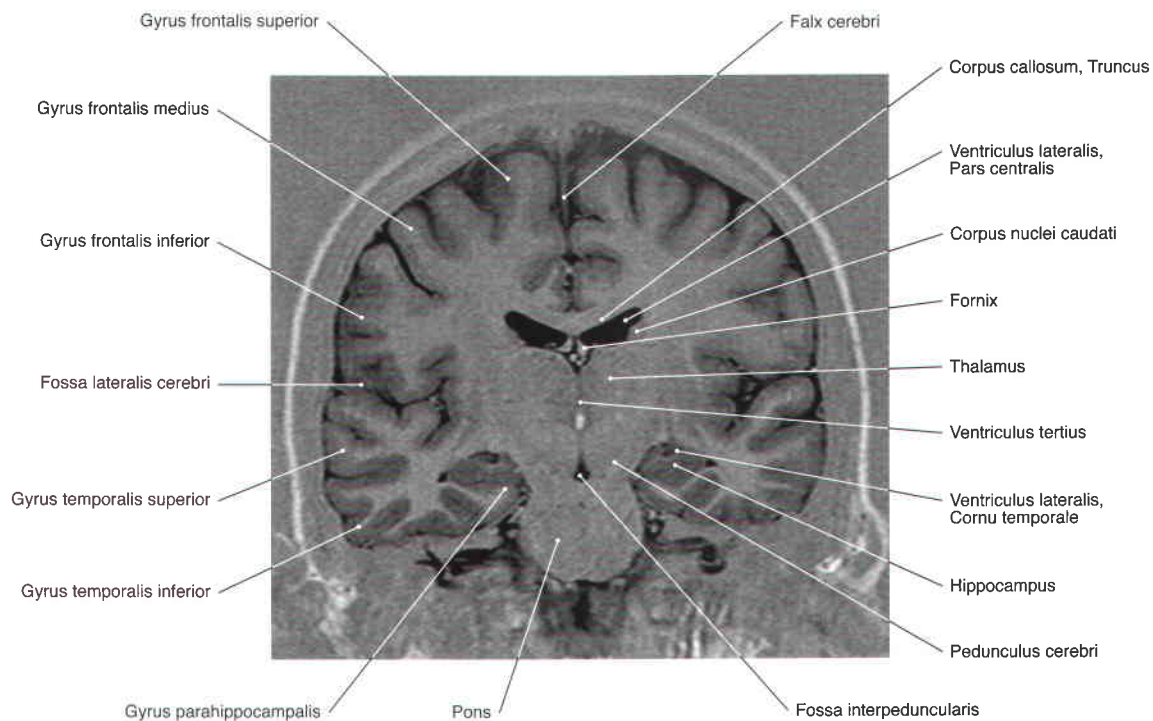
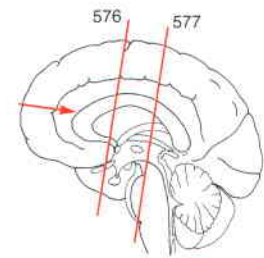


Fig. 577 Brain, Encephalon; magnetic resonance tomographic image (MRI); frontal section.

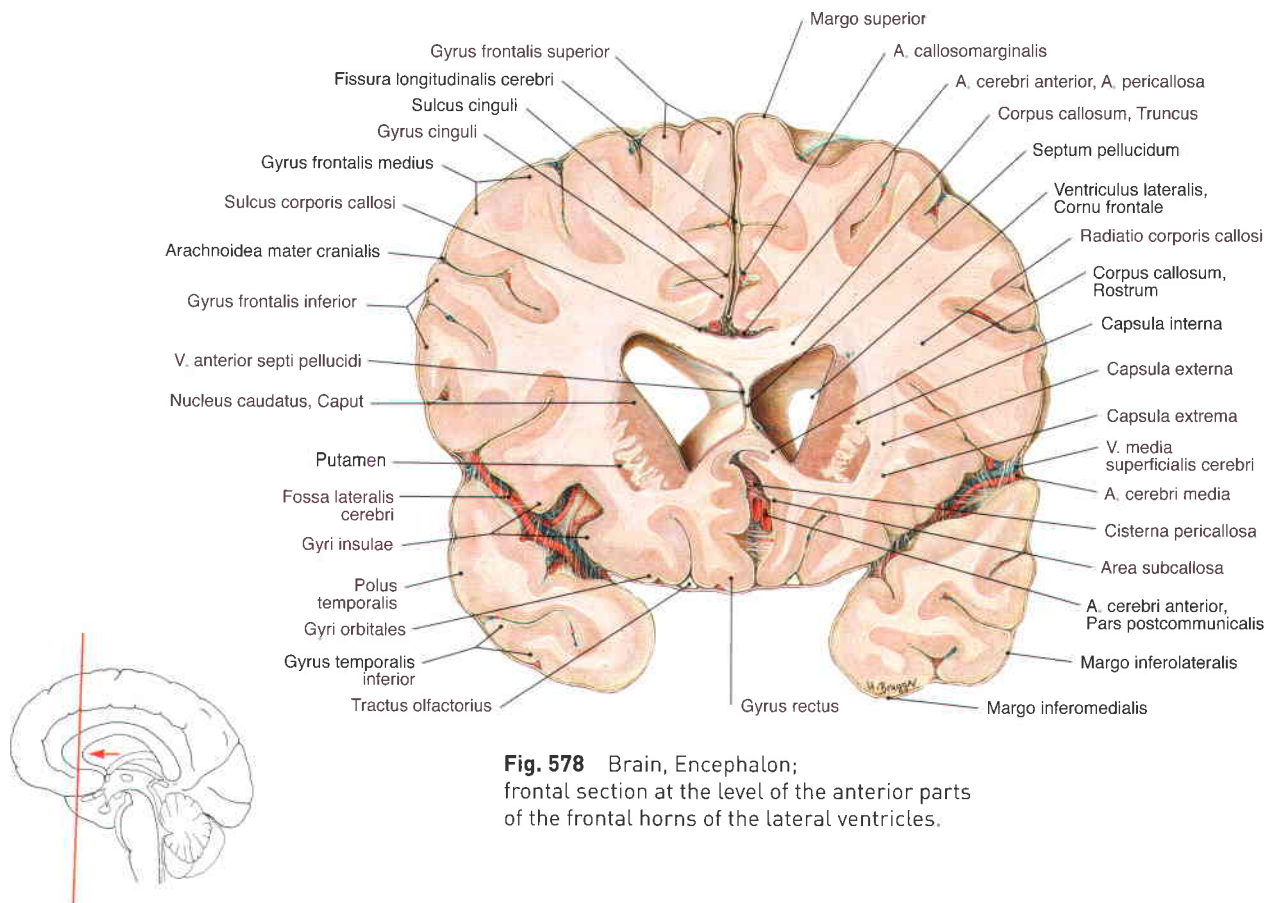
Brain, frontal sections

Fig. 578 Brain, Encephalon; frontal section at the level of the anterior parts of the frontal horns of the lateral ventricles.

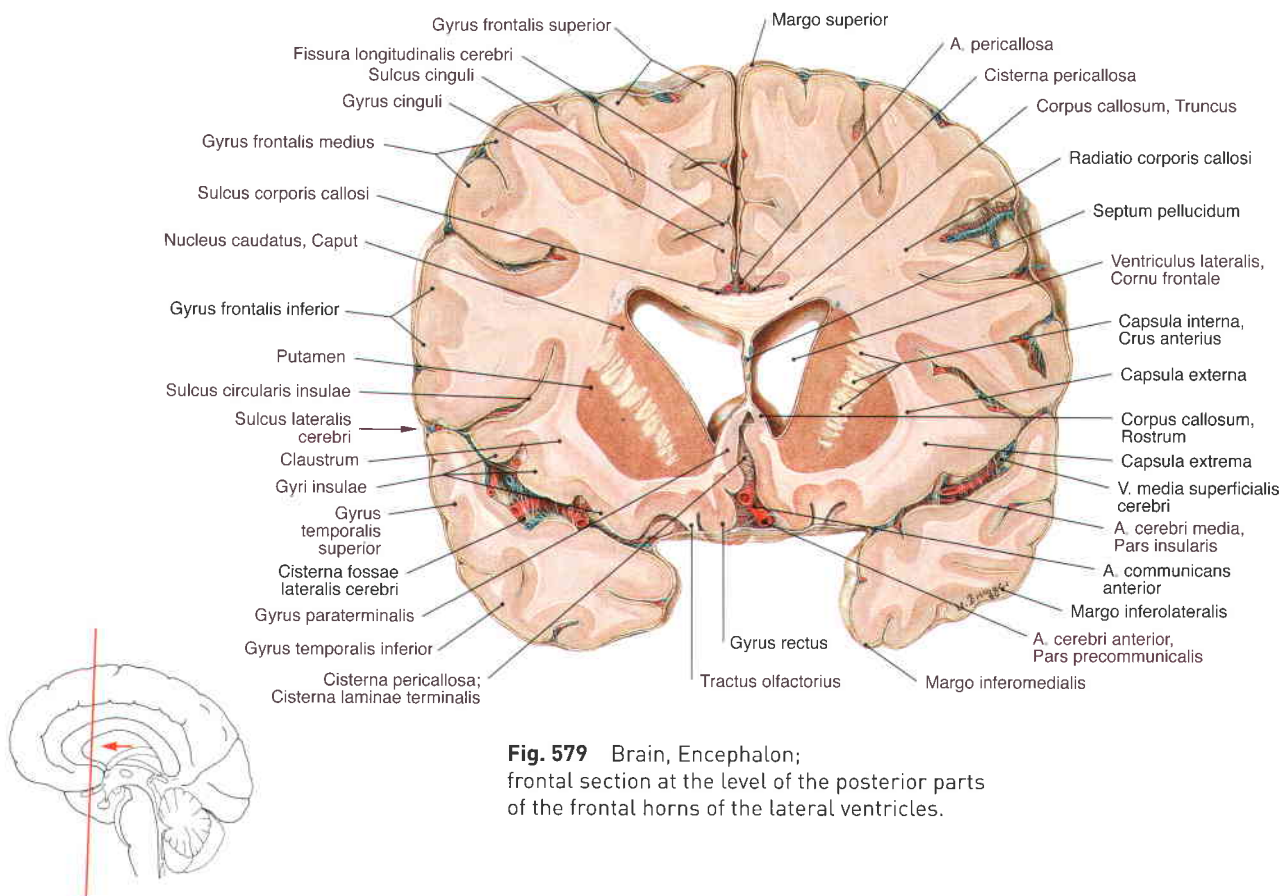


Fig. 579 Brain, Encephalon; frontal section at the level of the posterior parts of the frontal horns of the lateral ventricles.

Brain, frontal sections

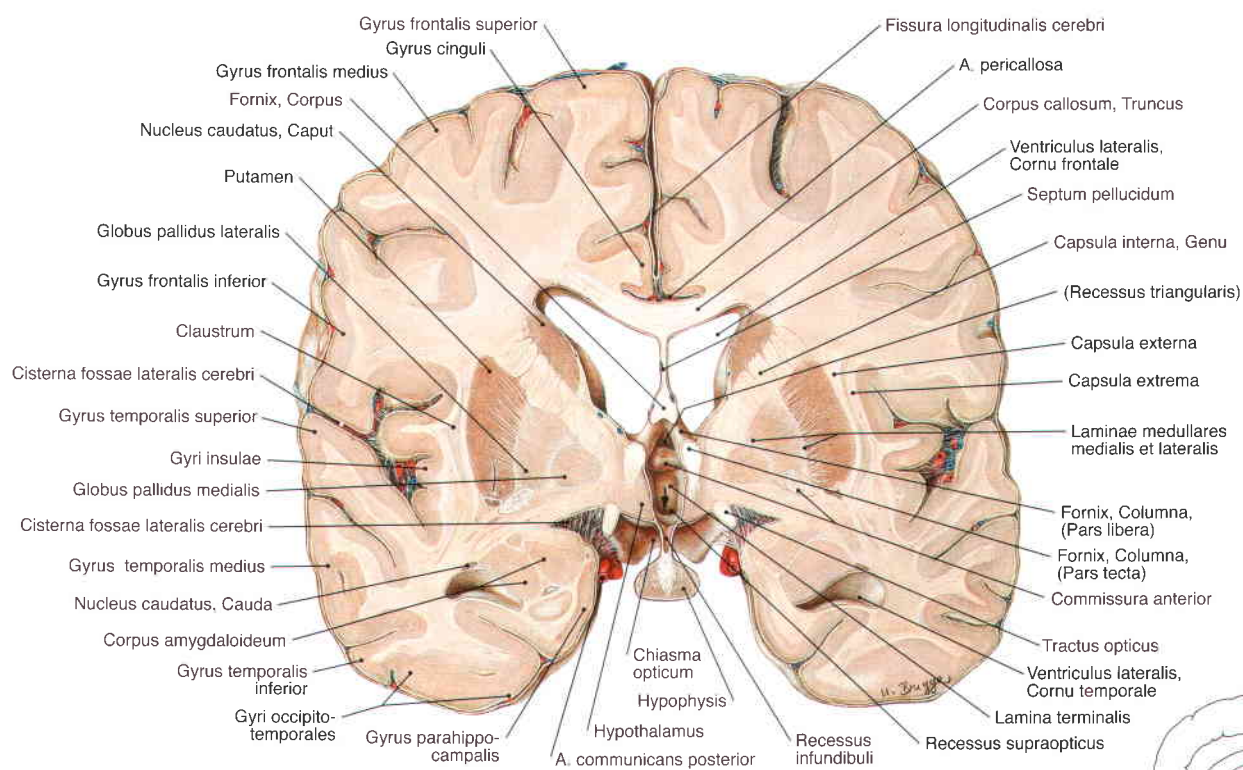


Fig. 580 Brain, Encephalon; frontal section at the level of the interventricular foramina.

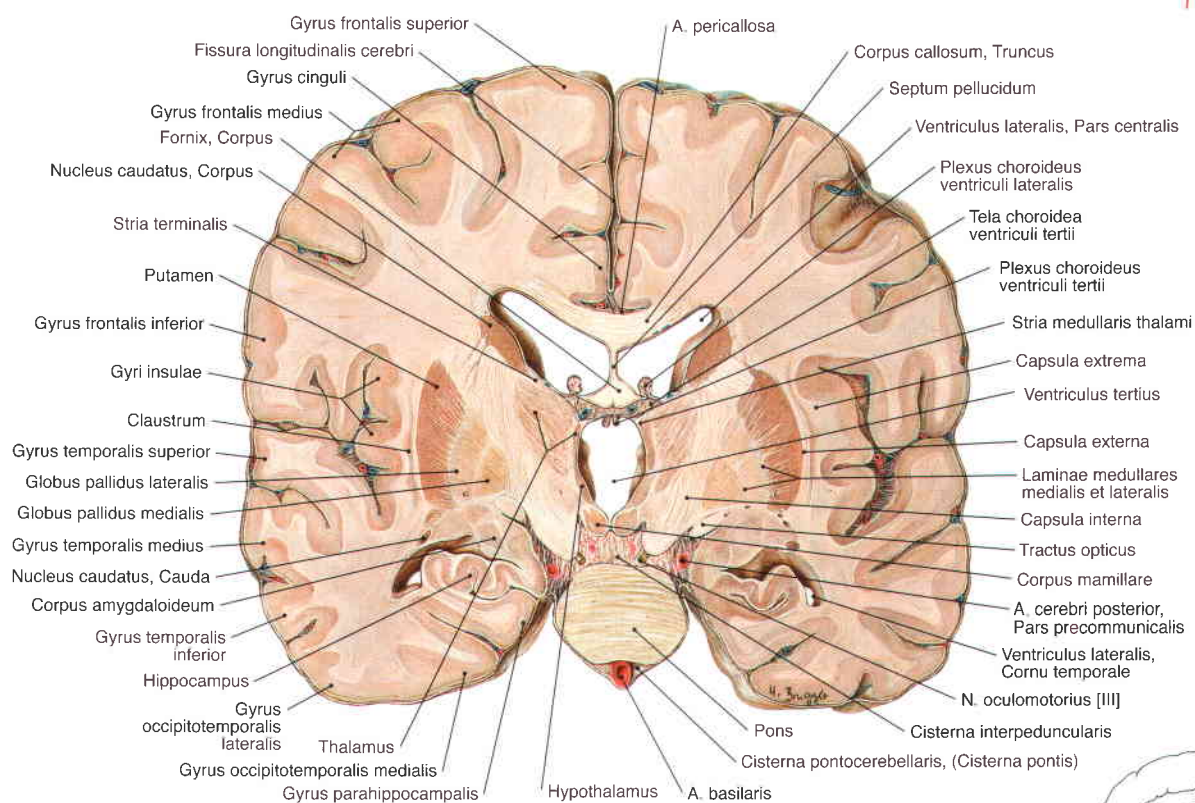


Fig. 581 Brain, Encephalon; frontal section at the level of the mamillary bodies.

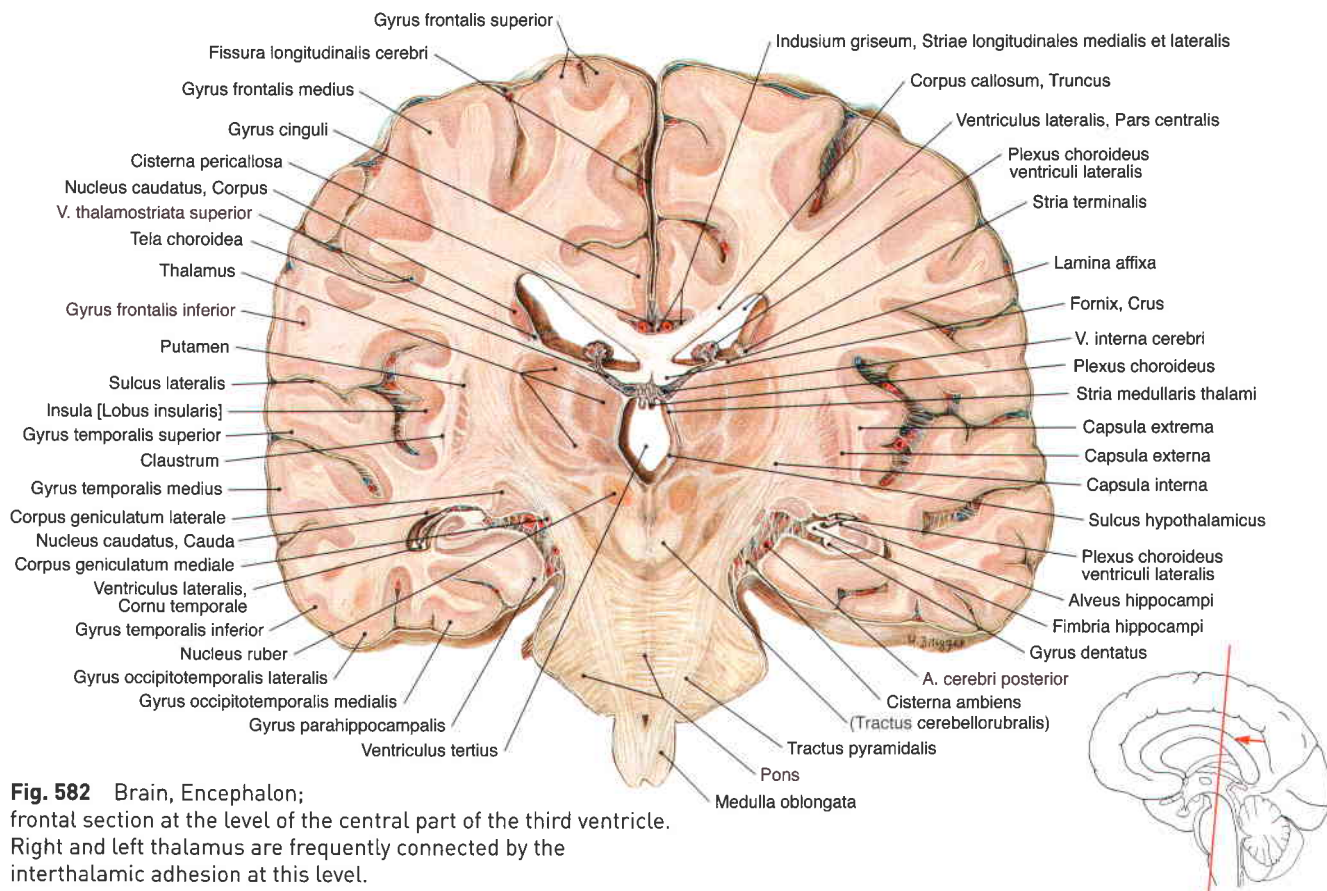
Brain, frontal sections

Fig. 582 Brain, Encephalon;
frontal section at the level of the central part of the third ventricle.
Right and left thalamus are frequently connected by the
interthalamic adhesion at this level.

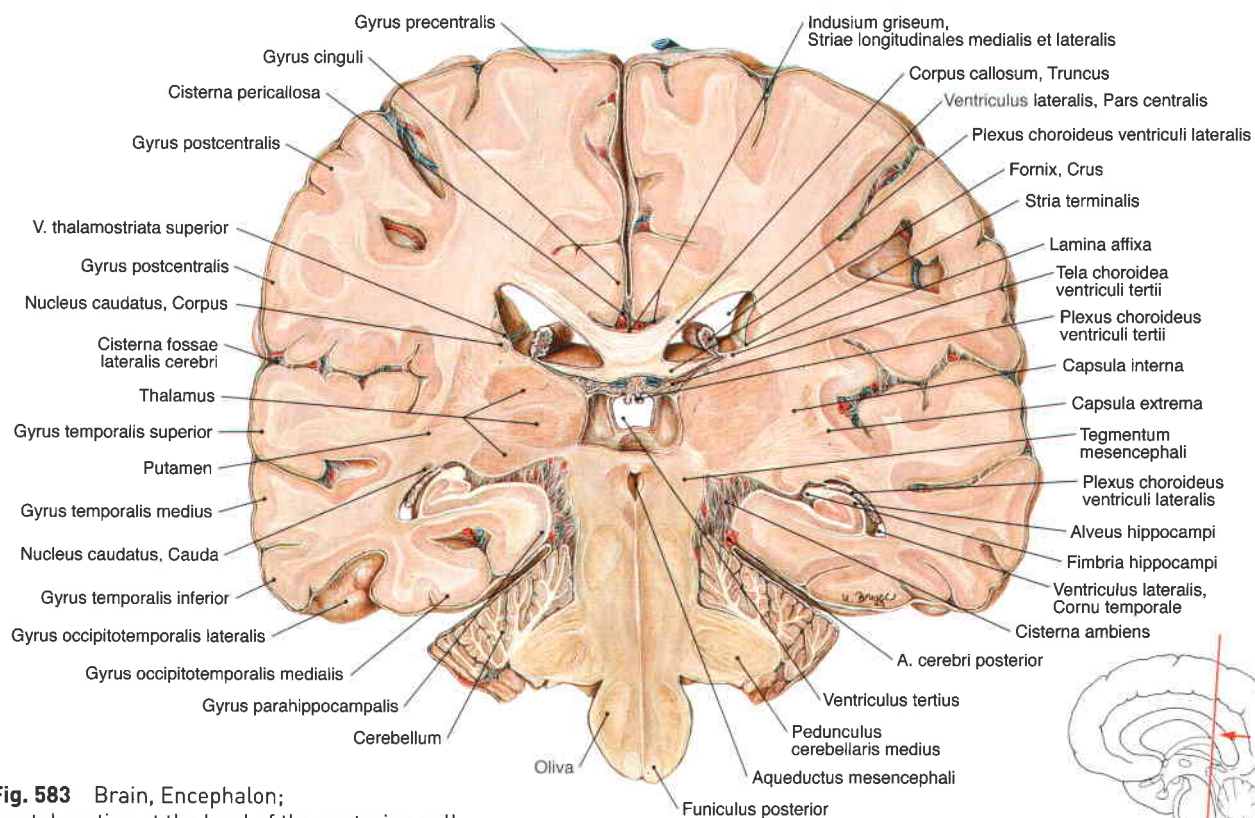


Fig. 583 Brain, Encephalon;
frontal section at the level of the posterior wall
of the third ventricle.

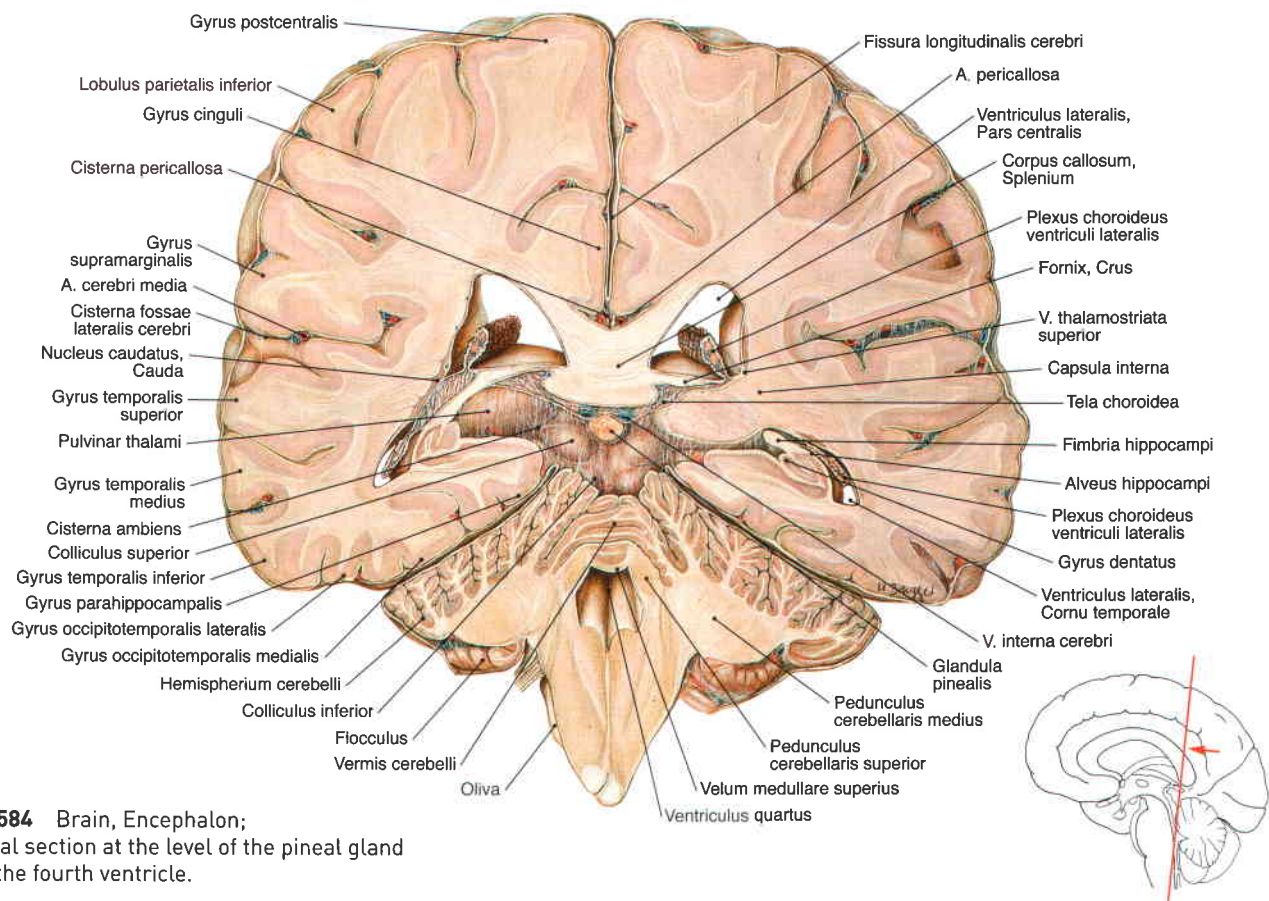


Fig. 584 Brain, Encephalon; frontal section at the level of the pineal gland and the fourth ventricle.

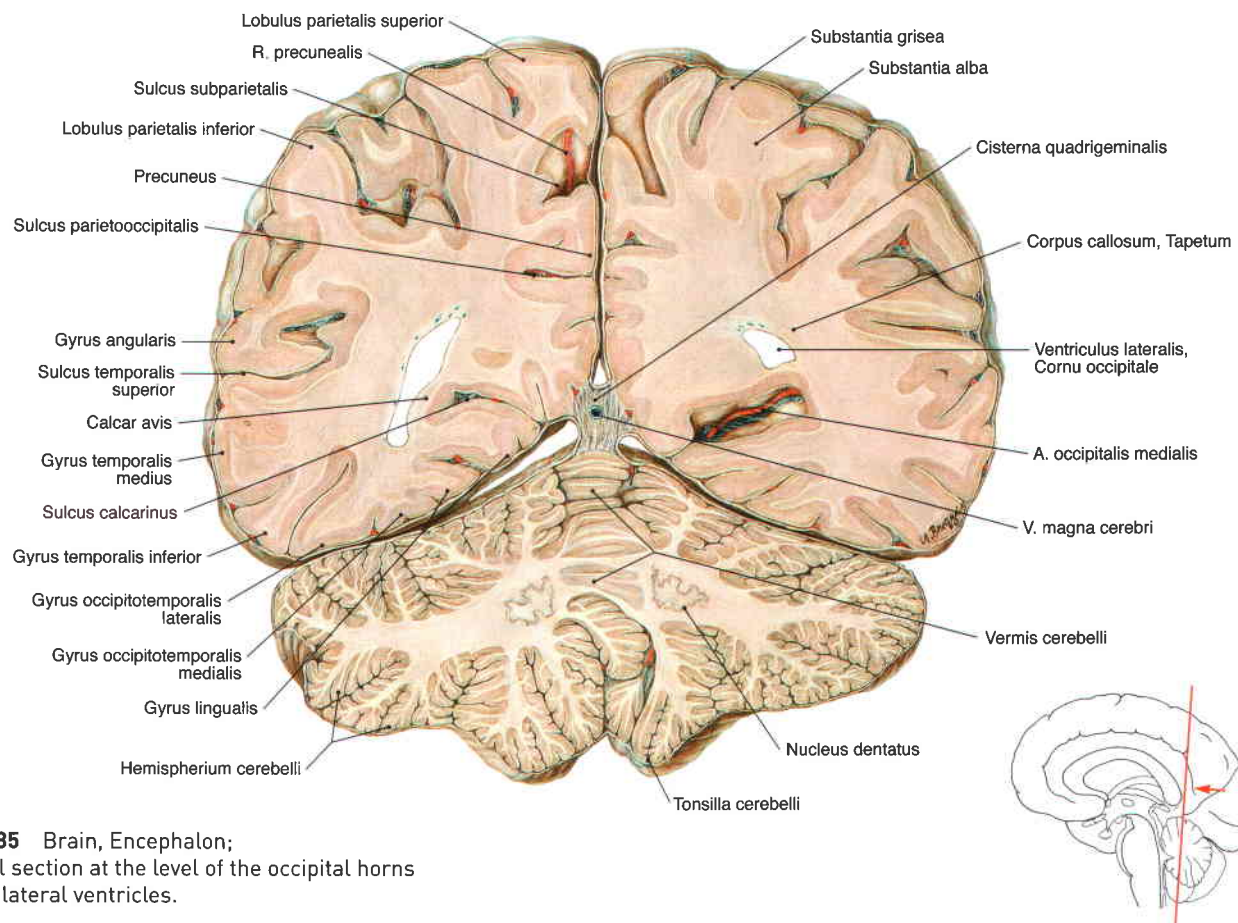


Fig. 585 Brain, Encephalon; frontal section at the level of the occipital horns of the lateral ventricles.

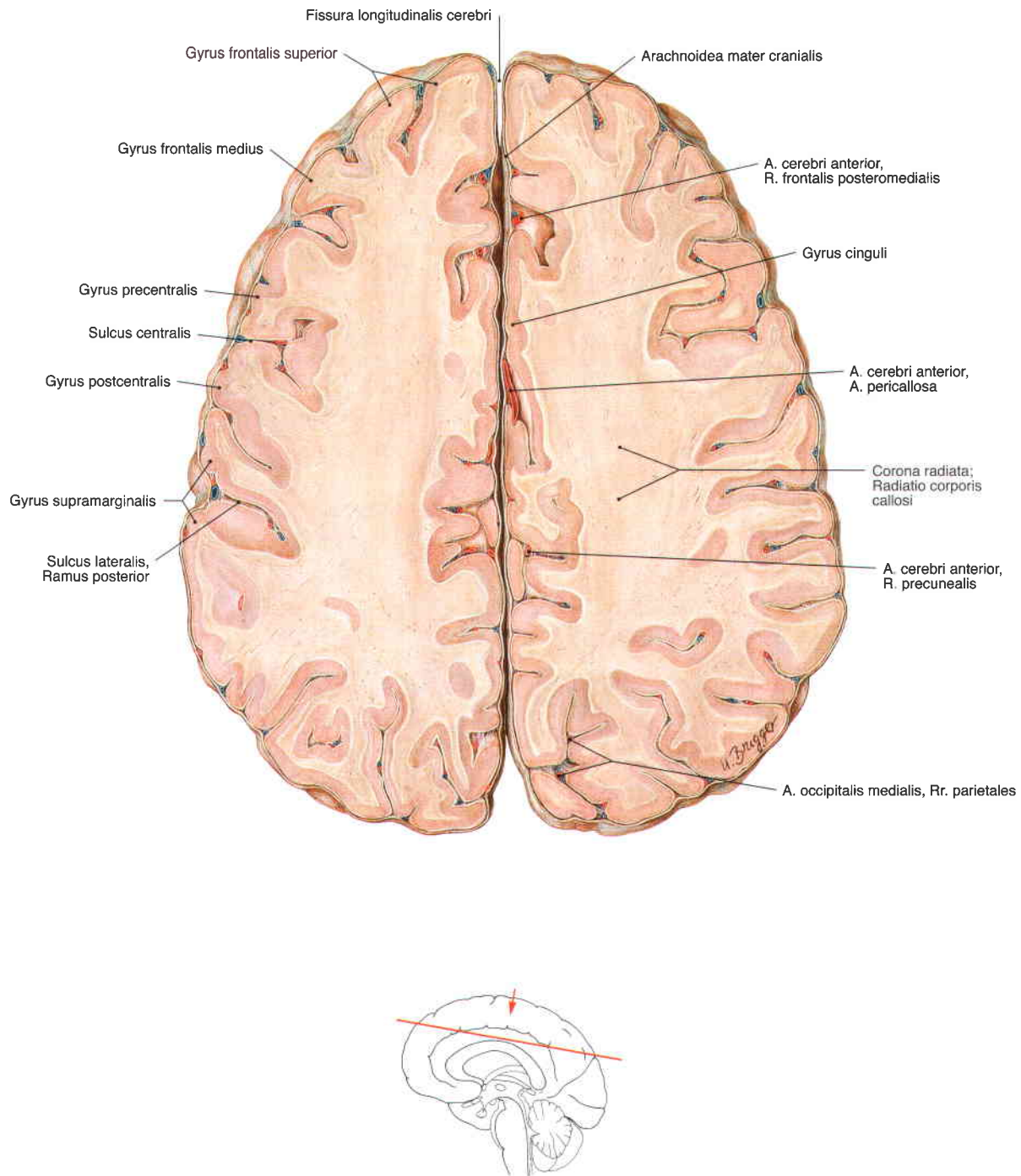
Brain, horizontal section

Fig. 586 Brain, Encephalon; horizontal section just above the corpus callosum. In Fig. 578–598, the subarachnoid space appears somewhat enlarged, particularly in the region of the hemispheric sulci, due to the fact that these specimens were taken from elderly individuals.

Brain, horizontal section

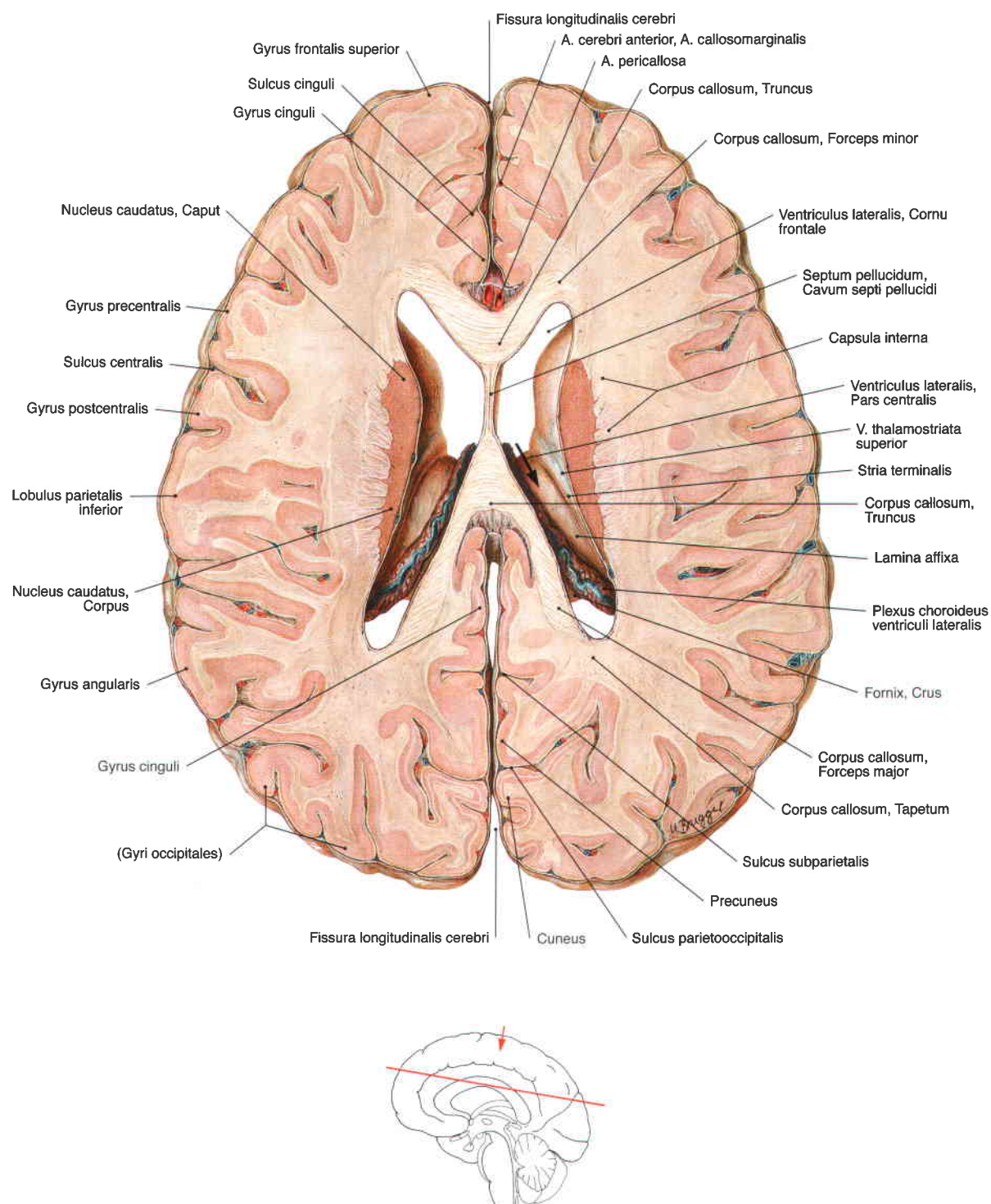


Fig. 587 Brain, Encephalon; horizontal section at the level of the central part of the lateral ventricles.

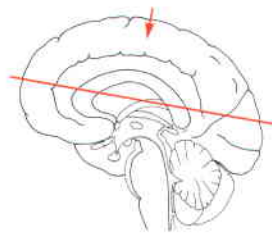
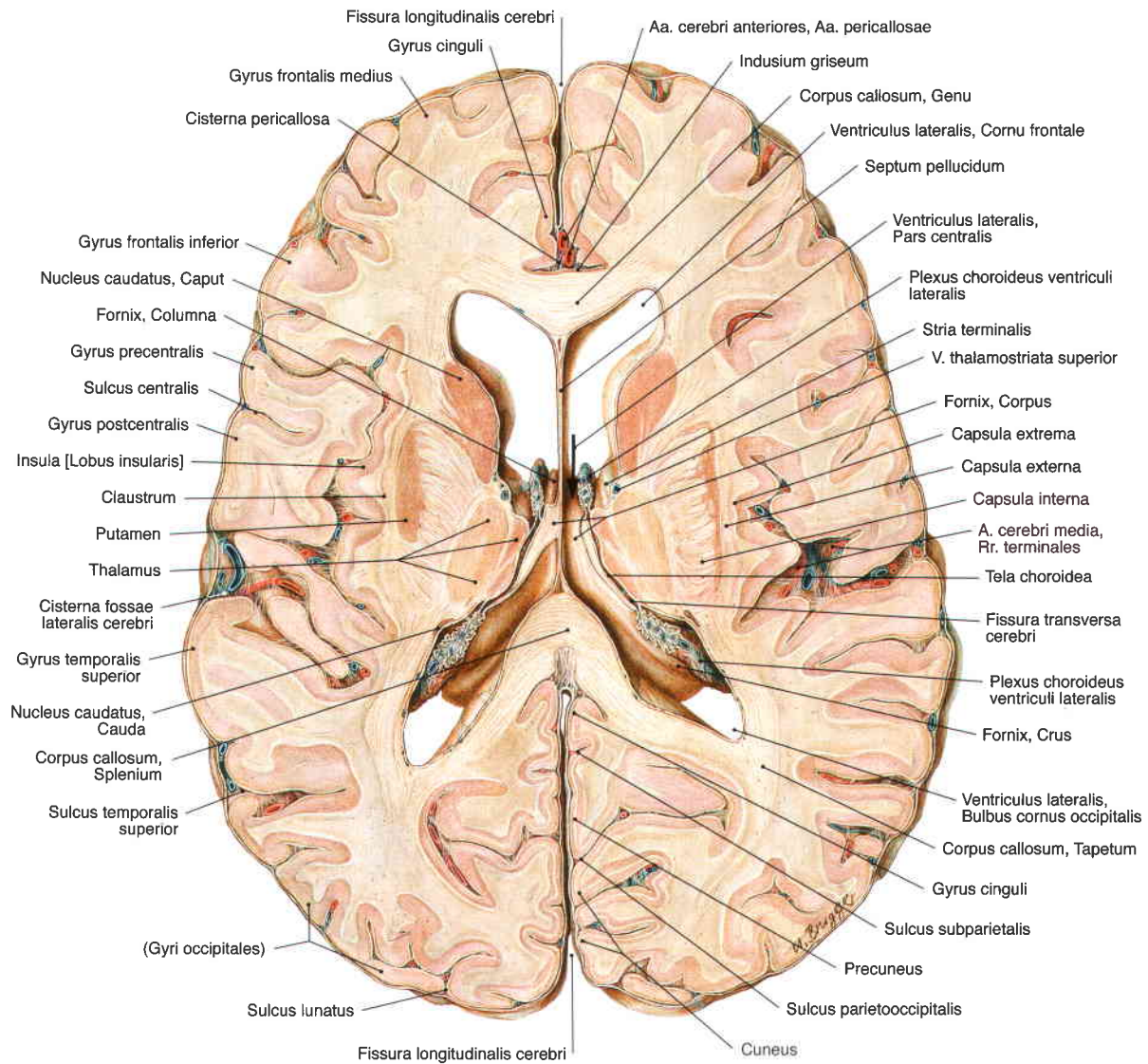
Brain, horizontal section

Fig. 588 Brain, Encephalon;
horizontal section at the level of the floor of
the central part of the lateral ventricles.

Brain, horizontal section

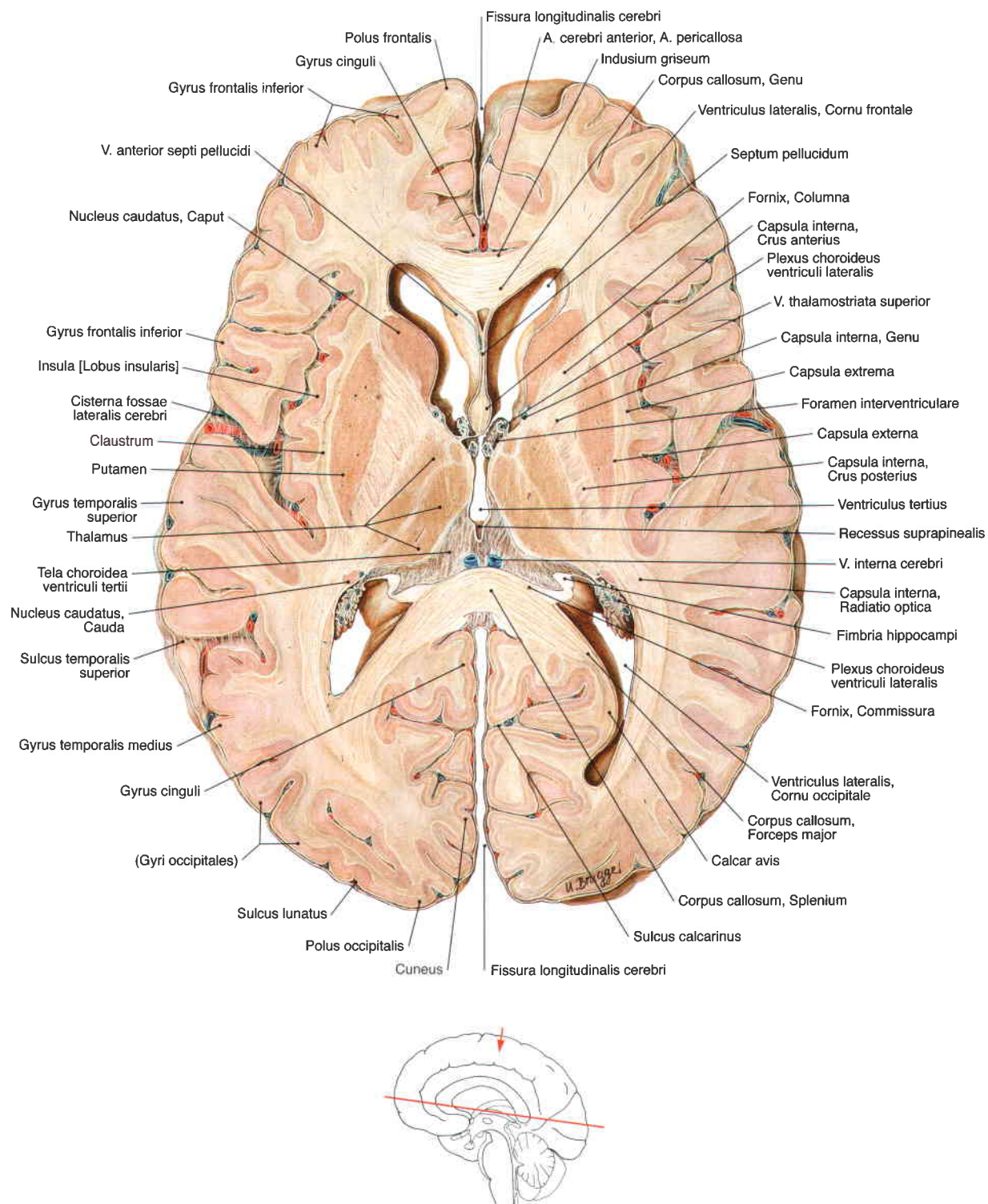


Fig. 589 Brain, Encephalon; horizontal section at the level of the upper part of the third ventricle.

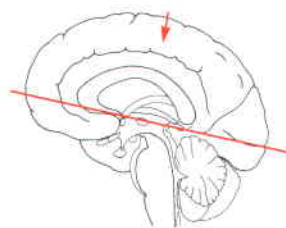
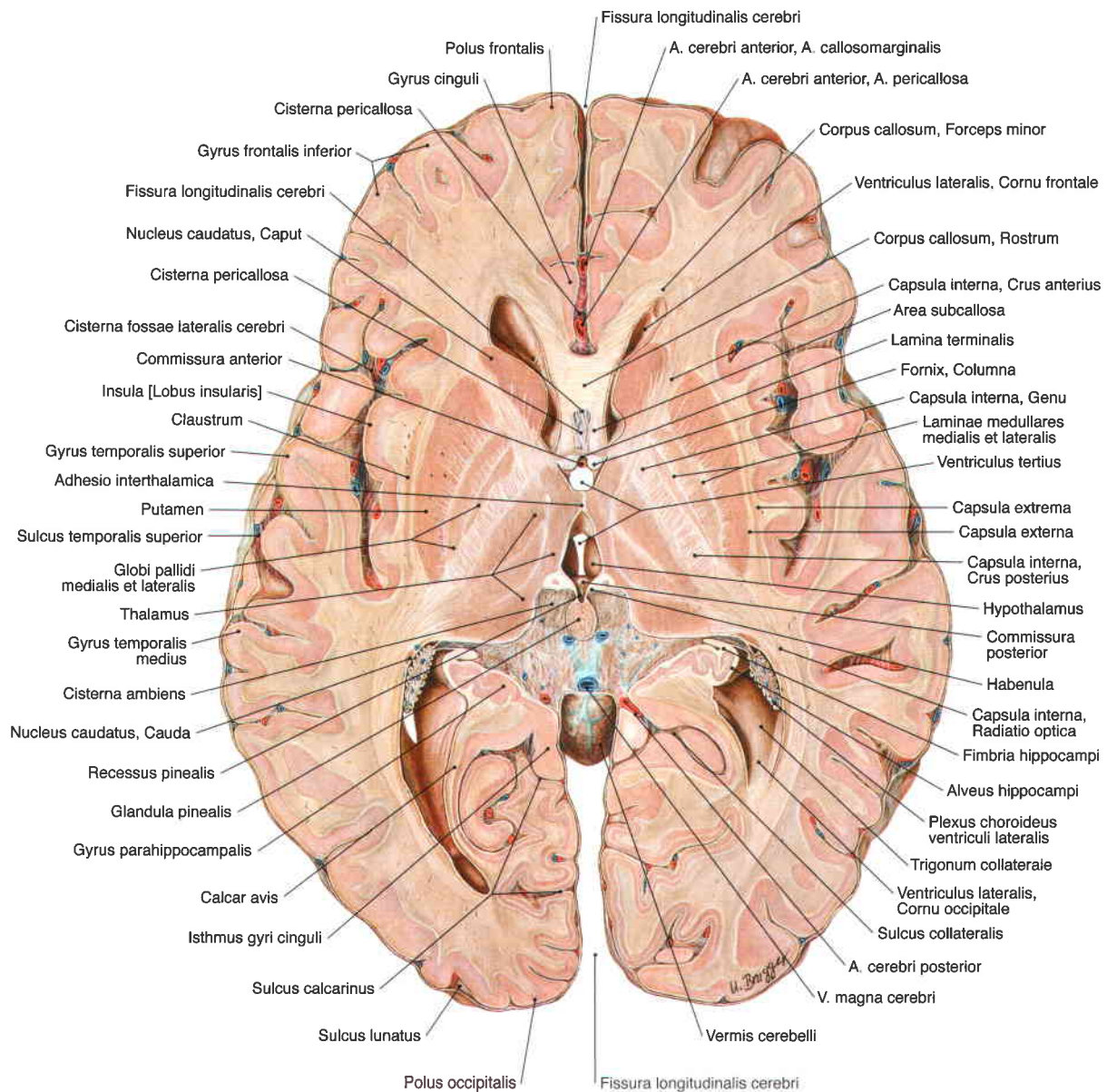
Brain, horizontal section

Fig. 590 Brain, Encephalon;
horizontal section through the centre of the third
ventricle at the level of the interthalamic adhesion.

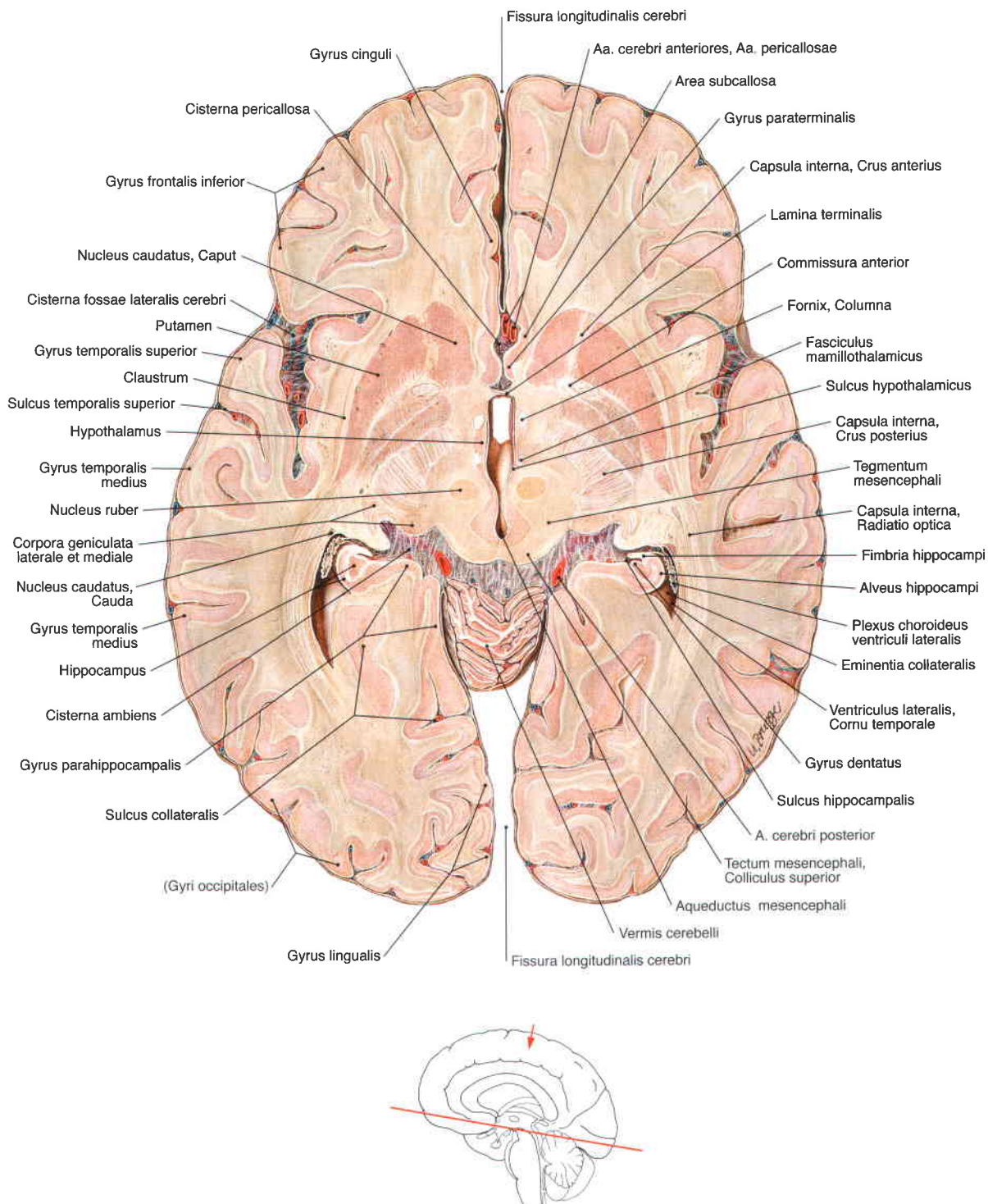


Fig. 591 Brain, Encephalon;
horizontal section through the third ventricle at the level
of the opening of the cerebral aqueduct.

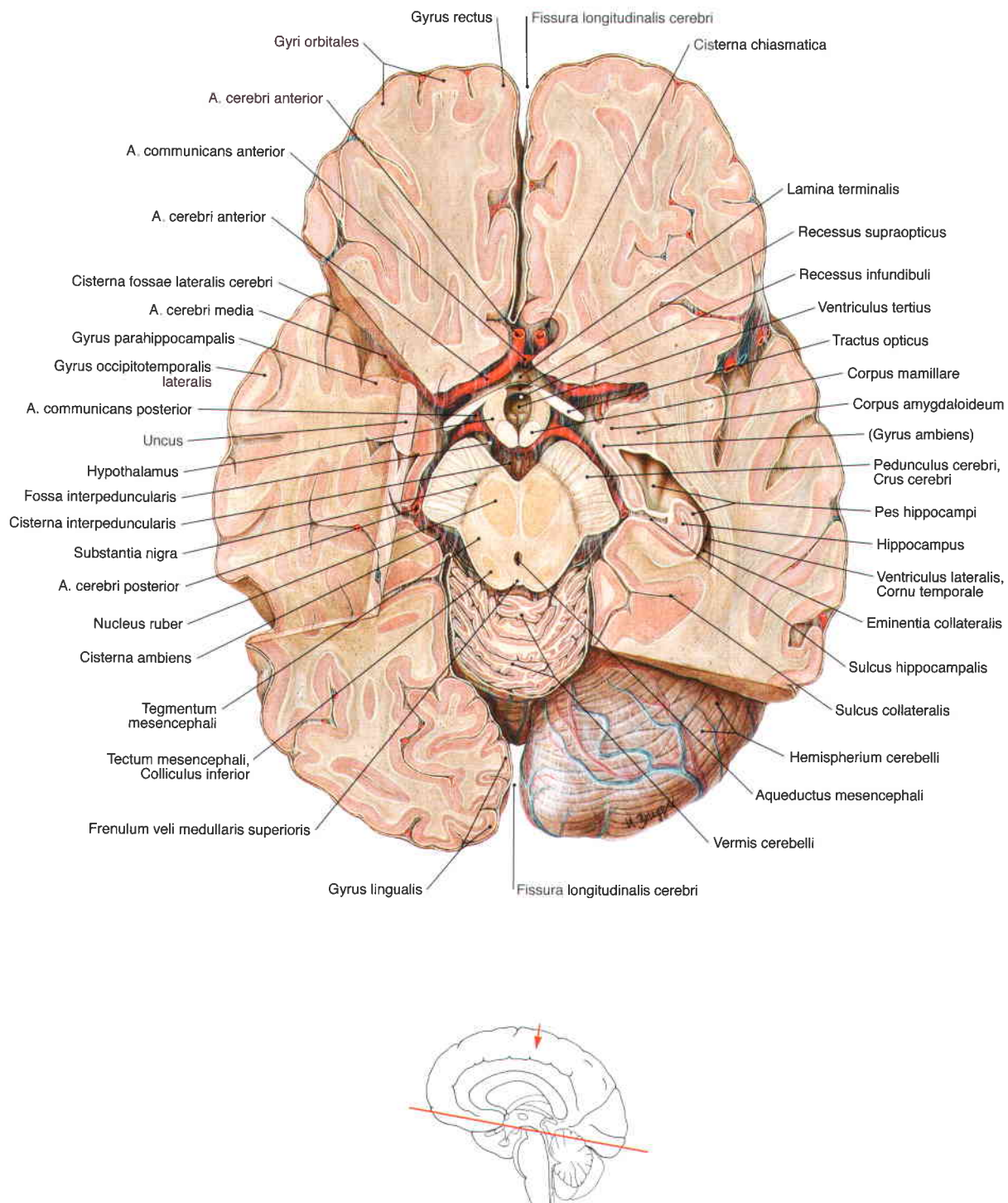
Brain, horizontal section

Fig. 592 Brain, Encephalon;
staggered horizontal section through the floor of the third
ventricle at the level of the mamillary bodies.

Brain, sagittal sections

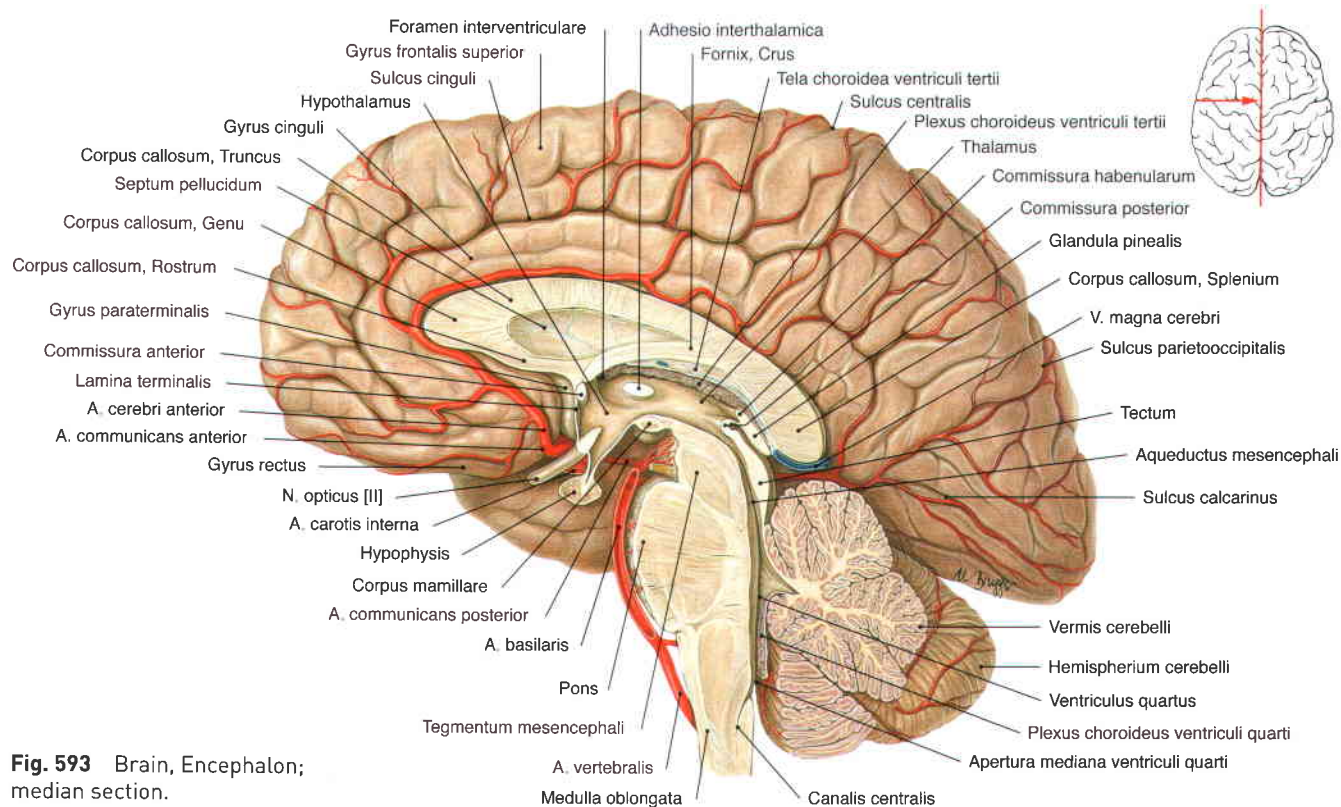


Fig. 593 Brain, Encephalon; median section.

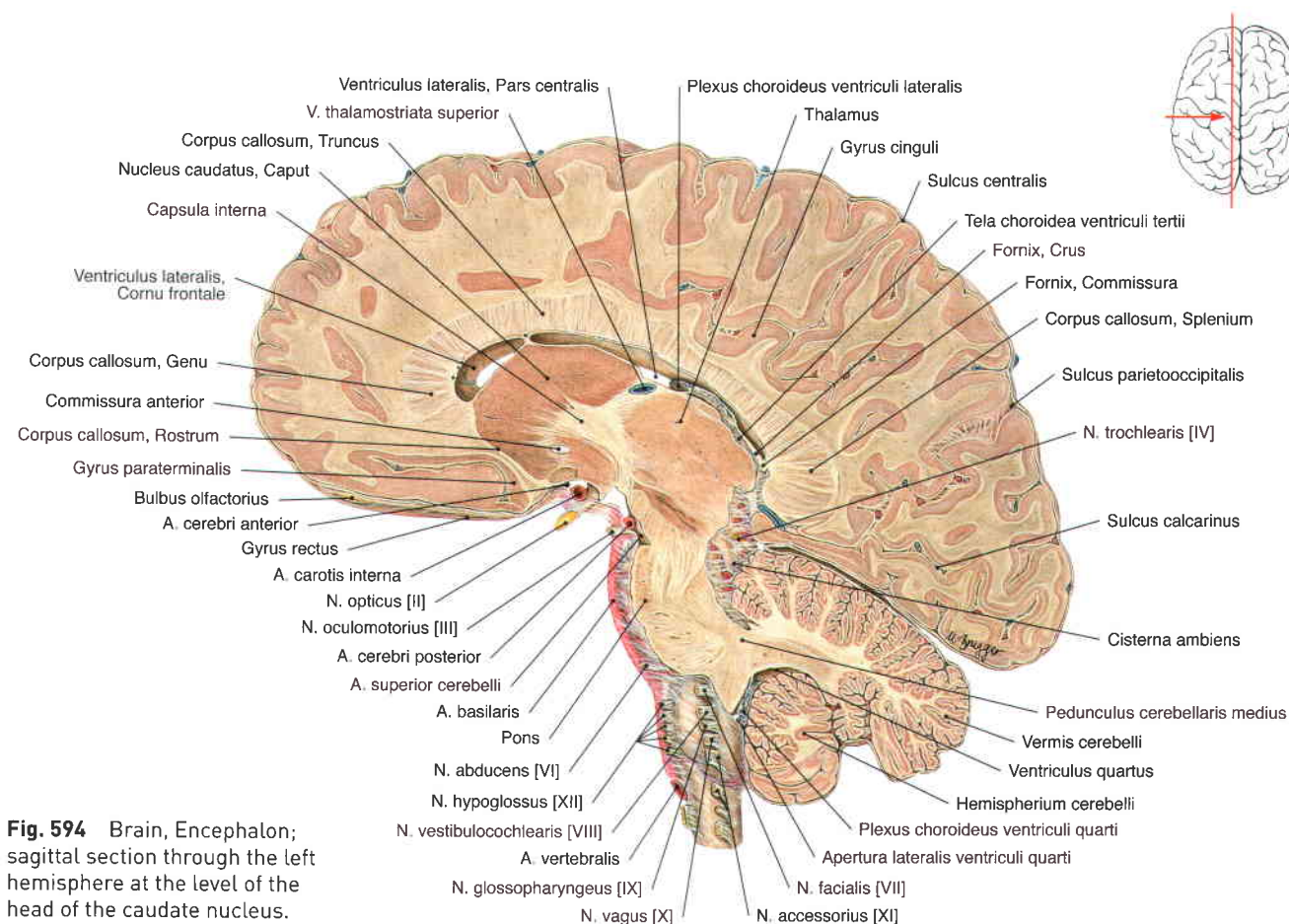


Fig. 594 Brain, Encephalon; sagittal section through the left hemisphere at the level of the head of the caudate nucleus.

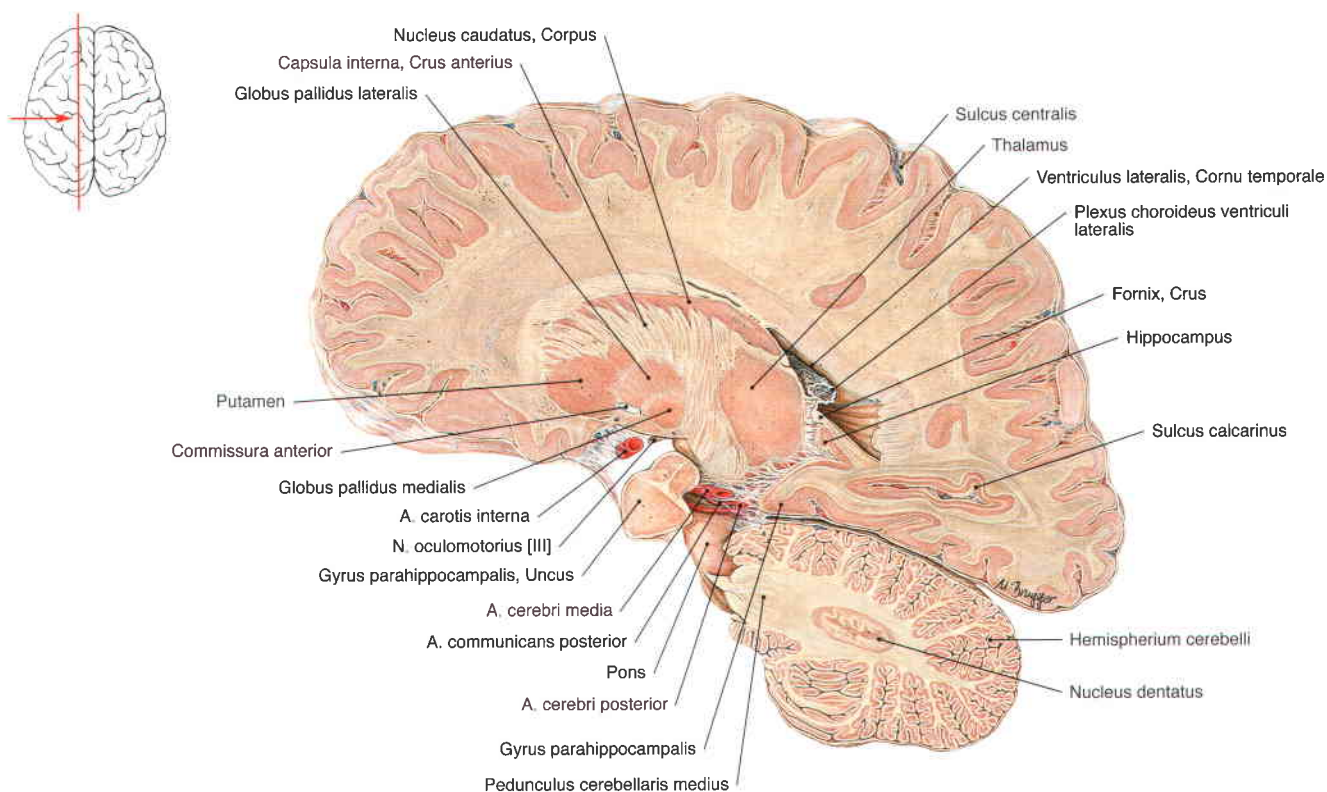
Brain, sagittal sections

Fig. 595 Brain, Encephalon; sagittal section through the left hemisphere at the level of the body of the caudate nucleus.

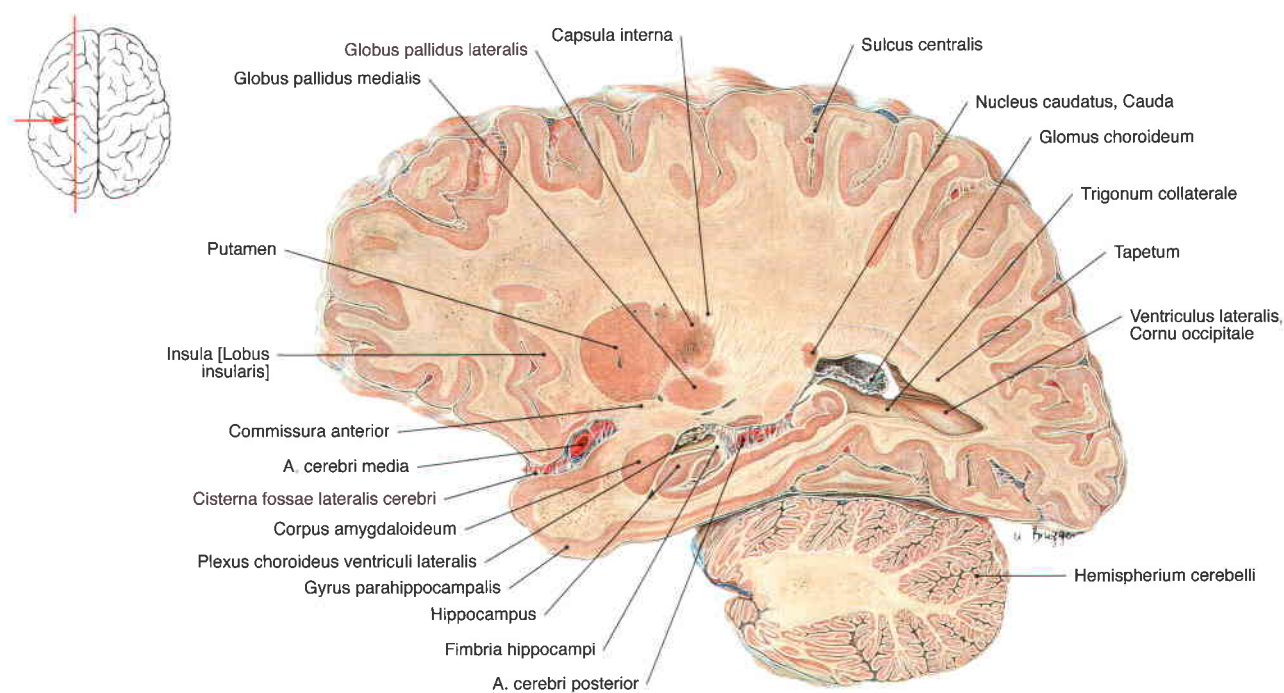


Fig. 596 Brain, Encephalon; sagittal section through the left hemisphere at the level of the amygdaloid body.

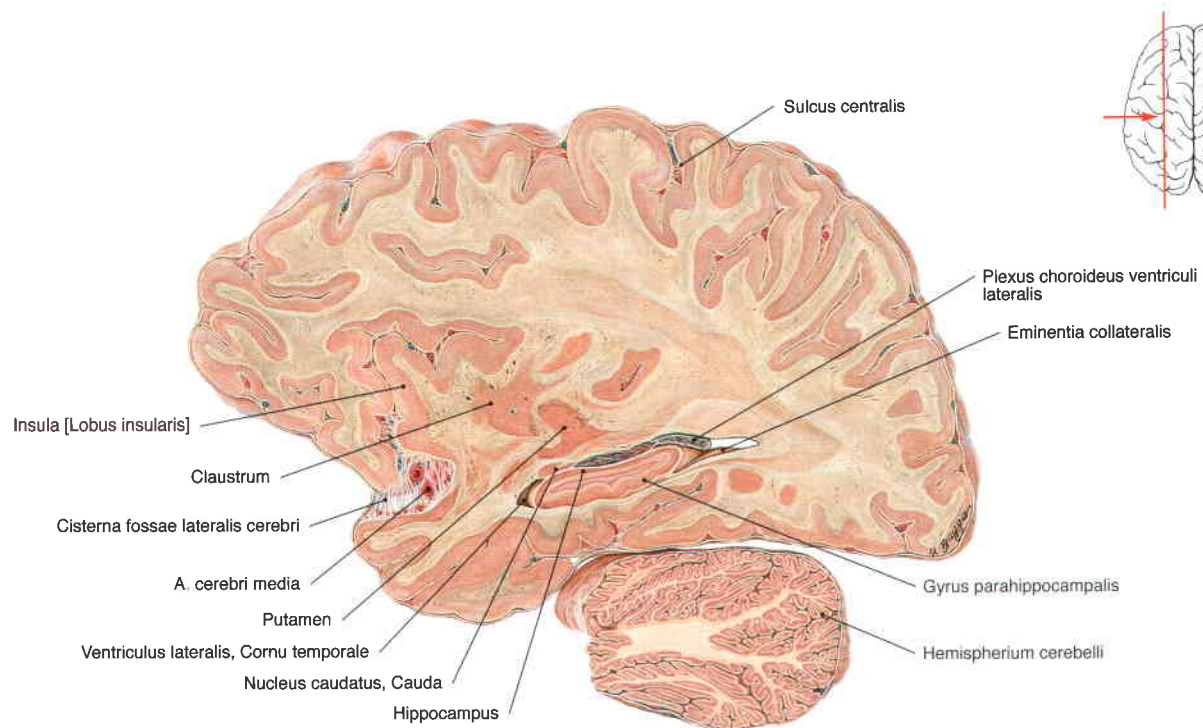


Fig. 597 Brain, Encephalon; sagittal section through the left hemisphere at the level of the apex of the temporal horn.

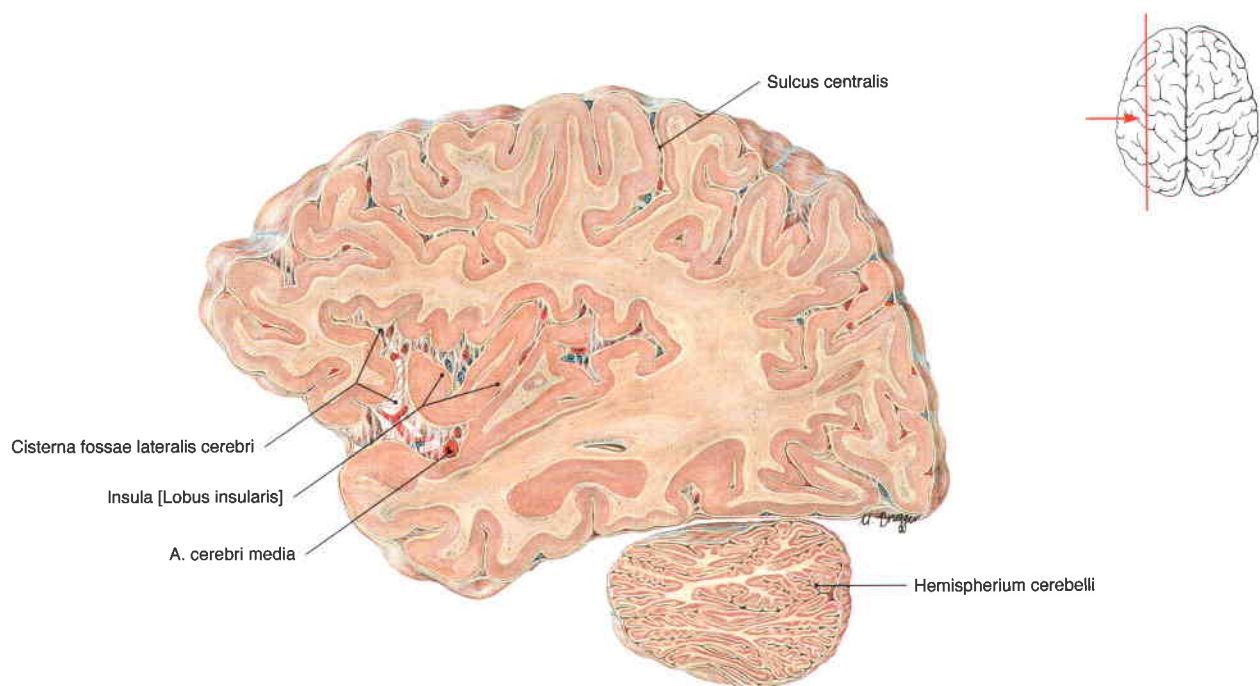


Fig. 598 Brain, Encephalon; sagittal section through the left hemisphere at the level of the insula.

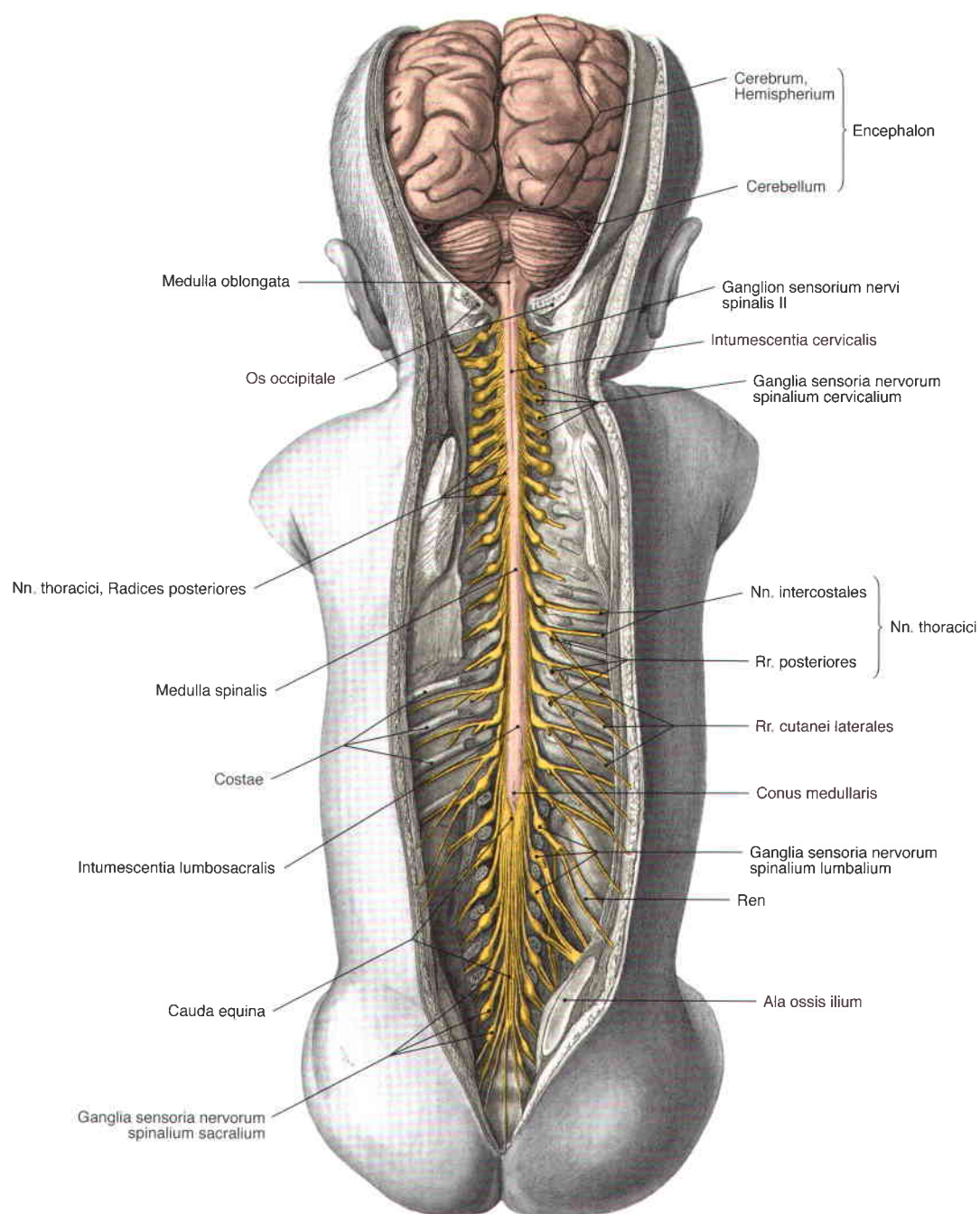
Situs of the spinal cord

Fig. 599 Brain, Encephalon; spinal cord, Medulla spinalis, and spinal nerves, Nn. spinales; brain and spinal nerves in a neonate. In the neonate, the spinal cord extends two vertebral segments further caudally compared to the adult.

Segmental structure of the spinal cord

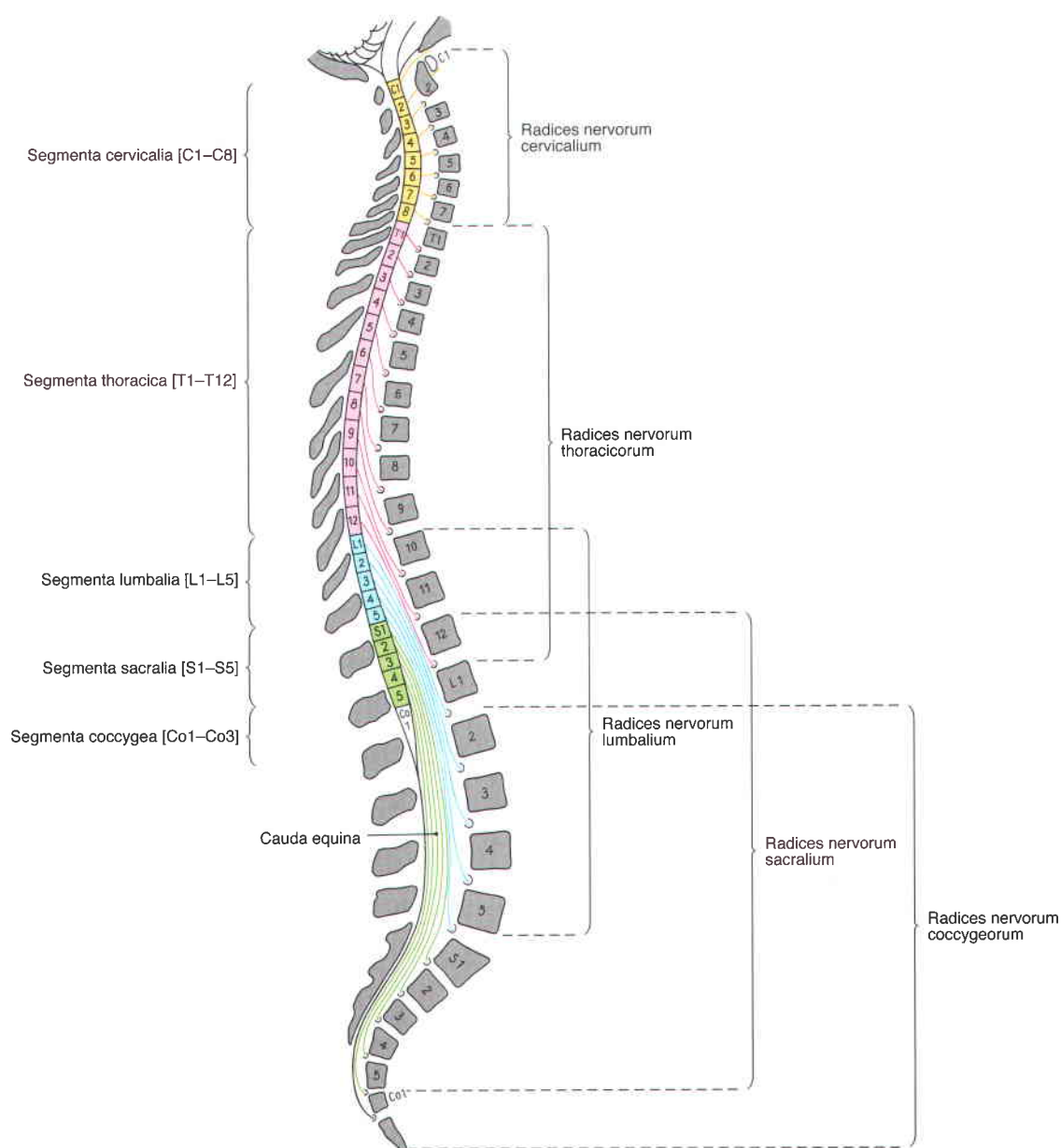


Fig. 600 Spinal cord segments, Segmenta medullae spinalis, and spinal nerve roots, Radices nervorum spinalium; schematic median section.

As the spinal cord does not follow the growth of the vertebral column, the course of the spinal roots towards their corresponding segmental intervertebral foramina becomes steeper from cranial to caudal. In the neonate, the spinal cord ends at the level of the spinous process of the fourth lumbar vertebra, whereas in the adult, it extends normally only to the second lumbar vertebra.

Spinal cord

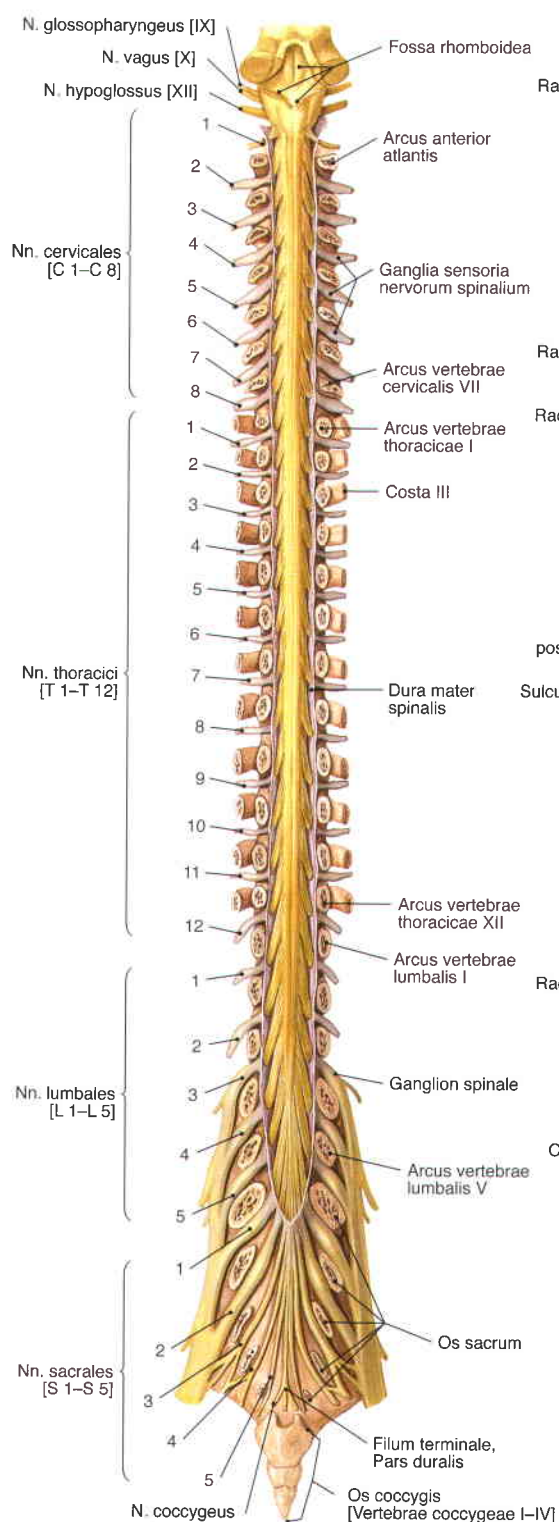


Fig. 601 Spinal cord, Medulla spinalis, and spinal nerves, Nn. spinales; situs of the spinal cord; dorsal view.

As spinal cord segments are numbered according to the spinal nerves, and the uppermost spinal nerve is counted as the first cervical nerve, there are actually eight cervical segments.

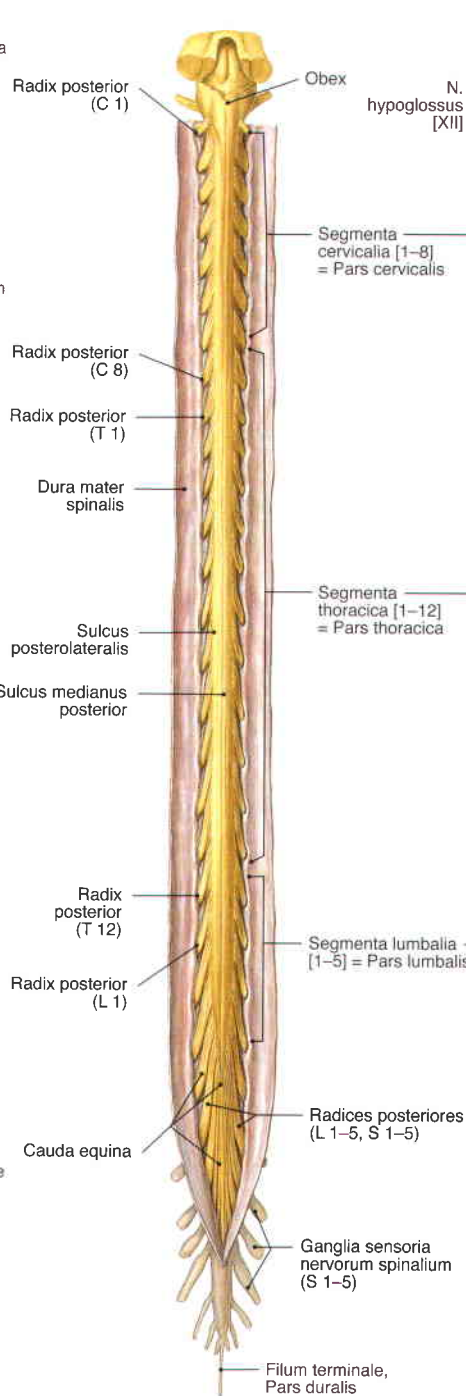


Fig. 602

Fig. 602 Spinal cord, Medulla spinalis, and spinal nerves, Nn. spinales; the spinal dura mater has been opened; dorsal view.

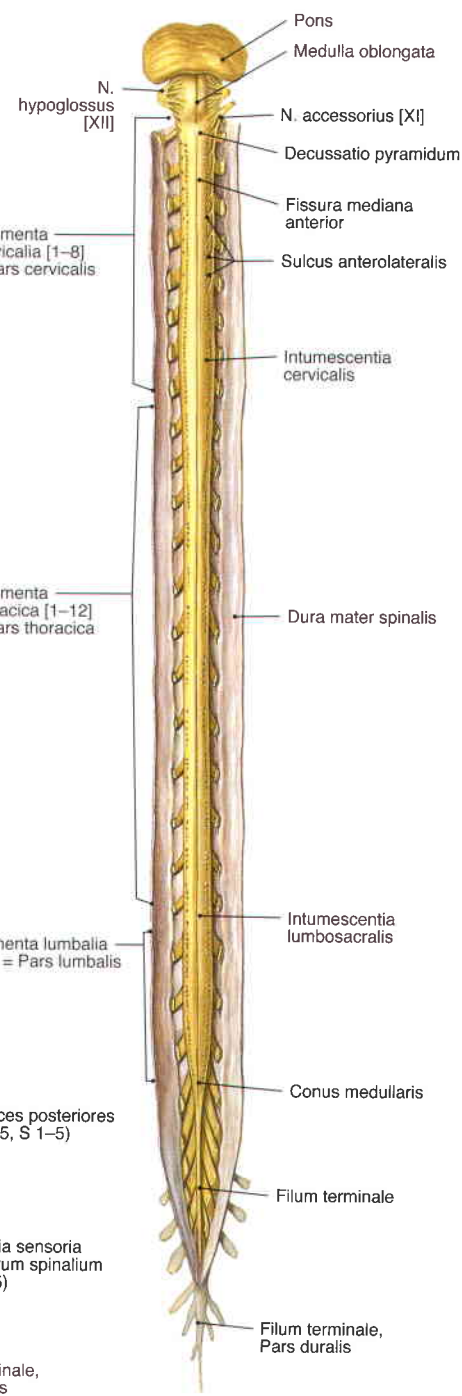


Fig. 603

Fig. 603 Spinal cord, Medulla spinalis, and spinal nerves, Nn. spinales; the spinal dura mater has been opened; ventral view.

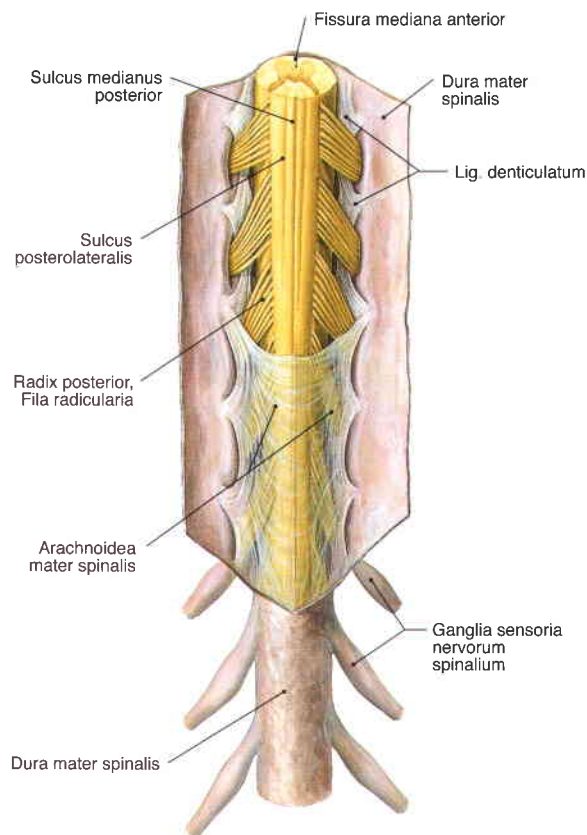


Fig. 604 Spinal cord, Medulla spinalis, and spinal meninges, Meninges spinales; dorsal view.

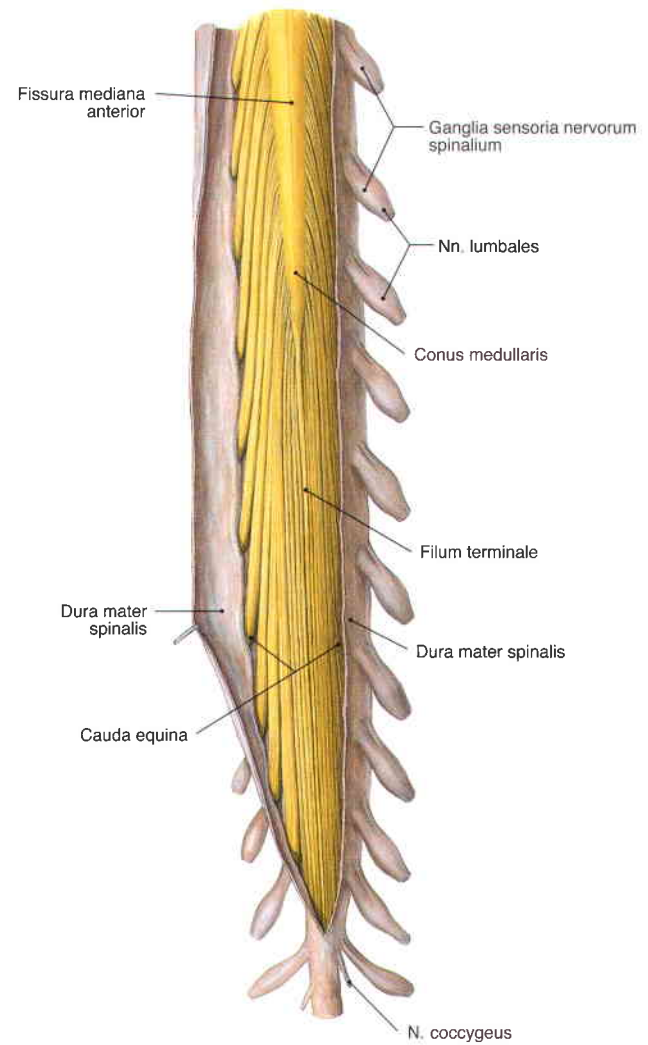


Fig. 605 Spinal cord, Medulla spinalis; caudal part with the cauda equina, Cauda equina; ventral view.

→ 818

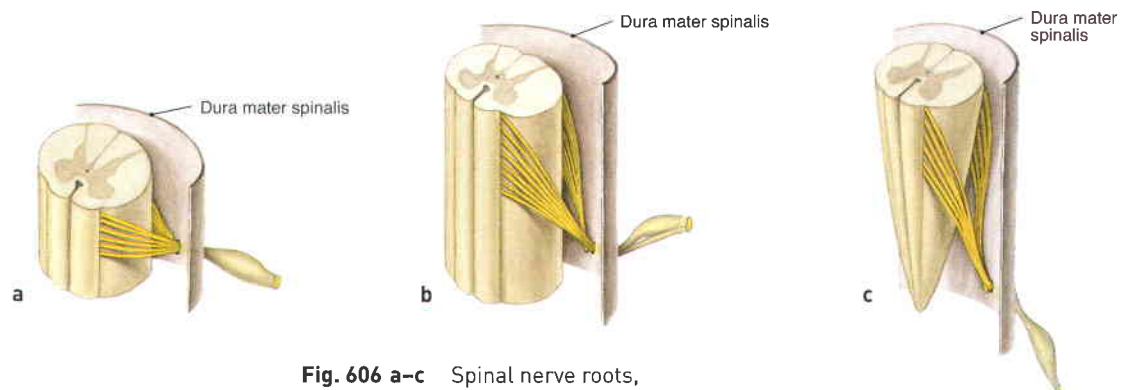
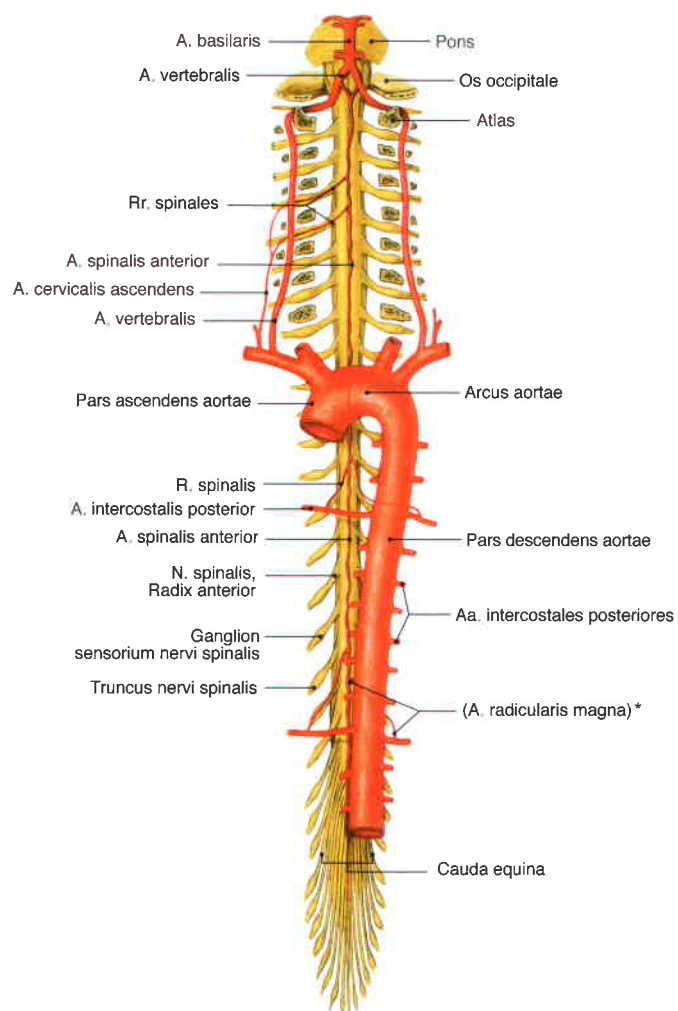
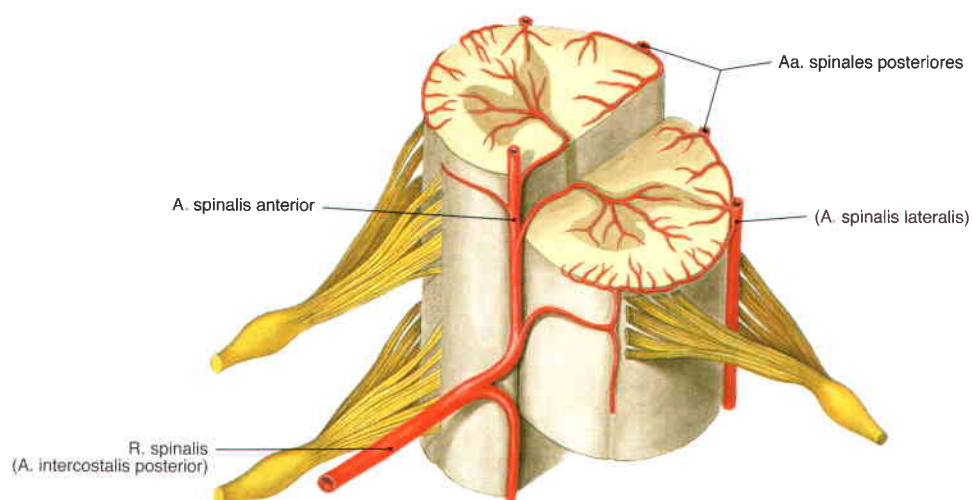
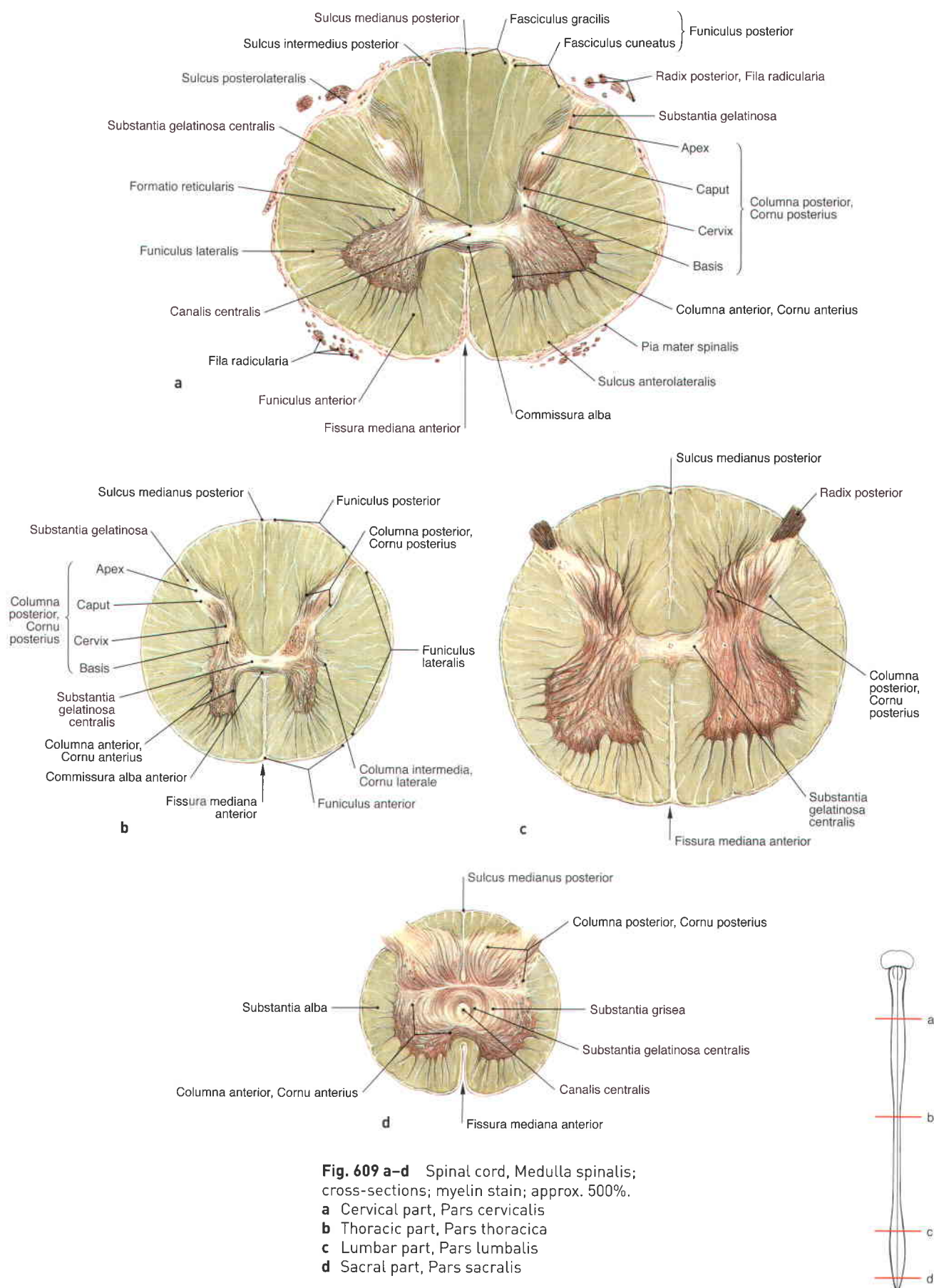


Fig. 606 a–c Spinal nerve roots, Nn. spinales, Radices; typical course within the subarachnoid space.
a Cervical segment, Segmentum cervicale
b Thoracic segment, Segmentum thoracicum
c Lumbar segment, Segmentum lumbale

Arteries of the spinal cord**Fig. 607** Arteries of the spinal cord, Medulla spinalis.

* Clinical term: artery of ADAMKIEWICZ

**Fig. 608** Arteries of the spinal cord, Medulla spinalis.



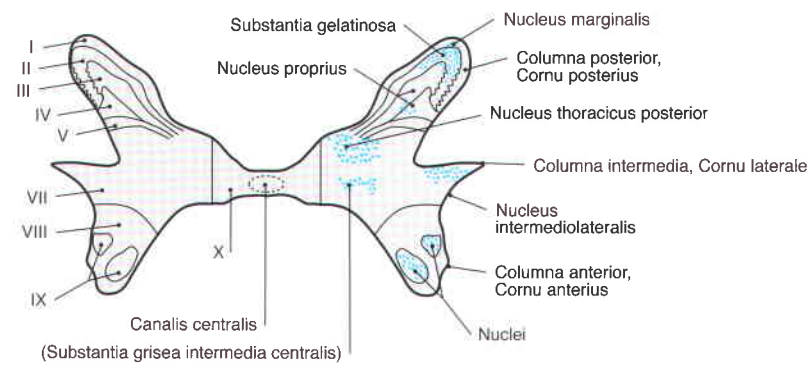
Functional organisation of the spinal cord

Fig. 610 Spinal cord, Medulla spinalis; laminar organisation of the grey matter according to its cytoarchitecture (according to REXED, 1952), exemplified by the tenth thoracic segment (T10). Formation and number of the laminae vary in different spinal cord segments.

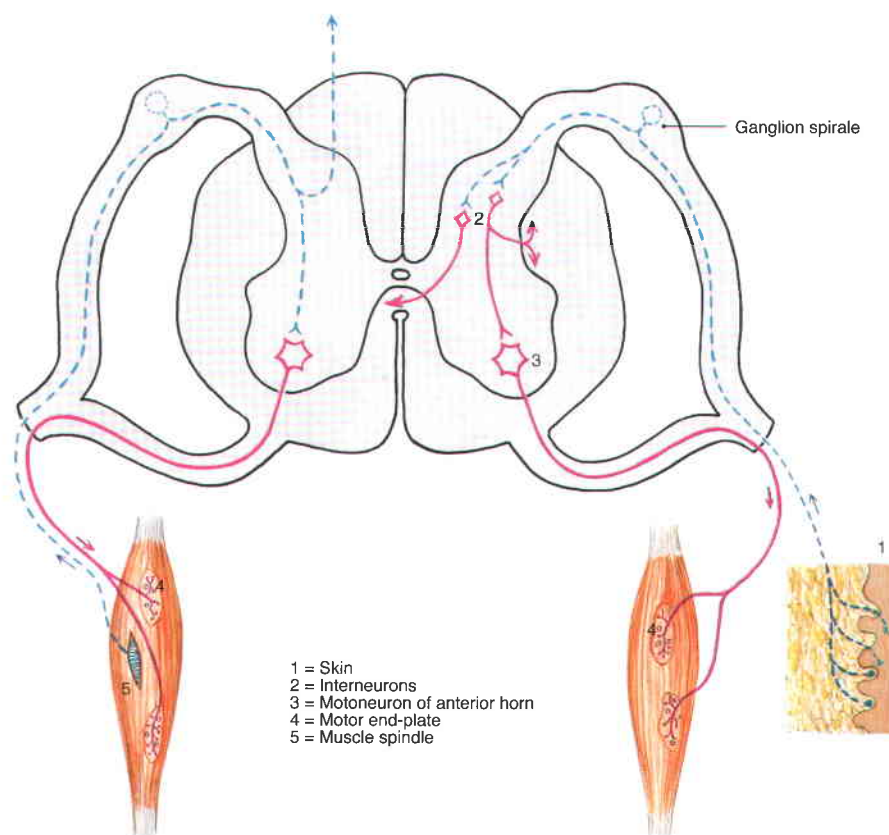


Fig. 611 Reflexes at the spinal cord; left: monosynaptic reflex (bireuronal, proprioceptive, myostatic, e.g., patellar tendon reflex, Achilles tendon reflex, etc.); right: polysynaptic reflex (polyneuronal, e.g., abdominal reflex, cremasteric reflex, plantar reflex, etc.).

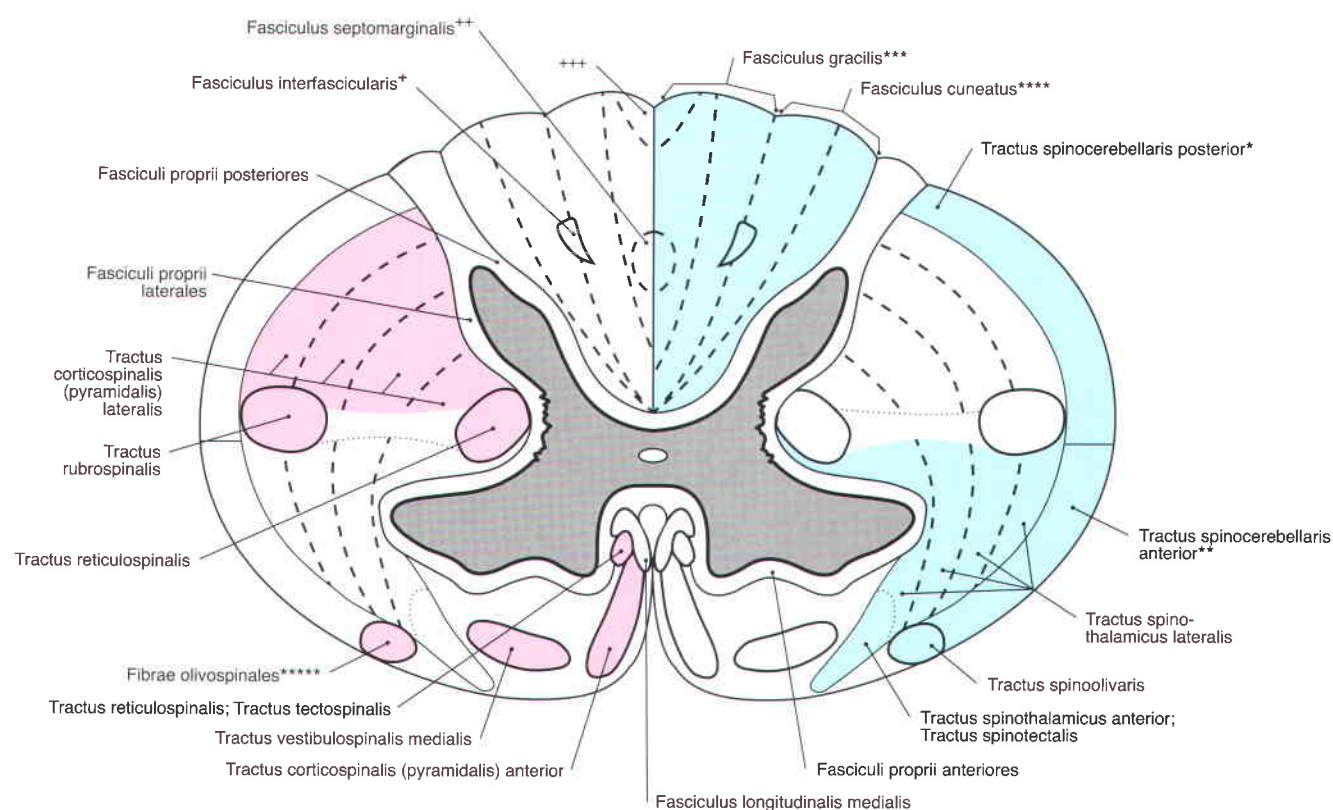


Fig. 612 Spinal cord, Medulla spinalis; schematic organisation of the white matter exemplified by a lower cervical segment.

Afferent (= ascending) pathways in blue; efferent (= descending) pathways in red.

- * Clinical term: FLECHSIG's tract
- ** Clinical term: GOWER's tract
- *** Clinical term: GOLL's tract
- **** Clinical term: BURDACH's tract
- ***** The actual existence of these fibres has not definitely been documented.

The regions indicated by +, ++, and +++ designate descending collateral tracts of the posterior fasciculi.

- + SCHULTZE's comma tract (cervical part)
- ++ FLECHSIG's oval bundle (thoracic part)
- +++ Triangle of PHILIPPE-GOMBAULT (lumbar and sacral parts)

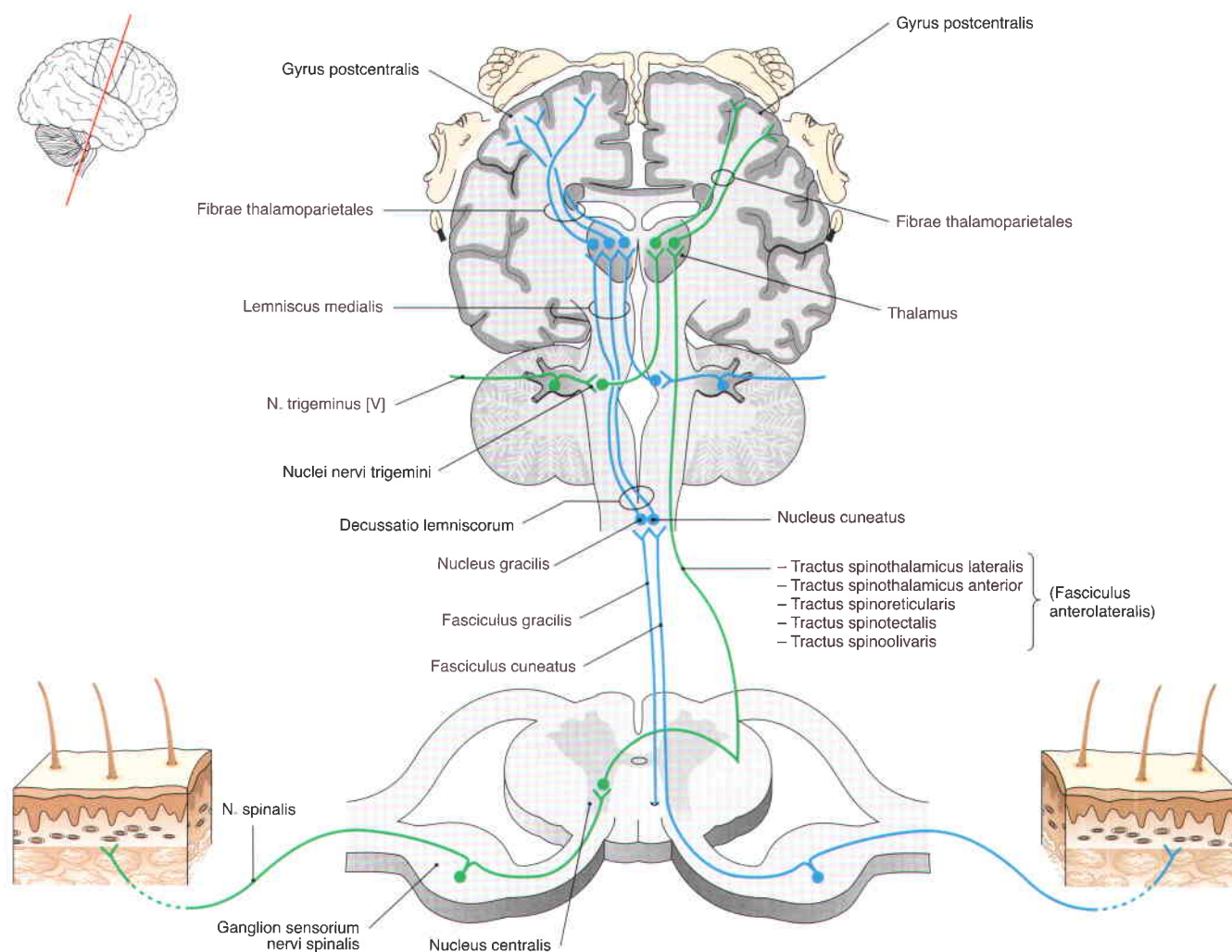
Pathways of the spinal cord

Fig. 613 Pathways for epicritic (blue) and protopathic (green) sensibility.

Ascending pathways

Pathway for epicritic sensibility (tactile pathway)

(Precise differentiation of pressure and touch)

1. neuron (uncrossed)
From receptors (exteroceptors) in the skin and the mucosa, as well as the periosteum, the joints and the muscle spindles etc., to the cuneate and gracile nucleus in the medulla oblongata: gracile and cuneate fasciculus (perikarya in the spinal ganglia): descending collaterals (see Fig. 612).
2. neuron (crossed)
From the medulla oblongata (cuneate and gracile nucleus) to the thalamus (medial lemniscus, perikarya in the cuneate and gracile nucleus).
3. neuron (uncrossed) From the thalamus to the cerebral cortex, particularly to the postcentral gyrus (thalamocortical fibres, perikarya in the thalamus).

Pathway for protopathic sensibility (pain pathway)

(Pain, temperature, general pressure sensation)

1. neuron (uncrossed)
From receptors (exteroceptors) of the skin and the mucosa etc., to the posterior horn, laminae I–V (perikarya in the spinal ganglia).
2. neuron (crossed, some fibres possibly uncrossed)
From the posterior horn to the thalamus, in the reticular formation and to the midbrain tectum (anterior and lateral spinothalamic tracts, spinoreticular tract, spinotectal tract; perikarya in the posterior column).
3. neuron (uncrossed)
From the thalamus among others to the cerebral cortex, particularly to the postcentral gyrus (thalamocortical fibres, perikarya in the thalamus).

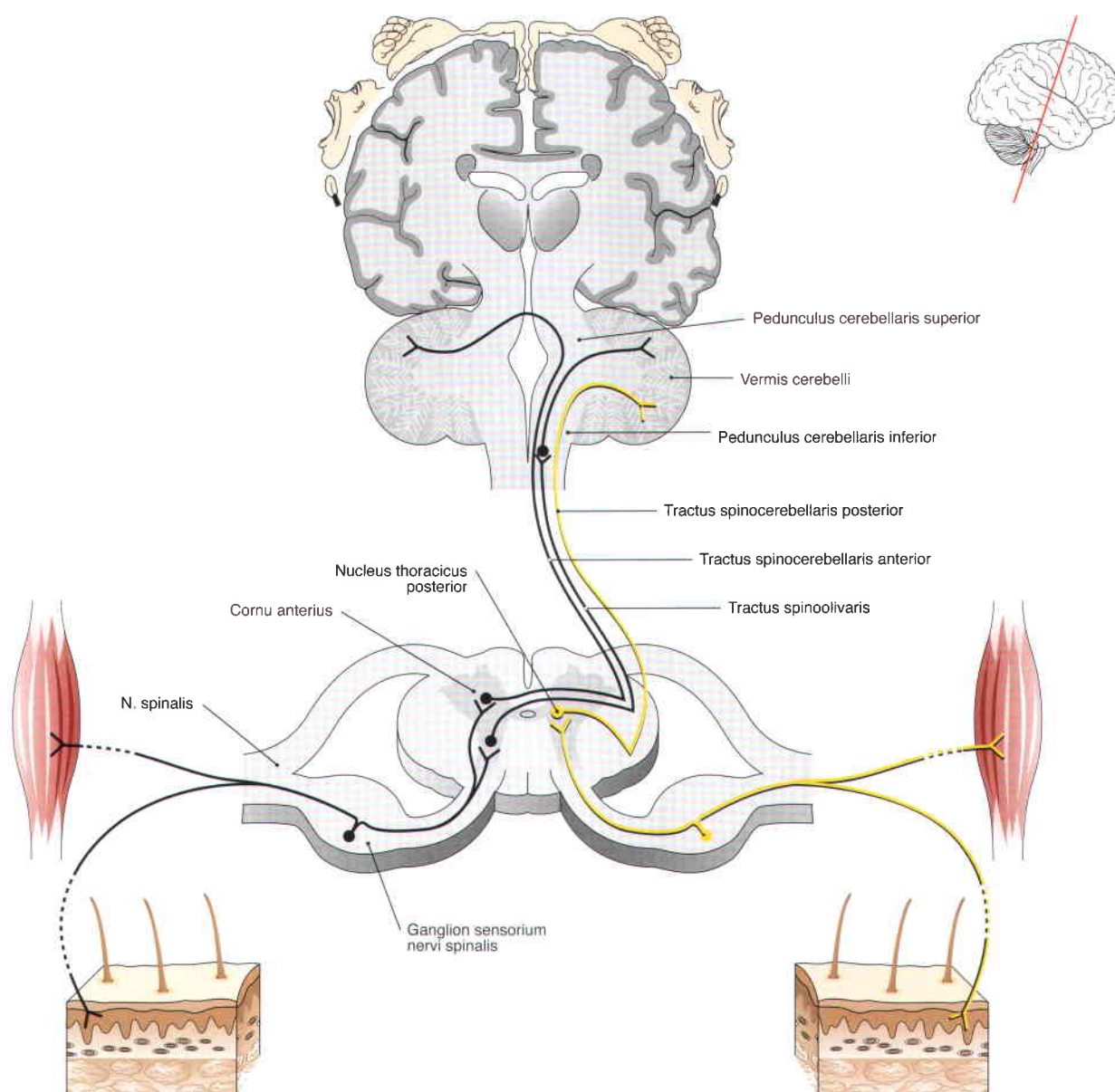


Fig. 614 Pathways for unconscious deep sensibility.

Ascending pathways

Pathway for unconscious deep sensibility

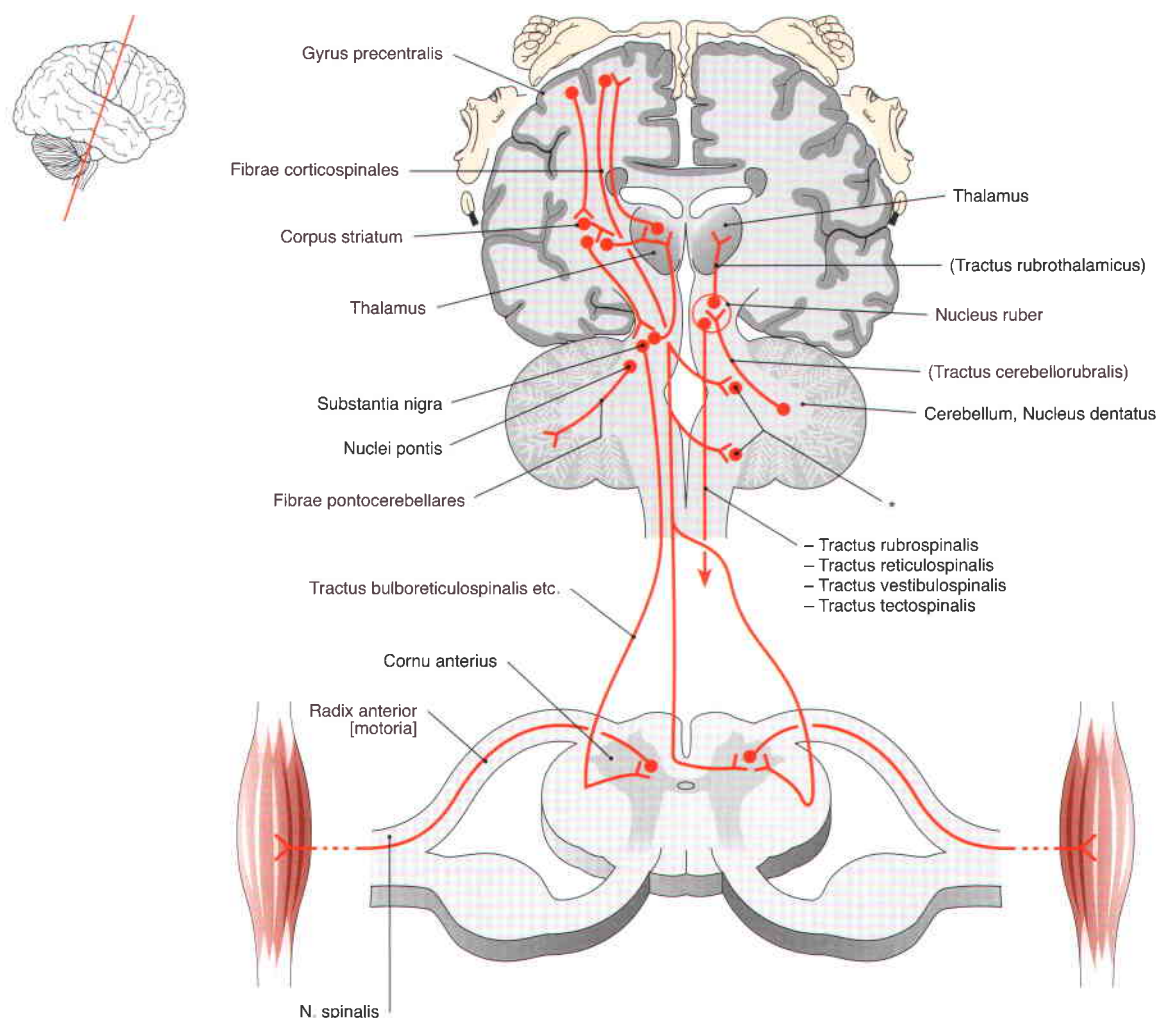
(Unconscious, but precise spatial differentiation as a prerequisite for movement coordination by the cerebellum)

Via the anterior cerebellar tract

1. neuron (uncrossed)
From receptors (proprioceptors) in muscles, tendons, and the connective tissue to the nuclei of the intermediate zone and the anterior column (perikarya in the spinal ganglia).
2. neuron (crossed)
From the anterior horn within the anterior spinocerebellar tract of the anterolateral tract to the cerebellum via the superior cerebellar peduncle (perikarya in the intermediate zone and the anterior horn).

Via the posterior cerebellar tract

1. neuron (uncrossed)
From end organs (proprioceptors) in muscles, tendons, and the connective tissue to the nuclei of the posterior column and the thoracic nucleus (perikarya in the spinal ganglia).
2. neuron (uncrossed)
From the posterior horn and the thoracic nucleus within the posterior spinocerebellar tract of the lateral tract to the cerebellum via the inferior cerebellar peduncle (perikarya in the thoracic nucleus and at the base of the posterior column).

Pathways of the spinal cord**Fig. 615** Pathways of the motor system.

* Motor nuclei of cranial nerves

Descending pathways

The motor system comprises a large number of nuclear regions and tracts. The "motor final path" are the motoneurons. Despite the extraordinary complexity of these circuits, the traditional organisation will be maintained for didactic reasons. (So-called) Pyramidal tract

1. (central) neuron (crossed)

From the cerebral cortex through the internal capsule and the cerebral peduncles to interneurons within the anterior and posterior column (lateral corticospinal tract, anterior corticospinal tract, perikarya in the precentral gyrus). Branching off of fibres to the nuclei of the cranial nerves (corticonuclear fibres and bulbar corticonuclear fibres).

2. (peripheral) neuron (motor end pathway, α -motoneurons)

From the anterior horn to the motor end plates of the skeletal musculature (motoneurons, perikarya in the anterior horn).

(So-called) Extrapyrarnidal motor system

1. central neurons (crossed and uncrossed)

From the cerebral cortex, particularly the precentral gyrus and the adjacent cortical areas including synapses to the basal ganglia, thalamus, subthalamic nucleus, red nucleus, substantia nigra, cerebellum, etc. and feedback loops to the interneurons of the anterior column (rubrospinal tract, medial and lateral vestibulospinal tract, reticulospinal tract, tectospinal tract).

2. peripheral neuron (motor end pathway, α -motoneurons)

From the anterior horn to the motor end-plates of the skeletal muscles (motoneurons; perikarya in the anterior horn).

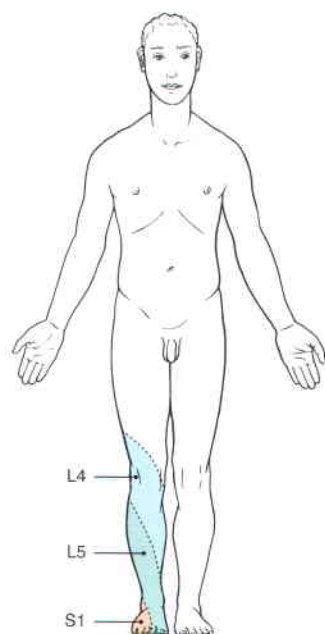


Fig. 616 Dysfunctional cutaneous innervation due to palsy of certain, frequently affected spinal nerves.



Fig. 617 Complete paraplegia at the level of the eleventh thoracic segment. Paralysis of the complete motor and sensory system.

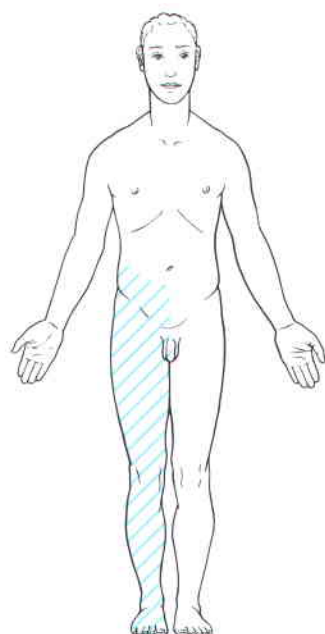


Fig. 618 Paralysis of the tracts of the right posterior funiculus at the level of the eleventh thoracic segment. Loss of fine tactile sensation as well as loss of sense of position and vibration [rough touch sensation remains functional].

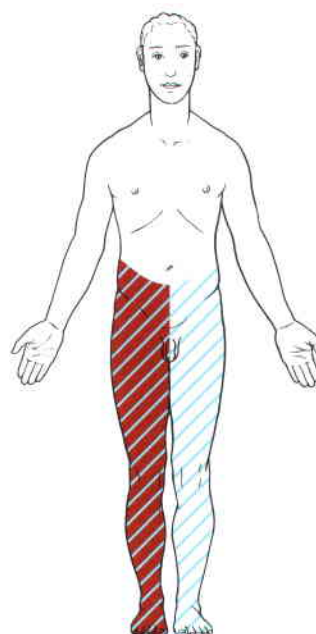


Fig. 619 Hemiplegia (BROWN-SÉQUARD) due to disruption of the half of the spinal cord on the right side at the level of the eleventh thoracic segment. On the right side (ipsilaterally): loss of motor function (initially flaccid, later spastic); loss of fine tactile sensation as well as loss of sense of position and vibration (rough touch sensation remains functional). On the left side (contralaterally): loss of pain and temperature sensation.

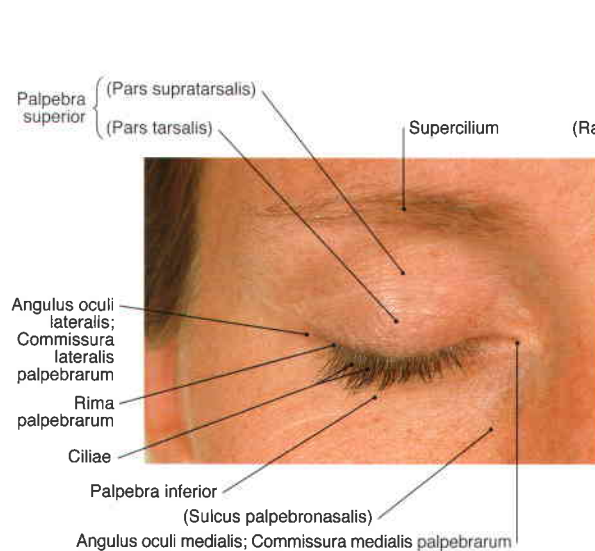


Fig. 620 Eyelids, Palpebrae.

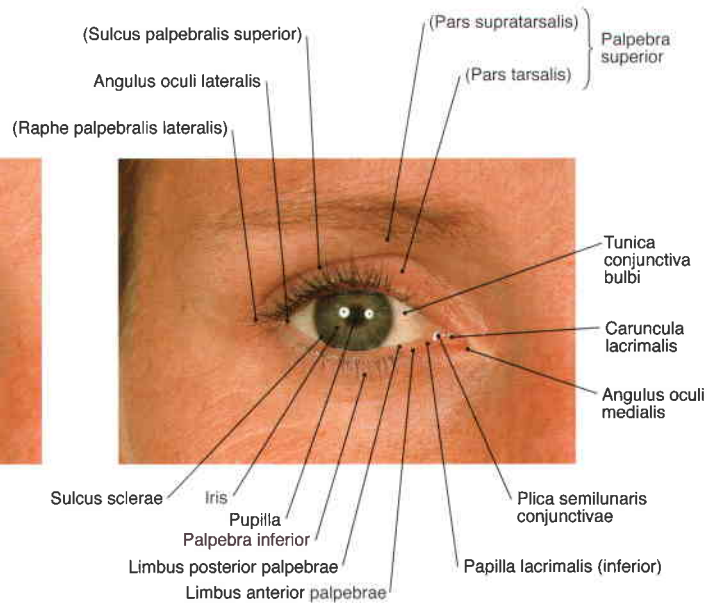


Fig. 621 Eye, Oculus, and eyelids, Palpebrae.

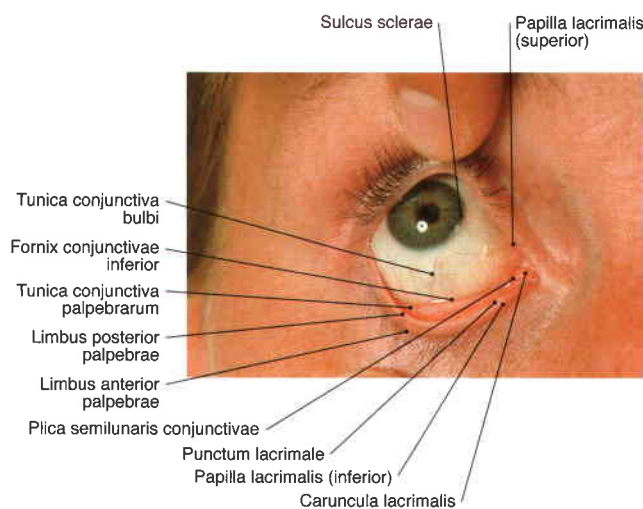


Fig. 622 Eye, Oculus, and eyelids, Palpebrae.

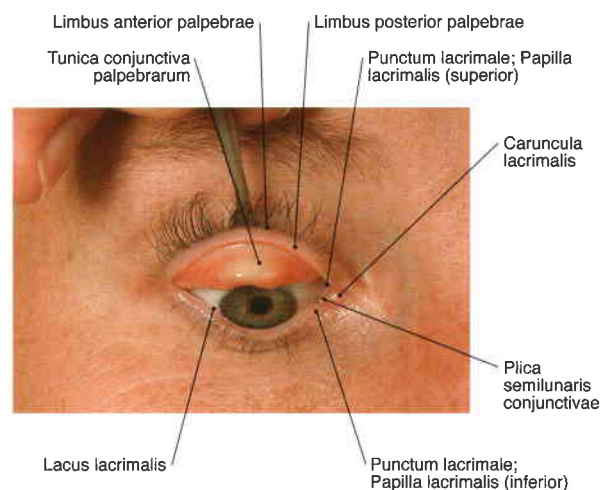


Fig. 623 Eye, Oculus, and eyelids, Palpebrae.
 Eversion of the upper eyelid (extropionisation) is hindered by the stiffness of the tarsus, but can be facilitated with the aid of a small hook.

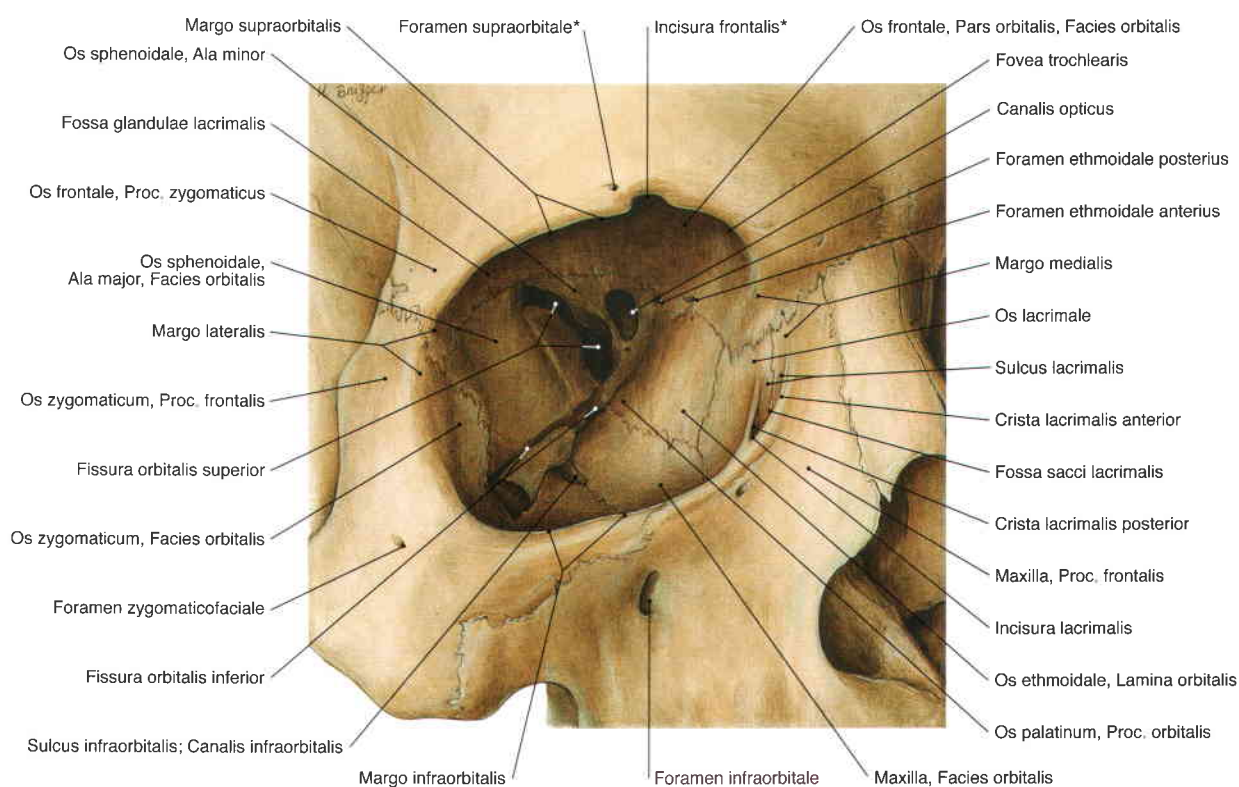


Fig. 624 Orbit, Orbita; oblique view from lateral.

* These structures can be present as foramina or notches.

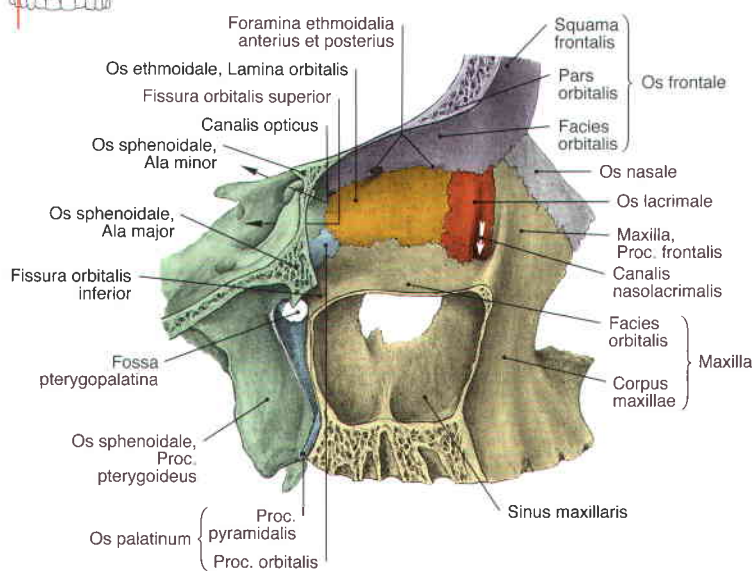
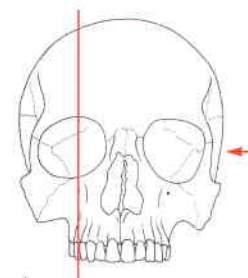
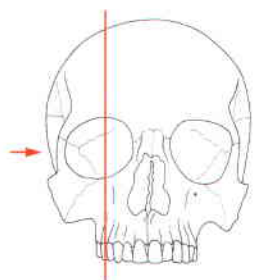


Fig. 625 Medial wall, Paries medialis, of the orbit, Orbita; lateral view.

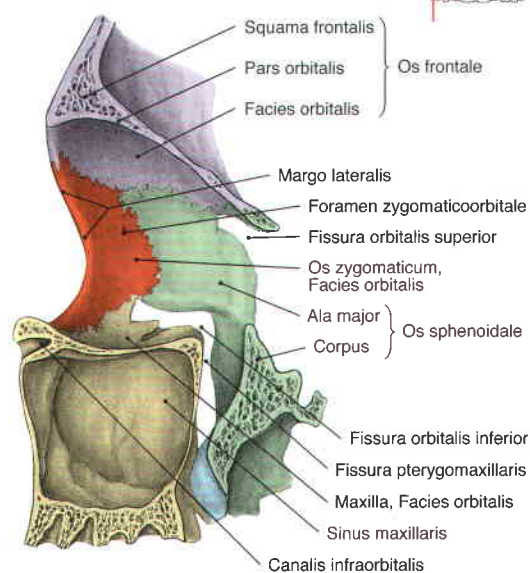
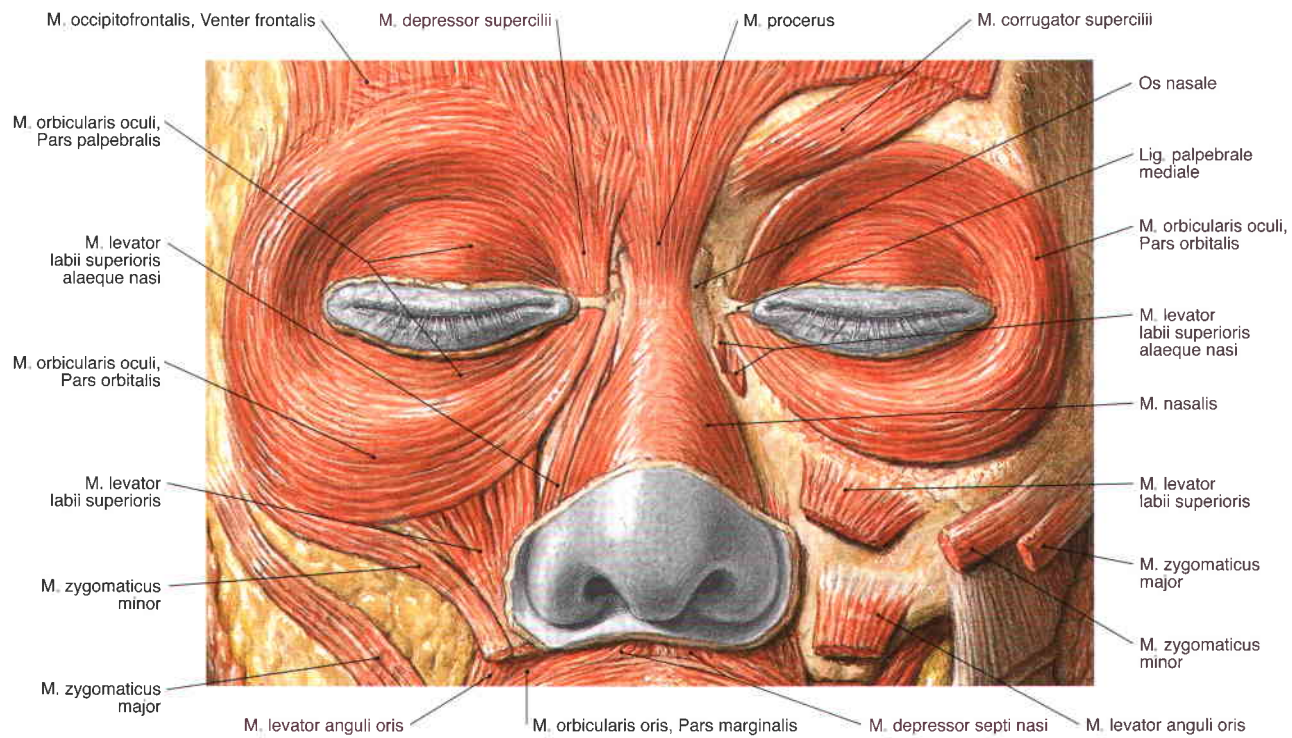
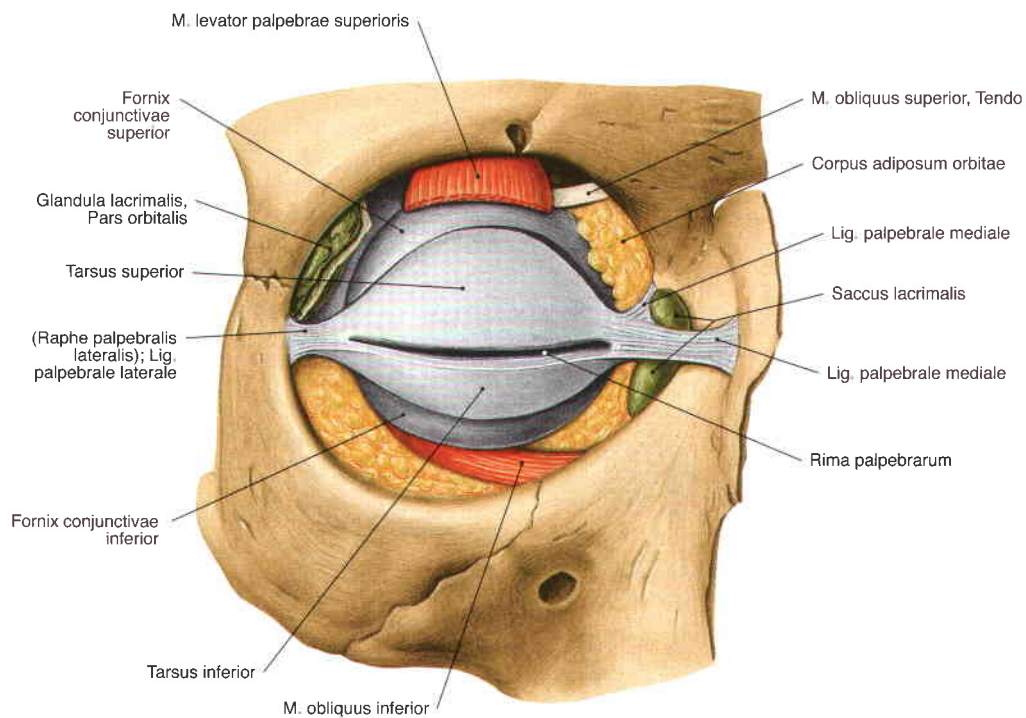


Fig. 626 Lateral wall, Paries lateralis, of the orbit, Orbita; medial view.

Eyelids

→ 119, 120, T 1 a, c, d, e

Fig. 627 Facial muscles, Mm. faciei.**Fig. 628** Orbital opening, Aditus orbitalis, with eyelids, Palpebrae.

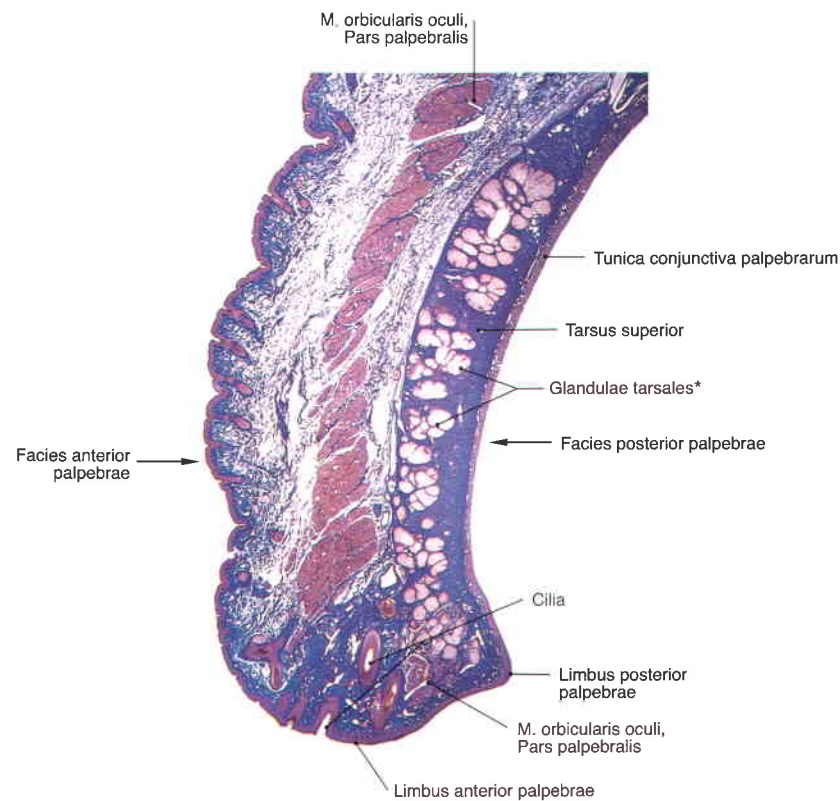


Fig. 629 Upper eyelid, Palpebra superior; photograph of a microscopic specimen; azan stain; sagittal section, magnified.
* Clinical term: MEIBOMian glands

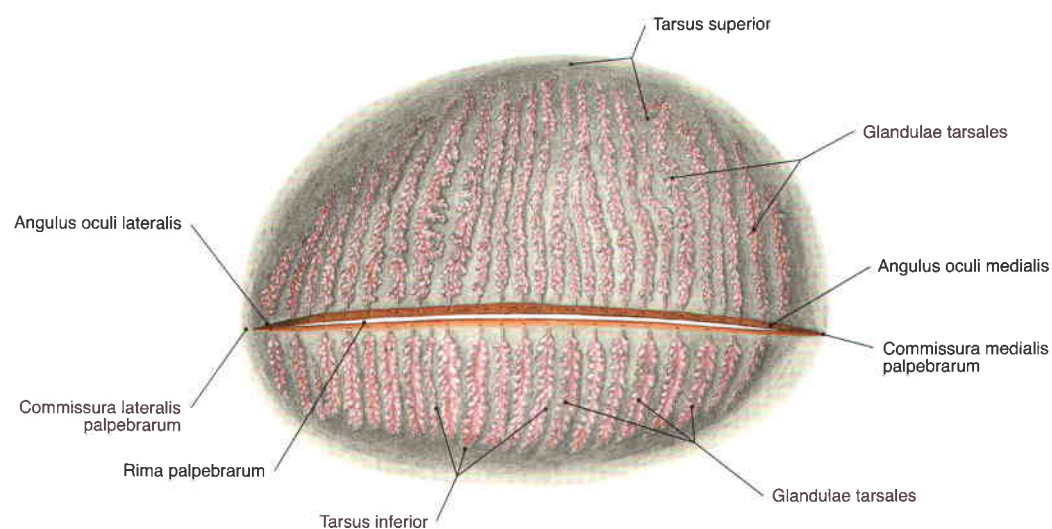


Fig. 630 Eyelids, Palpebrae; translucent specimen illustrating the excretory ductules of the tarsal glands; posterior view.

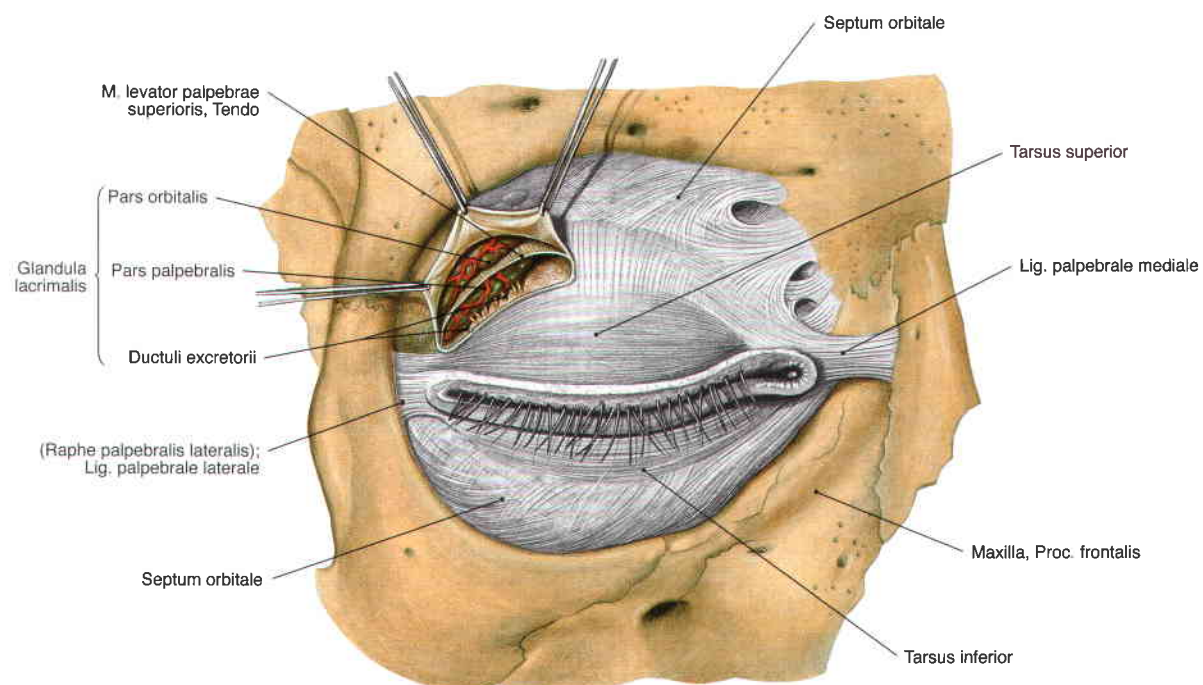
Lacrimal apparatus

Fig. 631 Orbital opening, Aditus orbitalis, with eyelids, Palpebrae, and lacrimal gland, Glandula lacrimalis.

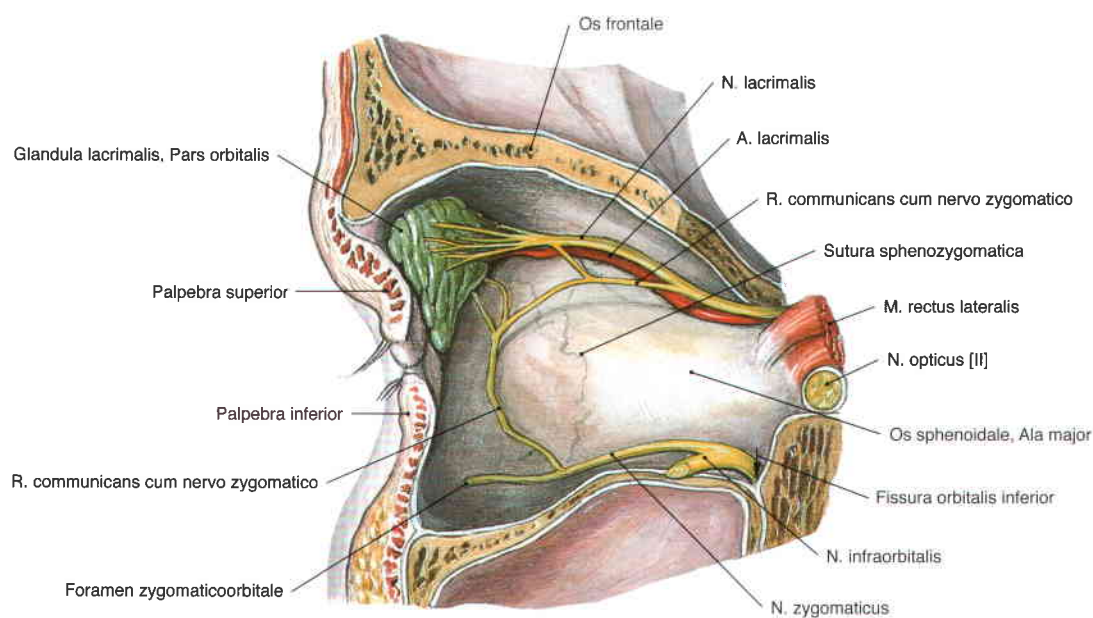


Fig. 632 Innervation of the lacrimal gland, Glandula lacrimalis; medial view.

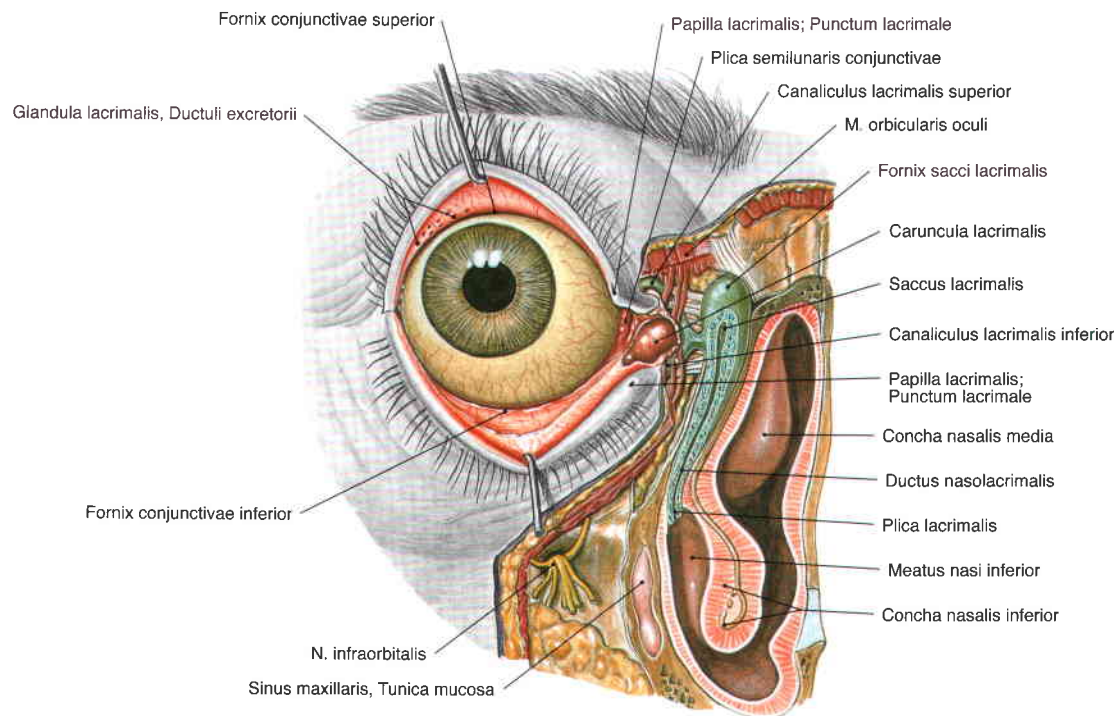
Lacrimal apparatus

Fig. 633 Lacrimal apparatus, Apparatus lacrimalis; the eyelids have been pulled away from the eyeball; the nasolacrimal duct has been opened up to the inferior nasal meatus.

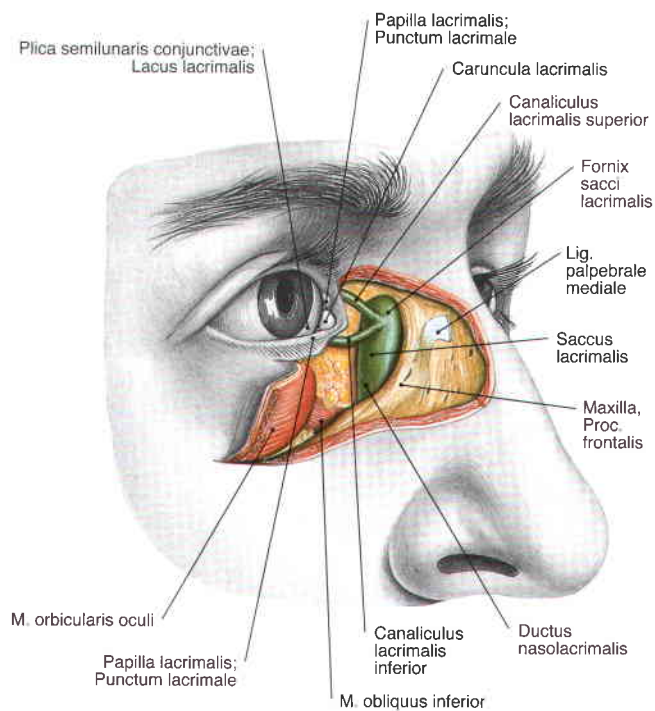


Fig. 634 Lacrimal apparatus, Apparatus lacrimalis.

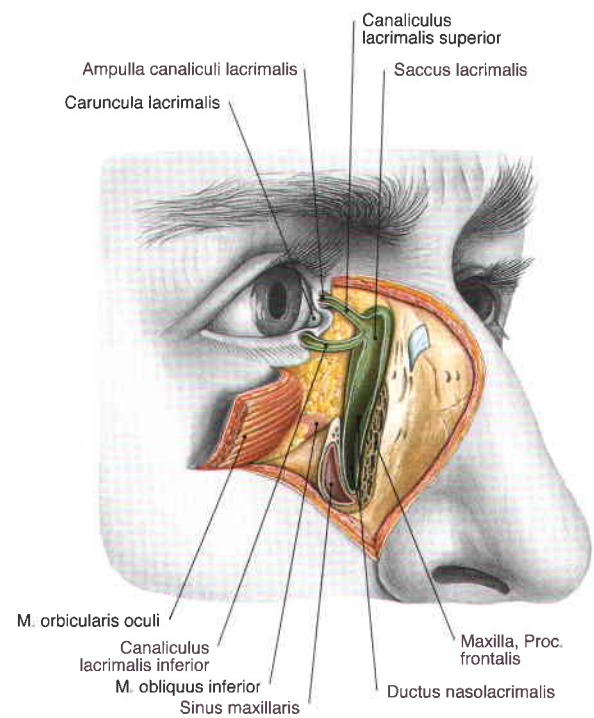


Fig. 635 Lacrimal apparatus, Apparatus lacrimalis; the nasolacrimal duct and the nasolacrimal canal have been opened.

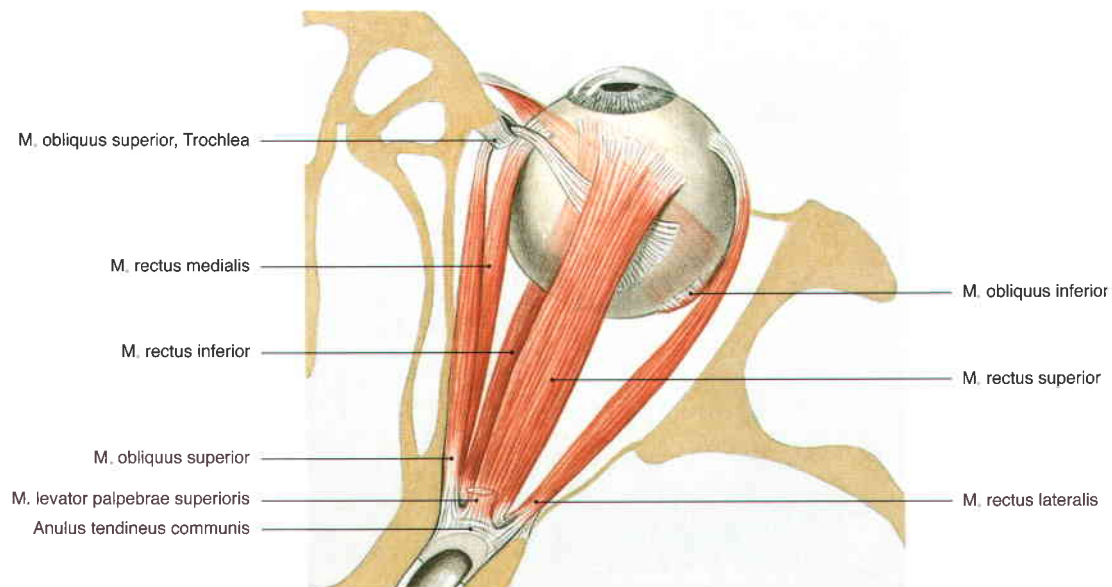
Extra-ocular muscles

Fig. 636 Extra-ocular muscles, Mm. externi bulbi; schema; superior view.

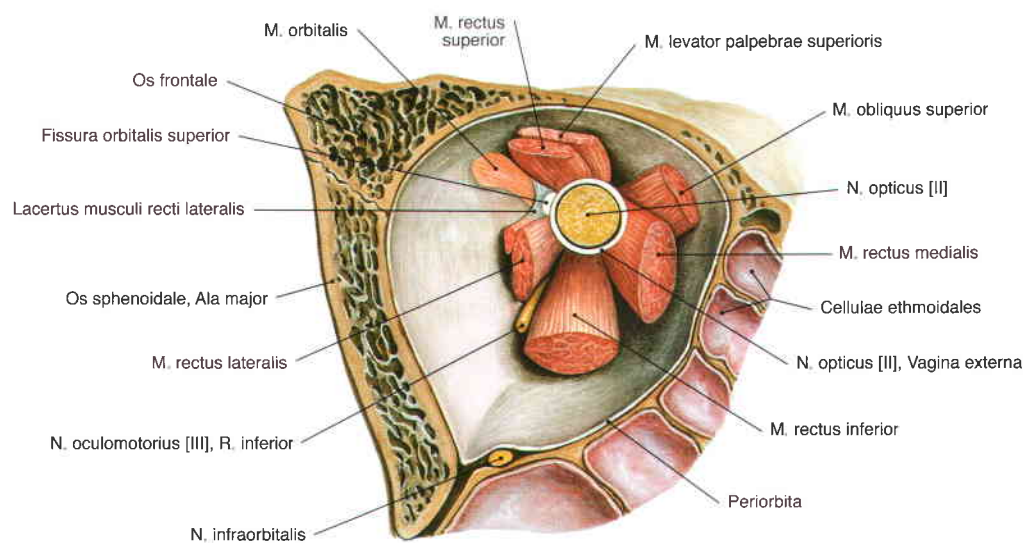


Fig. 637 Extra-ocular muscles, Mm. externi bulbi; anterior view.

Extra-ocular muscles

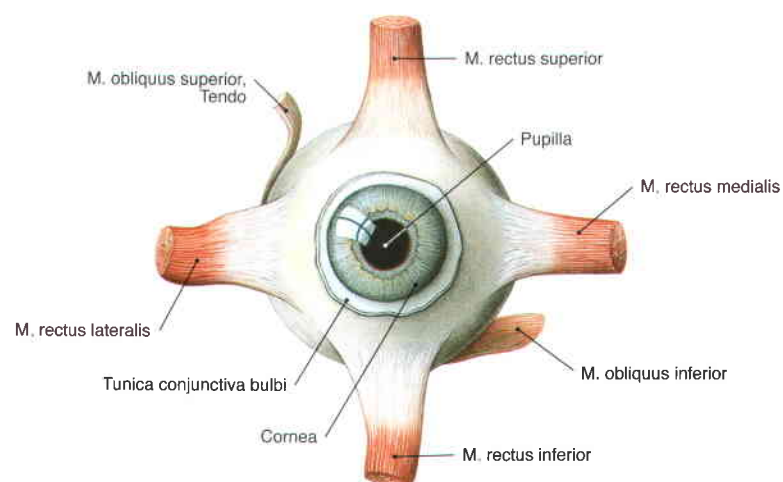


Fig. 638 Extra-ocular muscles, Mm. externi bulbi.

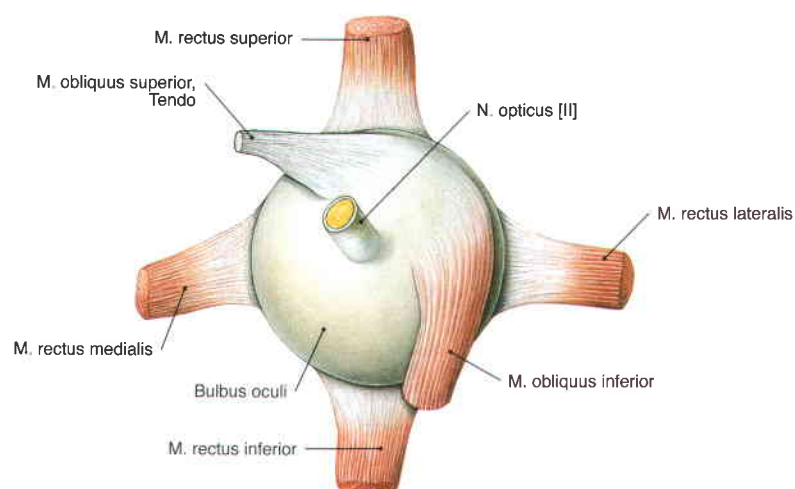


Fig. 639 Extra-ocular muscles, Mm. externi bulbi; posterior view.

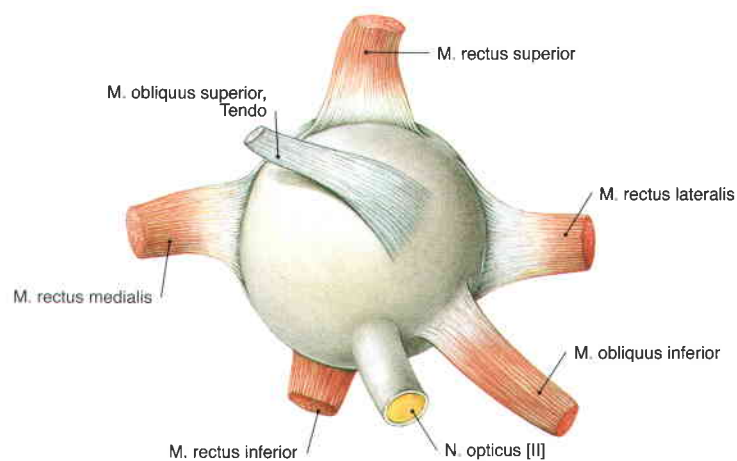


Fig. 640 Extra-ocular muscles, Mm. externi bulbi; posterior-superior view.

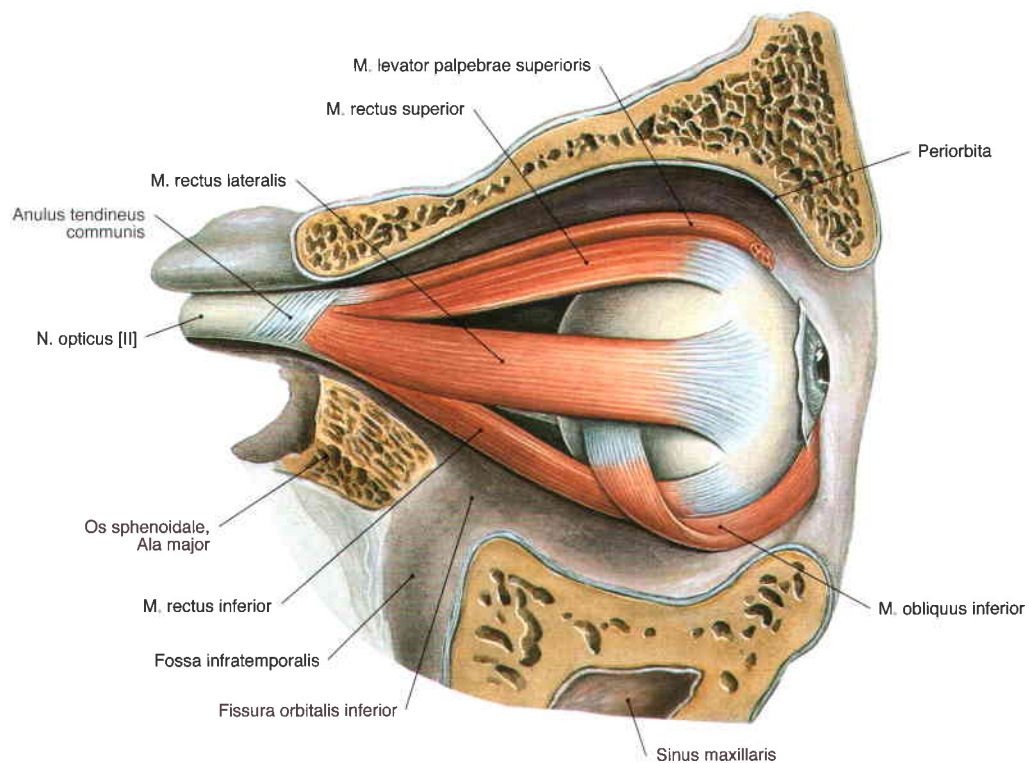
Extra-ocular muscles

Fig. 641 Extra-ocular muscles, Mm. externi bulbi; lateral view.

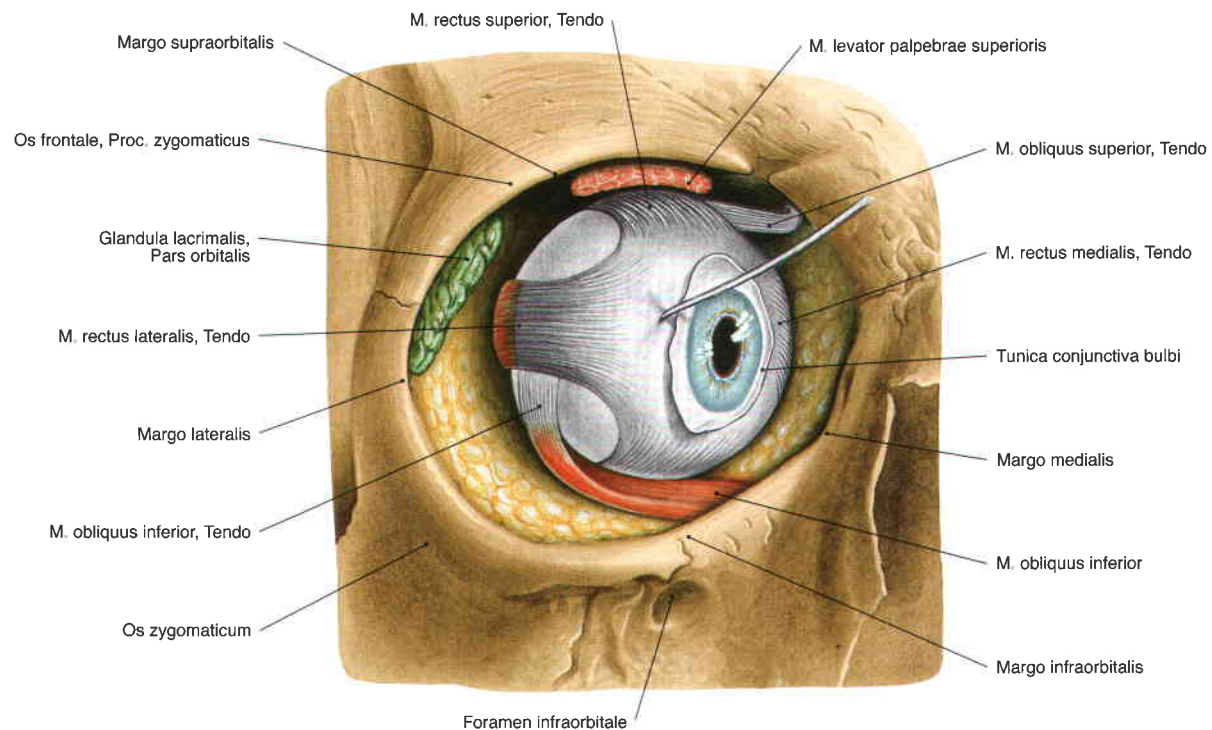


Fig. 642 Extra-ocular muscles, Mm. externi bulbi; oblique view from anterior.

Extra-ocular muscles

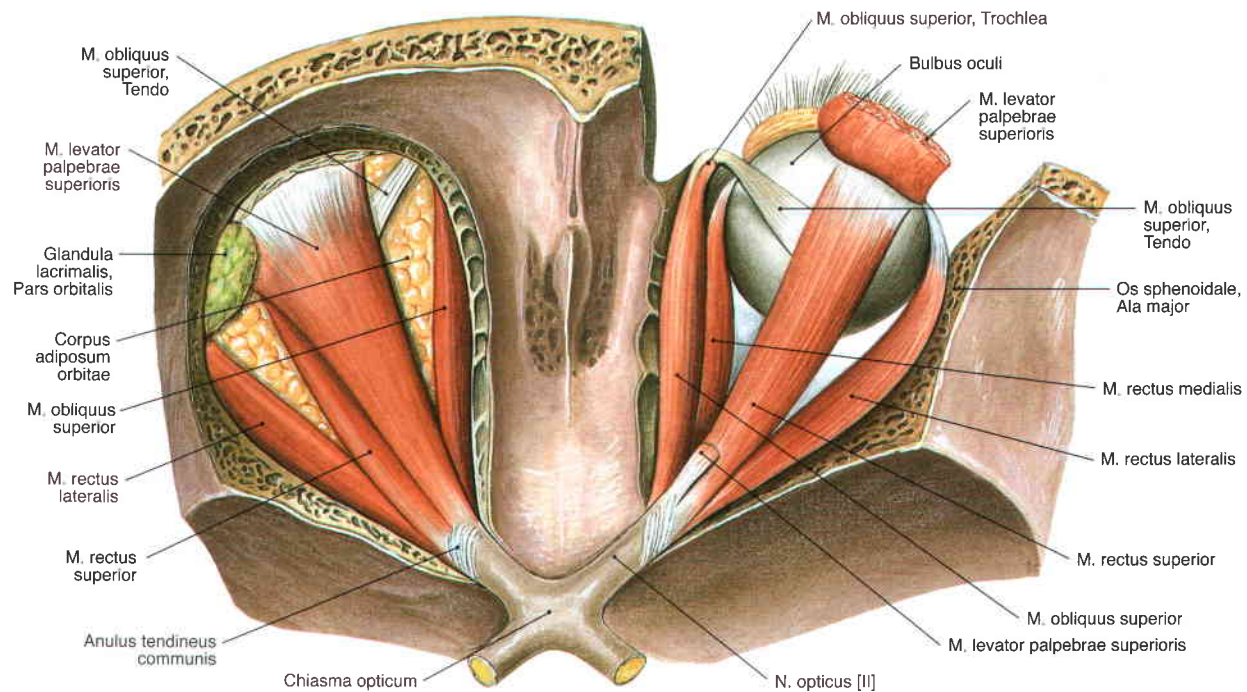


Fig. 643 Extra-ocular muscles, Mm. externi bulbi; superior view.

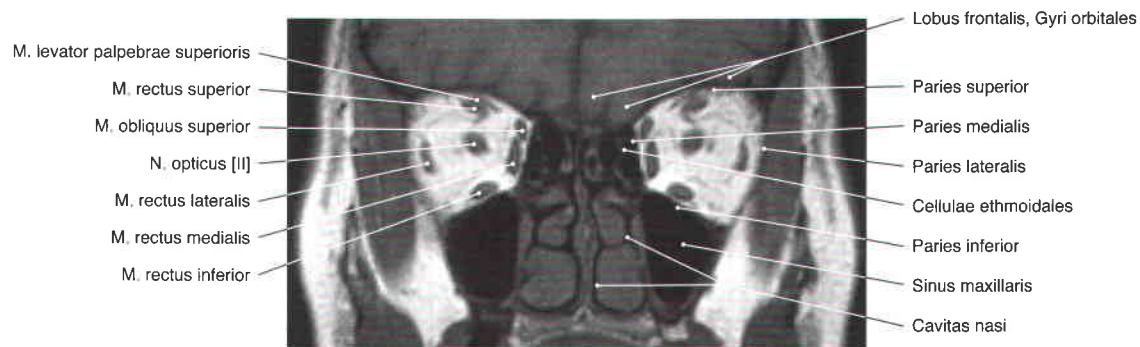


Fig. 644 Extra-ocular muscles, Mm. externi bulbi; magnetic resonance tomographic image (MRI); frontal section through the middle of the orbit; anterior view.

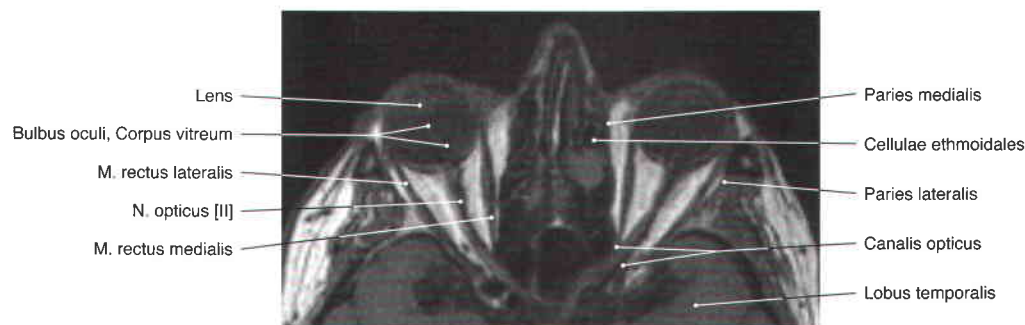


Fig. 645 Eyeball, Bulbus oculi, and extra-ocular muscles, Mm. externi bulbi; magnetic resonance tomographic image (MRI); horizontal section at the level of the optic nerve; superior view.

Eyeball, structure

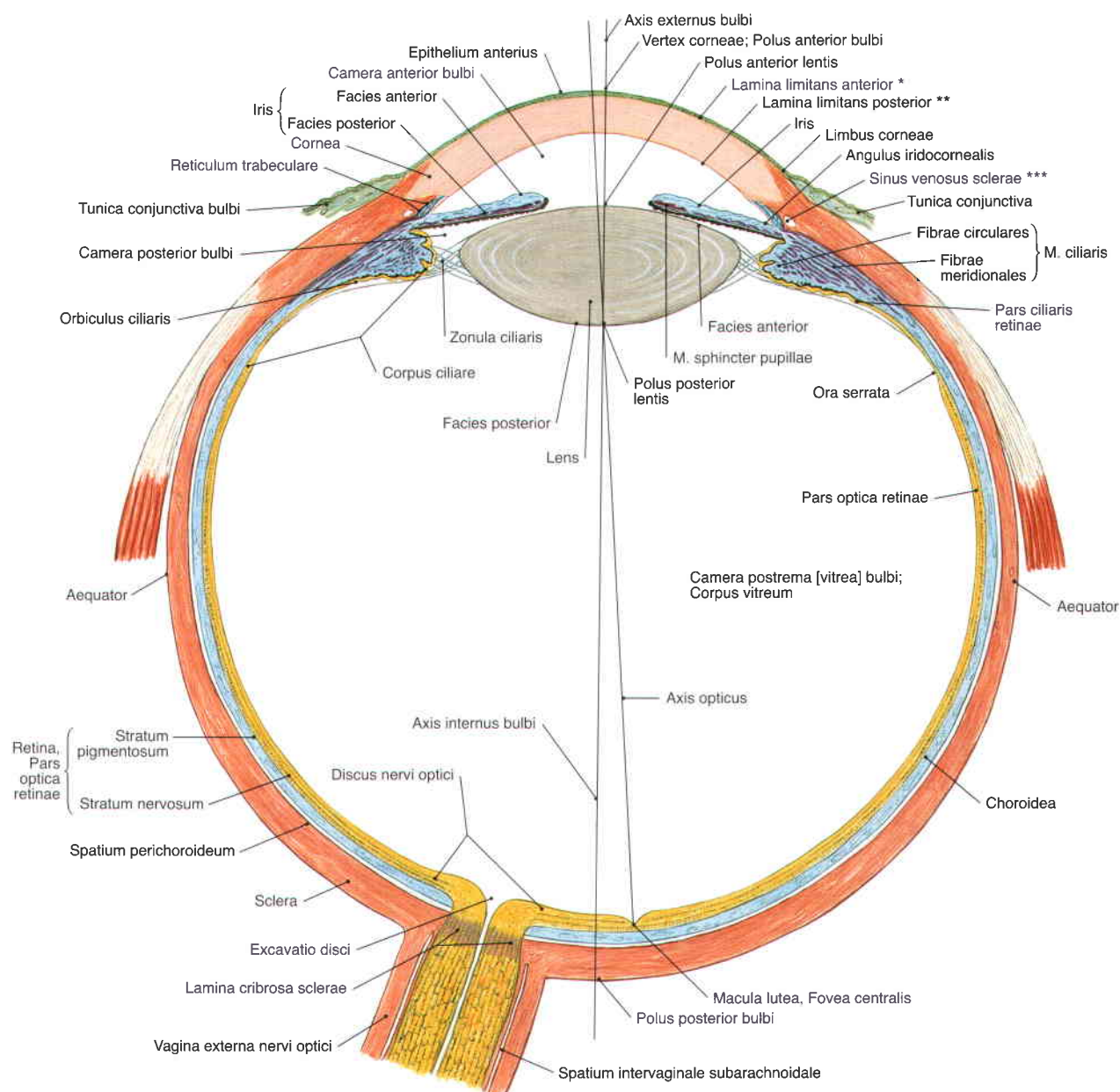


Fig. 646 Eyeball, Bulbus oculi; schematic horizontal section at the level of the exit of the optic nerve.

* Clinical term: BOWMAN's membrane

** Clinical term: DESCemet's membrane

*** Clinical term: canal of SCHLEMM

Dimensions of the eyeball

(Average values according to the anatomic and ophthalmologic literature)

External bulbar axis, Axis externus bulbi	24.0 mm	Radius of curvature of the sclera	13.0 mm
Internal bulbar axis, Axis internus bulbi	22.5 mm	Radius of curvature of the cornea	7.8 mm
Thickness of the cornea	0.5 mm	Power of the entire eye (distance vision)	59 dioptres
Depth of the anterior chamber	3.6 mm	Power of the cornea	43 dioptres
		Power of the lens (distance vision)	19 dioptres
Thickness of the lens	3.6 mm		
Distance between lens and retina	15.6 mm	Interpupillary distance	61–69 mm
Thickness of the retina	0.3 mm		

Blood vessels of the eyeball

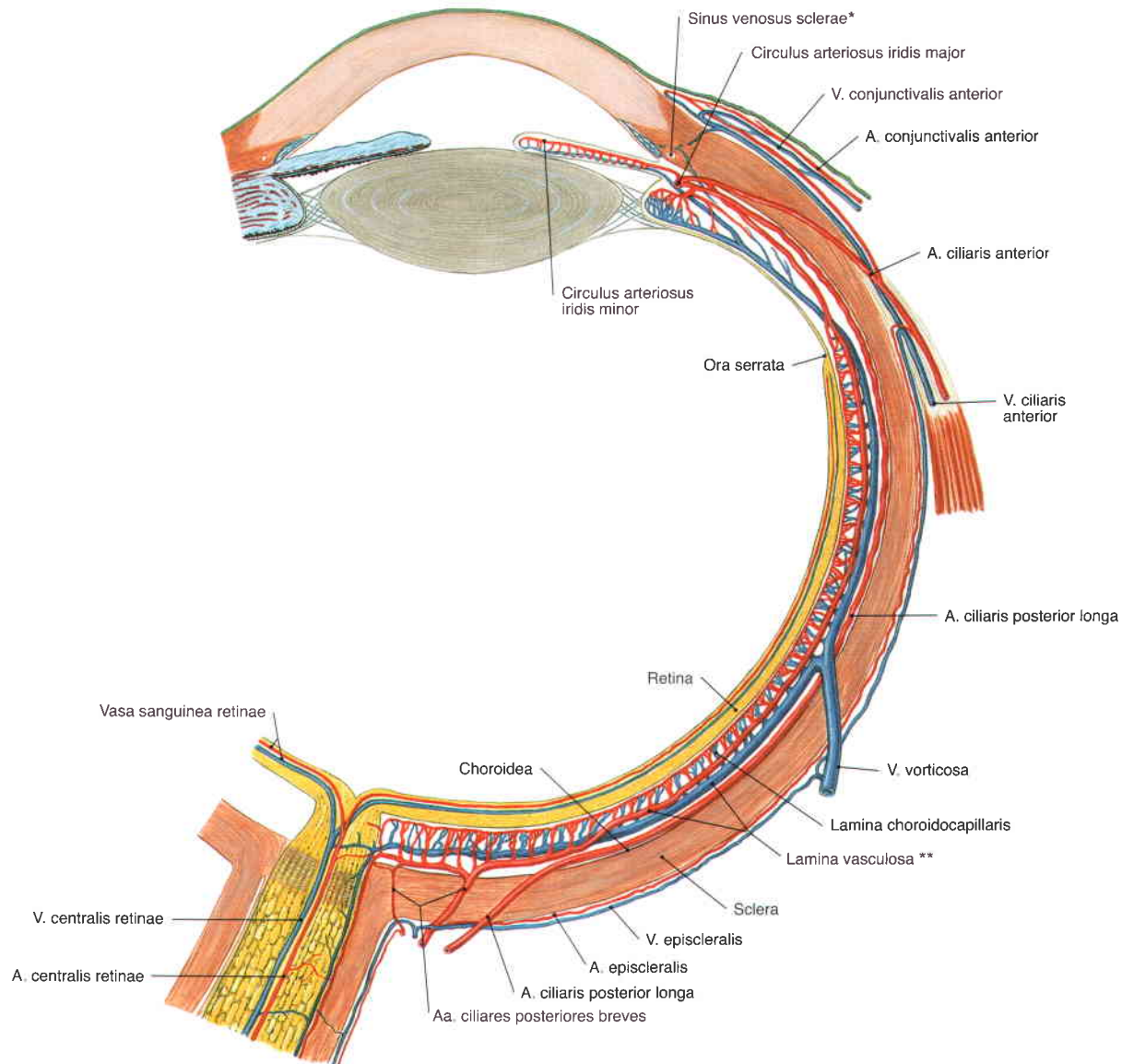


Fig. 647 Blood vessels of the eyeball, Bulbus oculi.

* Clinical term: canal of SCHLEMM

** Clinical term: uvea

Layers of the eyeball, Tunicae bulbi

Fibrous layer of the eyeball, Tunica fibrosa bulbi

- Cornea, Cornea (pronounced curvature, translucent)
- Sclera, Sclera (lesser curvature, opaque; bluish-white in infancy, yellowish-white in senescence)

Vascular layer of the eyeball, Tunica vasculosa bulbi

- Iris, Iris, with the central circular opening, the pupil, Pupilla
- Ciliary body, Corpus ciliare, with the ciliary muscle, M. ciliaris, the ciliary process, Processus ciliaris, the ciliary zonule, Zonula ciliaris, with the zonular fibres, Fibrae zonulares, and the zonular spaces, Spatia zonularia
- Choroid, Choroidea

Inner layer of the eyeball (retina), Tunica interna bulbi (Retina)

- Nonvisual retina, Pars caeca retinae (from the pupillary-iridial margin, Margo pupillaris iridis, to the ora serrata, Ora serrata)
- Iridial part of the retina, Pars iridica retinae (single-layered, heavily pigmented), Ciliary part of the retina, Pars ciliaris retinae (single-layered, unpigmented)
- Optic part of the retina, Pars optica retinae (stratified)
 1. neuron: vision cells (rod cells – brightness; cone cells – colour)
 2. neuron: bipolar ganglion cells within the retina (ganglion of the retina, Ganglion retinae)
 3. neuron: multi-polar ganglion cells (optic ganglion, Ganglion opticum), whose long axons form the optic nerve and continue in the optic tract

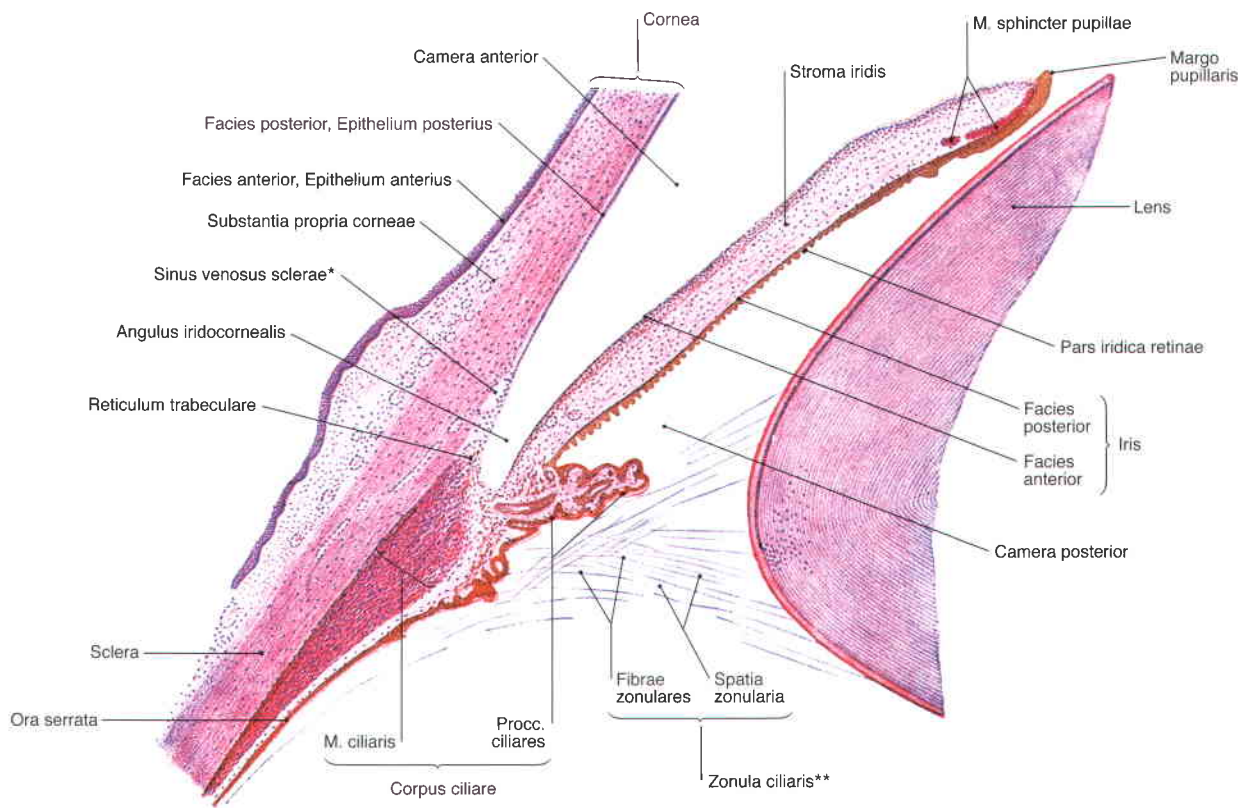
Ciliary body and iris

Fig. 648 Eyeball, Bulbus oculi; schematic horizontal section at the level of the pupil.

* Clinical term: canal of SCHLEMM

** Clinical term: zonule of ZINN

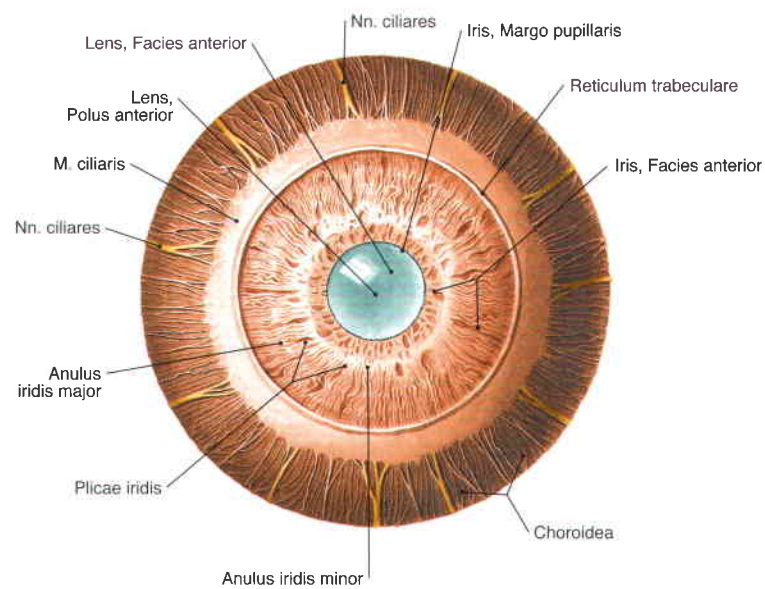


Fig. 649 Iris, Iris, and pupil, Pupilla; after removal of the sclera and cornea; anterior view.

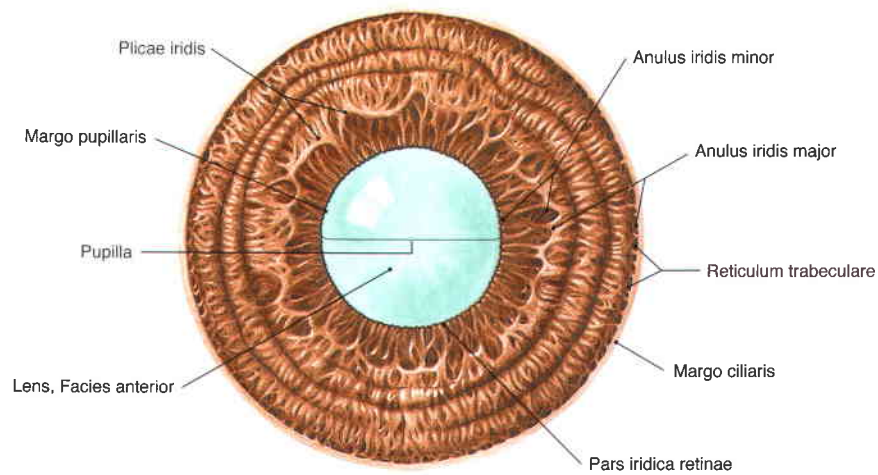


Fig. 650 Iris, Iris; after removal of the cornea; anterior view.

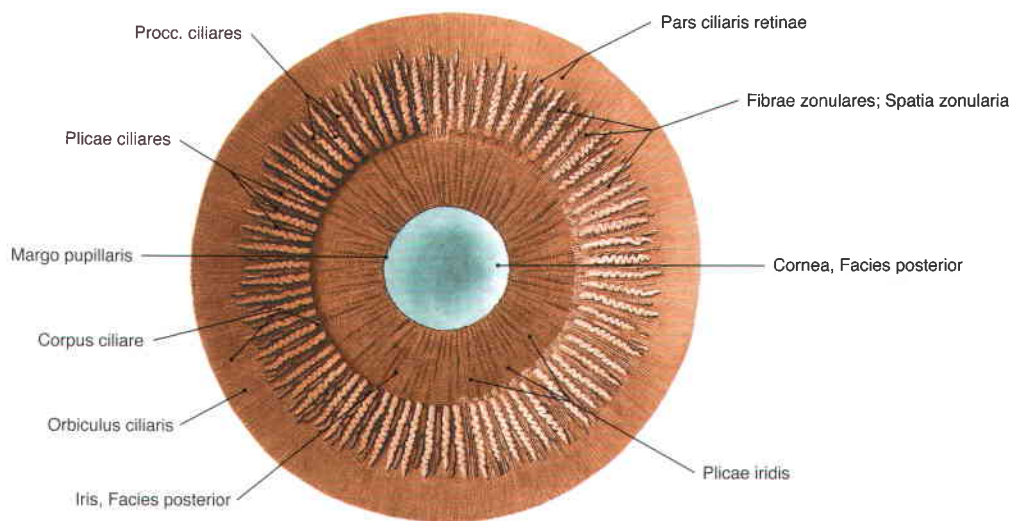


Fig. 651 Iris, Iris; posterior view.

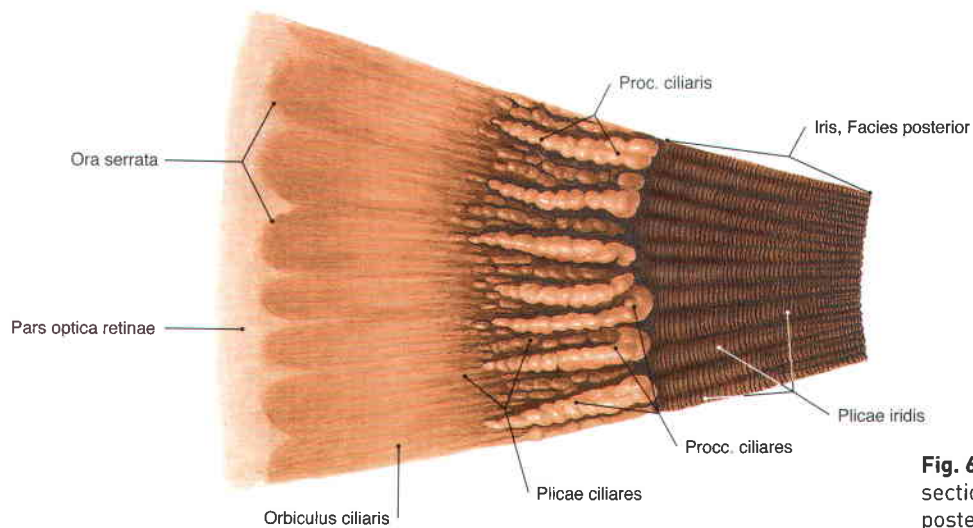


Fig. 652 Iris, Iris; section of Fig. 651; posterior view.

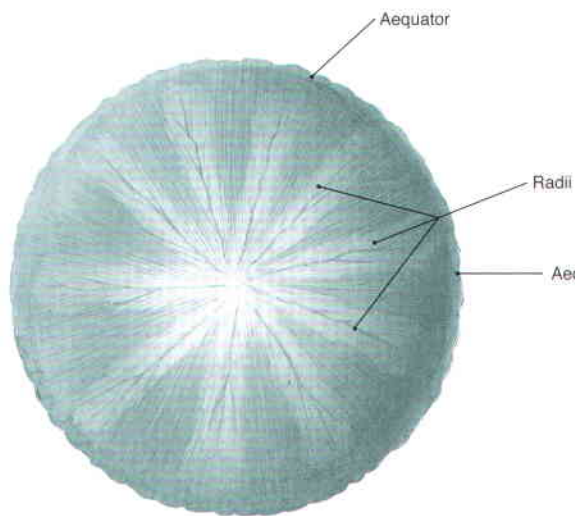


Fig. 653 Lens, Lens;
anterior view.

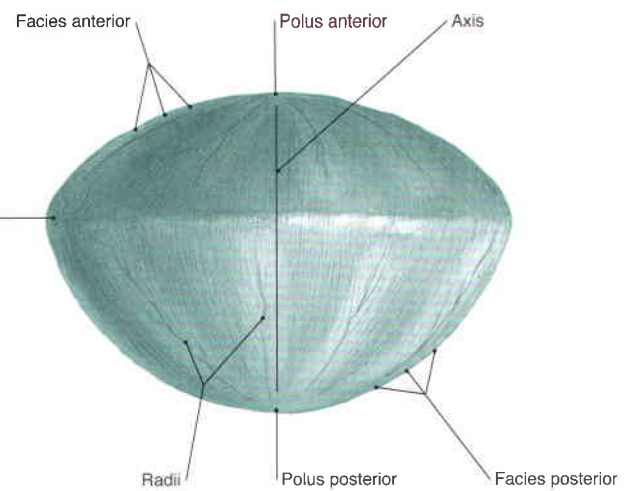


Fig. 654 Lens, Lens;
viewed from the equator.

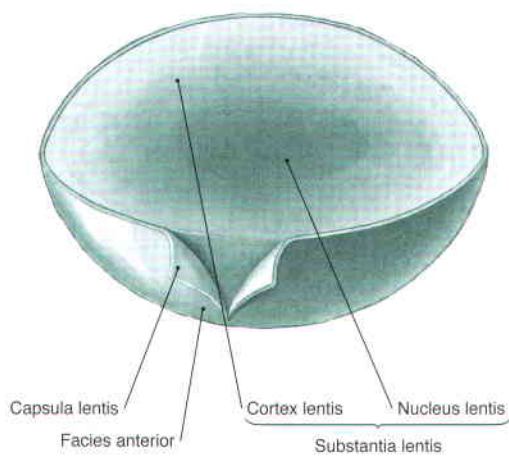


Fig. 655 Lens, Lens;
oblique view from anterior.

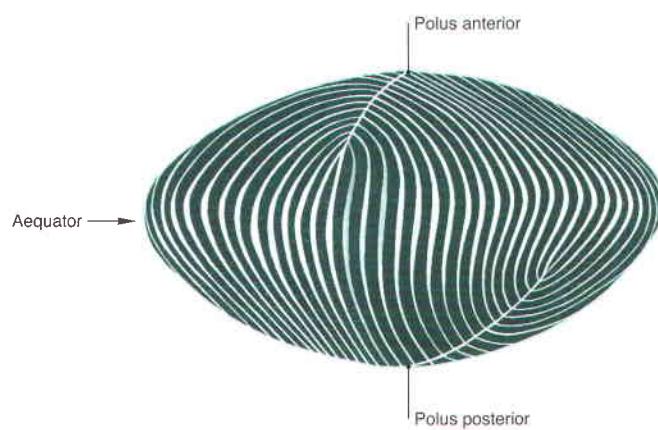


Fig. 656 Lens, Lens;
schema of the lens fibres in a neonate;
viewed from the equator.

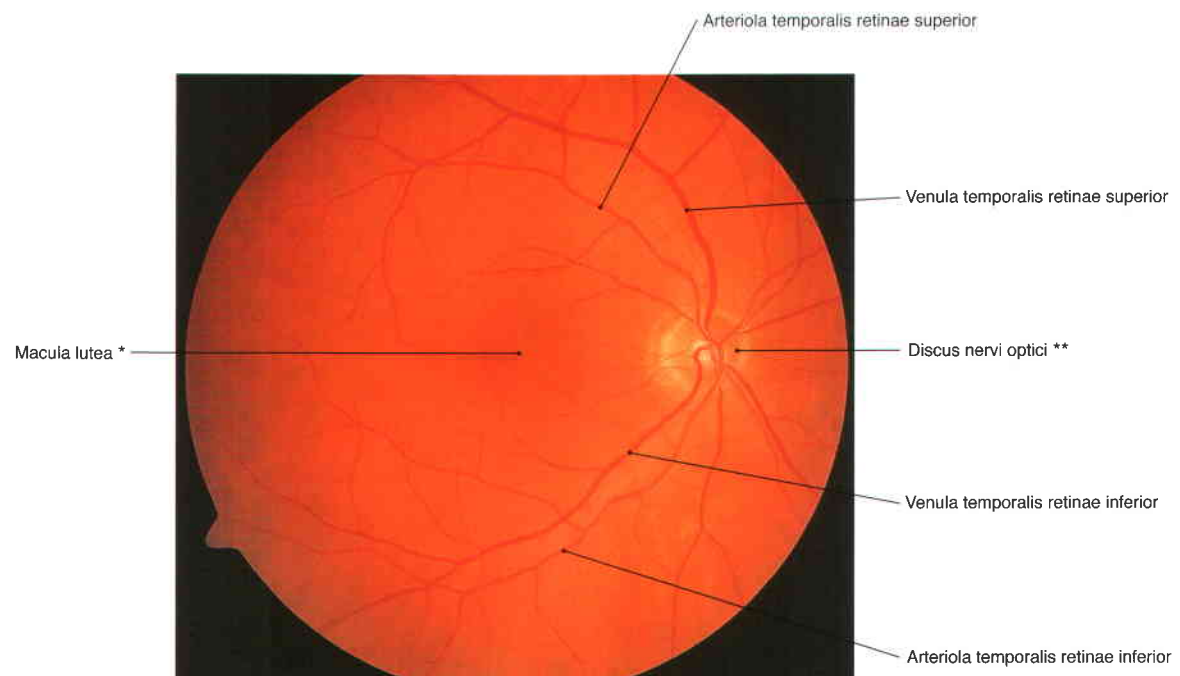


Fig. 657 Ocular fundus, Fundus oculi; ophthalmoscopic picture of the central region; anterior view.

* Clinical term: yellow spot

** Clinical term: papilla or blind spot

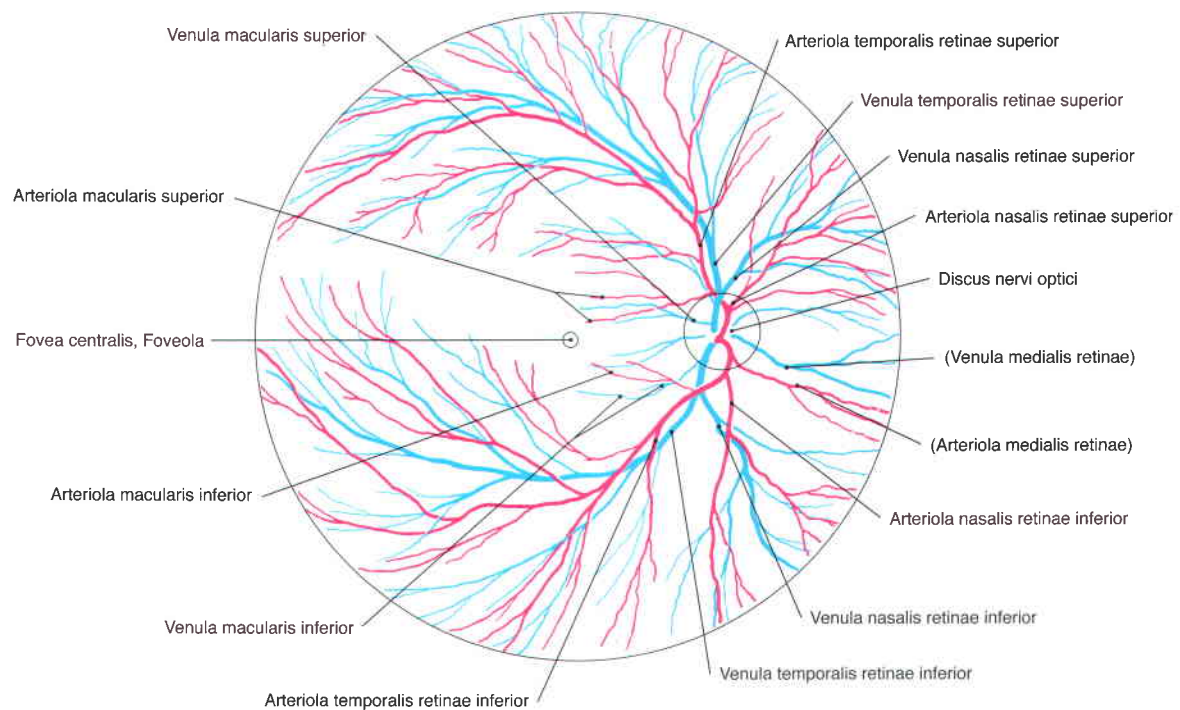


Fig. 658 Blood vessels of the retina, Vasa sanguinea retinae; schema of the course of the vessels; anterior view.

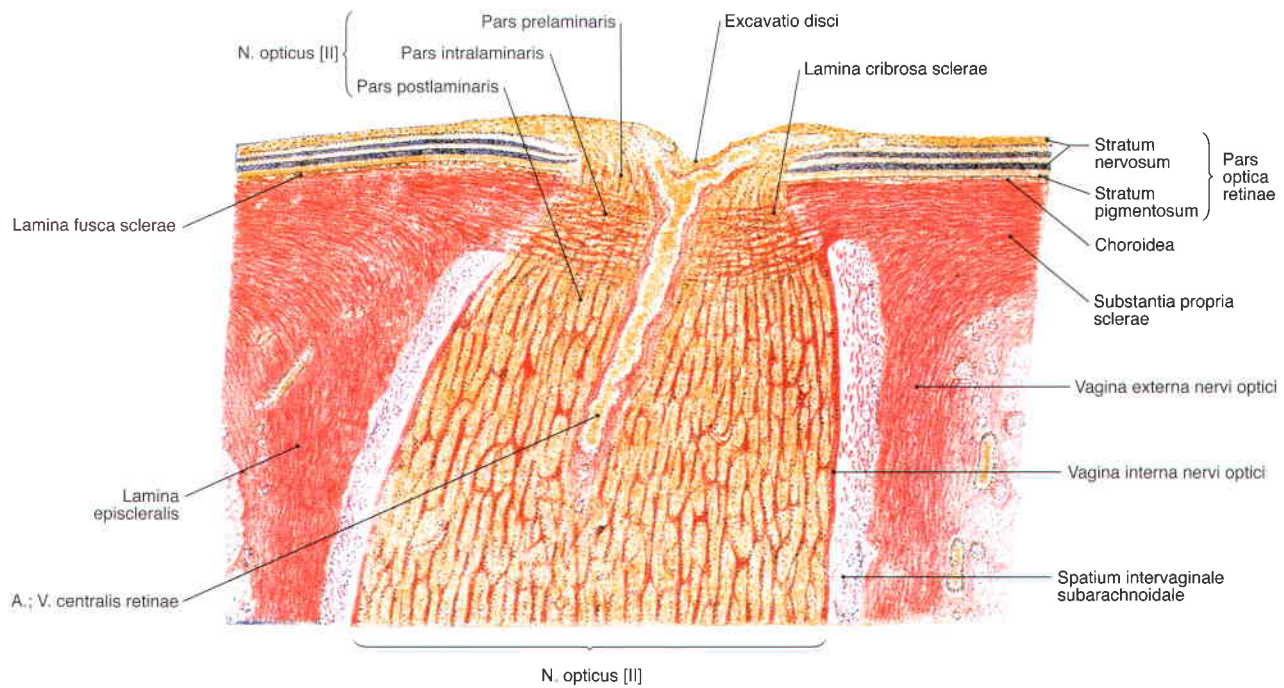
Optic nerve

Fig. 659 Optic nerve, N. opticus [II]; horizontal section at its exit from the eyeball.

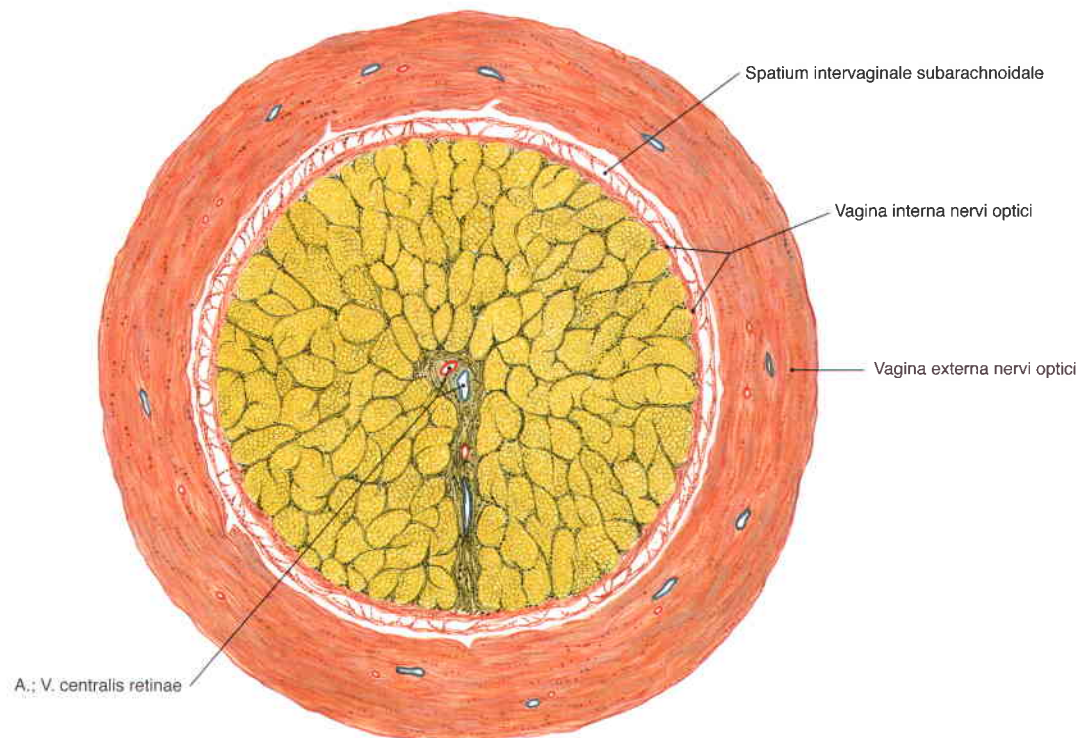


Fig. 660 Optic nerve, N. opticus [II]; cross-section near the eyeball.

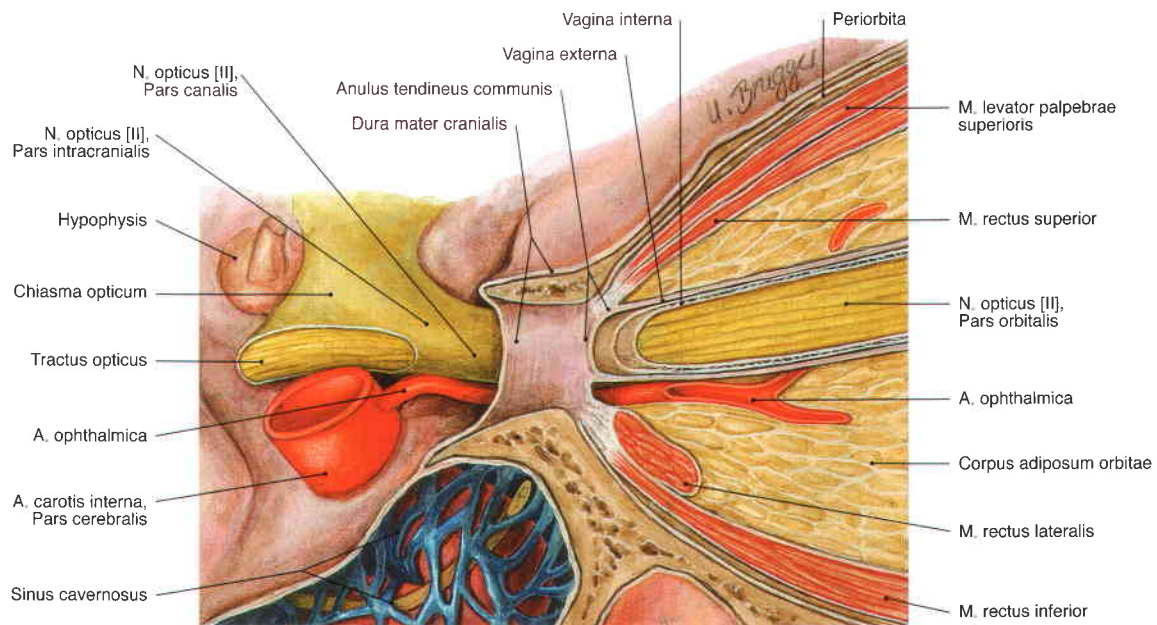


Fig. 661 Optic nerve, N. opticus [II]; the optic canal has been opened; viewed from the right.

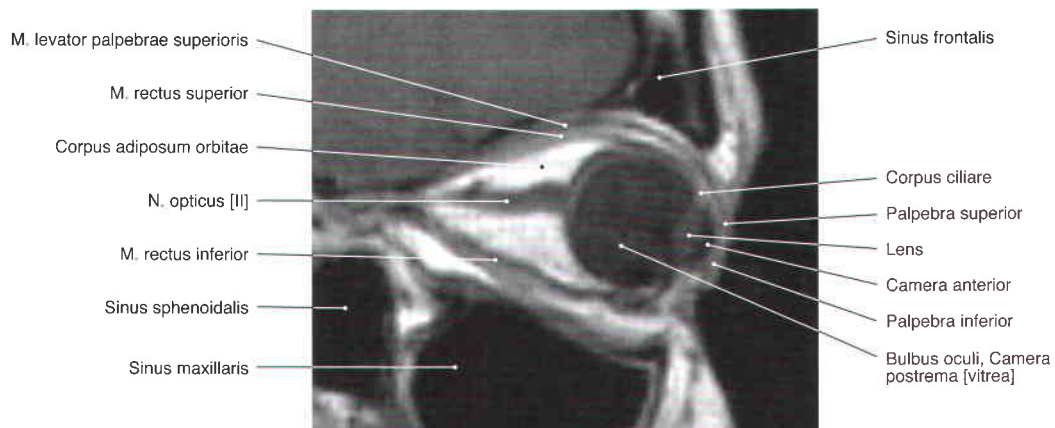
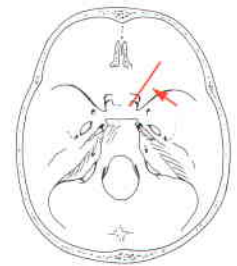


Fig. 662 Orbit, Orbita; magnetic resonance tomographic image (MRI); vertical section along the optic nerve; viewed from the right.

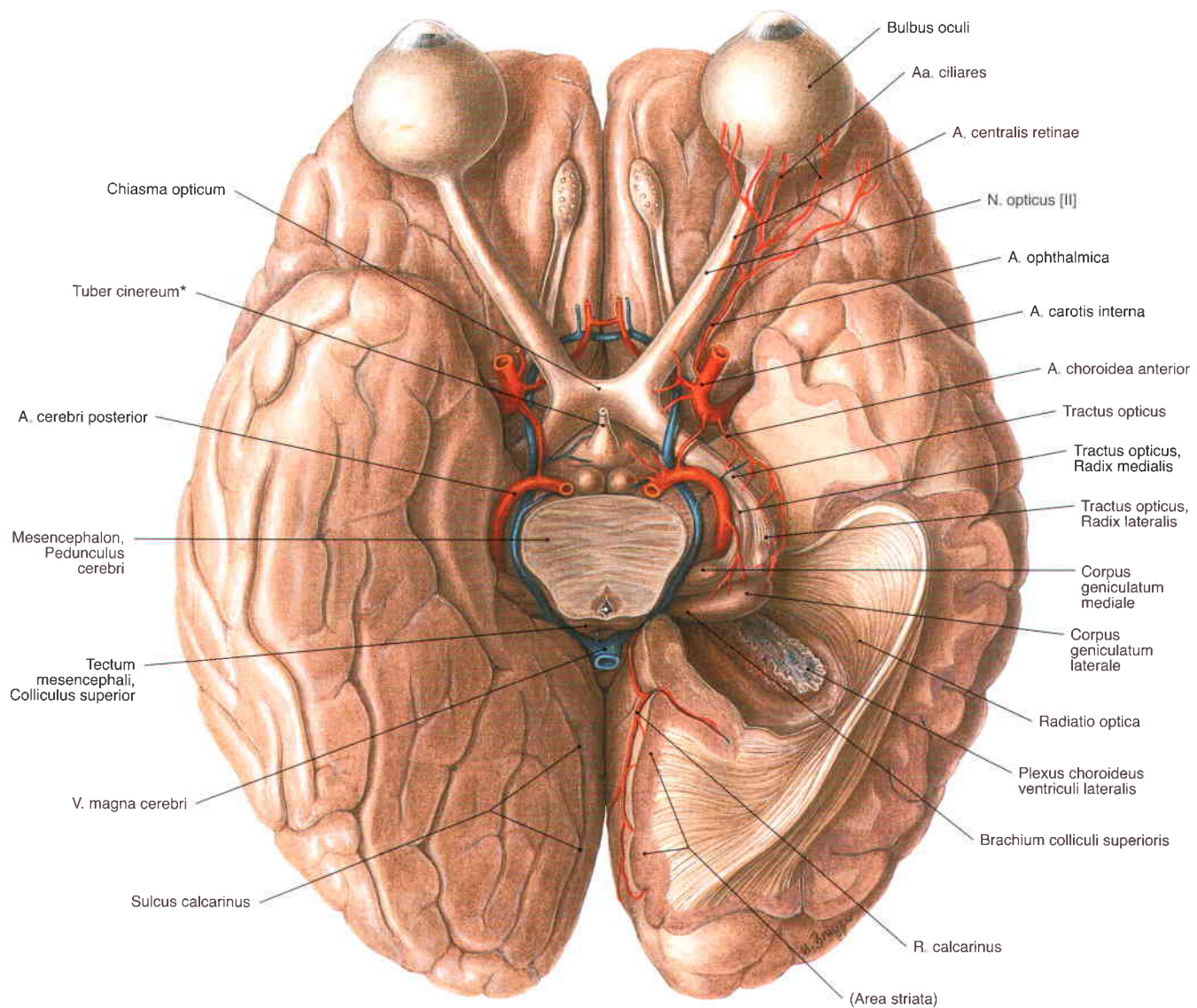
Optic pathway and blood vessels

Fig. 663 Brain, Encephalon, and blood supply of the parts of the optic pathway; inferior view.

The pituitary gland has been removed at its infundibulum (*). Due to the close proximity of the pituitary gland and the optic chiasm, pituitary tumours can cause visual disturbances.

Optic pathway

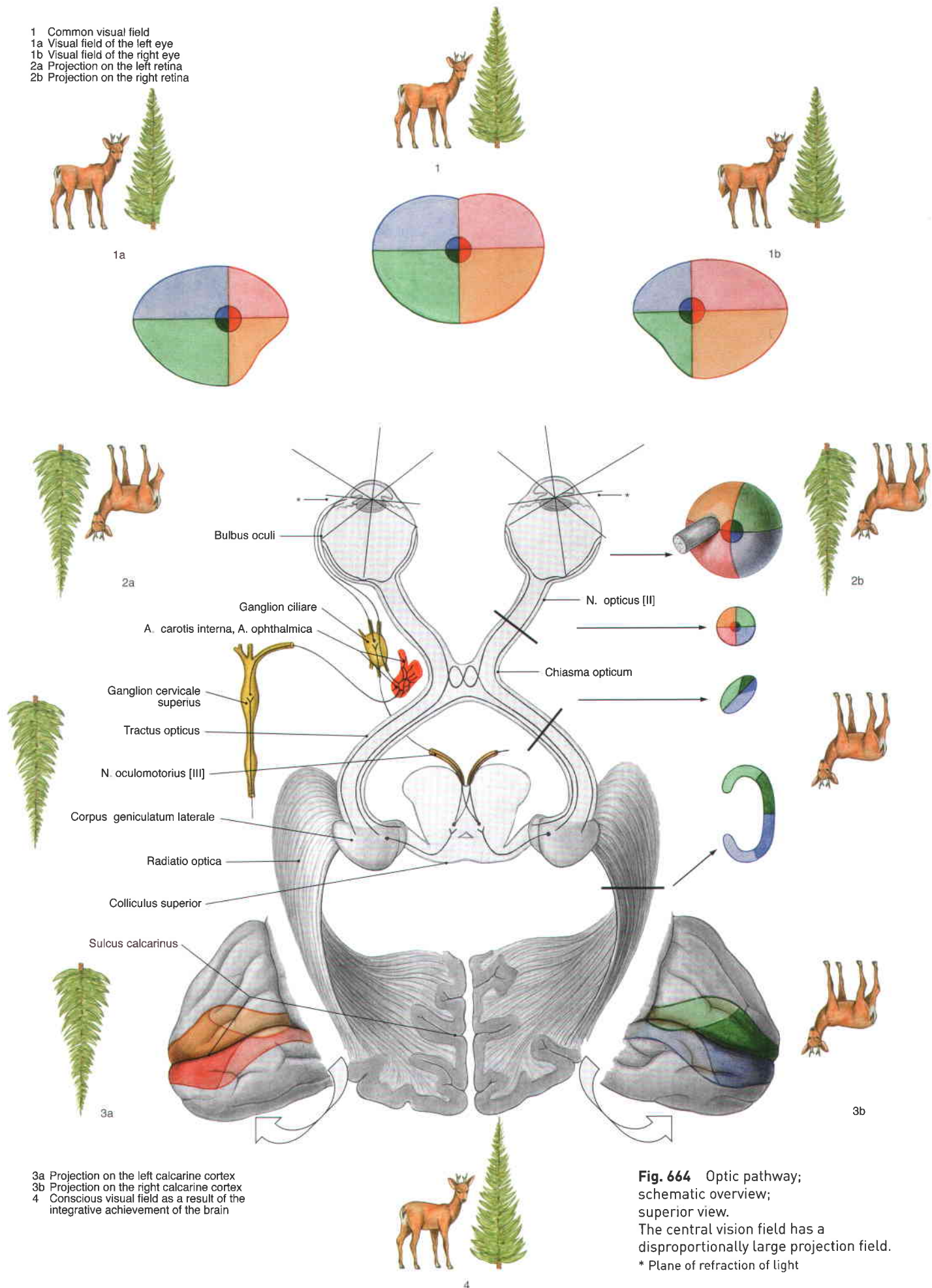
1. neuron: rod cells and cone cells of the retina
2. neuron: bipolar ganglion cells of the retina (perikarya in the retinal ganglion)
3. neuron: multi-polar ganglion cells of the retina (perikarya in the optic ganglion)
The axons of the optic ganglion cells extend primarily to the lateral geniculate body (lateral root), although several fibres also extend to the pretectal area and the superior colliculus (medial root), as well as to the hypothalamus.

They run within the optic nerve to the optic chiasm, where the fibres from the nasal part of the ocular fundus cross to the opposite side. Each optic tract contains fibres, which transmit information from the contralateral half of the visual field.

4. neuron: Its axons travel primarily from the lateral geniculate body to areas 17 and 18 of the cerebral cortex (striate area) in the region surrounding the calcarine sulcus.

Optic pathway

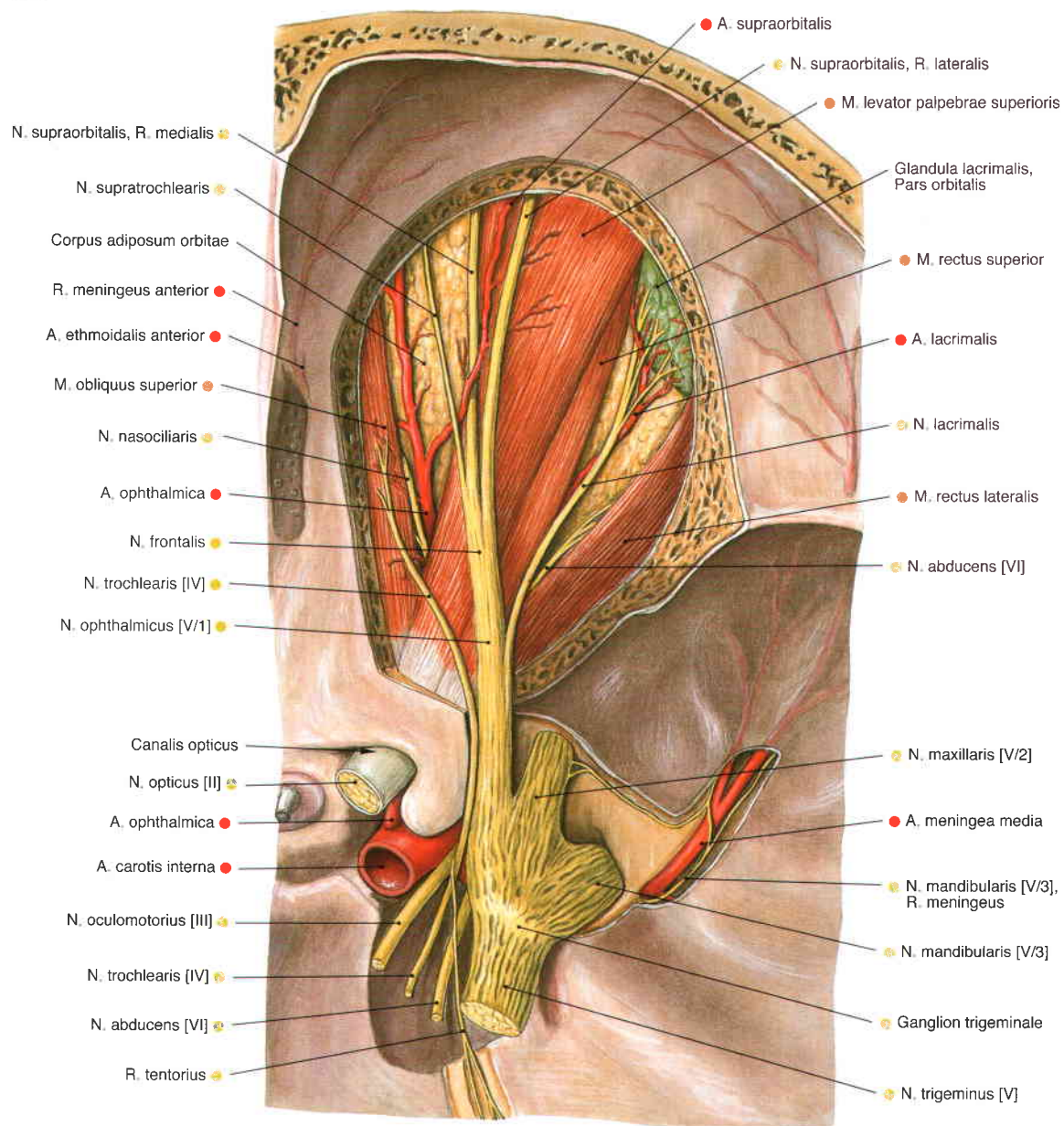
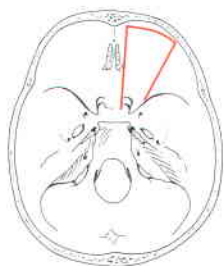
- 1 Common visual field
 1a Visual field of the left eye
 1b Visual field of the right eye
 2a Projection on the left retina
 2b Projection on the right retina



- 3a Projection on the left calcarine cortex
 3b Projection on the right calcarine cortex
 4 Conscious visual field as a result of the integrative achievement of the brain

Fig. 664 Optic pathway; schematic overview; superior view.
 The central vision field has a disproportionately large projection field.
 * Plane of refraction of light

Orbit, topography



666



Fig. 665 Arteries and nerves of the orbit, Orbita; superior view.

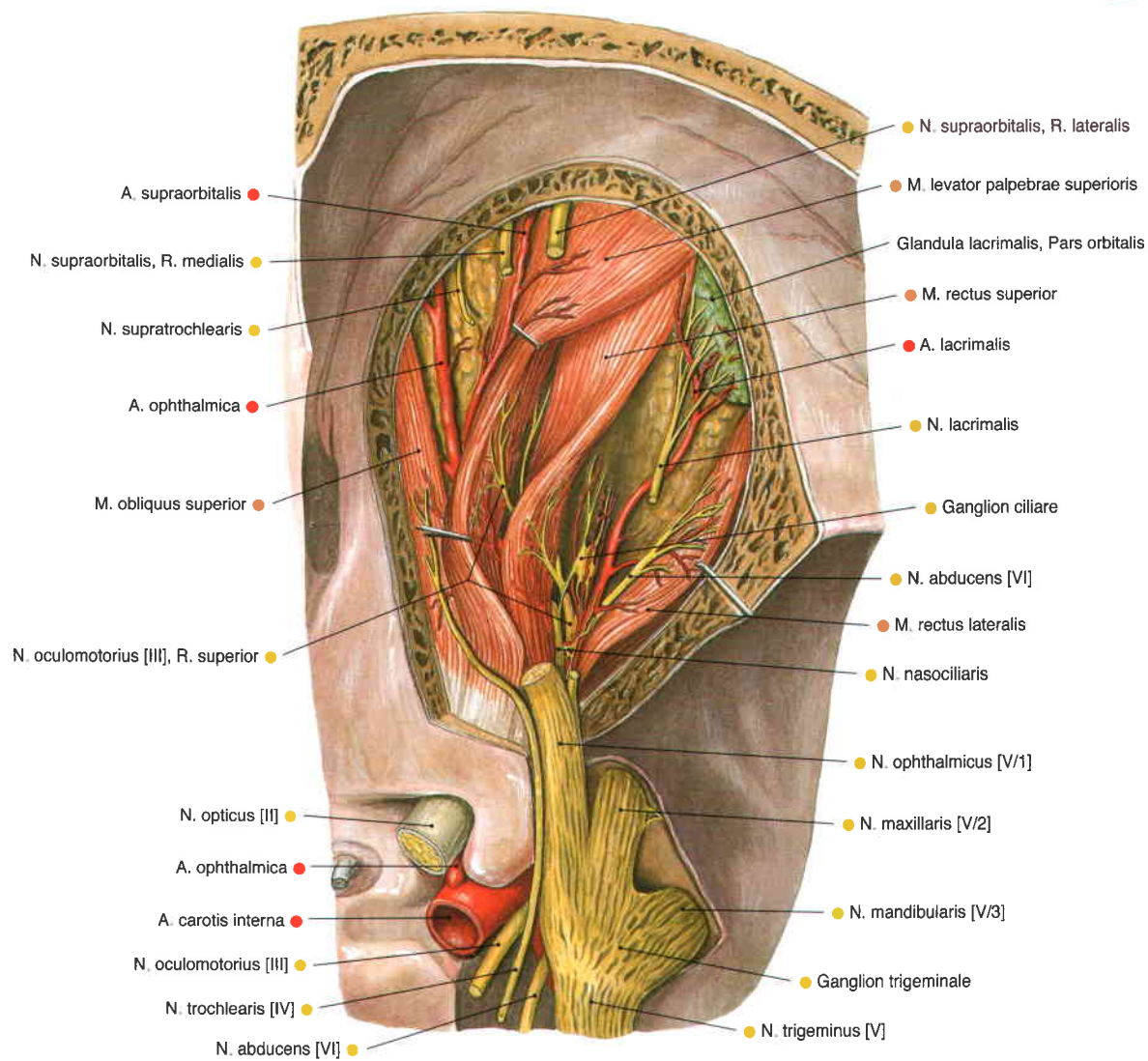
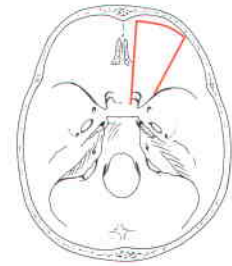


Fig. 666 Arteries and nerves of the orbit, Orbita; after removal of the roof of the orbit; superior view.



Orbit, topography

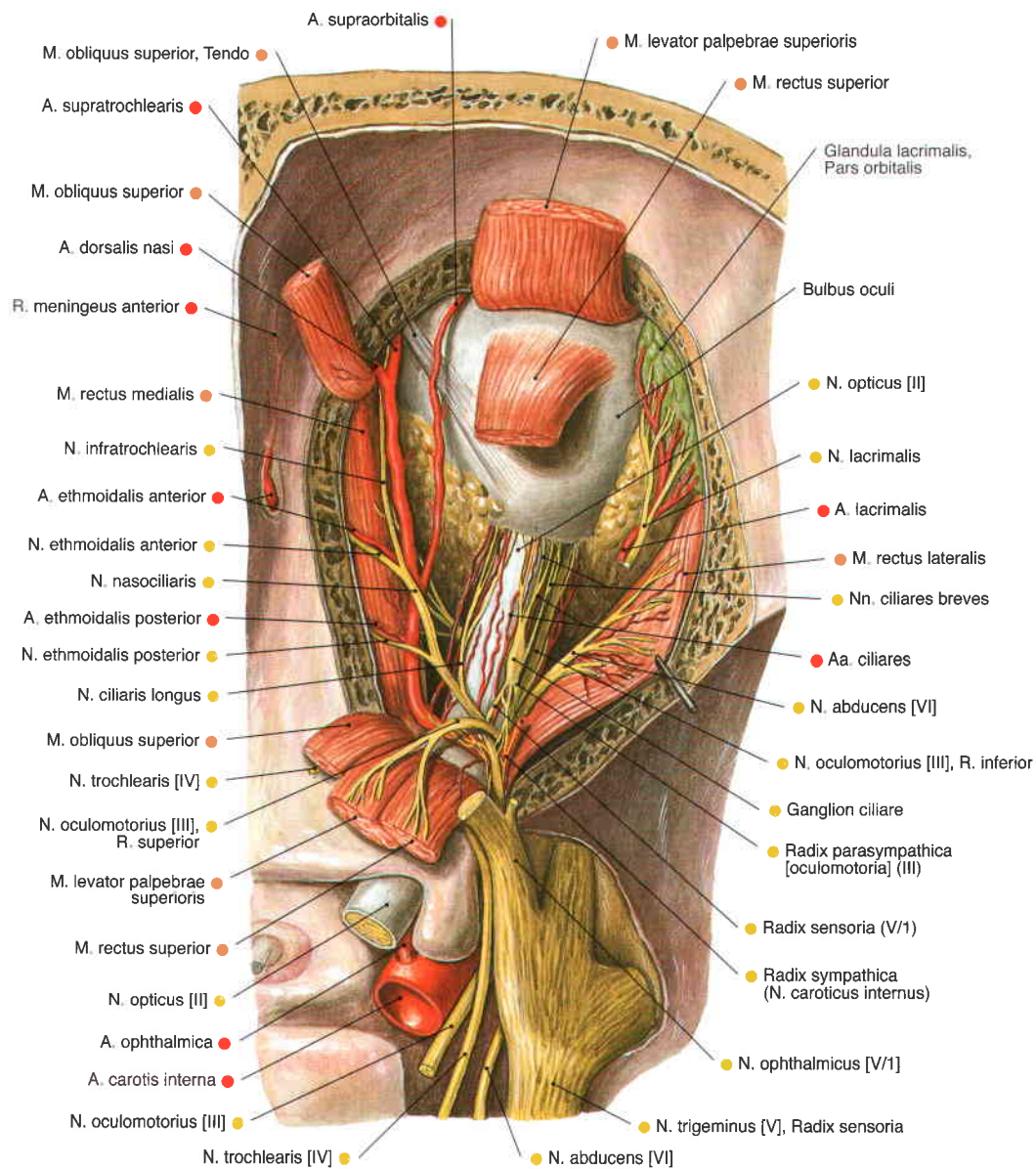
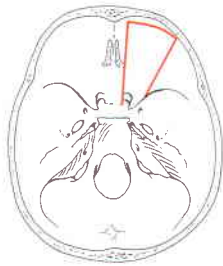


Fig. 667 Arteries and nerves of the orbit, Orbita; after partial removal of the levator palpebrae superioris, the rectus superior and the obliquus superior muscle; superior view.

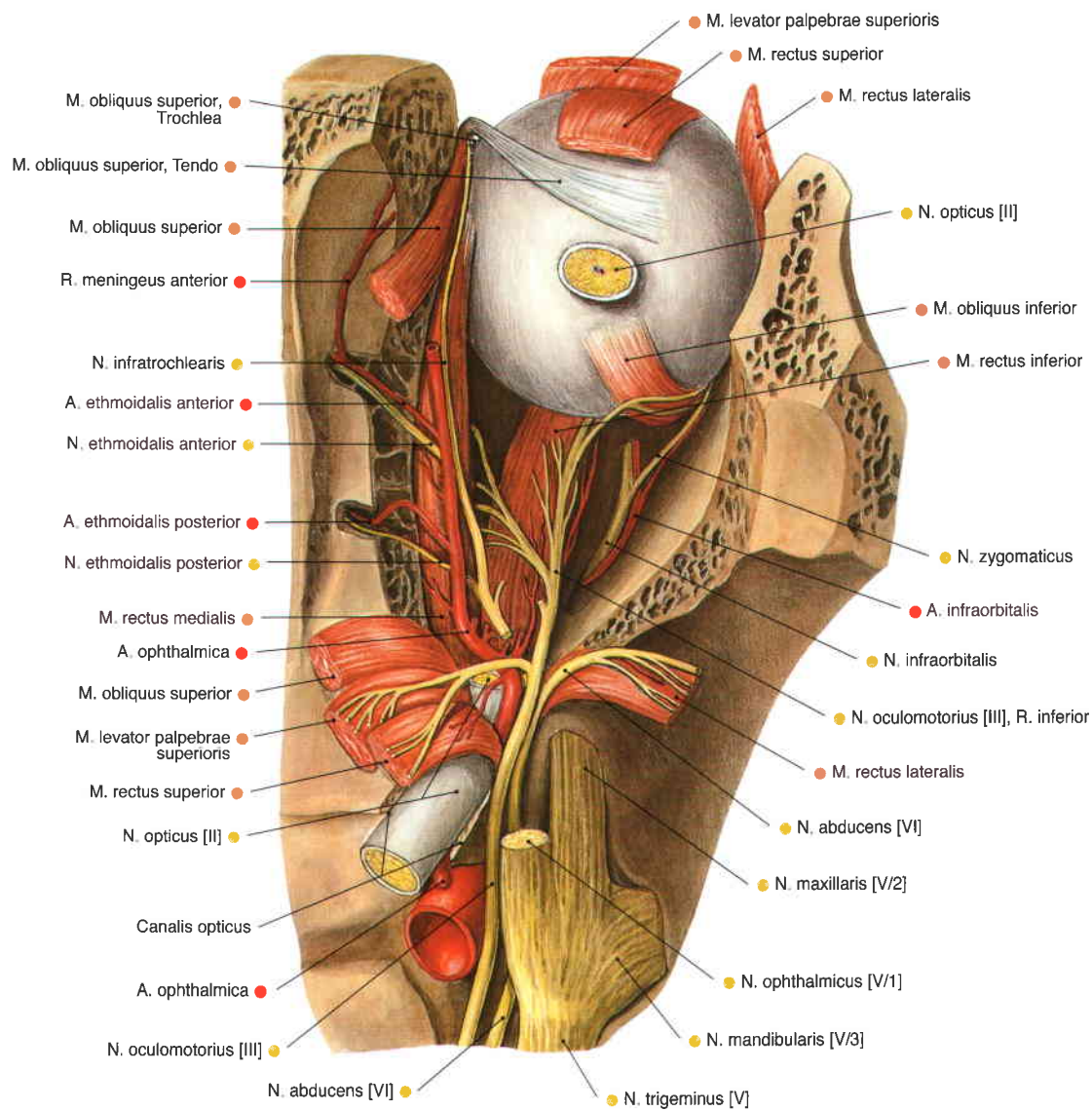
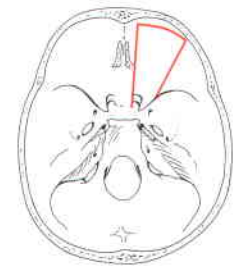


Fig. 668 Arteries and nerves of the orbit, Orbita; after section of the optic nerve; superior view.

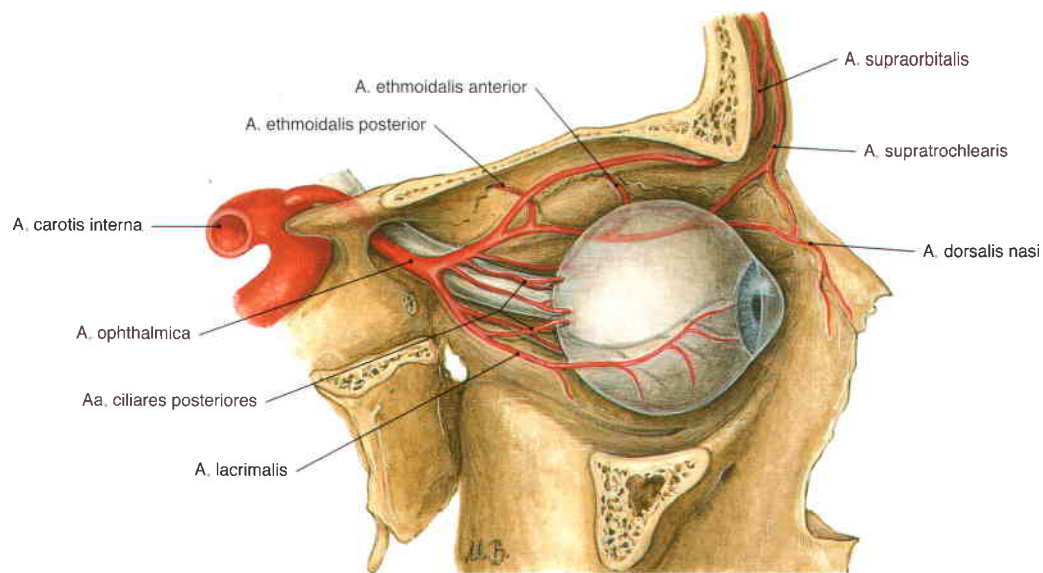
Blood vessels of the orbit

Fig. 669 Arteries of the orbit, Orbita; lateral view.

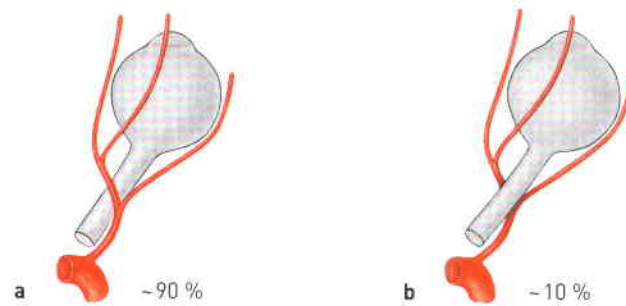


Fig. 670 a, b Variations of the ophthalmic artery, A. ophthalmica; superior view.

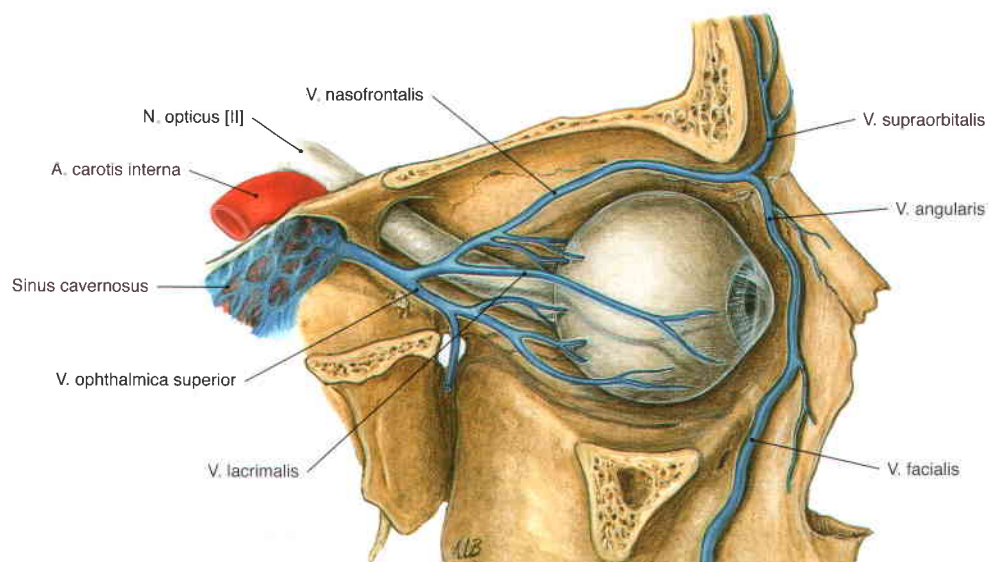


Fig. 671 Veins of the orbit, Orbita; lateral view.

Orbit, topography

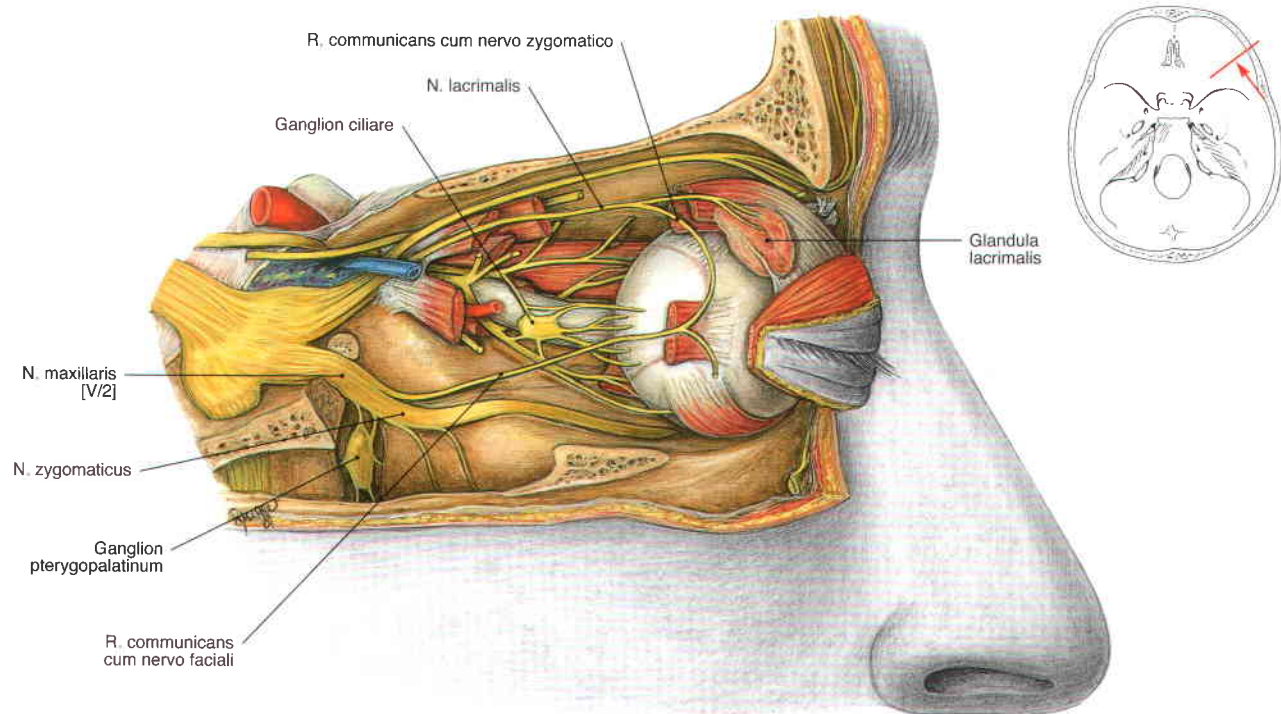


Fig. 672 Orbit, Orbita; viewed from the right.

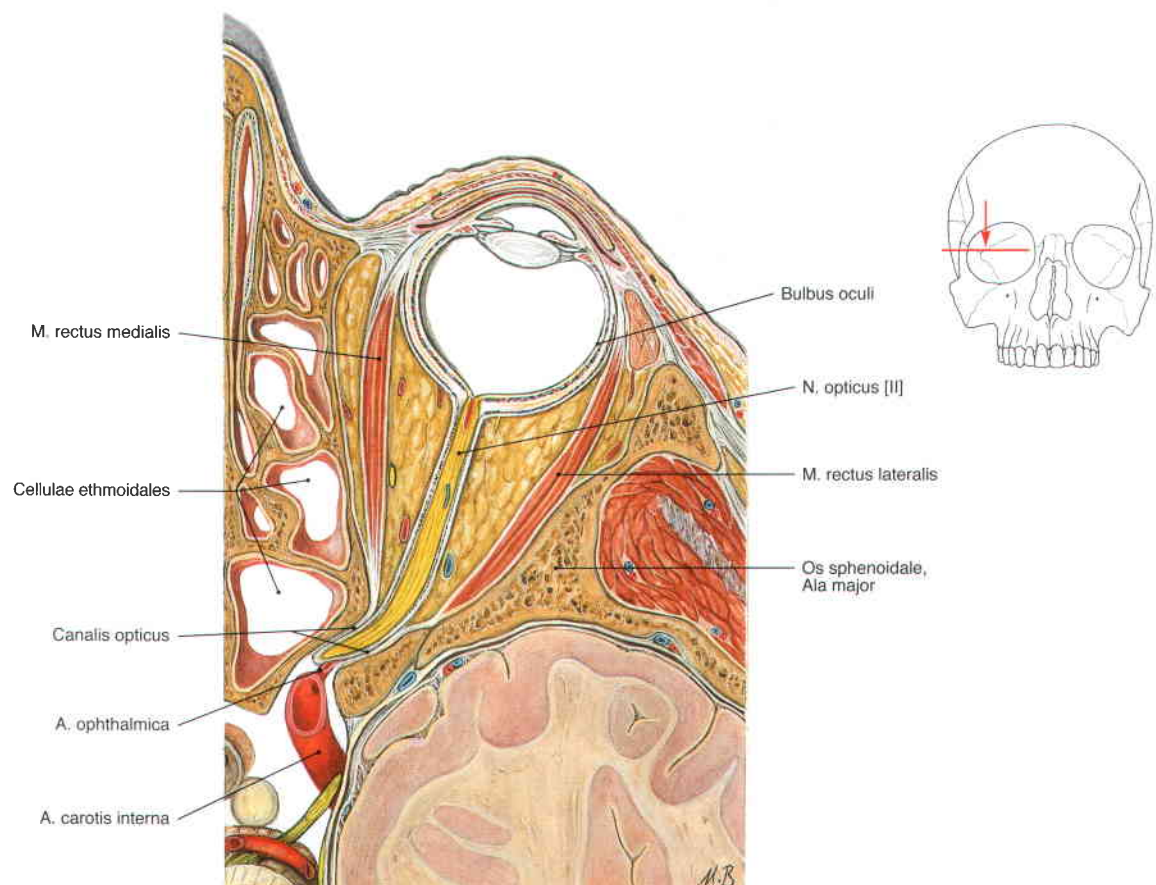


Fig. 673 Orbit, Orbita; horizontal section; superior view.

Orbit, sections

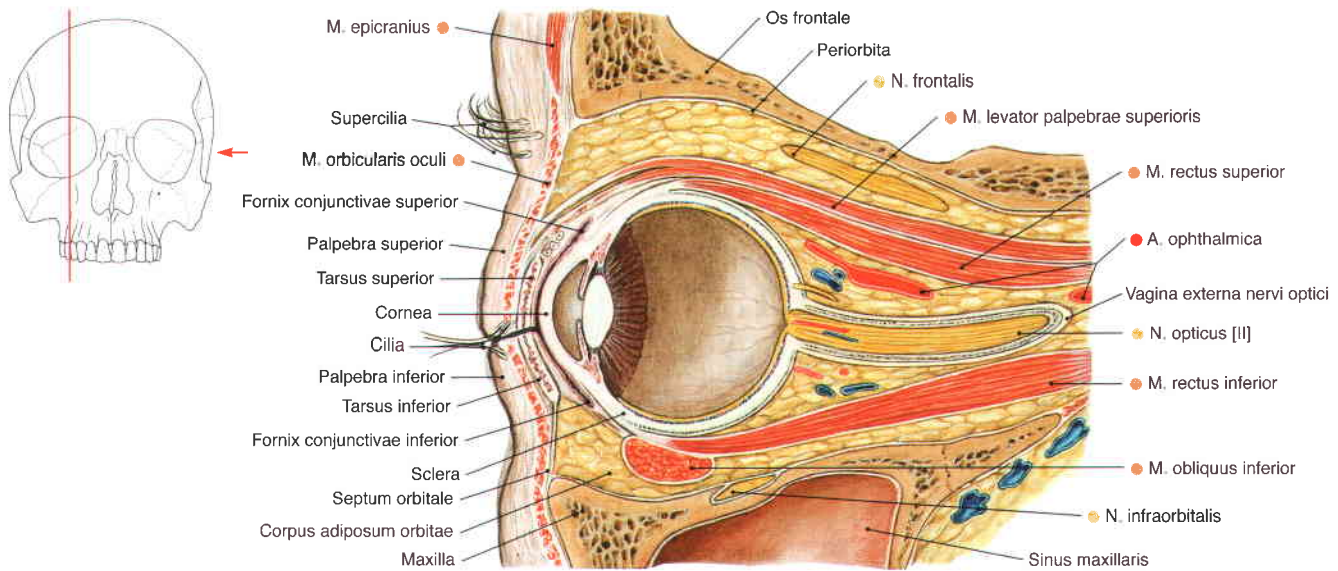


Fig. 674 Orbit, Orbita;
vertical section through the eyeball and the optic nerve;
medial view.

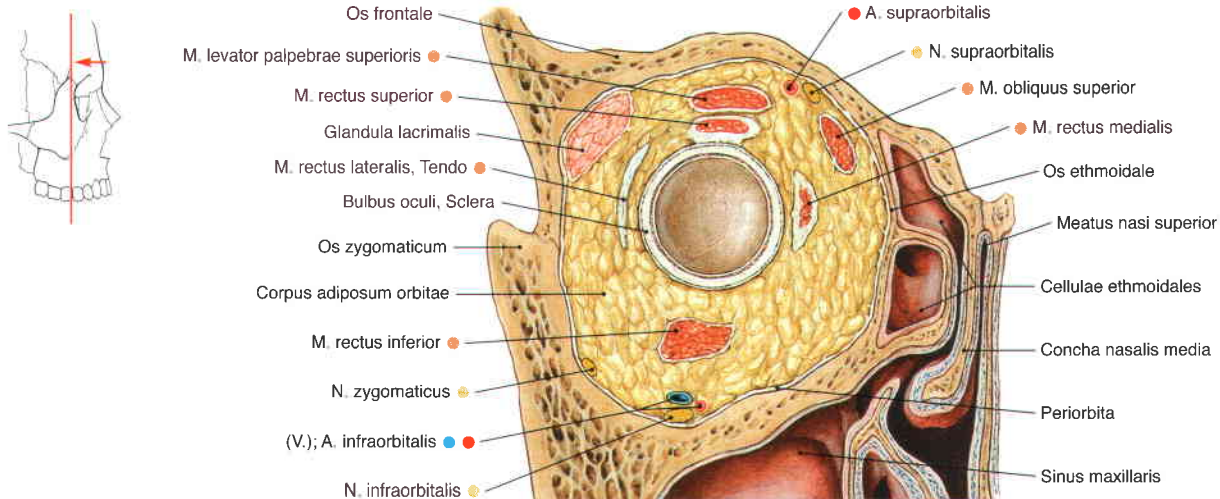


Fig. 675 Orbit, Orbita;
frontal section at the level of the posterior part of the eyeball;
anterior view.

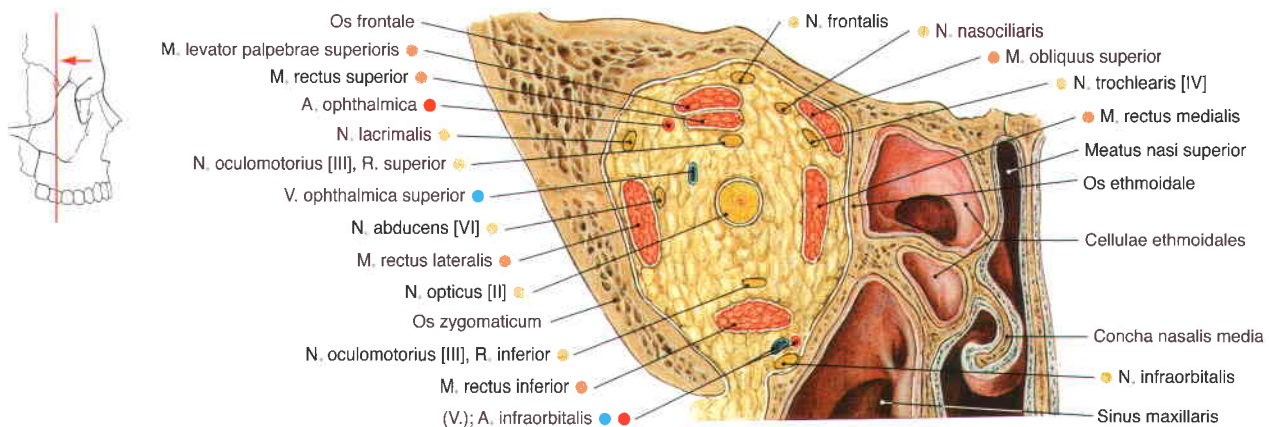


Fig. 676 Orbit, Orbita;
frontal section at the level of the middle of the extracranial
course of the optic nerve;
anterior view.

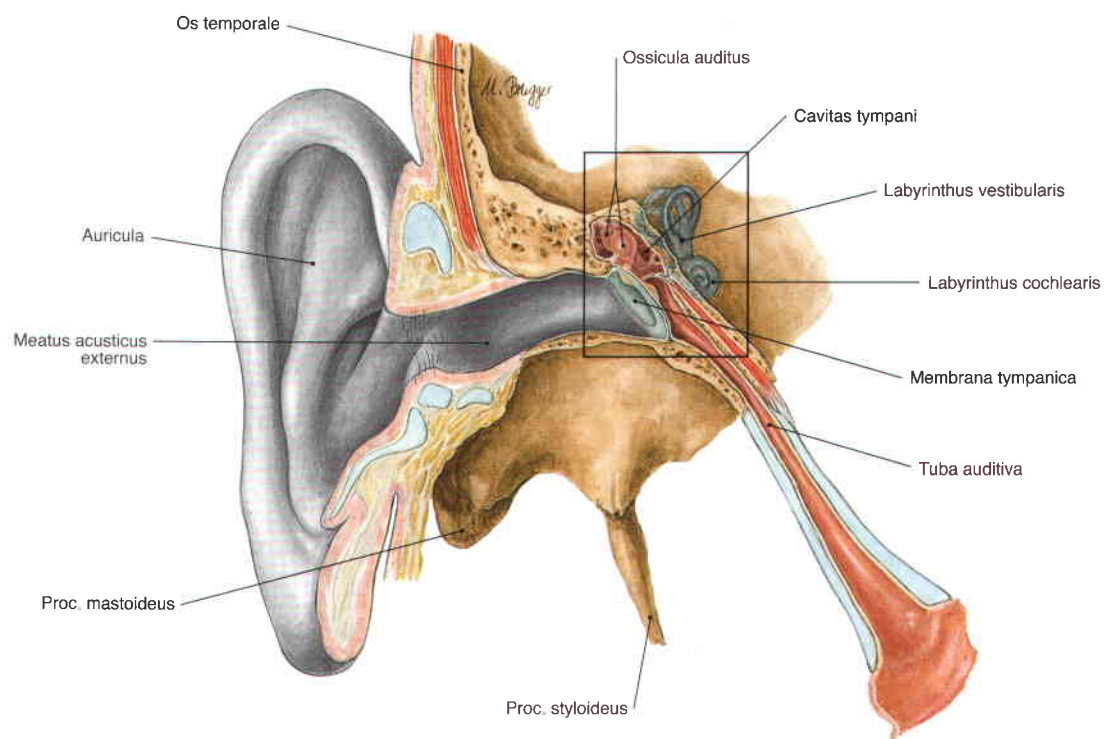


Fig. 677 Ear, Auris.

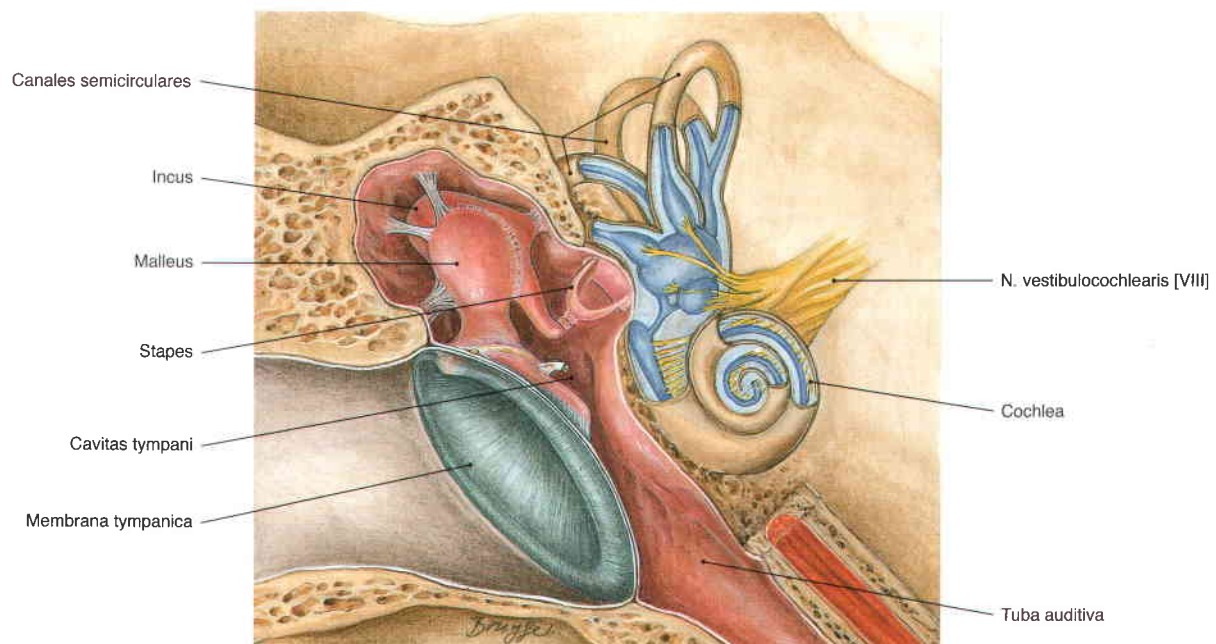
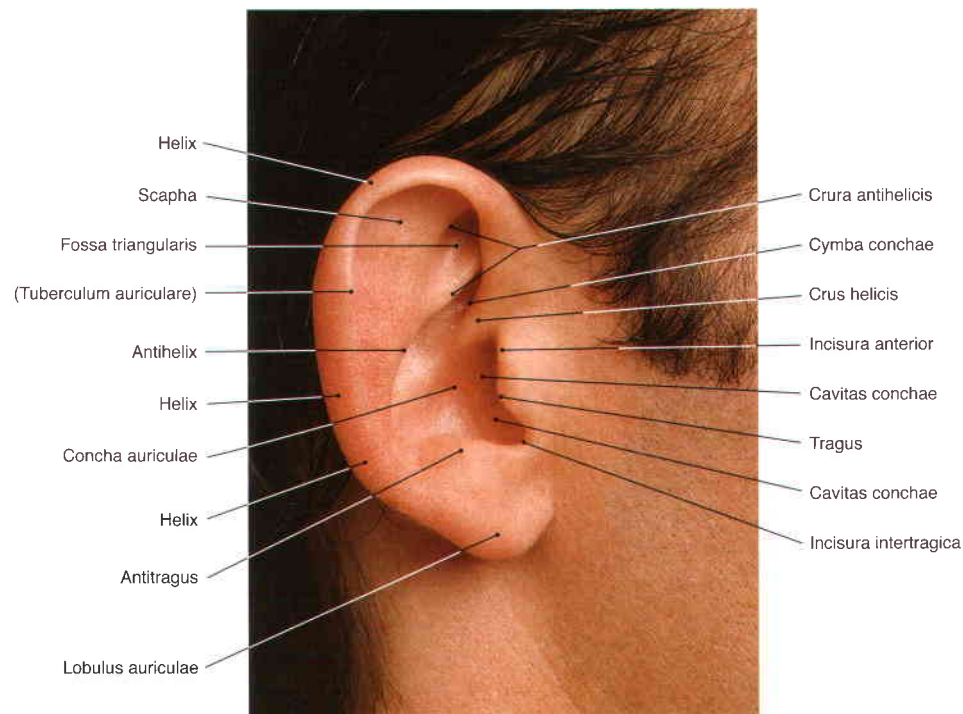
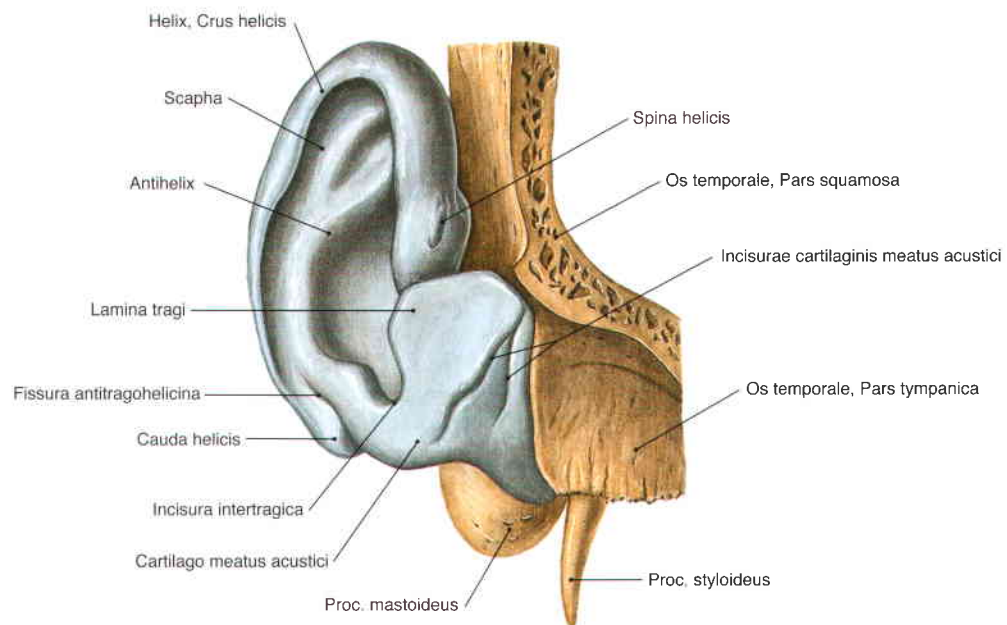


Fig. 678 Middle and inner ear, Auris media et interna; section from Fig. 677; anterior view.

Auricle**Fig. 679** Auricle, Auricula.**Fig. 680** Auricular cartilage, Cartilago auricularis.

Auricular muscles

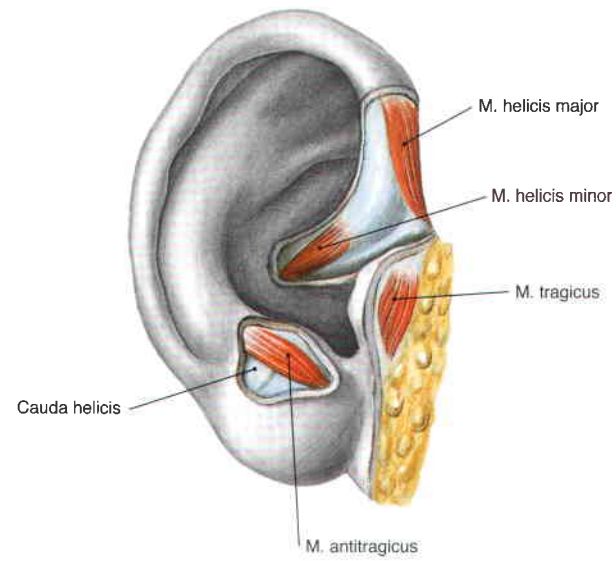


Fig. 681 Auricular muscles, Mm. auriculares.

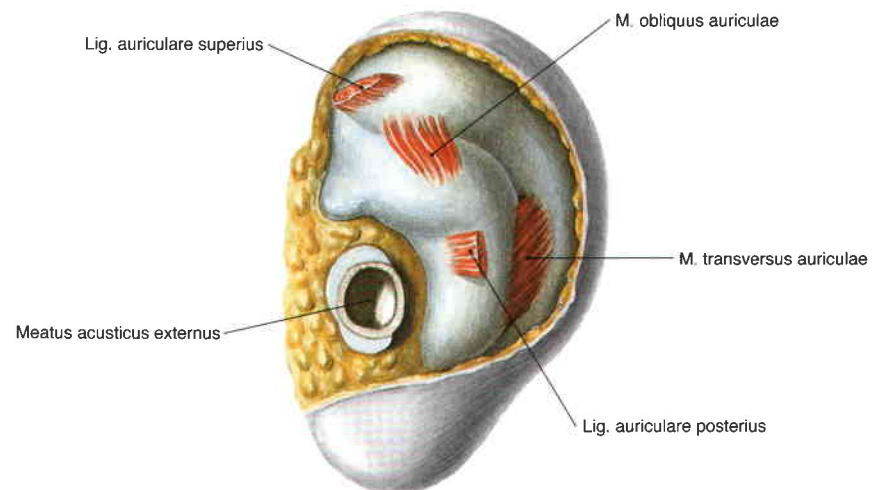


Fig. 682 Auricular muscles, Mm. auriculares.

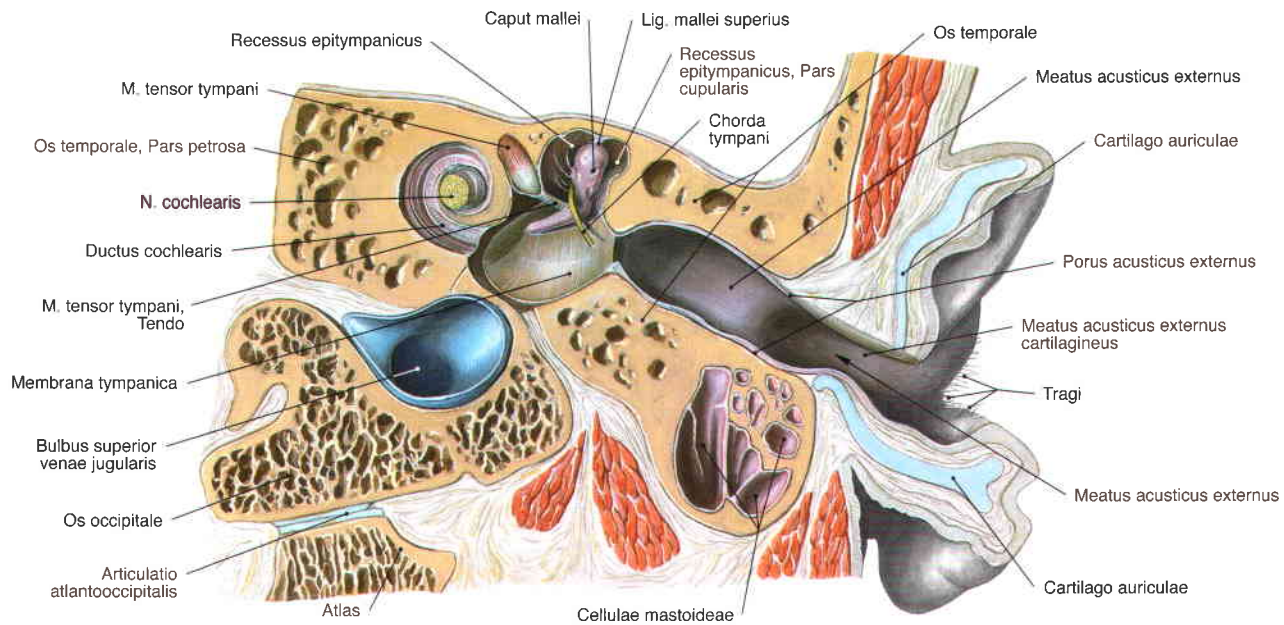
External acoustic meatus and tympanic membrane

Fig. 683 External acoustic meatus, Meatus acusticus externus; tympanic cavity, Cavitas tympani, and cochlea, Cochlea; frontal section; posterior view.

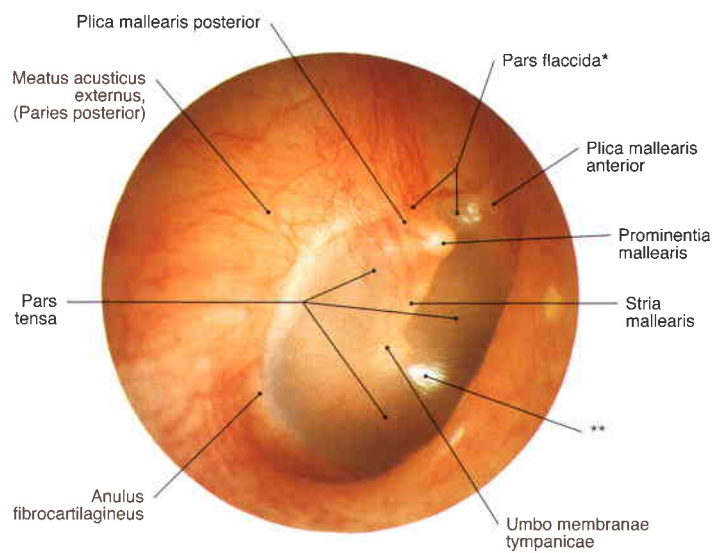
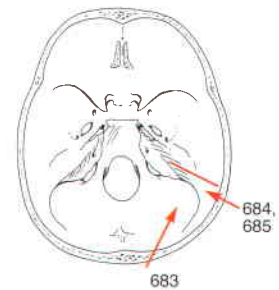


Fig. 684 Tympanic membrane, Membrana tympanica; otoscopic image; lateral view.

* Clinical term: SHRAPNELL's membrane
** Typically occurring reflection of light

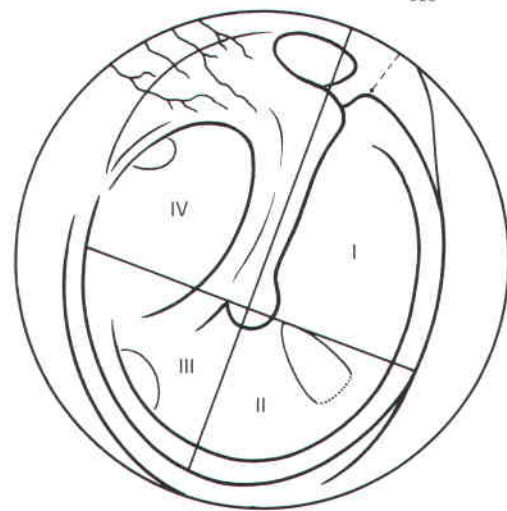


Fig. 685 Tympanic membrane, Membrana tympanica; quadrant schema; lateral view.

In order to obtain a complete otoscopic overview of the cutaneous surface of the tympanic membrane, the external acoustic meatus must be stretched by pulling the auricle upwards and posteriorly. To facilitate orientation, the tympanic membrane is usually divided into four quadrants (I–IV).

The longer diameter of the tympanic membrane in the adult is 10–11 mm, the shorter diameter is approx. 9 mm. The light source characteristically produces a triangular reflection of light at the umbo in the region of quadrant II.

Auditory ossicles

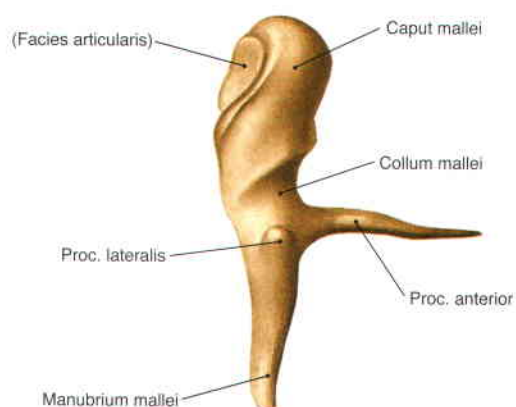


Fig. 686 Malleus, Malleus; lateral view.

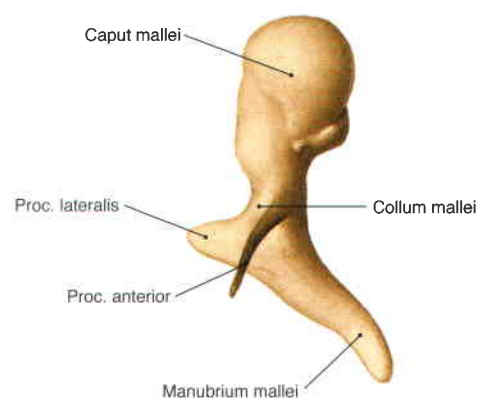


Fig. 687 Malleus, Malleus; anterior view.

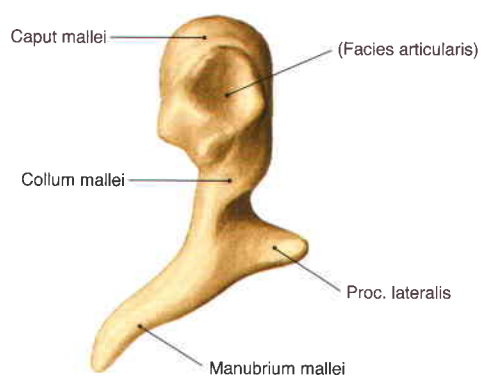


Fig. 688 Malleus, Malleus; posterior view.

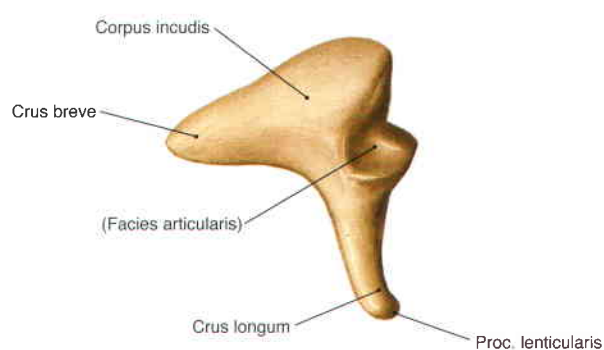


Fig. 689 Incus, Incus; lateral view.

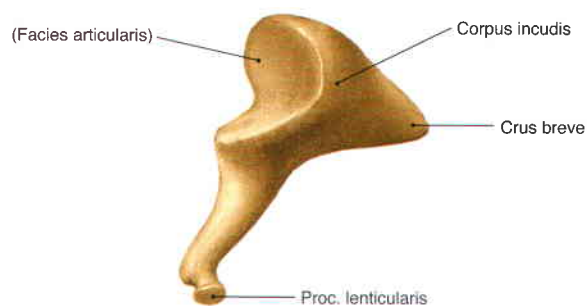


Fig. 690 Incus, Incus; medial view.

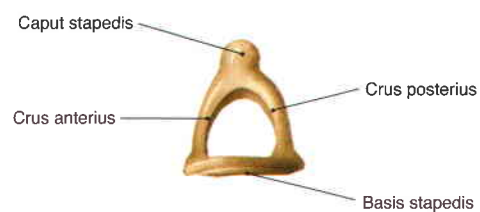


Fig. 691 Stapes, Stapes; superior view.

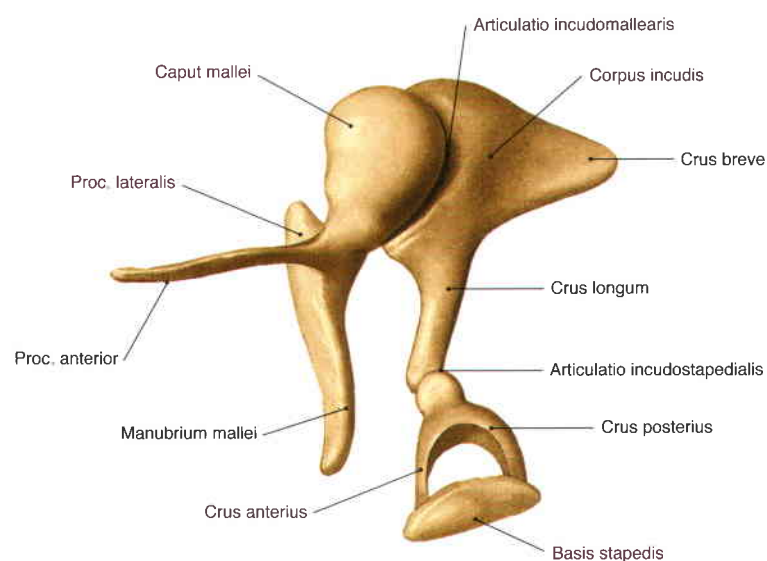
Auditory ossicles

Fig. 692 Auditory ossicles, Ossicula auditus; superomedial view.

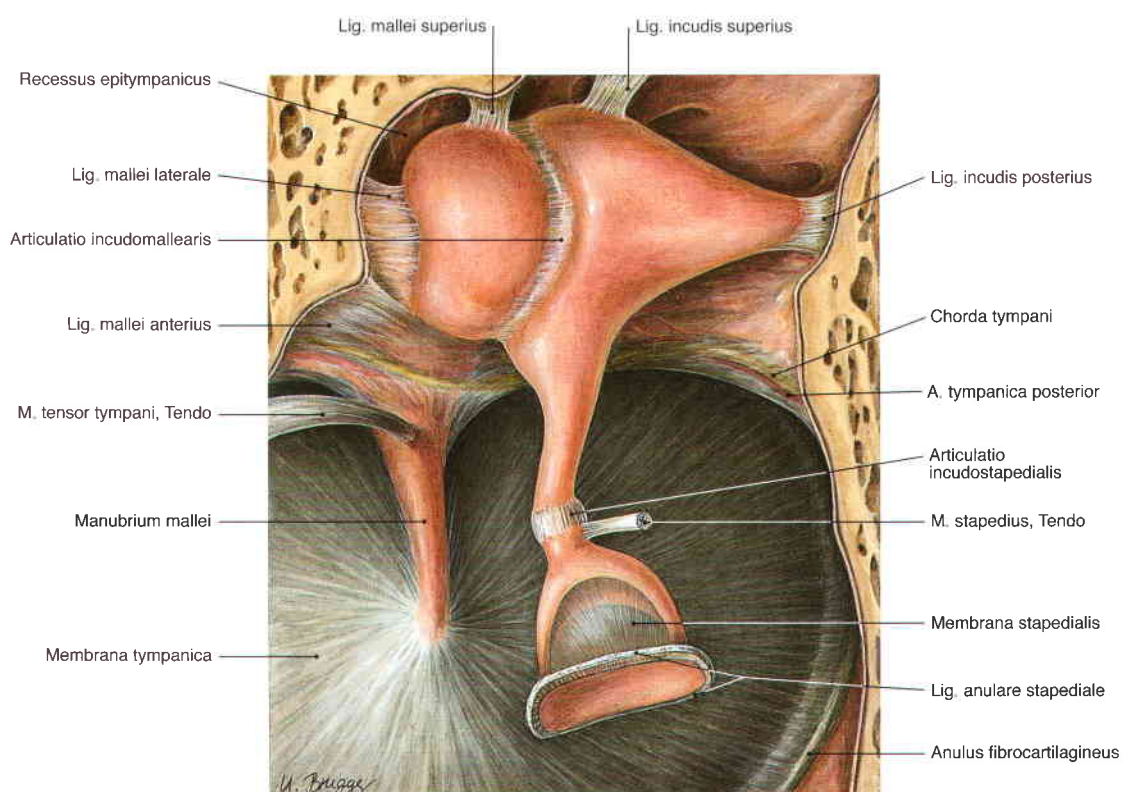


Fig. 693 Joints and ligaments of the auditory ossicles, Articulationes et Ligamenta ossiculorum auditus; covered with mucosa; superomedial view.

Tympanic cavity

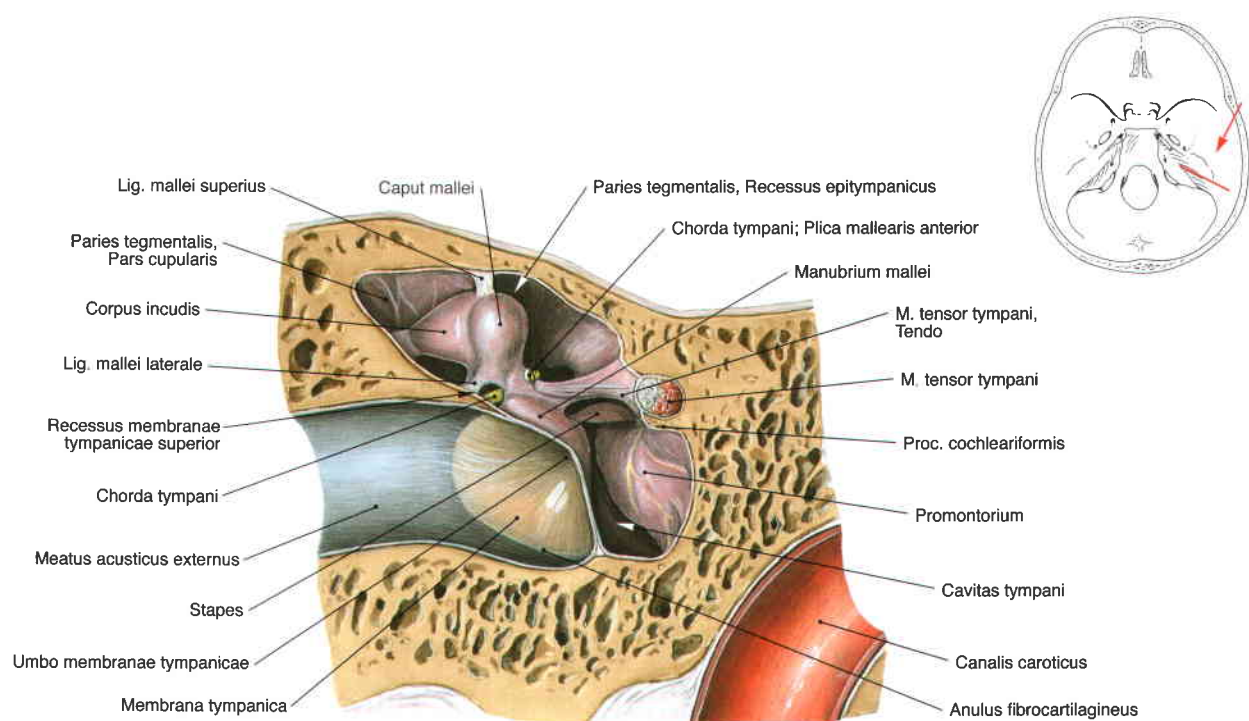


Fig. 694 Tympanic cavity, Cavitas tympani; frontal section; anterior view.

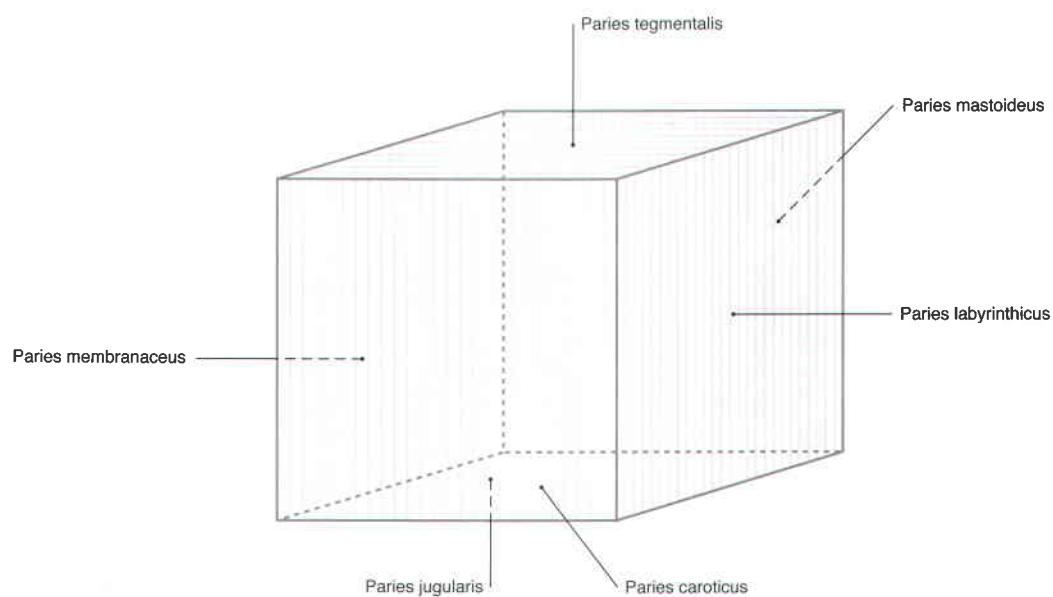


Fig. 695 Walls of the tympanic cavity, Cavitas tympani; schema for orientation.

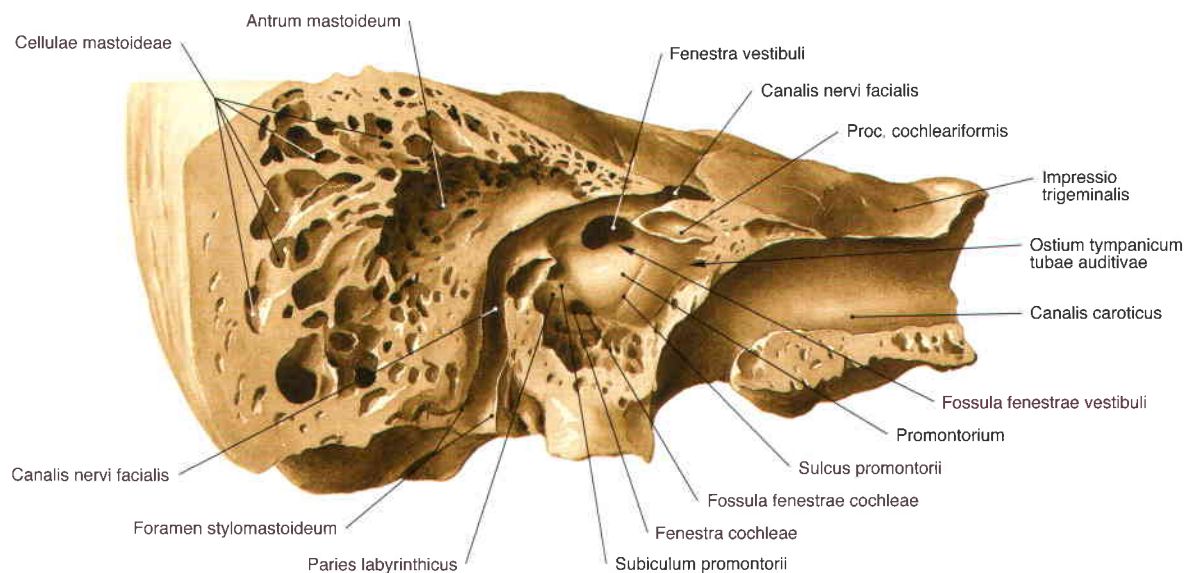
Tympanic cavity

Fig. 696 Medial wall, Paries labyrinthicus, of the tympanic cavity, Cavitas tympani; after removal of the lateral wall and the adjacent parts of the anterior and superior wall; the facial canal and the carotid canal have been opened; anterolateral view.

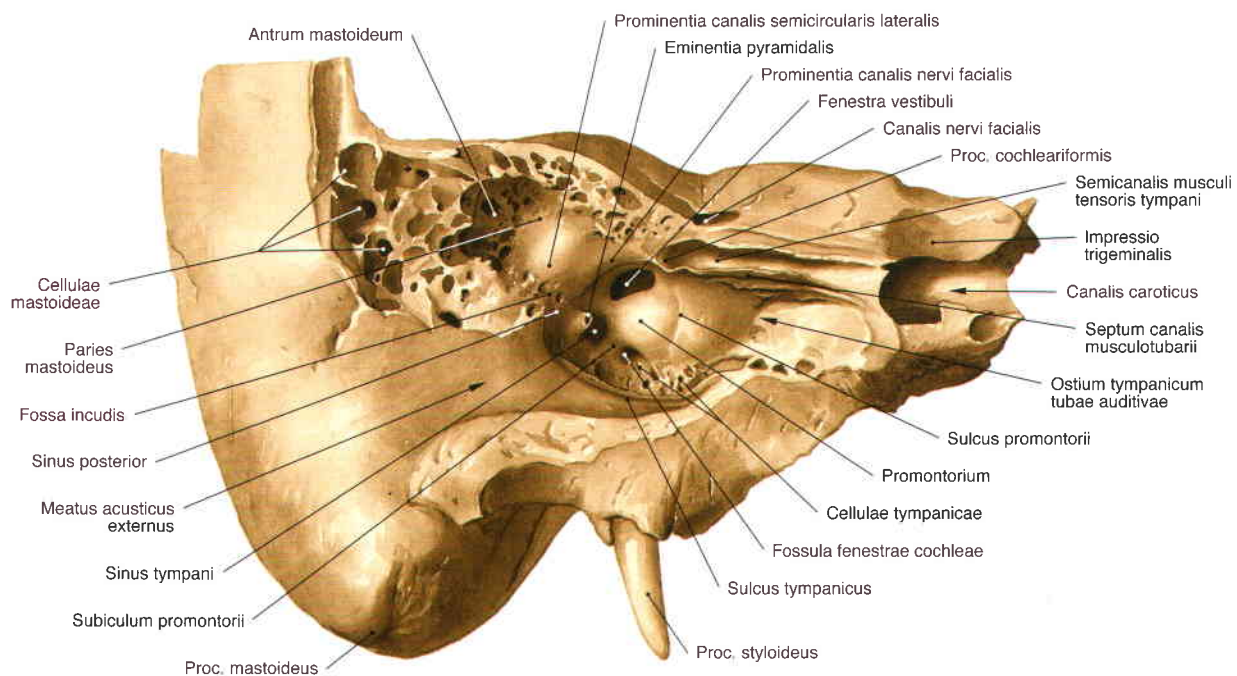


Fig. 697 Medial wall, Paries labyrinthicus, of the tympanic cavity, Cavitas tympani; vertical section along the longitudinal axis of the petrous part of the temporal bone; anterolateral view.

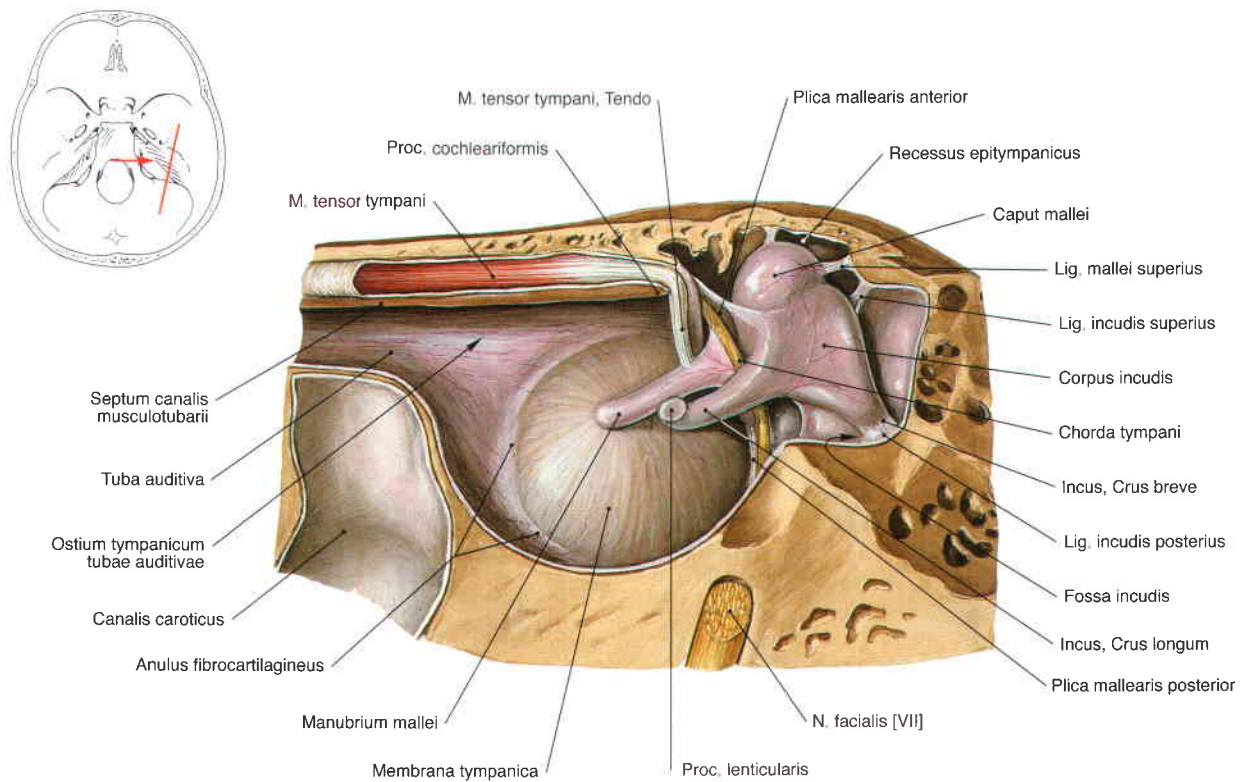
Tympanic cavity

Fig. 698 Lateral wall, Paries membranaceus, of the tympanic cavity, Cavitas tympani; medial view.

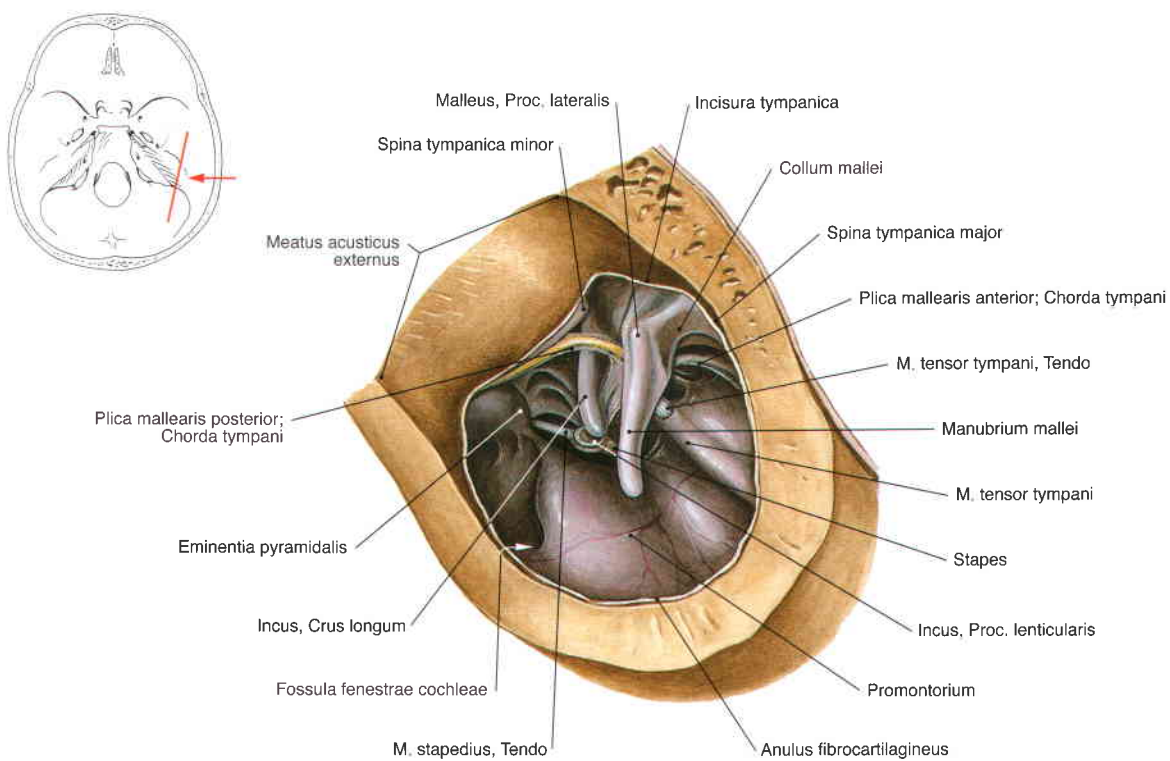


Fig. 699 Tympanic cavity, Cavitas tympani; after removal of the tympanic membrane; lateral view.

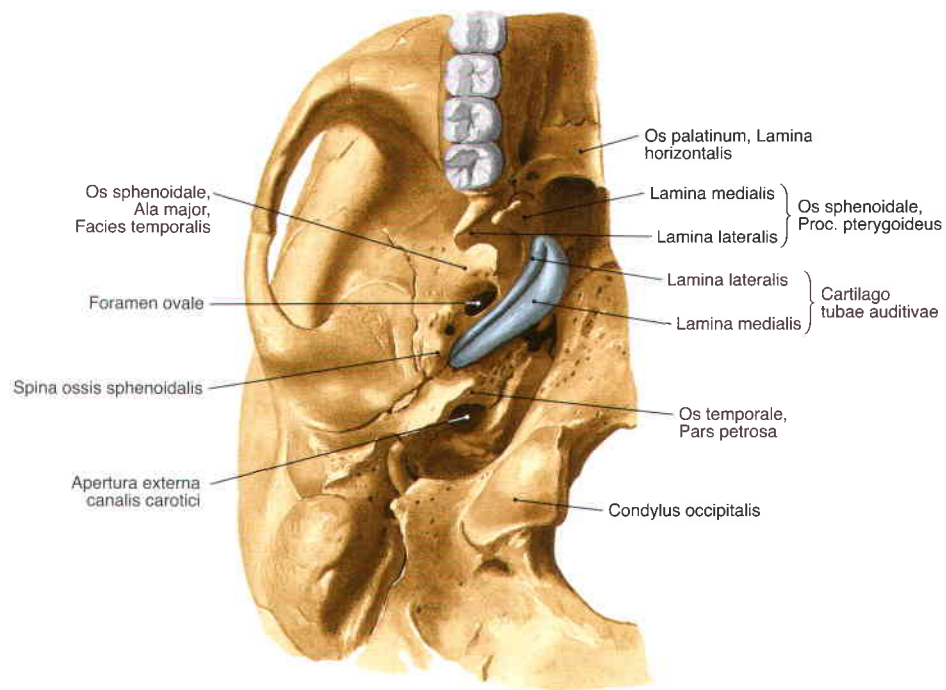
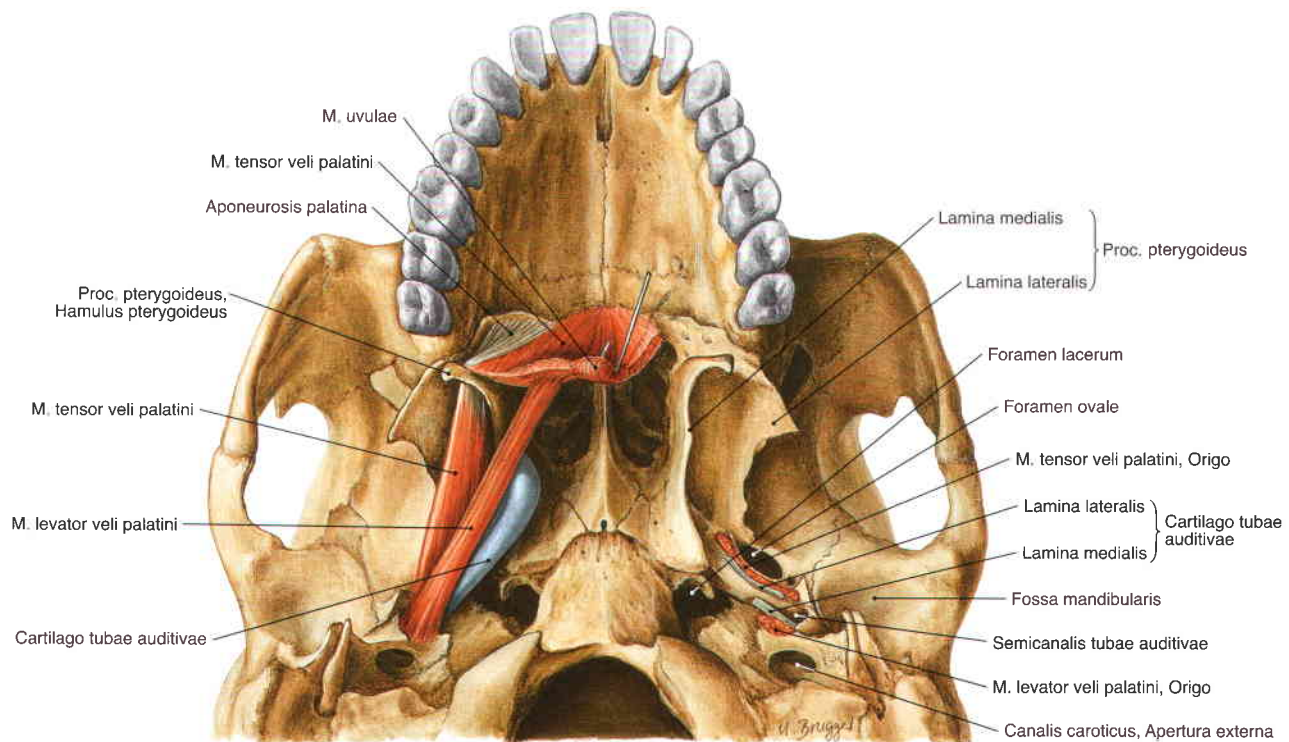
Auditory tube

Fig. 700 Cartilage of the auditory tube, *Cartilago tubae auditivae*; exposed at the base of the skull; inferior view.



→ 246, 249, T 3

Fig. 701 Levator and tensor veli palatini muscles, *Mm. levator et tensor veli palatini*, and the cartilage of the auditory tube, *Cartilago tubae auditivae*.

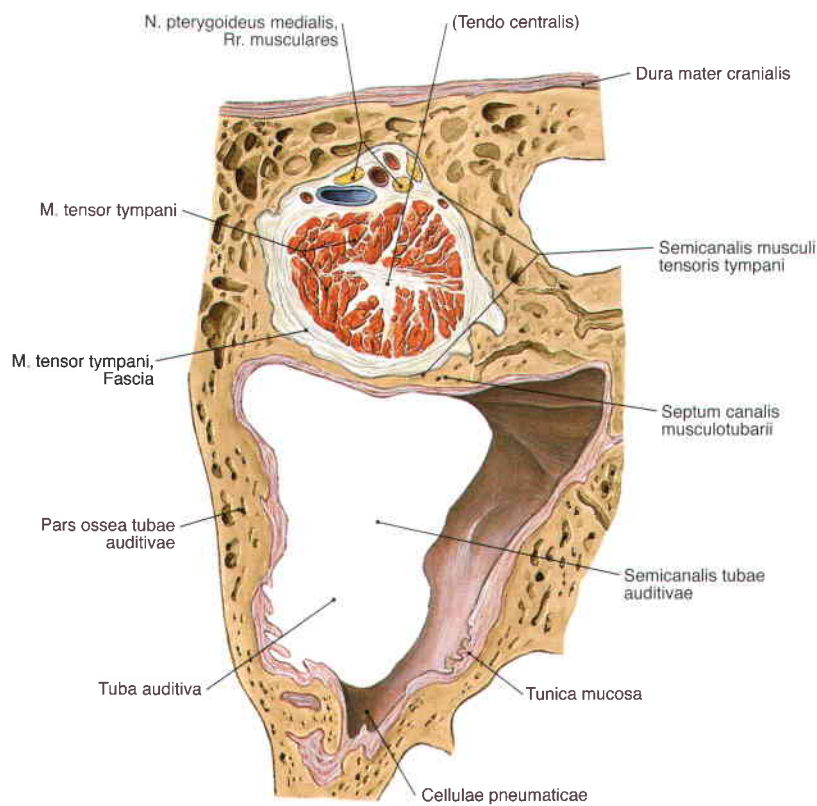


Fig. 702 Auditory tube, Tuba auditiva;
cross-section at the level of the osseous part;
lateral view.

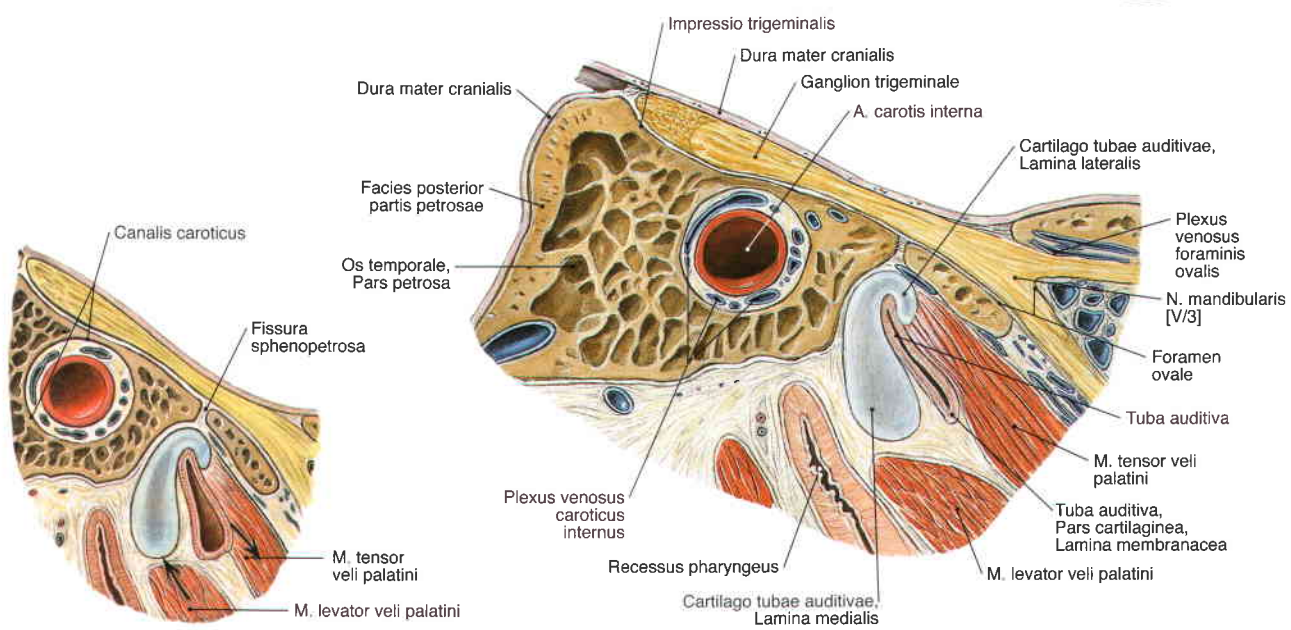
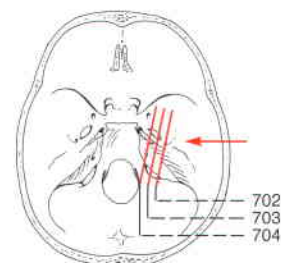


Fig. 703 Auditory tube, Tuba auditiva; cross-section at the level of the lateral aspect of the cartilaginous part; lateral view.

Fig. 704 Auditory tube, Tuba auditiva; cross-section at the level of the medial aspect of the cartilaginous part; lateral view.

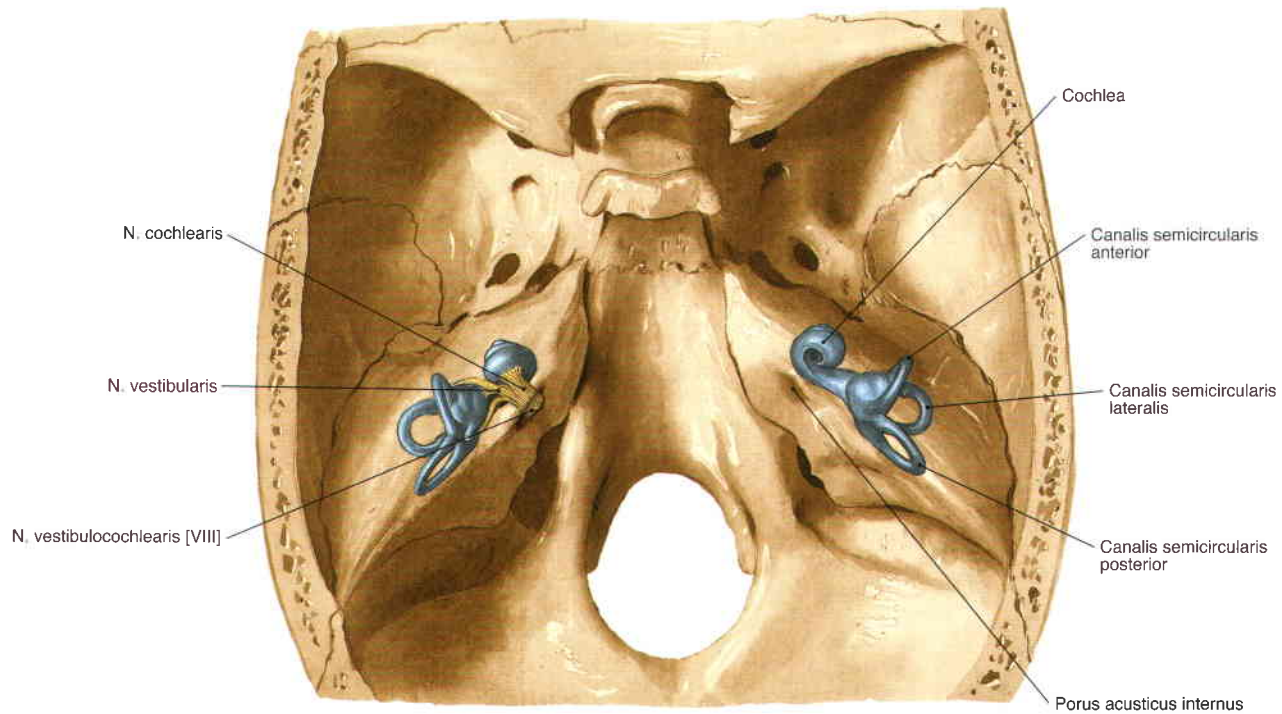
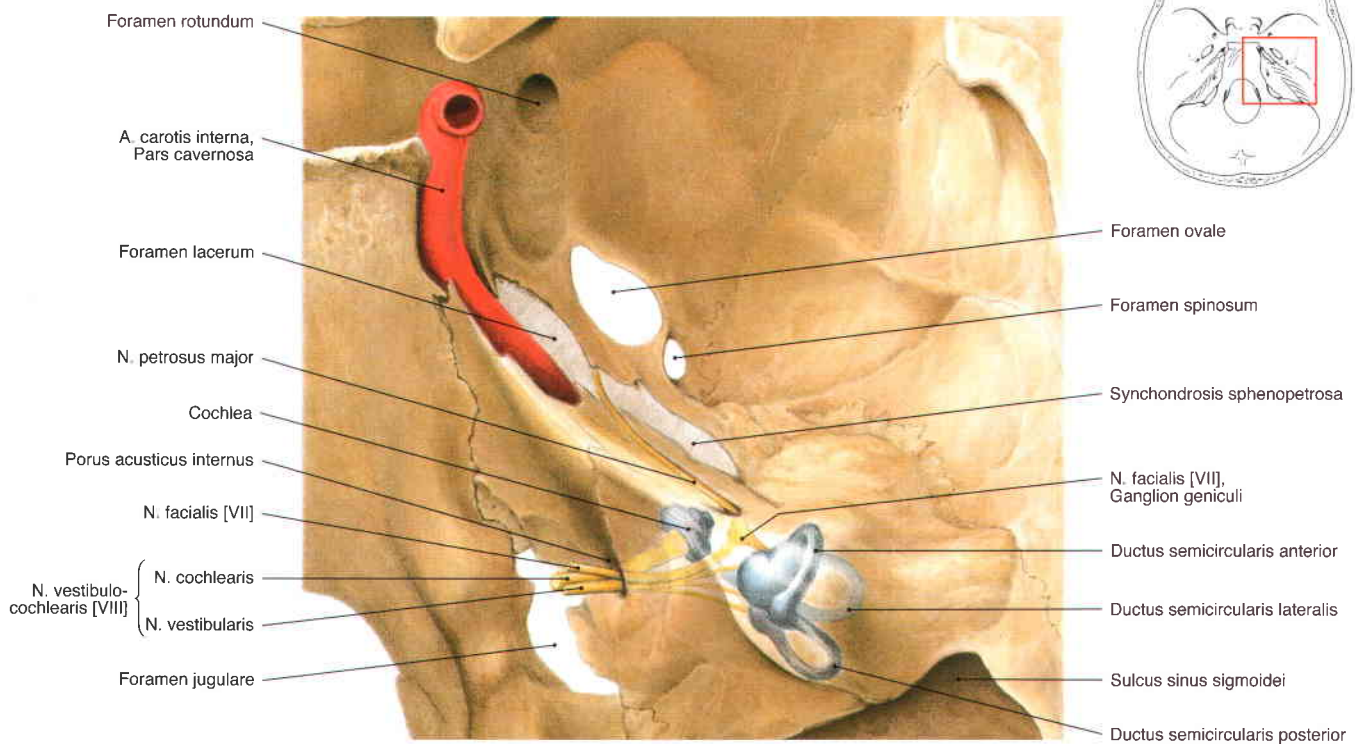
Bony labyrinth

Fig. 705 Inner ear, Auris interna, and vestibulocochlear nerve, N. vestibulocochlearis [VIII]; cast specimen projected onto the petrous part of the temporal bone illustrating its natural position; superior view.



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Fig. 706 Inner ear, Auris interna, with the facial nerve, N. facialis [VII], and the vestibulocochlear nerve, N. vestibulocochlearis [VIII]; projected onto the petrous part of the temporal bone; superior view.

Bony labyrinth

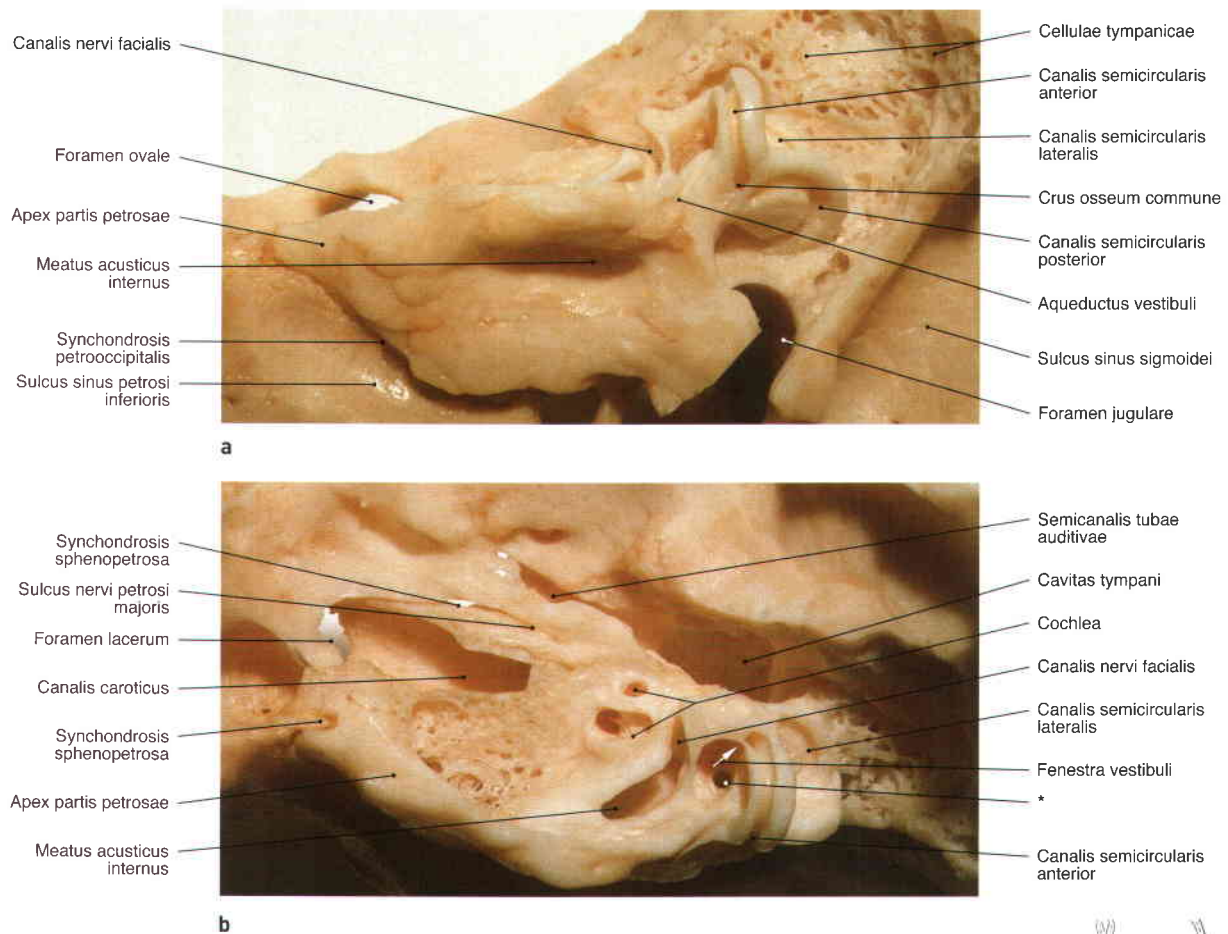


Fig. 707 a, b Bony labyrinth, Labyrinthus osseus; hollowed out of the petrous part of the temporal bone.

a Posterior-superior view

b Superior view

* Opening of the posterior canaliculus

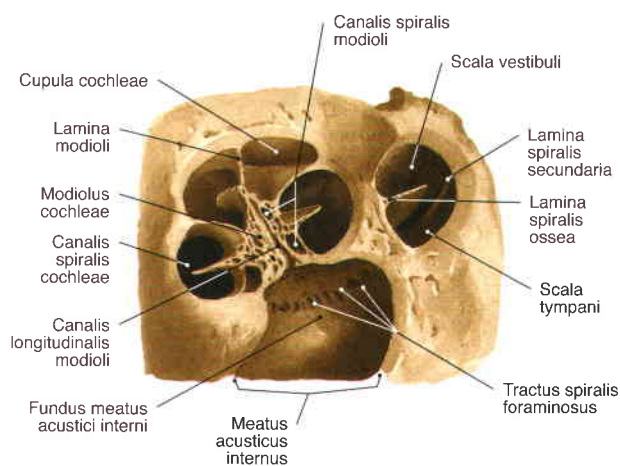
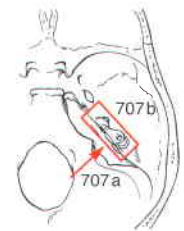


Fig. 708 Spiral canal of the cochlea, Canalis spiralis cochleae; opened along the axis of the modiolus; superior view.

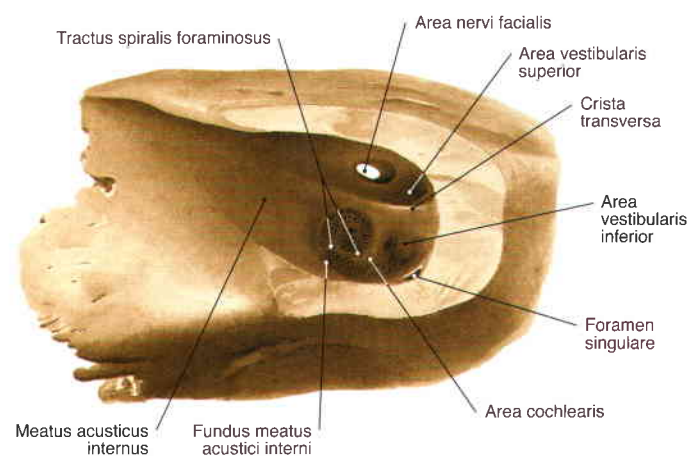


Fig. 709 Internal acoustic meatus, Meatus acusticus internus, and fundus of the internal acoustic meatus, Fundus meatus acustici interni; after partial removal of the posterior wall; medial view.

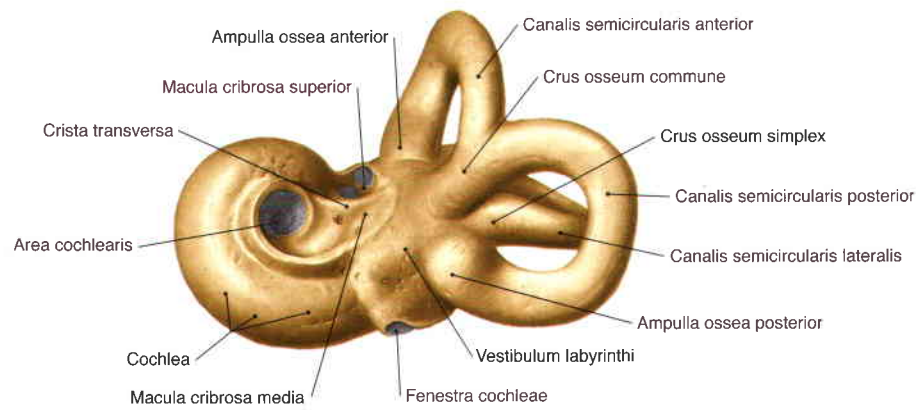
Bony labyrinth

Fig. 710 Bony labyrinth, Labyrinthus osseus; the osseous lining of the membranous labyrinth has been hollowed out of the petrous part of the temporal bone; oblique view from posterior.

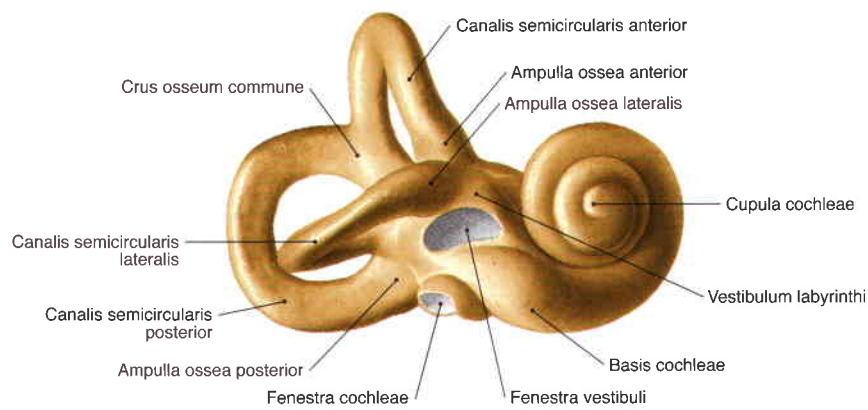


Fig. 711 Bony labyrinth, Labyrinthus osseus; the osseous lining of the membranous labyrinth has been hollowed out of the petrous part of the temporal bone; lateral view.

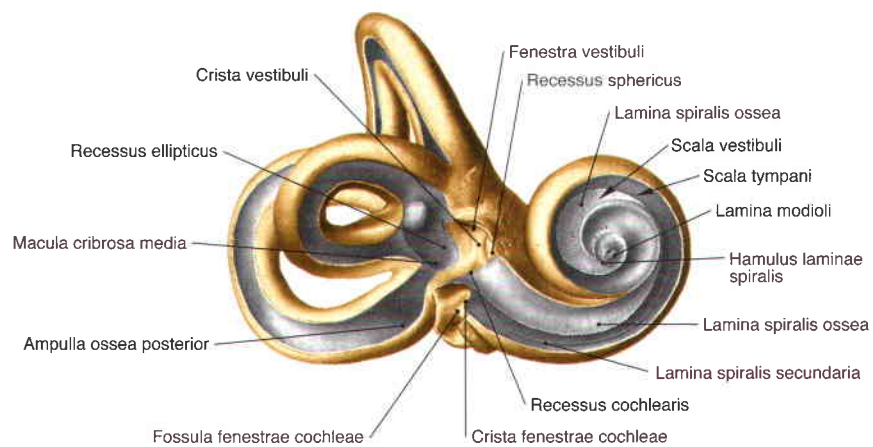


Fig. 712 Bony labyrinth, Labyrinthus osseus; cavities have been hollowed out; anterolateral view.

Membranous labyrinth

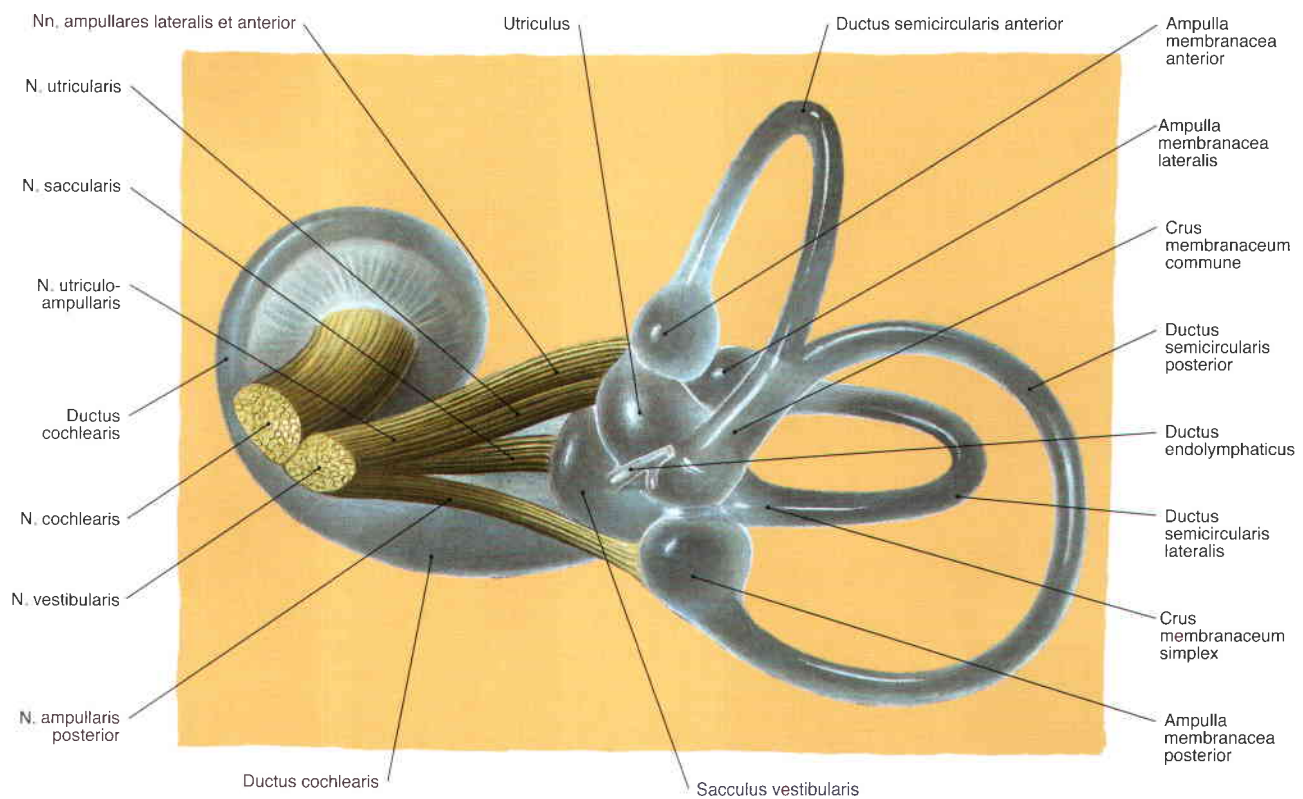


Fig. 713 Vestibulocochlear nerve, N. vestibulocochlearis [VIII], and membranous labyrinth, Labyrinthus membranaceus; semi-schematic overview; posterior view.

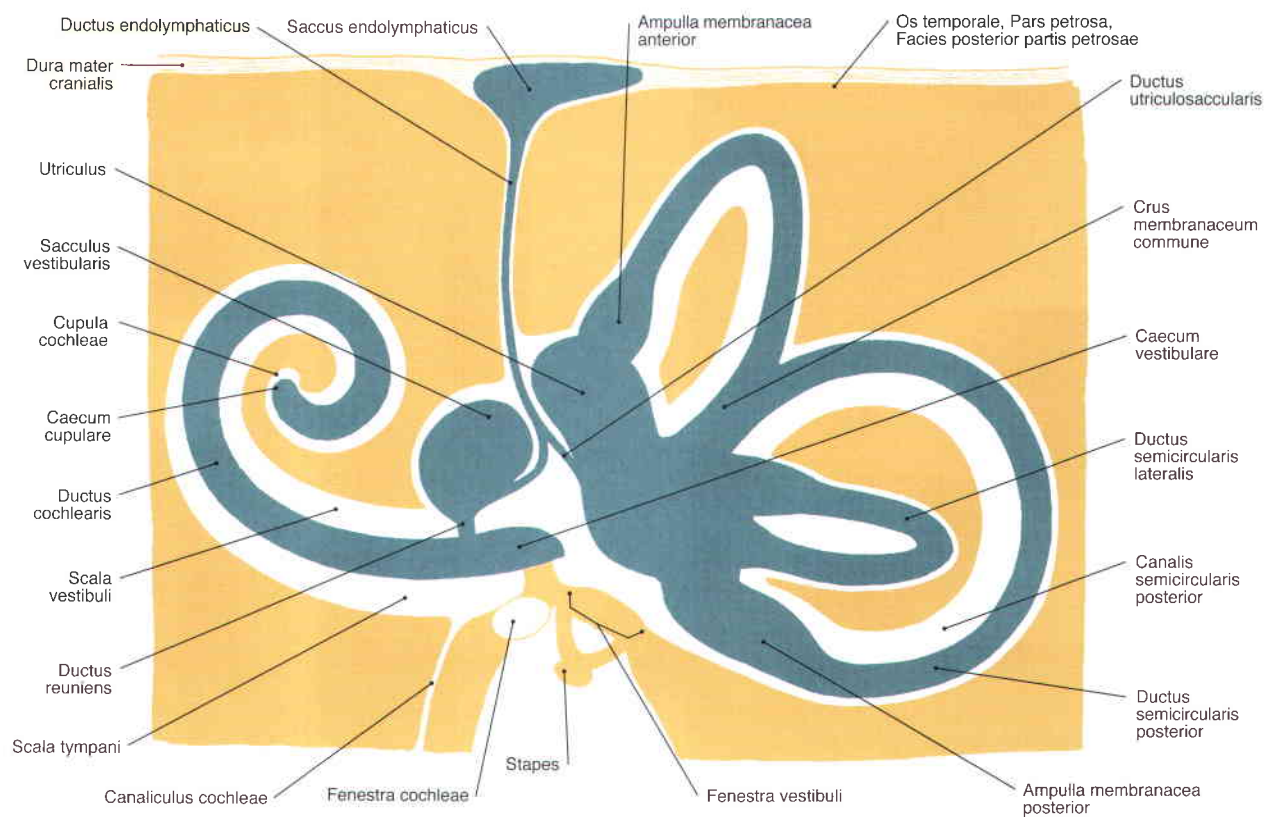


Fig. 714 Membranous labyrinth, Labyrinthus membranaceus; overview.

Cochlea

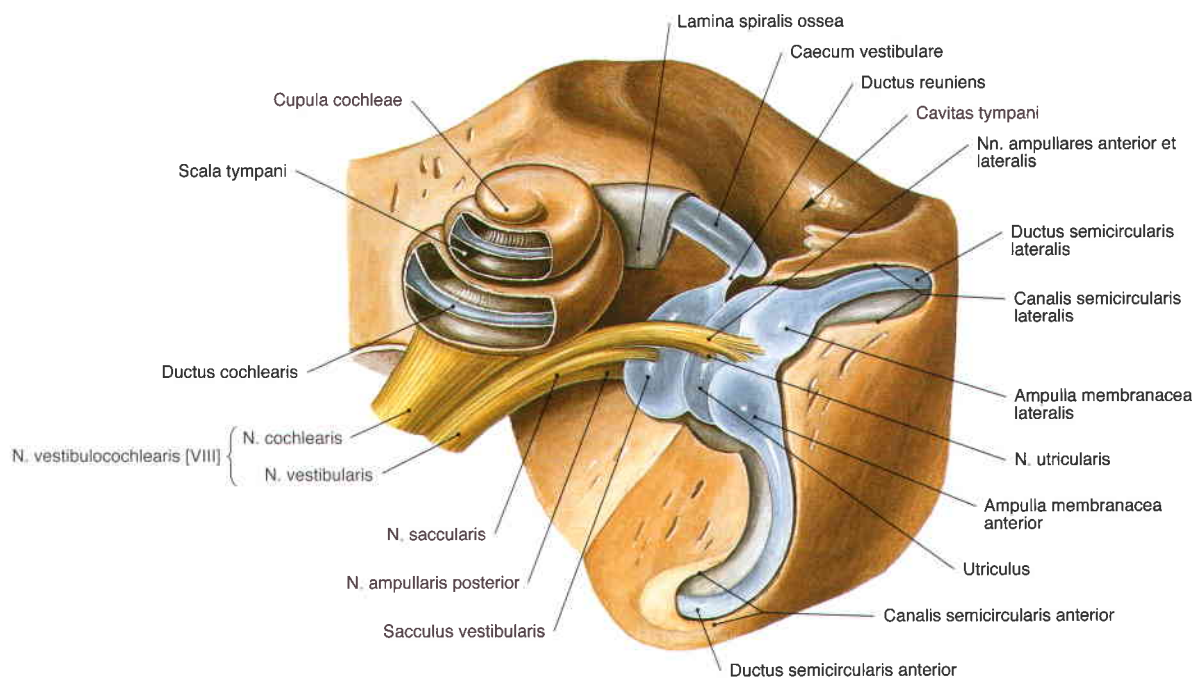


Fig. 715 Vestibulocochlear nerve, N. vestibulocochlearis [VIII], and membranous labyrinth, Labyrinthus membranaceus; superior view.

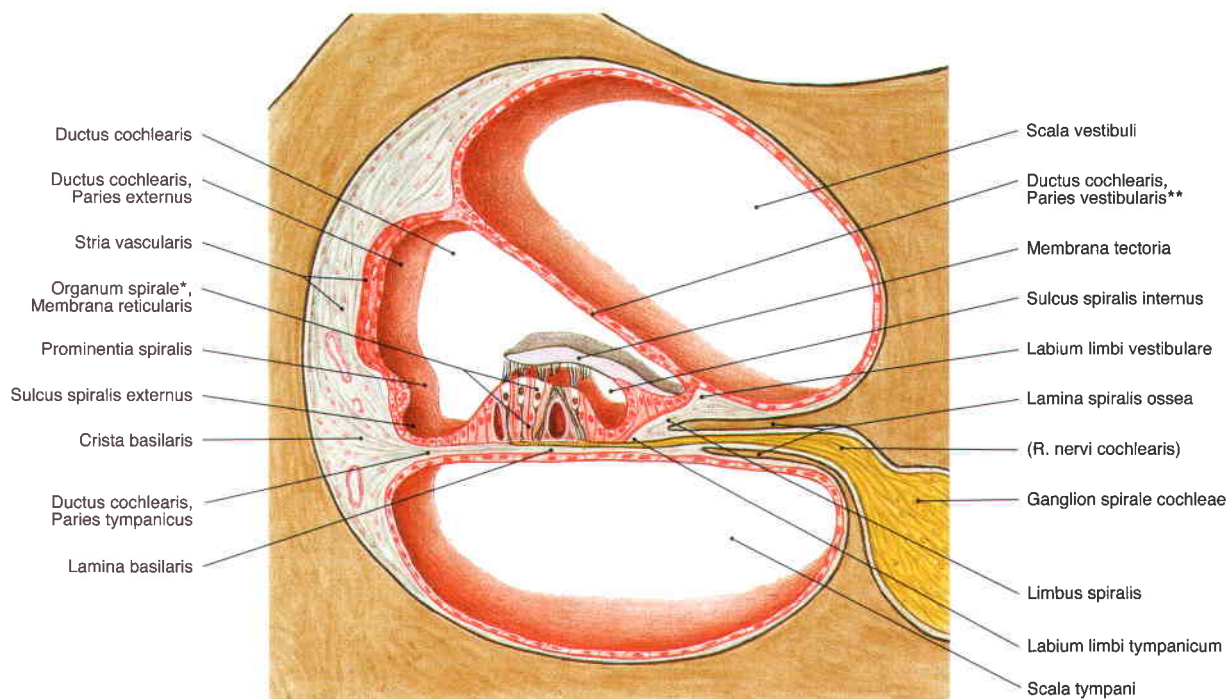


Fig. 716 Cochlea, Cochlea, with the spiral organ, Organum spirale.

* Clinical term: organ of Corti

** Clinical term: REISSNER's membrane

Equilibrium organ, structure

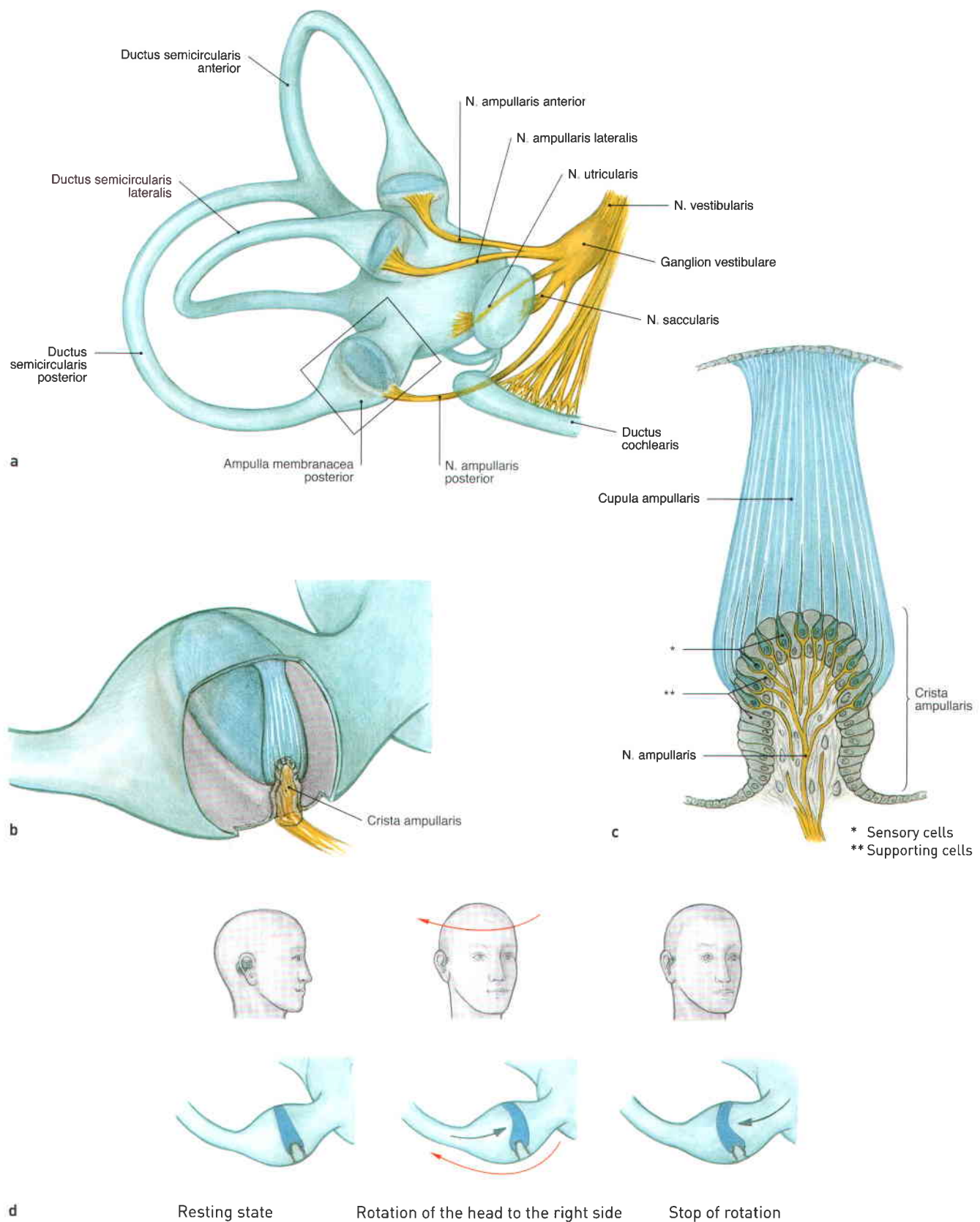


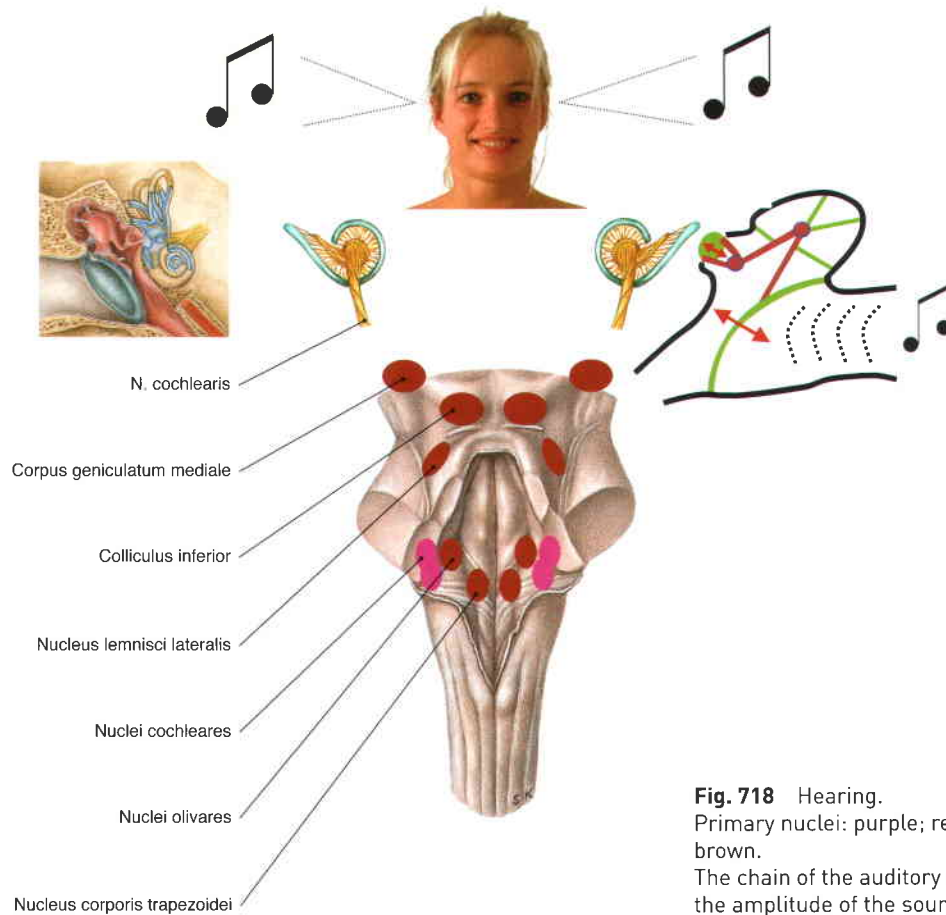
Fig. 717 a-d Equilibrium organ; Labyrinthus vestibularis.

a Anterior view

b Higher magnification of the area indicated in **a**: the anterior part of the posterior membranous ampulla, Ampulla membranacea posterior, has been opened.

c Cross-section through the ampullary crest, *Crista ampullaris*

d Function of the cupula of the lateral semicircular duct, Ductus semicircularis lateralis, during rotation of the head

Hearing and equilibrium**Fig. 718** Hearing.

Primary nuclei: purple; remaining nuclei: brown.

The chain of the auditory ossicles amplifies the amplitude of the sound waves physically.

**Fig. 719** Control of equilibrium and stabilisation of the visual field.

Afferent fibres originate in the muscles of the eye, the equilibrium organ and the muscles of the neck; efferent fibres modulate the muscles of the eye and the body. The cerebellum plays a predominant role in this coordination.

Auditory pathway

1. neuron: Bipolar cells in the spiral cochlear ganglion. After exiting the small apertures of the foraminous spiral tract within the internal acoustic meatus, the fibres form the cochlear nerve and unite with the vestibular nerve at the floor of the internal acoustic meatus to form the vestibulocochlear nerve [VIII]. Fibres from the basal cochlear parts traverse to the posterior cochlear nucleus and those from the apical parts terminate in the anterior cochlear nucleus.
2. neuron: Multi-polar ganglion cells of the cochlear nuclei. The fibres from the anterior cochlear nucleus pass mainly within the trapezoid body to the opposite side and form the lateral lemniscus, which provides a connection to the inferior colliculus. A few fibres join the lateral lemniscus of the same side. The axons of the posterior cochlear nucleus cross superficially to the rhomboid fossa and enter the lateral lemniscus of the opposite side.
3. or 4. neuron: From the inferior colliculus connections are made with the medial geniculate body.
4. or 5. neuron: The acoustic radiation connects the medial geniculate body to HESCHL's transverse gyrus and with WERNICKE's centre in the temporal lobe.

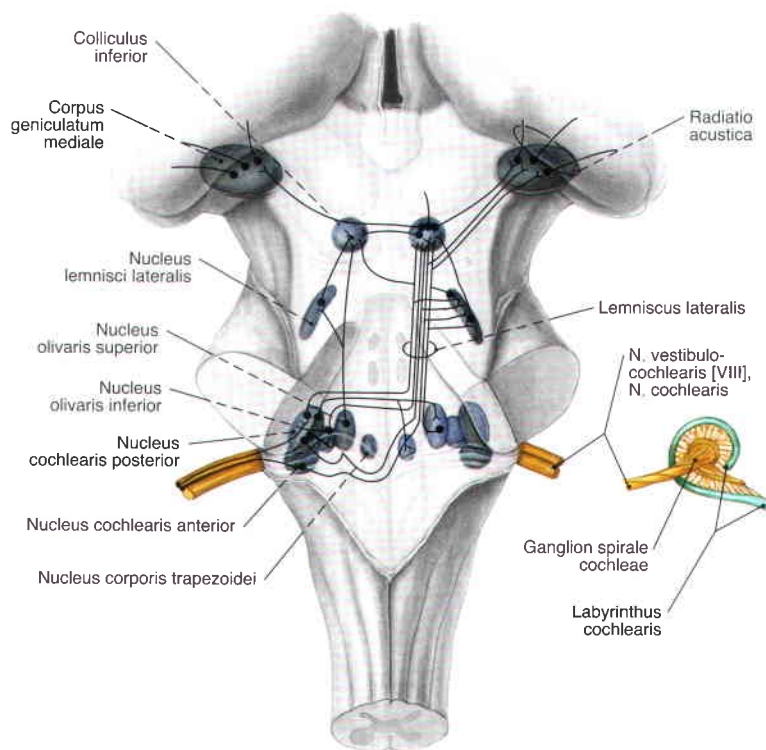


Fig. 720 Auditory pathway; overview.

Equilibrium pathway

1. neuron: Bipolar cells in the vestibular ganglion. Their neurites pass the inferior and superior vestibular areas to form the vestibular nerve at the floor of the internal acoustic meatus, which together with the cochlear nerve then forms the vestibulocochlear nerve [VIII]. These fibres terminate at the vestibular nuclei in the lateral angle of the floor of the rhomboid fossa.
2. and subsequent neurons: Fibres originating in the lateral vestibular nucleus (DEITERS' nucleus) traverse within the lateral vestibulospinal tract to the anterior column of the spinal cord. Fibres originating in the superior vestibular nucleus (nucleus of BECHTEREW), the medial vestibular nucleus (SCHWALBE's nucleus) as well as the inferior vestibular nucleus (ROLLER's nucleus) traverse to the cerebellum and connect to the motor nuclei of the cranial nerves III, IV and VI, mostly via the medial longitudinal fasciculus. The medial vestibular nucleus and the inferior vestibular nucleus send fibres along the medial vestibulospinal tract to the anterior column of the spinal cord.

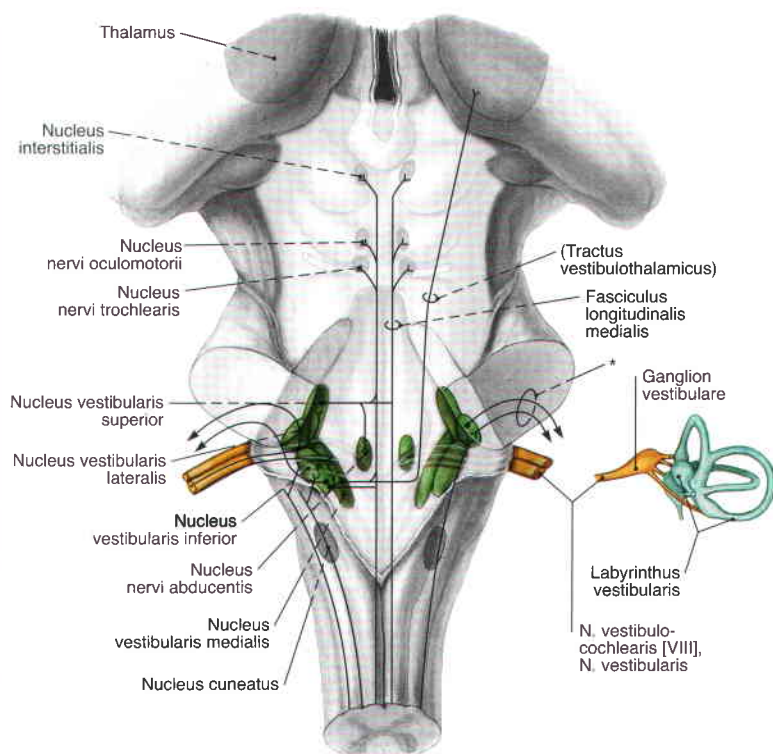
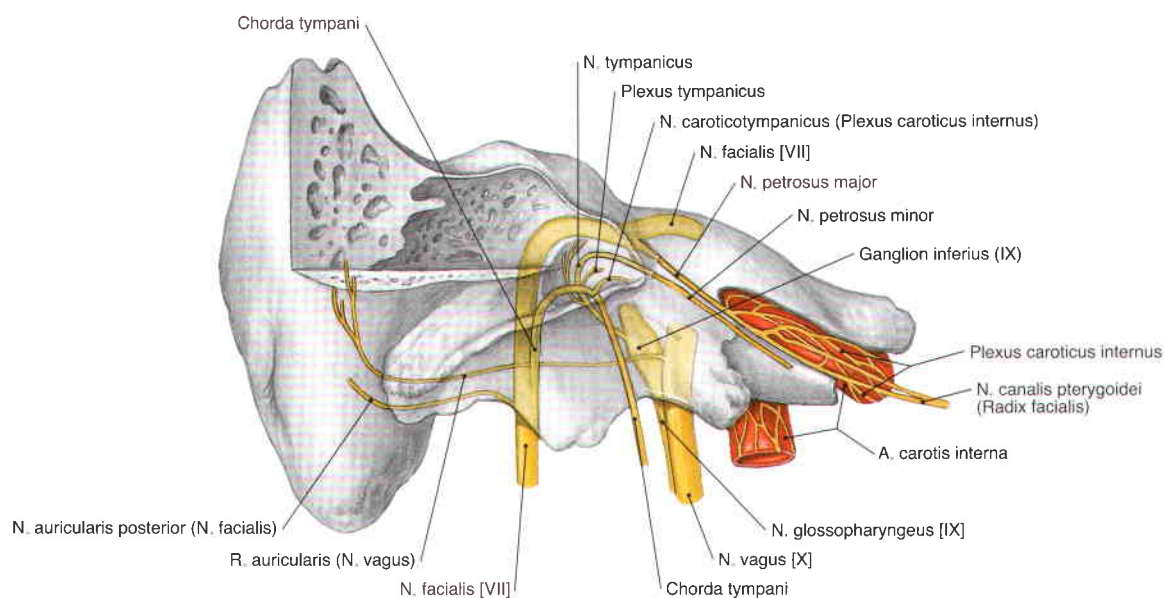


Fig. 721 Equilibrium pathway; overview.

* Connections to the cerebellum

Nerves in the petrous part of the temporal bone



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Fig. 722 Facial nerve, N. facialis [VII];
glossopharyngeal nerve, N. glossopharyngeus [IX];
and vagus nerve, N. vagus [X];
the petrous part of the temporal bone has been partly sectioned;
the nerves are illustrated translucently;
anterior view.

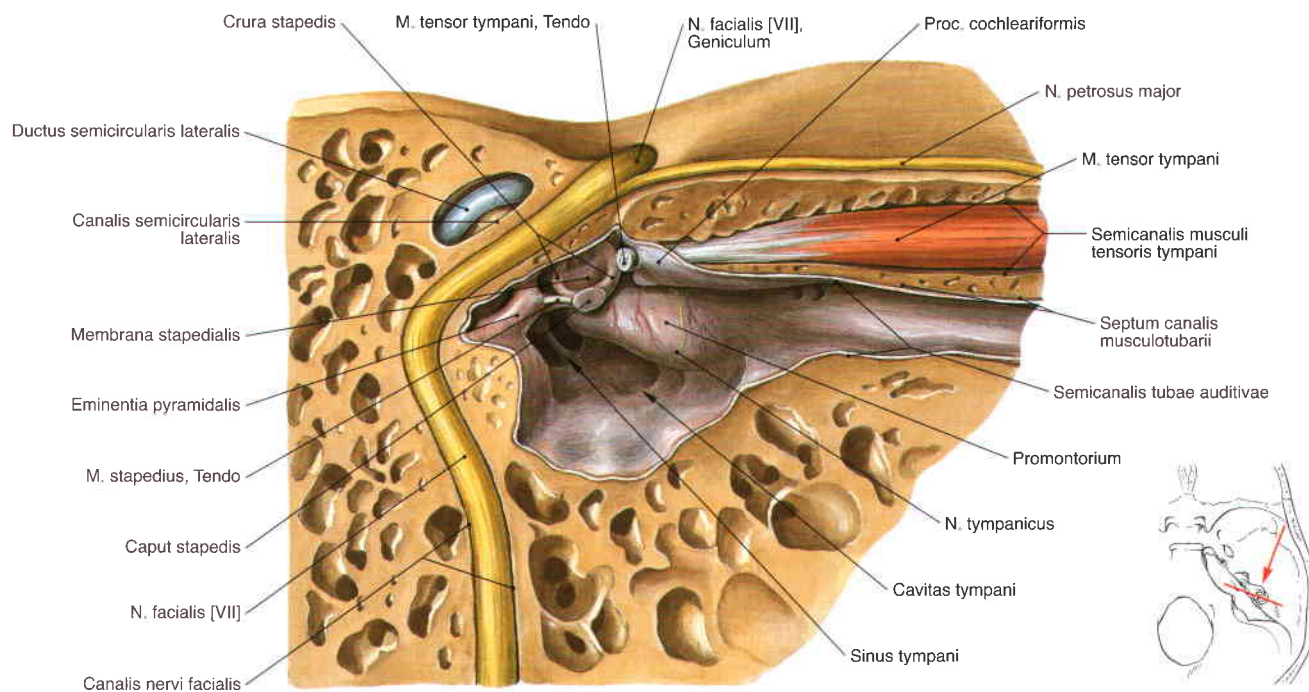


Fig. 723 Facial nerve, N. facialis [VII], and tympanic cavity, Cavitas tympani; vertical section along the longitudinal axis of the petrous part of the temporal bone; the facial canal has been opened; anterior view.

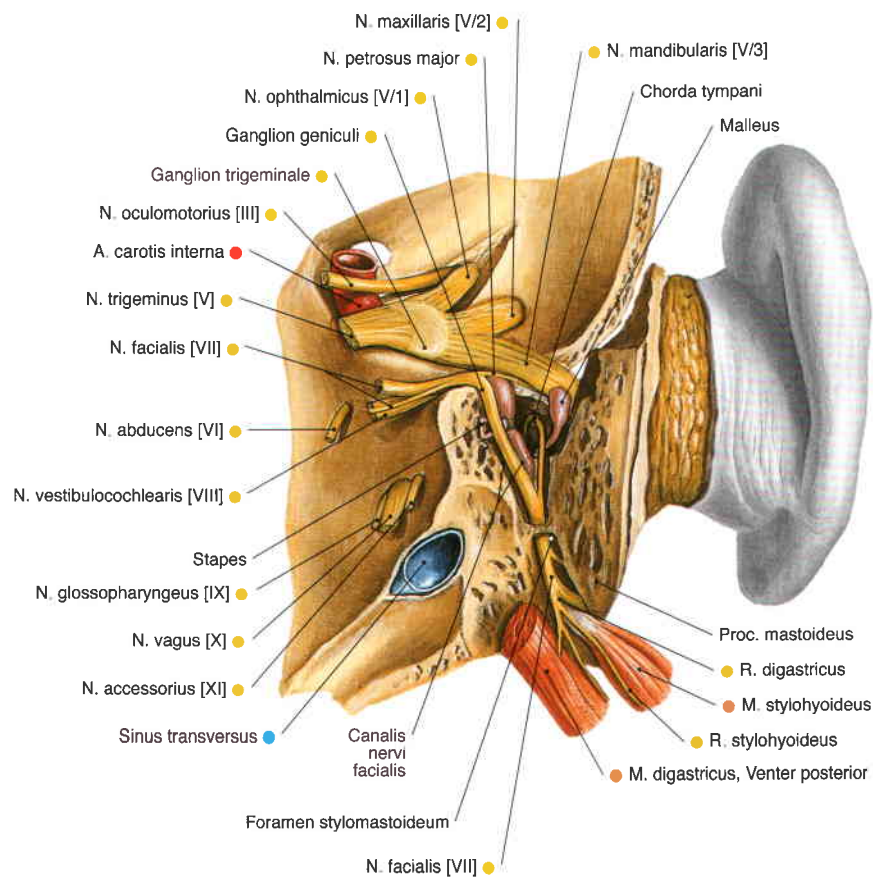


Fig. 724 Facial nerve, N. facialis [VII], within the petrous part of the temporal bone, Os temporale, Pars petrosa; the petrous part of the temporal bone as well as the facial canal and the tympanic cavity have been partially opened; posterior view.

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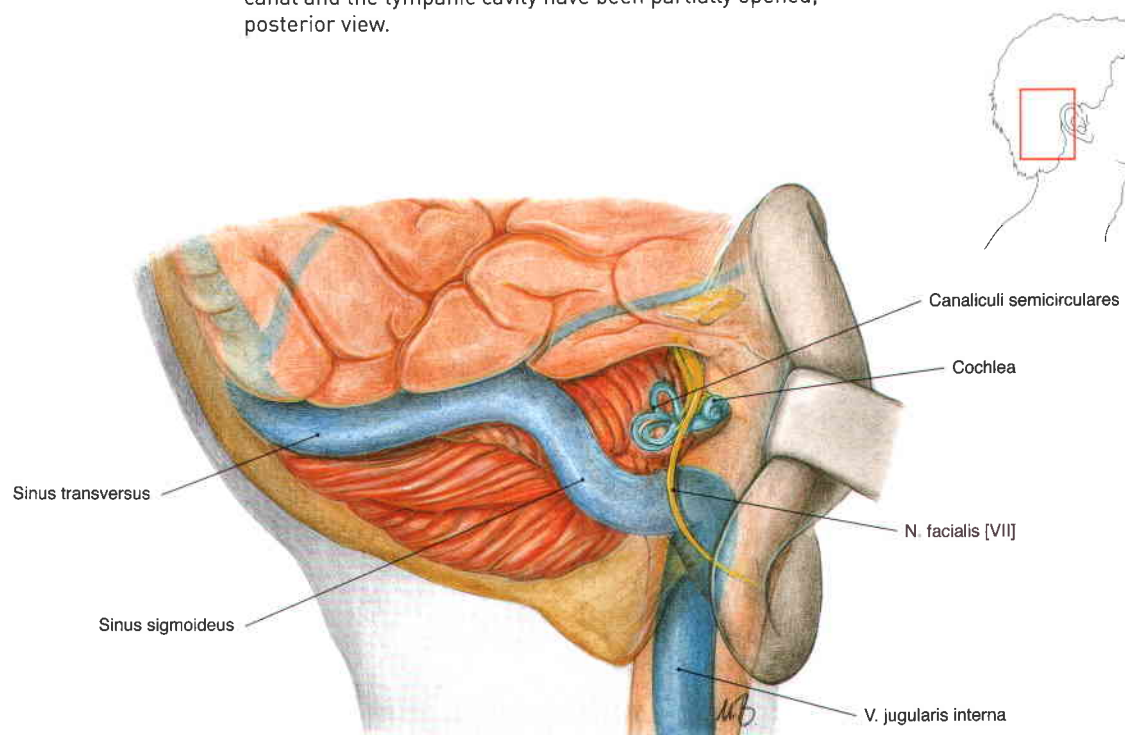


Fig. 725 Lateral projection of the inner ear.

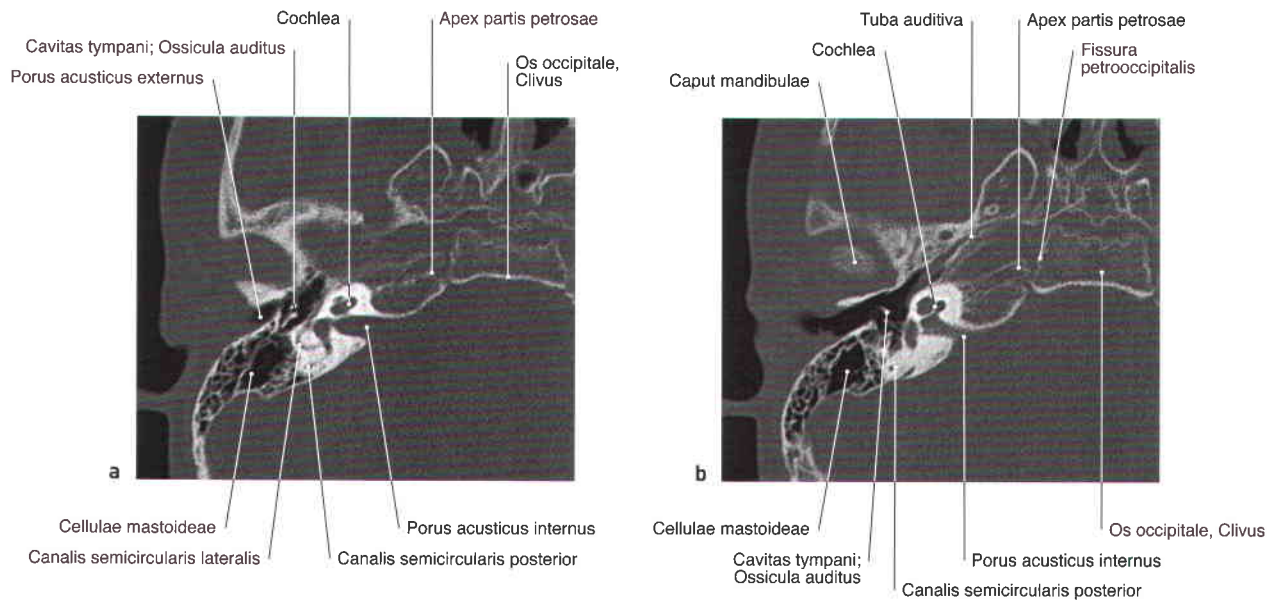
Petrous part of the temporal bone, imaging

Fig. 726 a, b Petrous part of the temporal bone, Os temporale, Pars petrosa; high-resolution computed tomographic horizontal sections (HRCT); inferior view.

- a** Through the lateral semicircular canal, Canalis semicircularis lateralis
- b** Inferior to the lateral semicircular canal, Canalis semicircularis lateralis

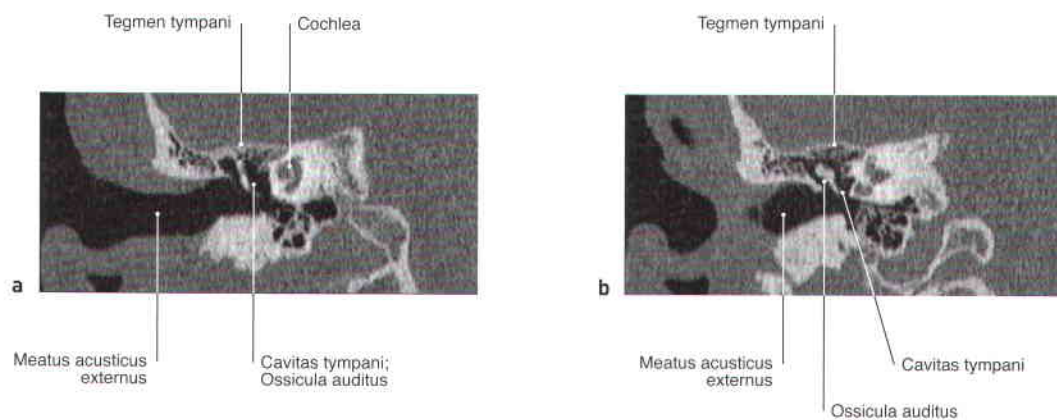


Fig. 727 a, b Ear, Auris; high-resolution computed tomographic frontal sections (HRCT); anterior view.

- a** Through the base of the cochlea
- b** Through the external acoustic meatus

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