

Anatomy for Dental Medicine in Your Pocket

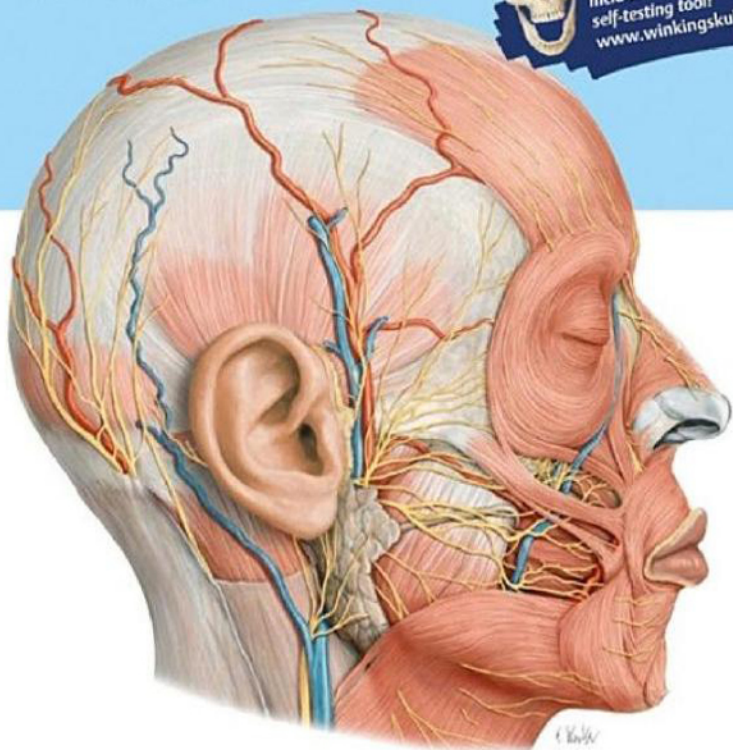
Eric W. Baker
Johanna Warshaw

Based on the work of
Michael Schuenke
Erik Schulte
Udo Schumacher

Illustrations by
Markus Voll
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Anatomy for Dental Medicine in Your Pocket

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*To my wonderful wife Amy,
and my awe-inspiring daughters,
Phoebe and Claire.*
—Eric Baker

*For Joseph, Ivy, and Rosy,
who fill my life to the brim.*
—Johanna Warshaw

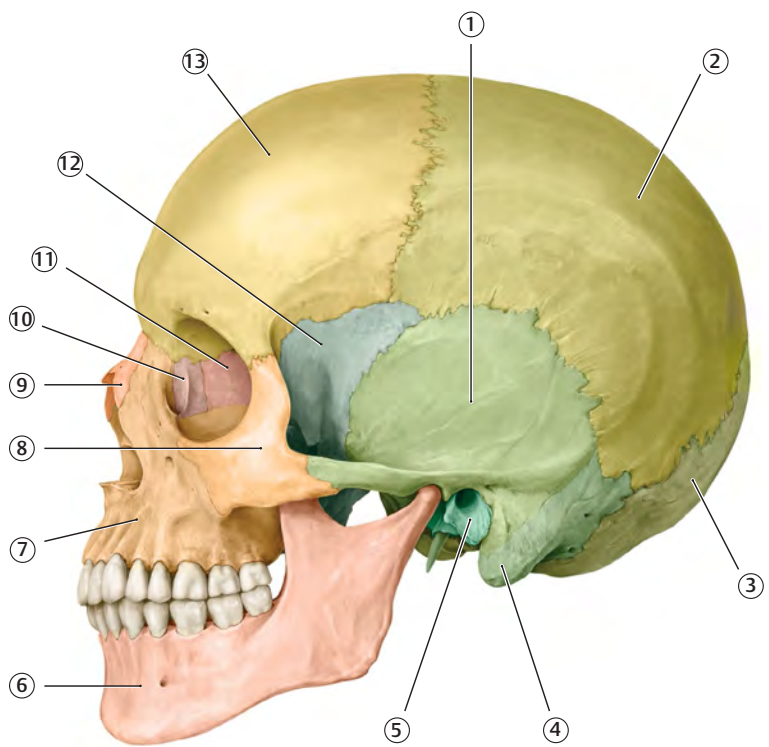
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Cranial Bones: Lateral View



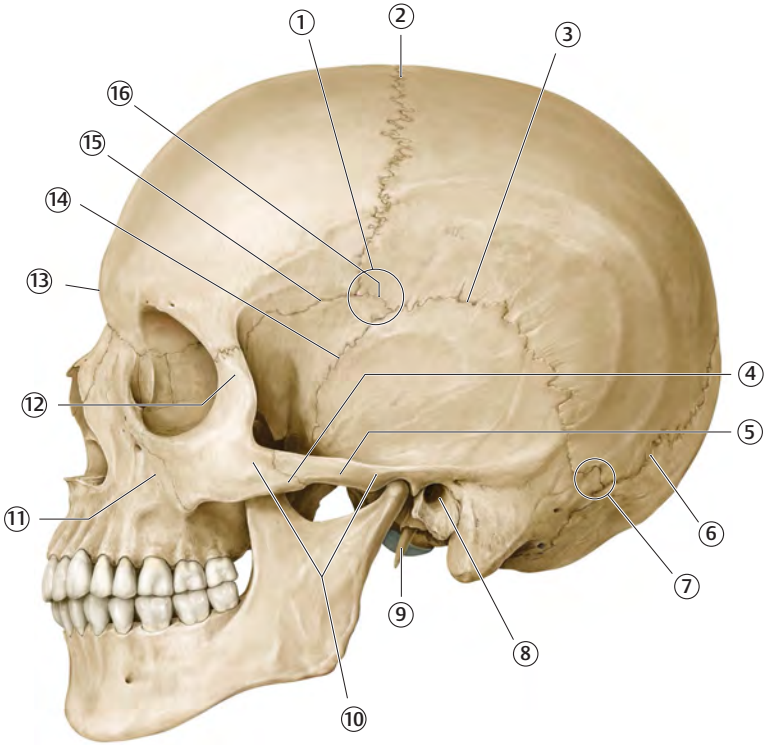
Cranial Bones: Lateral View

- ① Temporal bone, squamous part
- ② Parietal bone
- ③ Occipital bone
- ④ Temporal bone, mastoid process
- ⑤ Temporal bone, tympanic part
- ⑥ Mandible
- ⑦ Maxilla
- ⑧ Zygomatic bone
- ⑨ Nasal bone
- ⑩ Lacrimal bone
- ⑪ Ethmoid bone
- ⑫ Sphenoid bone, greater wing
- ⑬ Frontal bone



The skull is composed of neurocranial bones (surrounding the brain) and viscerocranial bones (associated with the face).

Skull: Bony Features and Landmarks: Lateral View

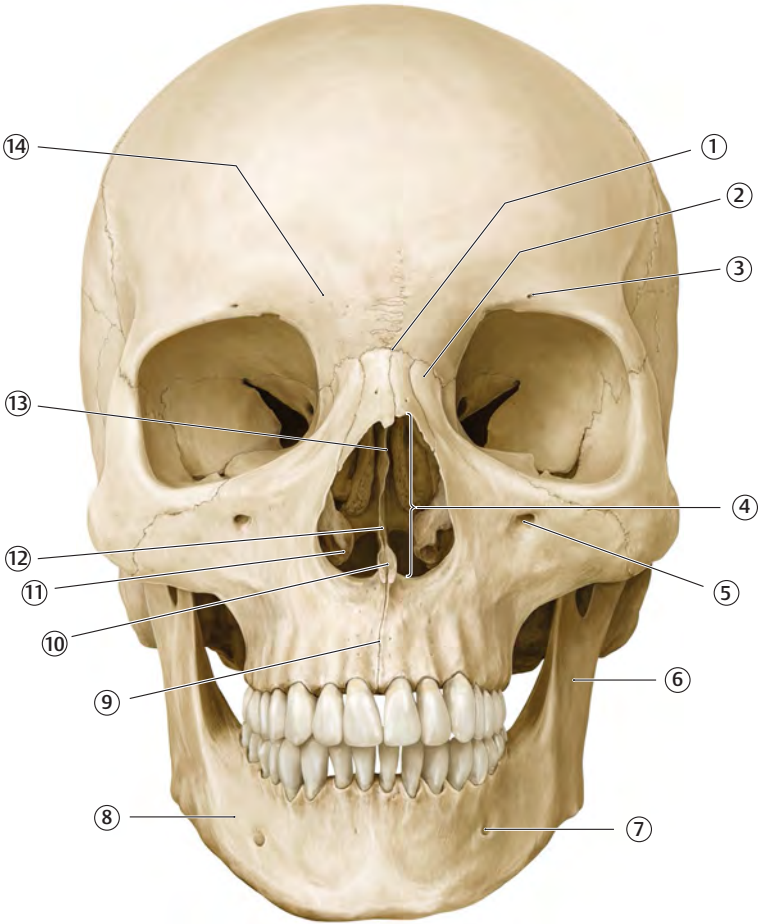


Skull: Bony Features and Landmarks: Lateral View

- ① Pterion
- ② Coronal suture
- ③ Squamous suture
- ④ Zygomatic bone, temporal process
- ⑤ Temporal bone, zygomatic process
- ⑥ Lambdoid suture
- ⑦ Asterion
- ⑧ External acoustic meatus
- ⑨ Styloid process
- ⑩ Zygomatic arch
- ⑪ Maxilla, zygomatic process
- ⑫ Zygomatic bone, frontal process
- ⑬ Glabella
- ⑭ Sphenosquamous suture
- ⑮ Sphenofrontal suture
- ⑯ Sphenoparietal suture

 Pterion and asterion are the location of the fetal anterolateral and posterolateral fontanelles, respectively. In the mature skull, pterion is a thin area of bone overlying branches of the middle meningeal a., where the sphenoid, temporal, frontal, and parietal bones meet. This thinness makes the arteries susceptible to trauma and epidural hemorrhage. Asterion is the region where the temporal, parietal, and occipital bones meet.

Skull: Anterior View



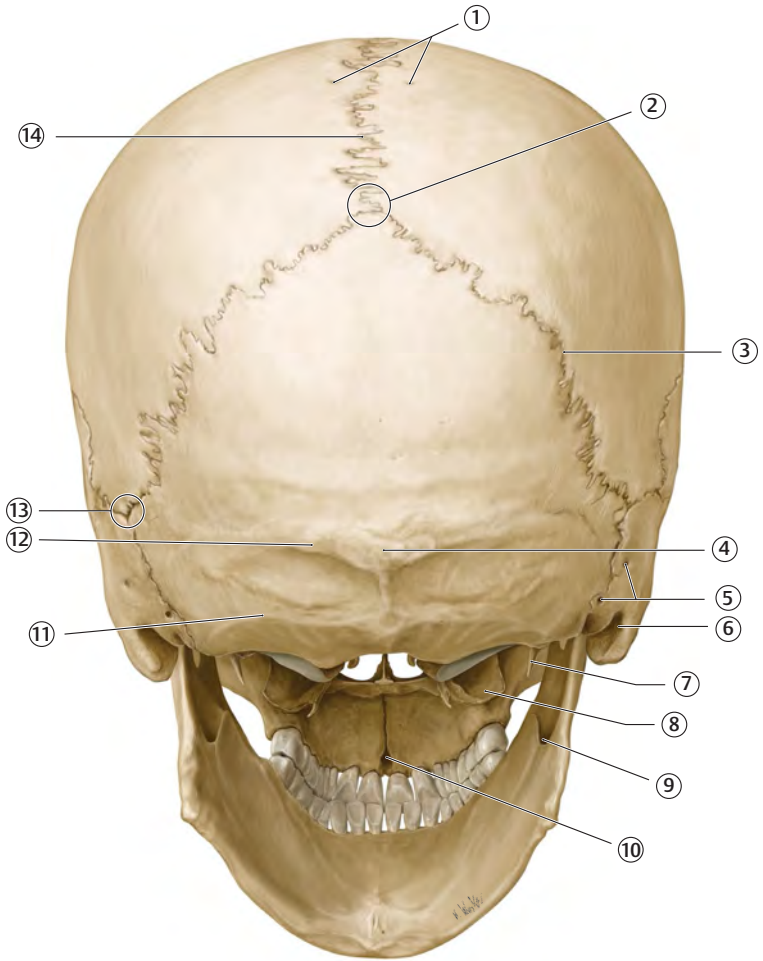
Skull: Anterior View

- ① Nasion
- ② Maxilla, frontal process
- ③ Supraorbital foramen
- ④ Piriform (anterior nasal) aperture
- ⑤ Infraorbital foramen
- ⑥ Mandible, ramus
- ⑦ Mental foramen
- ⑧ Mandible, body
- ⑨ Intermaxillary suture
- ⑩ Anterior nasal spine
- ⑪ Inferior nasal concha
- ⑫ Vomer
- ⑬ Ethmoid, perpendicular plate
- ⑭ Superciliary arch



The supraorbital, infraorbital, and mental foramina line up with each other along a vertical plane. Sensory branches of the trigeminal n. emerge through these openings onto the face. Cutaneous (sensory) branches of the ophthalmic n. (CN V1) emerge from the supraorbital foramen, the maxillary n. (CN V2) through the infraorbital foramen, and the mandibular n. (CN V3) through the mental foramen.

Skull: Posterior View



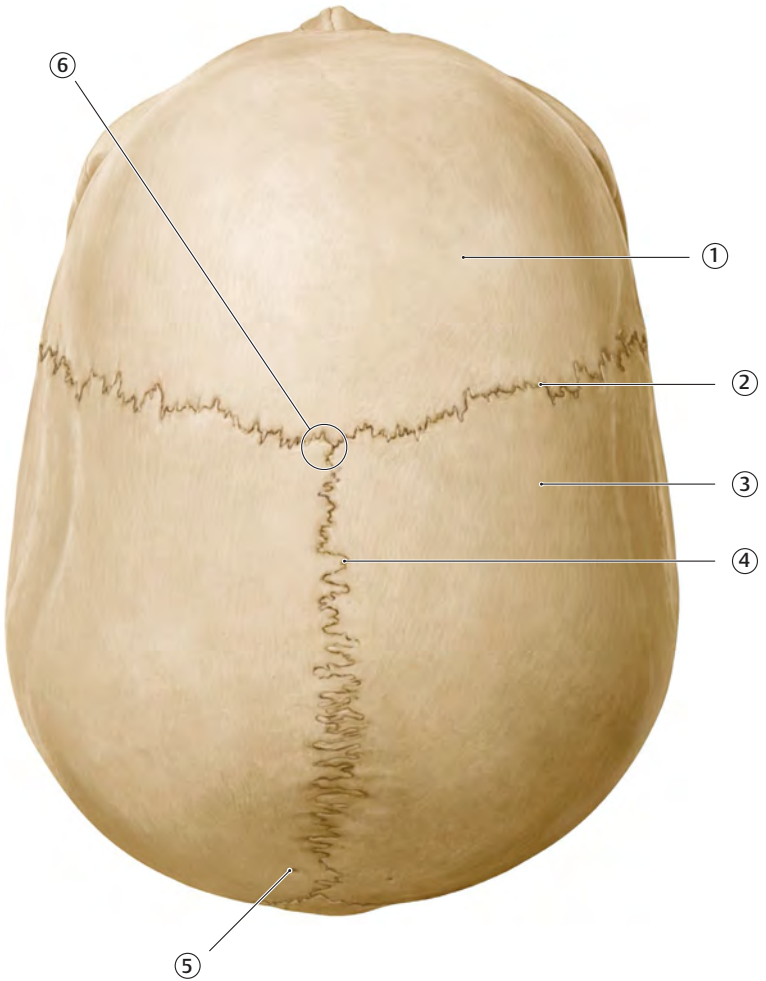
Skull: Posterior View

- ① Parietal foramina
- ② Lambda
- ③ Lambdoid suture
- ④ External occipital protuberance (inion)
- ⑤ Mastoid foramina
- ⑥ Mastoid notch
- ⑦ Temporal bone, styloid process
- ⑧ Sphenoid bone, pterygoid process
- ⑨ Mandibular foramen
- ⑩ Incisive fossa
- ⑪ Inferior nuchal line
- ⑫ Superior nuchal line
- ⑬ Asterion
- ⑭ Sagittal suture



Lambda is the location of the posterior fetal fontanelle. It is located at the junction of the two parietal bones and the occipital bone. The parietal and mastoid foramina communicate with the dural venous sinuses and carry emissary vv., which may pass infection from the extracranial to the intracranial region.

Skull: External Surface of Calvaria



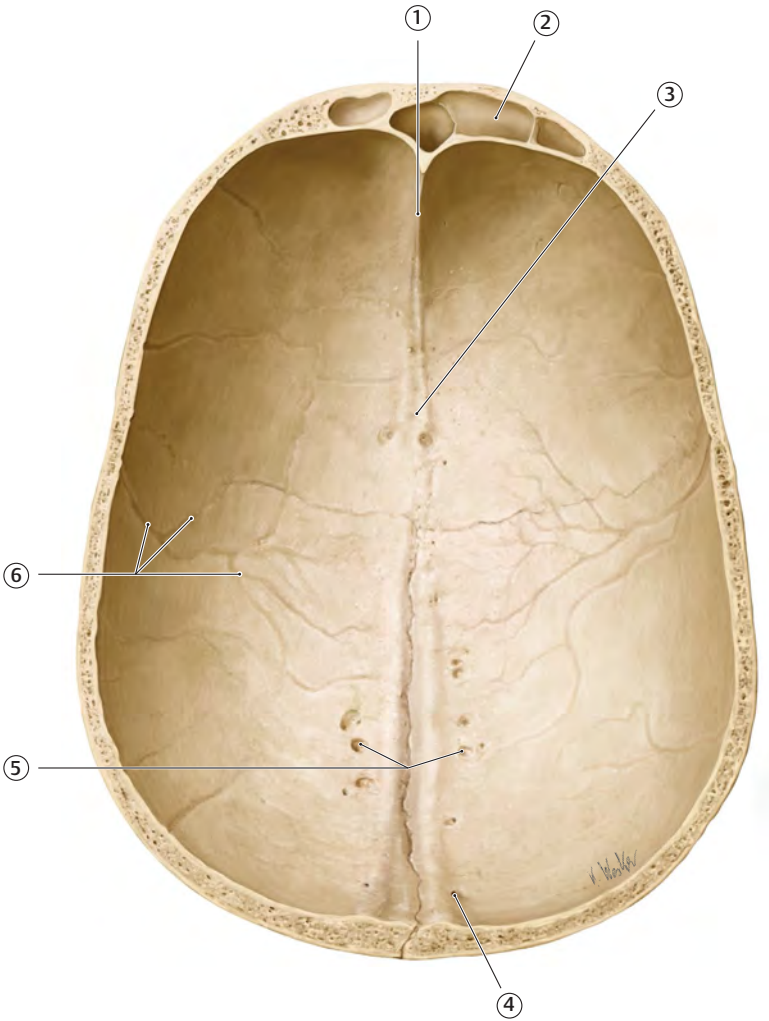
Skull: External Surface of Calvaria

- ① Frontal bone
- ② Coronal suture
- ③ Parietal bone
- ④ Sagittal suture
- ⑤ Parietal foramen
- ⑥ Bregma



Bregma is the location of the anterior fetal fontanelle, at the junction of the two parietal bones and the frontal bone.

Skull: Internal Surface of Calvaria



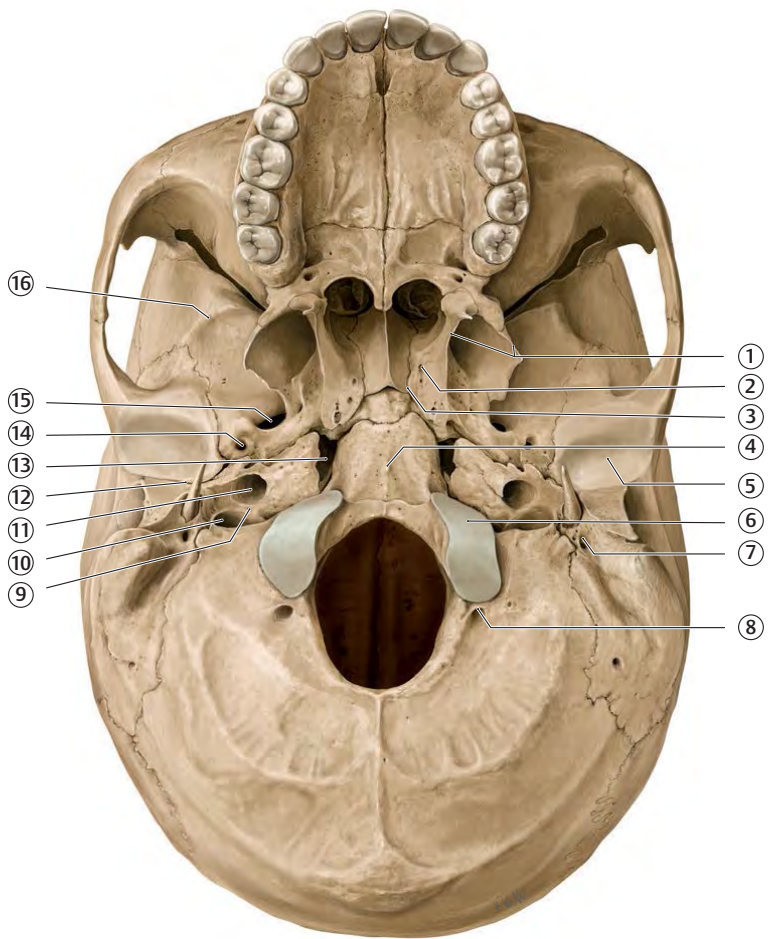
Skull: Internal Surface of Calvaria

- ① Frontal crest
- ② Frontal sinus
- ③ Groove for superior sagittal sinus
- ④ Parietal foramen
- ⑤ Granular foveolae
- ⑥ Meningeal grooves



Note how the branches of the middle meningeal a. create grooves as they fan out on the inner surface of the calvarium. Arachnoid foveolae are created by arachnoid granulations associated with the return of cerebrospinal fluid to the dural venous system.

Skull: Inferior View

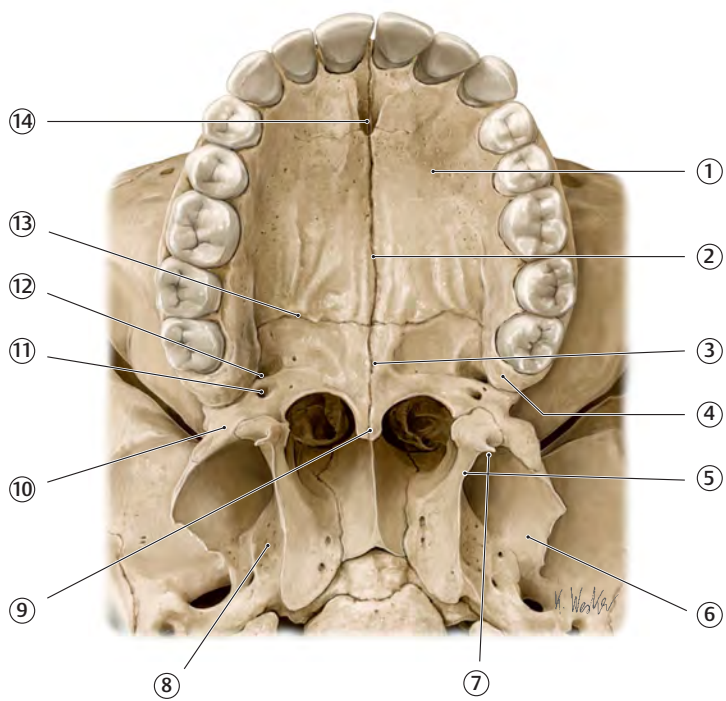


Skull: Inferior View

- ① Medial and lateral pterygoid plates
- ② Pharyngeal canal
- ③ Vomerovaginal canal
- ④ Pharyngeal tubercle
- ⑤ Mandibular (glenoid) fossa
- ⑥ Occipital condyle
- ⑦ Stylomastoid foramen
- ⑧ (Posterior) condylar canal
- ⑨ Tympanic canaliculus
- ⑩ Jugular foramen
- ⑪ Carotid canal
- ⑫ Petrotympanic fissure
- ⑬ Foramen lacerum
- ⑭ Foramen spinosum
- ⑮ Foramen ovale
- ⑯ Infratemporal crest

 The petrotympanic fissure is continuous laterally with the squamotympanic fissure. The petrotympanic fissure transmits the chorda tympani n. (CN VII) and the anterior tympanic a. The squamotympanic fissure is the attachment site of the posterior superior lamellae of the articular disk of the temporomandibular joint.

Hard Palate: Inferior View



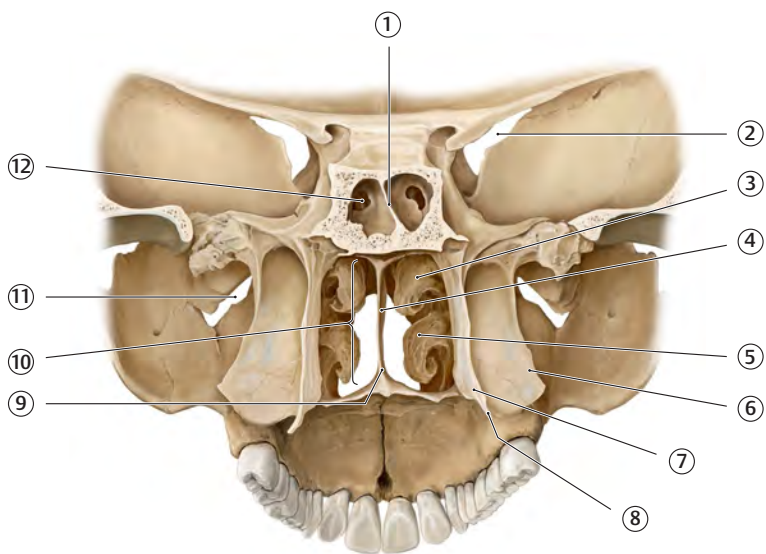
Hard Palate: Inferior View

- ① Palatine process of maxilla
- ② Median (intermaxillary) palatine suture
- ③ Interpalatine suture
- ④ Maxillary tuberosity
- ⑤ Medial pterygoid plate
- ⑥ Lateral pterygoid plate
- ⑦ Pterygoid hamulus
- ⑧ Scaphoid fossa
- ⑨ Posterior nasal spine
- ⑩ Pyramidal process of palatine bone
- ⑪ Lesser palatine foramen
- ⑫ Greater palatine foramen
- ⑬ Transverse palatine suture
- ⑭ Incisive fossa (opening of incisive canals)



The hard palate separates the oral cavity from the nasal cavity. Incisive canals transmit vessels and nerves between the two cavities. The greater and lesser palatine foramina are openings of the greater palatine canal, which connects the oral cavity to the pterygopalatine fossa.

Hard Palate, Nasal Cavity, and Middle Cranial Fossa: Posterior View



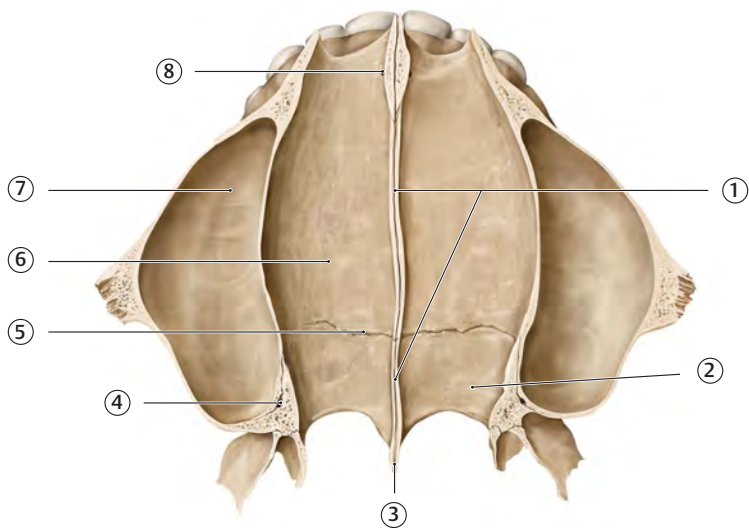
Hard Palate, Nasal Cavity and Middle Cranial Fossa: Posterior View

- ① Septum of sphenoid sinus
- ② Superior orbital fissure
- ③ Middle nasal concha
- ④ Ethmoid bone, perpendicular plate
- ⑤ Inferior nasal concha
- ⑥ Lateral pterygoid plate
- ⑦ Medial pterygoid plate
- ⑧ Pterygoid hamulus
- ⑨ Vomer
- ⑩ Choana
- ⑪ Inferior orbital fissure
- ⑫ Ostium of sphenoid sinus



Note the hard palate forming the roof of the oral cavity and floor of the nasal cavity. The posterior edge of the hard palate contributes to the perimeter of the choanae (posterior nasal apertures).

Nasal Cavity View of the Hard Palate (Superior View)

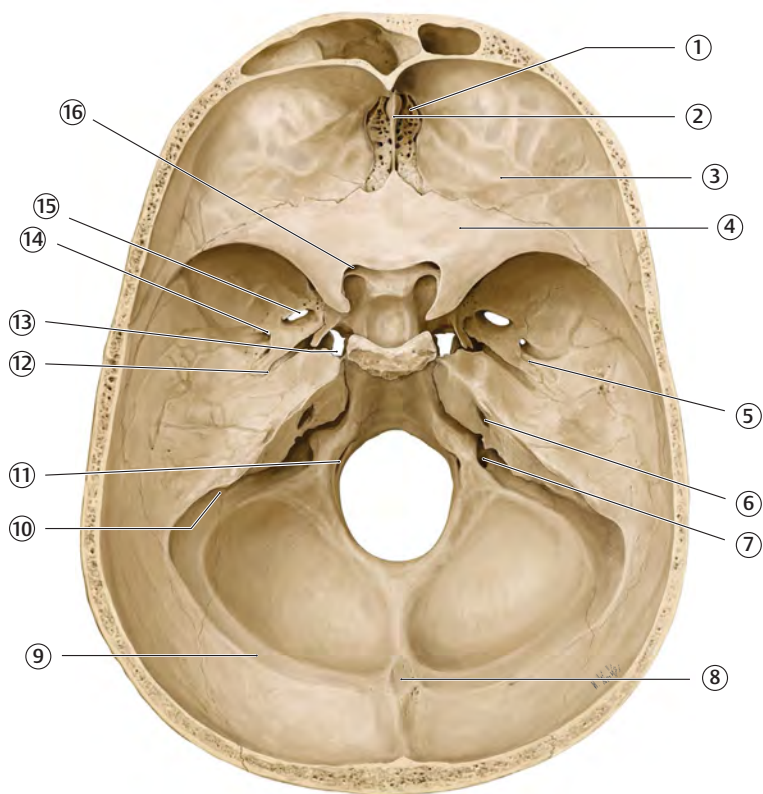


Nasal Cavity View of the Hard Palate (Superior View)

- ① Nasal crest (cut)
- ② Palatine bone, horizontal plate
- ③ Palatine bone, posterior nasal spine
- ④ Greater palatine canal
- ⑤ Transverse palatine (palatomaxillary) suture
- ⑥ Maxilla, palatine process
- ⑦ Maxillary sinus
- ⑧ Incisive canal

 The hard palate is composed of the palatine process of the maxilla and the horizontal plate of the palatine bone. The posterior edge of the hard palate serves as an attachment for the structures of the soft palate. The greater palatine canal transmits the descending (greater and lesser) palatine nn. and vessels to the oral cavity.

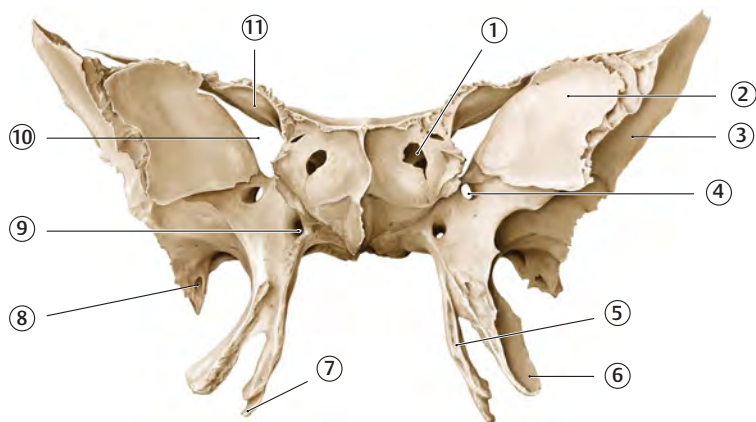
Cranial Cavity: Superior View



Cranial Cavity: Superior View

- ① Ethmoid bone, cribriform plate
- ② Ethmoid bone, crista galli
- ③ Frontal bone
- ④ Sphenoid bone, lesser wing
- ⑤ Groove for lesser petrosal n.
- ⑥ Internal acoustic meatus
- ⑦ Jugular foramen
- ⑧ Internal occipital protuberance
- ⑨ Groove for transverse sinus
- ⑩ Groove for sigmoid sinus
- ⑪ Hypoglossal canal
- ⑫ Hiatus of facial canal
- ⑬ Foramen lacerum
- ⑭ Foramen spinosum
- ⑮ Foramen ovale
- ⑯ Optic canal

Sphenoid Bone: Anterior View

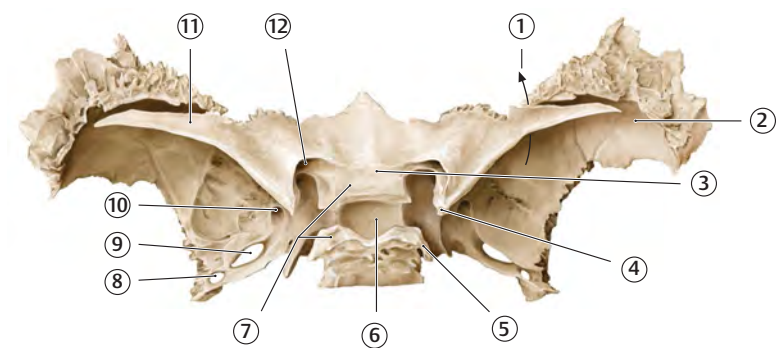


Sphenoid Bone: Anterior View

- ① Ostium of sphenoid sinus
- ② Orbital surface
- ③ Temporal surface
- ④ Foramen rotundum
- ⑤ Medial plate of pterygoid process
- ⑥ Lateral plate of pterygoid process
- ⑦ Pterygoid hamulus
- ⑧ Foramen spinosum
- ⑨ Pterygoid canal
- ⑩ Superior orbital fissure
- ⑪ Lesser wing

 Note that both the pterygoid canal and the foramen rotundum connect the pterygopalatine fossa with the middle cranial fossa. The superior orbital fissure, connecting the orbit with the middle cranial fossa, is located between the greater and the lesser wings of the sphenoid. The foramen spinosum, located on the anterior surface of the sphenoid spine, connects the infratemporal fossa with the middle cranial fossa.

Sphenoid Bone: Superior View



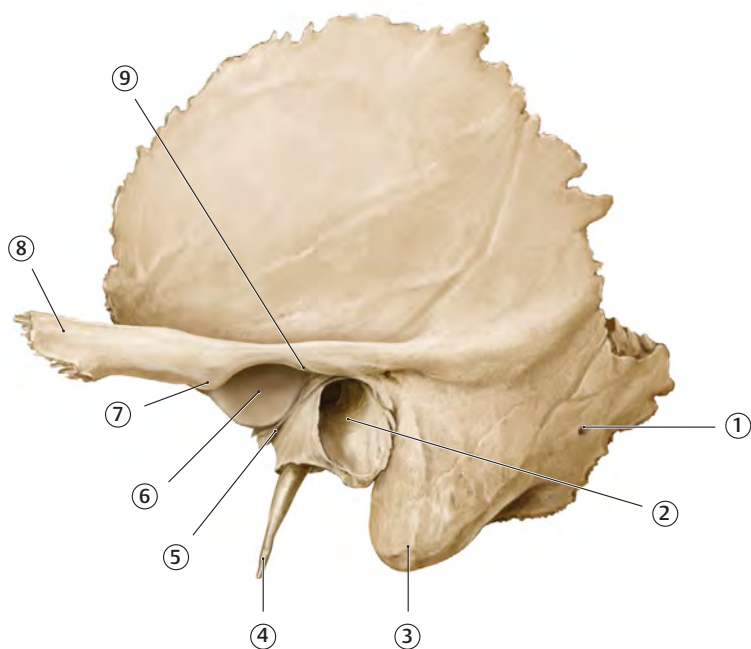
Sphenoid Bone: Superior View

- ① Superior orbital foramen
- ② Greater wing
- ③ Chiasmatic groove
- ④ Anterior clinoid process
- ⑤ Posterior clinoid process
- ⑥ Hypophyseal fossa
- ⑦ Sella turcica
- ⑧ Foramen spinosum
- ⑨ Foramen ovale
- ⑩ Foramen rotundum
- ⑪ Lesser wing
- ⑫ Optic canal



The foramen ovale, located in the greater wing of the sphenoid, connects the middle cranial fossa and the infratemporal fossa. The optic canal, connecting the middle cranial fossa with the orbit, is located at the posterior margin of the lesser wing. The hypophyseal fossa, part of the sella turcica, houses the pituitary gland.

Temporal Bone: Lateral View



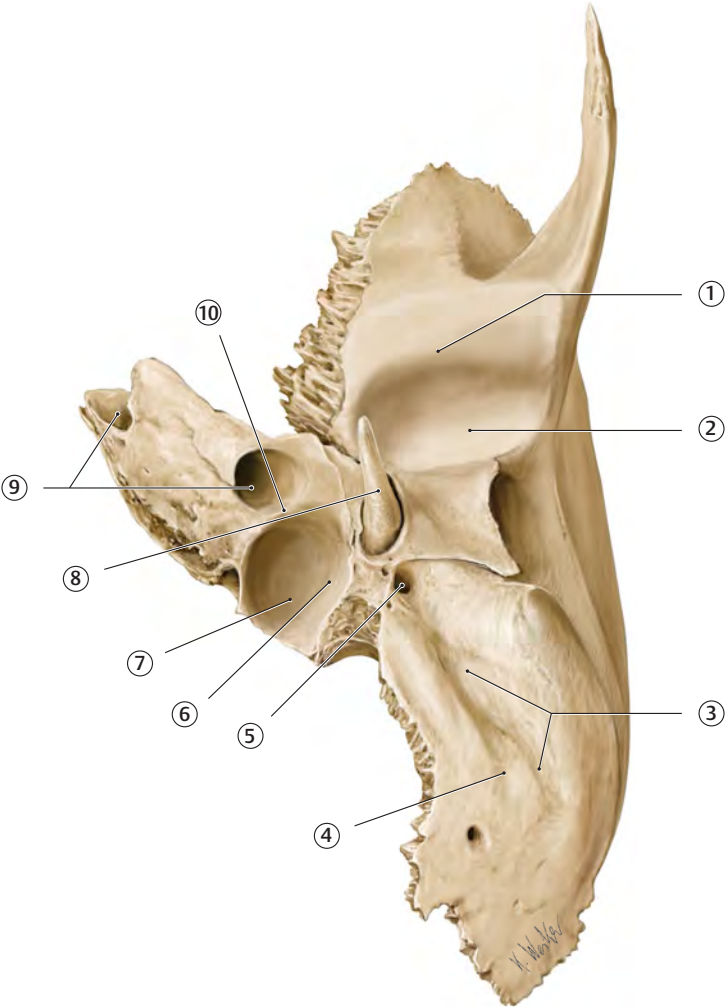
Temporal Bone: Lateral View

- ① Mastoid foramen
- ② External acoustic meatus
- ③ Mastoid process
- ④ Styloid process
- ⑤ Petrotympenic fissure
- ⑥ Mandibular (glenoid) fossa
- ⑦ Articular tubercle (articular eminence)
- ⑧ Zygomatic process
- ⑨ Postglenoid tubercle



The petrotympanic fissure is a communication between the infratemporal fossa and the tympanic cavity (middle ear). It conveys both the anterior tympanic a. and the chorda tympani n. (CN VII), which carries both taste and preganglionic parasympathetic fibers. The styloid process serves as an attachment for the stylohyoid, stylopharyngeus, and styloglossus muscles (each with a different cranial nerve supply) as well as the stylohyoid and stylomandibular lig.

Temporal Bone: Inferior View



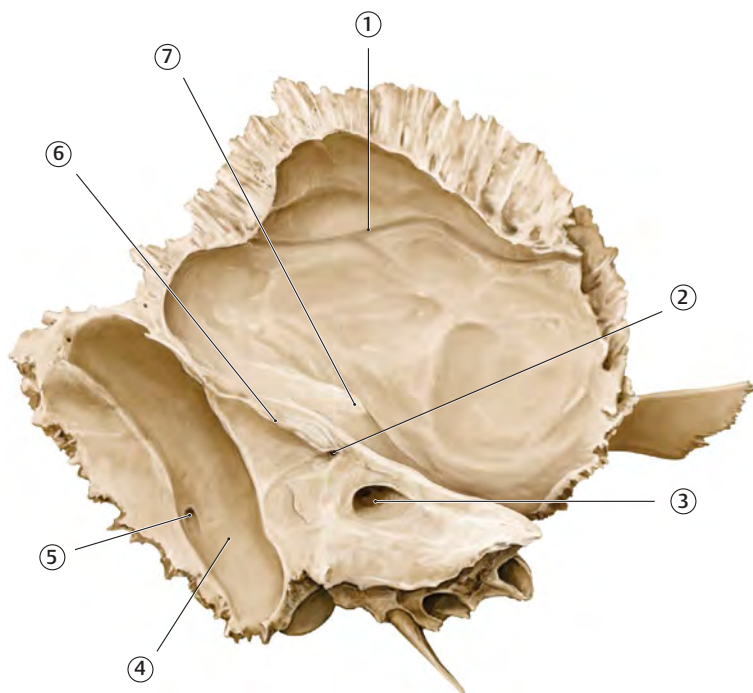
Temporal Bone: Inferior View

- ① Articular tubercle (articular eminence)
- ② Mandibular (glenoid) fossa
- ③ Mastoid notch
- ④ Occipital groove
- ⑤ Stylomastoid foramen
- ⑥ Small foramen for mastoid canaliculus
- ⑦ Jugular fossa, temporal part
- ⑧ Styloid process
- ⑨ Carotid canal
- ⑩ Tympanic canaliculus



The stylomastoid foramen is the terminus of the facial canal. Emerging from it is a large motor branch of CN VII, which supplies the muscles of facial expression and the posterior digastric and stylohyoid muscles. The tympanic canaliculus, located on the crest separating the carotid canal and the jugular fossa, leads to the tympanic cavity and transmits the tympanic n. (a sensory and preganglionic parasympathetic branch of CN IX). The mastoid canaliculus transmits the auricular branch of the vagus n. (a sensory branch of CN X).

Temporal Bone: Medial View



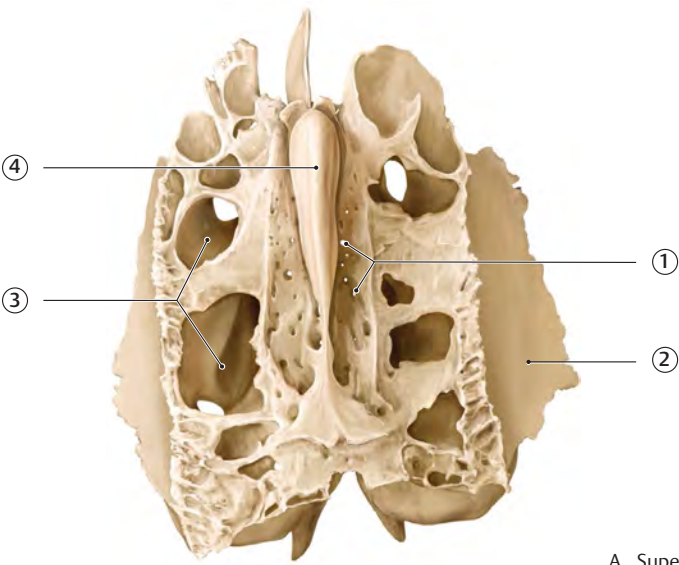
Temporal Bone: Medial View

- ① Groove for middle meningeal arteries
- ② Aqueduct of the vestibule
- ③ Internal acoustic meatus
- ④ Groove for sigmoid sinus
- ⑤ Mastoid foramen
- ⑥ Petrous ridge (groove for superior petrosal sinus)
- ⑦ Arcuate eminence

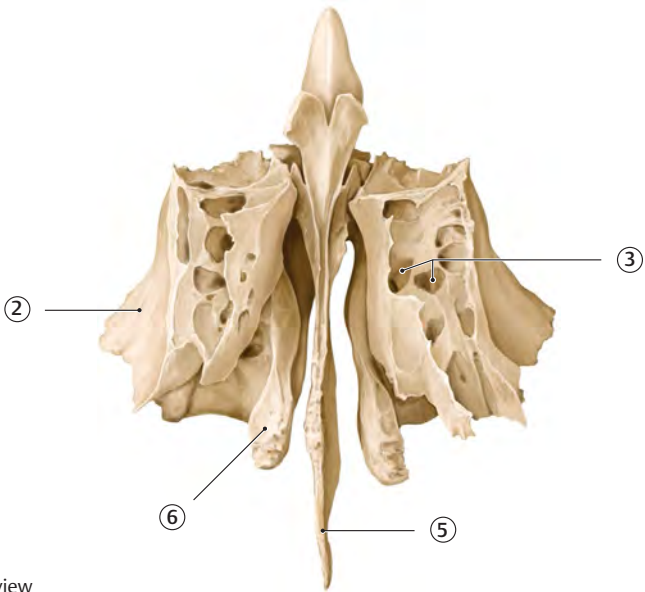


The internal acoustic meatus, located on the posterior slope of the petrous part of the temporal bone, transmits CN VII and CN VIII. The groove for the sigmoid sinus connects the groove for the transverse sinus with the jugular foramen. The petrous ridge is a boundary marking the division between the middle and the posterior cranial fossae and serves as an attachment point for the tentorium cerebelli.

Ethmoid Bone



A. Superior view



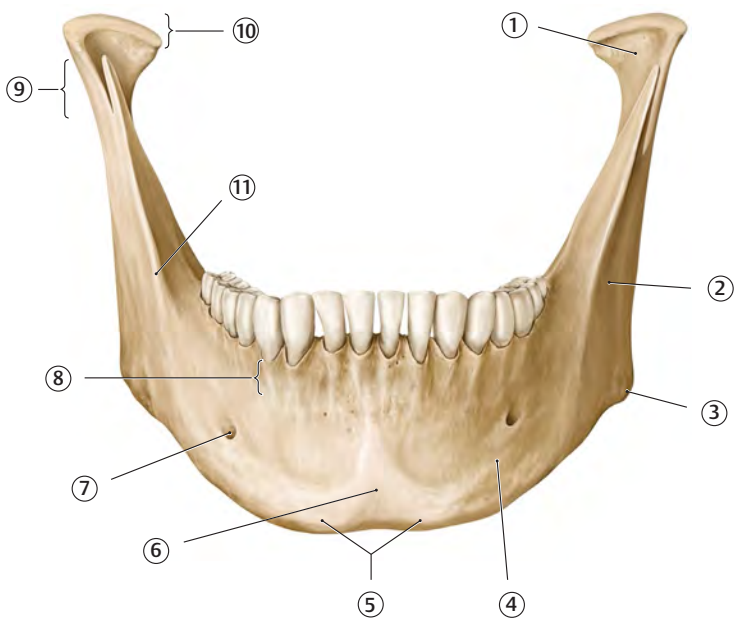
B. Anterior view

Ethmoid Bone

- ① Cribriform plate
- ② Orbital plate
- ③ Ethmoid air cells
- ④ Crista galli
- ⑤ Perpendicular plate
- ⑥ Middle concha

 The olfactory nn. (CN I) pass through the cribriform plate, located on either side of the crista galli, to reach the olfactory bulbs laying on the superior surface of the cribriform plate. The crista galli serves as an attachment point for the falx cerebri. The perpendicular plate of the ethmoid contributes to the formation of the nasal septum. The ethmoid air cells, which drain into the nasal cavity, are found medial to the orbital plate. Unlike the inferior concha, which is its own bone, the middle and superior concha (not visible here) are parts of the ethmoid bone.

Mandible: Anterior View



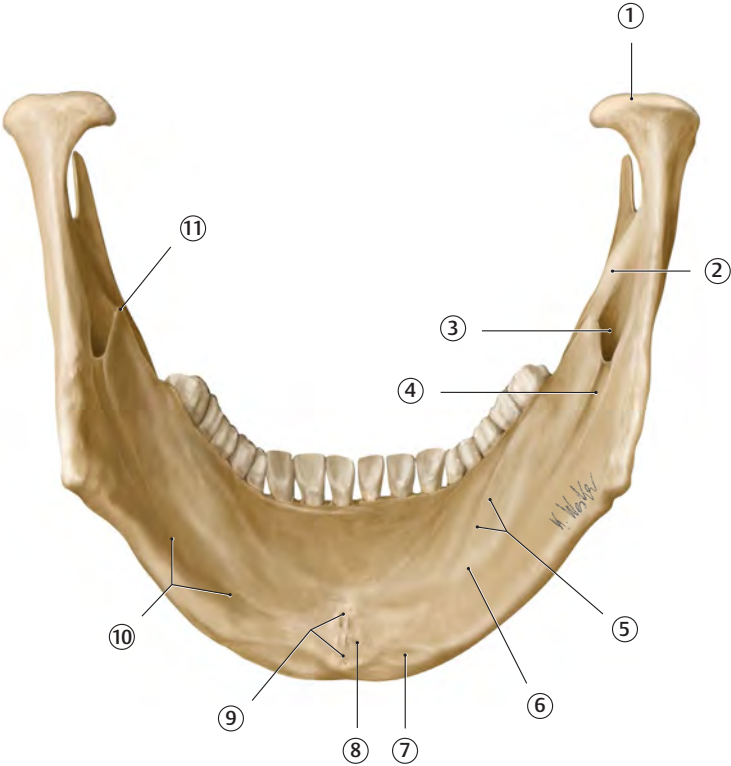
Mandible: Anterior View

- ① Pterygoid fovea
- ② Ramus of mandible
- ③ Angle of mandible
- ④ Body of mandible
- ⑤ Mental tubercles
- ⑥ Mental protuberance
- ⑦ Mental foramen
- ⑧ Alveolar process
- ⑨ Neck of mandible
- ⑩ Head (condyle) of mandible
- ⑪ Oblique line



The pterygoid fovea is an attachment point for the inferior head of the lateral pterygoid. This muscle serves to protrude the mandible. The mental foramen transmits the mental n. and vessels, which are, along with the incisive nn. and vessels, the terminal branches of the inferior alveolar n. (CN V3), traveling in the mandibular canal.

Mandible: Posterior View

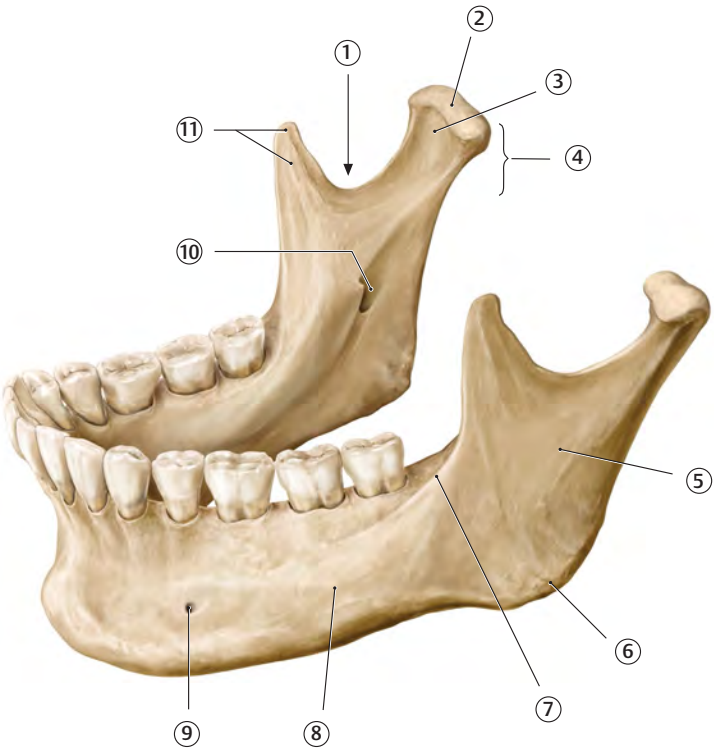


Mandible: Posterior View

- ① Head (condyle) of mandible
- ② Internal oblique ridge
- ③ Mandibular foramen
- ④ Mylohyoid groove
- ⑤ Sublingual fossa
- ⑥ Mylohyoid line
- ⑦ Digastric fossa
- ⑧ Lingual foramen
- ⑨ Superior and inferior mental spines (genial tubercles)
- ⑩ Submandibular fossa
- ⑪ Lingula

 The inferior alveolar n. and vessels pass through the mandibular foramen. The mylohyoid groove marks the passage of the nerve to the mylohyoid, a motor branch of the inferior alveolar n. (CN V3). The lingual foramen may play a role in the phenomenon of escape from anesthesia during efforts to anesthetize the anterior mandibular dentition. Sensory fibers normally entering the mandibular foramen and traveling with the inferior alveolar nerve may on occasion travel with the nerve to the mylohyoid and enter the lingual foramen to innervate the roots of the anterior mandibular teeth.

Mandible: Oblique Lateral View



Mandible: Oblique Lateral View

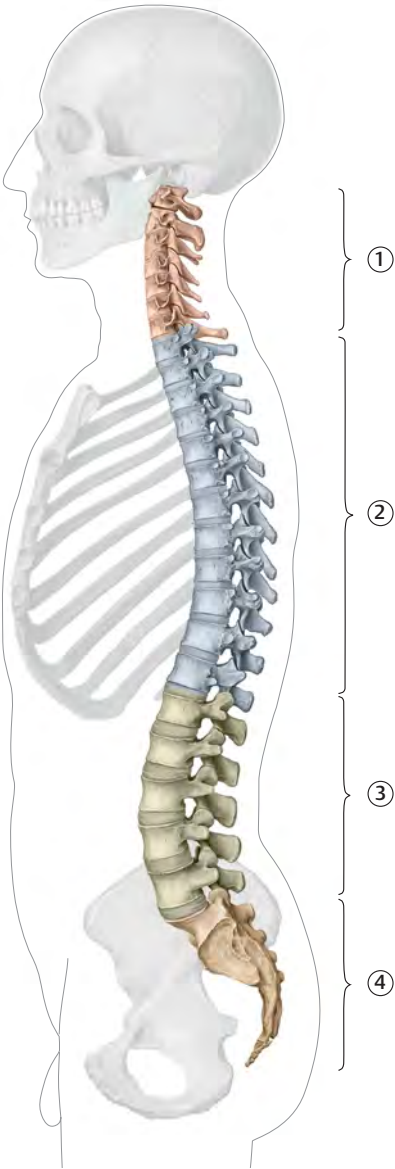
- ① Mandibular notch
- ② Head (condyle) of mandible
- ③ Pterygoid fovea
- ④ Condylar process
- ⑤ Ramus of mandible
- ⑥ Angle
- ⑦ External oblique ridge
- ⑧ Body of mandible
- ⑨ Mental foramen
- ⑩ Mandibular foramen
- ⑪ Coronoid process

 The mandibular notch is bounded anteriorly by the coronoid process and posteriorly by the condylar process. The coronoid process serves as an attachment for the temporalis muscle. Passing through the mandibular notch is the masseteric neurovascular bundle. The masseter muscle attaches to the lateral surface of the ramus of the mandible.

Vertebral Column

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Spinal Curvature: Lateral View

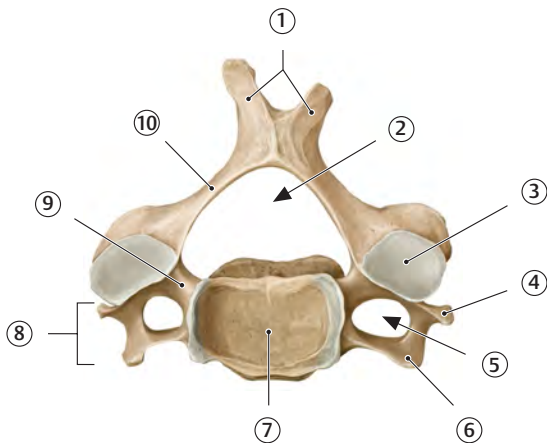


Spinal Curvature: Lateral View

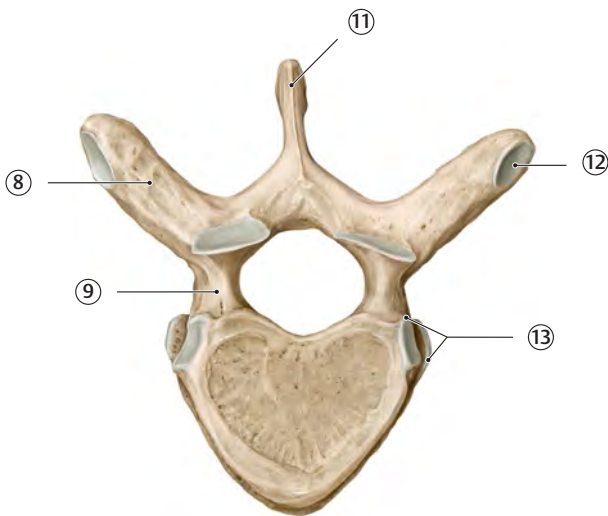
- ① Cervical curvature (secondary): C1–C7
- ② Thoracic curvature (primary): T1–T12
- ③ Lumbar curvature (secondary): L1–L5
- ④ Sacral and coccygeal curvature (primary): S1–S5 and Co1–Co4

 The neonatal primary curvature is concave anteriorly. During development, convex secondary curvatures develop in the cervical and lumbar regions. The cervical secondary curvature is associated with the extension of the neck when infants begin to hold the head up. The development of the lumbar secondary curvature is associated with the onset of standing and walking in an upright posture.

Cervical and Thoracic Vertebrae: Superior view



A. Cervical Vertebra

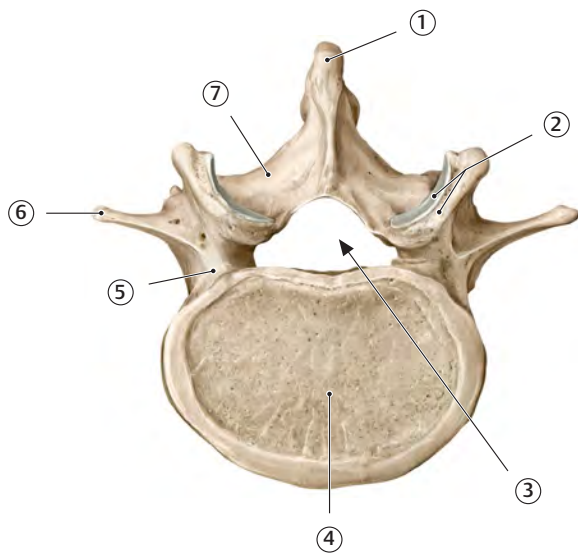


B. Thoracic Vertebra

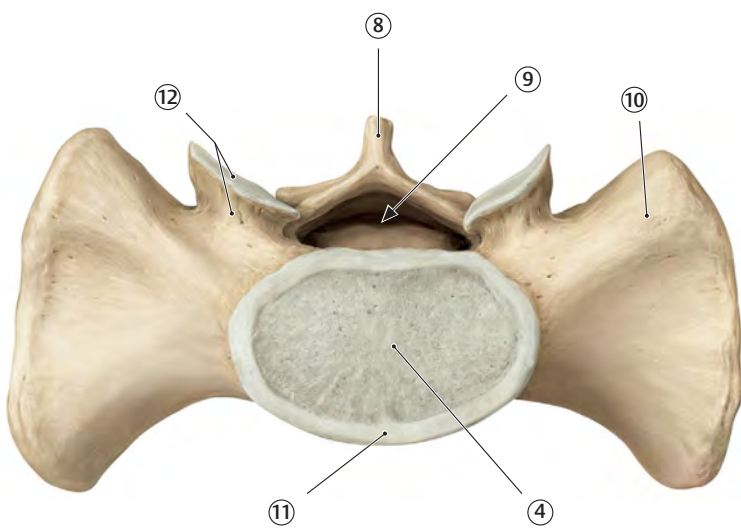
Cervical and Thoracic Vertebrae: Superior View

- ① Bifid spinous process
- ② Vertebral foramen
- ③ Superior articular facet
- ④ Posterior tubercle
- ⑤ Transverse foramen
- ⑥ Anterior tubercle
- ⑦ Vertebral body
- ⑧ Transverse process
- ⑨ Pedicle
- ⑩ Lamina
- ⑪ Spinous process
- ⑫ Costal facet, transverse process
- ⑬ Superior and inferior articular facets, vertebral body

Lumbar Vertebra and Sacrum: Superior View



A. Lumbar vertebra



B. Sacrum

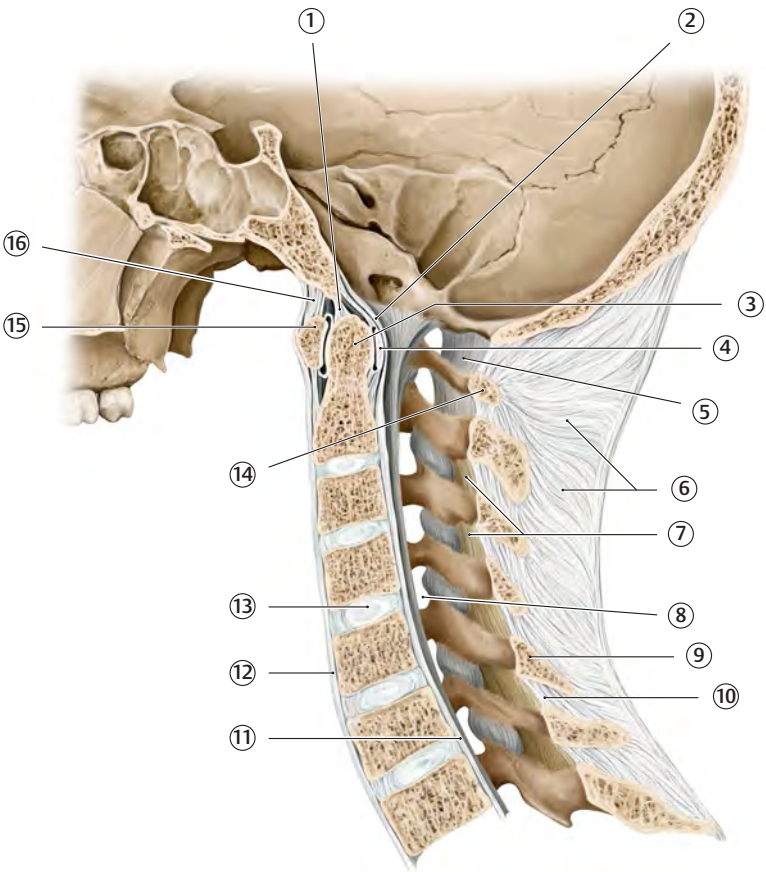
Lumbar Vertebra and Sacrum: Superior View

- ① Spinous process
- ② Superior articular process with facet
- ③ Vertebral foramen
- ④ Vertebral body
- ⑤ Pedicle
- ⑥ Transverse process
- ⑦ Lamina
- ⑧ Spinous process (median sacral crest)
- ⑨ Sacral canal (vertebral foramen)
- ⑩ Wing
- ⑪ Sacral promontory
- ⑫ Articular process and facet



The sacrum is formed by the fusion of five vertebrae.

Cervical Vertebral Column: Midsagittal View



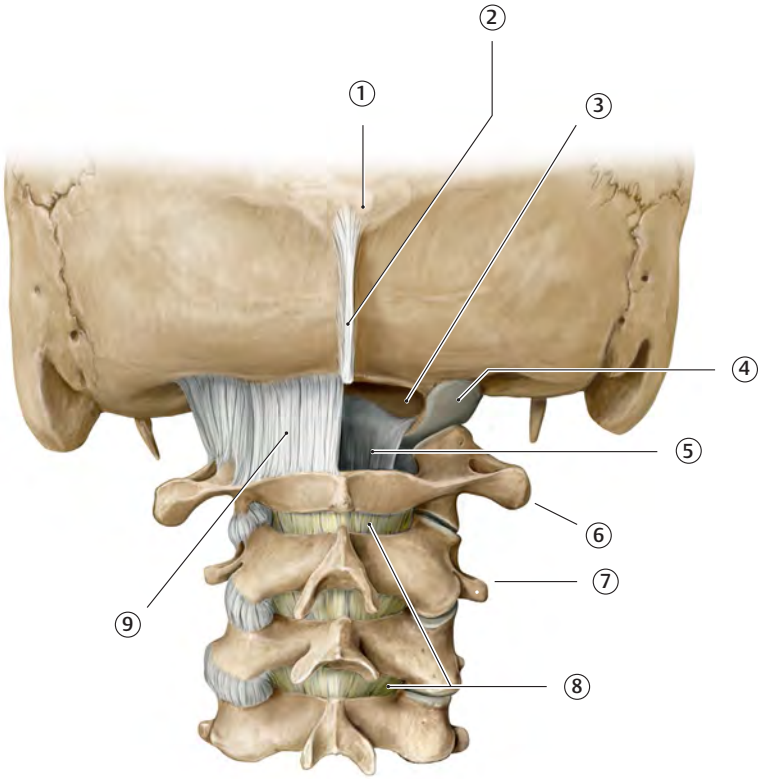
Cervical Vertebral Column: Midsagittal View

- ① Apical lig.
- ② Tectorial membrane
- ③ Dens of axis (C2)
- ④ Transverse lig. of atlas
- ⑤ Posterior atlanto-occipital membrane
- ⑥ Nuchal lig.
- ⑦ Ligamenta fl va
- ⑧ Intervertebral foramen
- ⑨ Spinous process
- ⑩ Interspinous lig.
- ⑪ Posterior longitudinal lig.
- ⑫ Anterior longitudinal lig.
- ⑬ Intervertebral disk (nucleus pulposus)
- ⑭ Posterior arch of atlas (C1)
- ⑮ Anterior arch of atlas (C1)
- ⑯ Anterior atlanto-occipital membrane



The ligamentum nuchae is the continuation of the supraspinous lig. in the cervical region. It attaches superiorly to the external occipital protuberance and the external occipital crest.

Cervical Vertebral Column and Skull: Posterior View



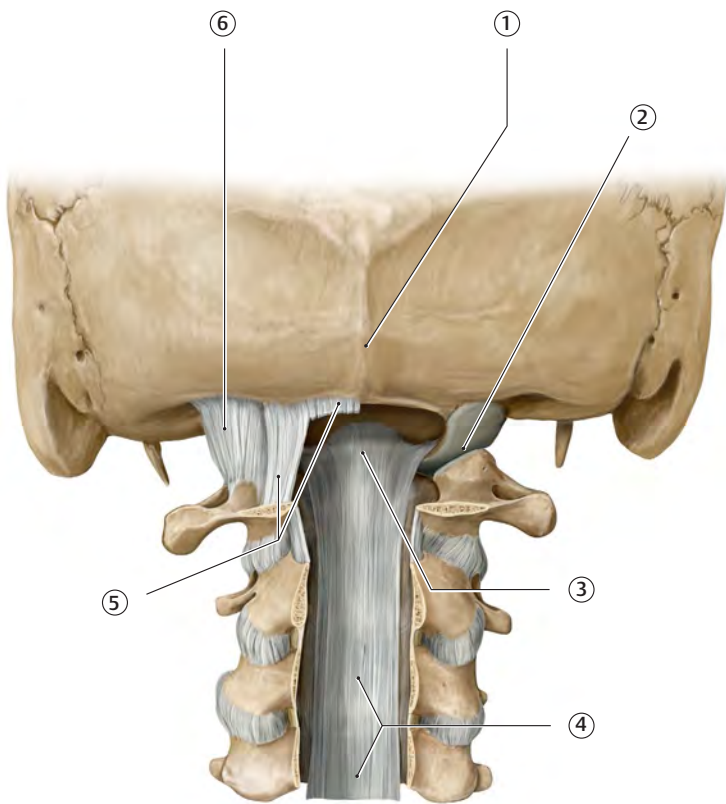
Cervical Vertebral Column and Skull: Posterior View

- ① External occipital protuberance
- ② Nuchal lig. (cut)
- ③ Foramen magnum
- ④ Occipital condyle
- ⑤ Tectorial membrane
- ⑥ Atlas (C1)
- ⑦ Axis (C2)
- ⑧ Ligamenta fl va
- ⑨ Posterior atlanto-occipital membrane



Ligamenta fl va connect adjacent laminae. Ligamenta fl va are so named because of their yellowish color (*flavus* = “yellow”).

Cervical Vertebral Column and Skull: Posterior View (Laminae Cut)



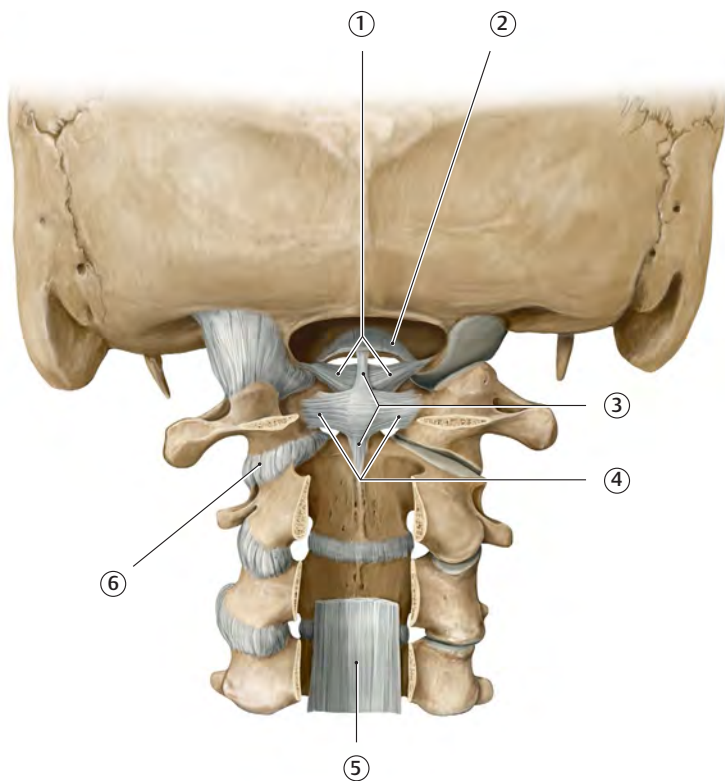
Cervical Vertebral Column and Skull: Posterior View (Laminae Cut)

- ① External occipital crest
- ② Atlanto-occipital joint
- ③ Tectorial membrane
- ④ Posterior longitudinal lig.
- ⑤ Posterior atlanto-occipital membrane (cut)
- ⑥ Atlanto-occipital capsule



The tectorial membrane is the continuation of the posterior longitudinal lig. from the region of C2 to the occipital bone. Note that the tectorial membrane does not have an attachment to the atlas (see also **Cervical Vertebral Column: Midsagittal View**).

Cervical Vertebral Column and Skull: Posterior View (Tectorial Membrane Cut)

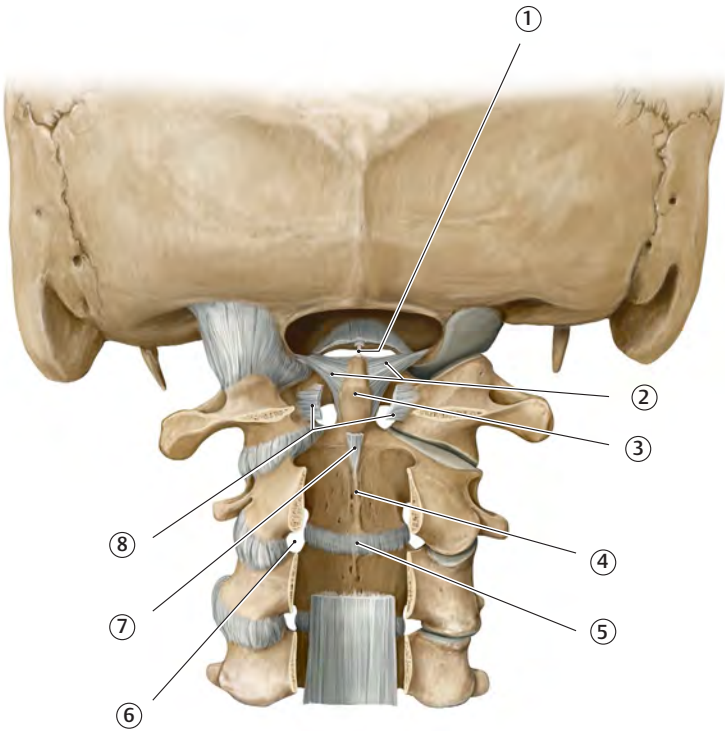


Cervical Vertebral Column and Skull: Posterior View (Tectorial Membrane Cut)

- ① Alar lig.
- ② Tectorial membrane (cut)
- ③ Longitudinal fascicles (part of cruciform lig.)
- ④ Transverse lig. of atlas (part of cruciform lig.)
- ⑤ Posterior longitudinal lig. (cut)
- ⑥ Lateral atlantoaxial joint

 The cruciform lig. is composed of the longitudinal fascicles and the transverse lig. of the atlas. The transverse lig., which passes posterior to the dens, stabilizes the median atlantoaxial joint between the dens and the anterior arch of the atlas. The two lateral atlantoaxial joints are located between the inferior articular surfaces of the atlas and the superior articular surfaces of the axis.

Cervical Vertebral Column and Skull: Posterior View (Cruciform Ligament Cut)



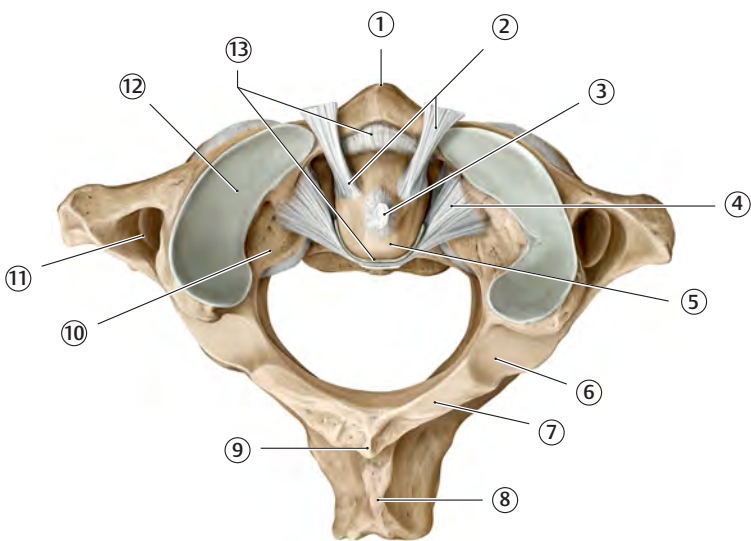
Cervical Vertebral Column and Skull: Posterior View (Cruciform Ligament Cut)

- ① Apical lig. of dens
- ② Alar lig.
- ③ Dens
- ④ Body of axis (C2)
- ⑤ Intervertebral disk
- ⑥ Intervertebral foramen
- ⑦ Longitudinal fascicles (cut)
- ⑧ Transverse lig. of atlas (cut)



The apical lig. extends from the dens to the anterior border of foramen magnum. The alar lig. extend from the dens to the medial aspects of the occipital condyles. The intervertebral disk connects adjacent vertebral bodies. Each disk is composed of an annulus fibrosus and a nucleus pulposus (see **Cervical Vertebral Column: Midsagittal View**).

Atlantoaxial Joint: Superior View



Atlantoaxial Joint: Superior View

- ① Anterior tubercle
- ② Alar lig. (cut)
- ③ Apical lig. of dens (cut)
- ④ Transverse lig. of atlas
- ⑤ Dens
- ⑥ Groove for vertebral a.
- ⑦ Posterior arch of atlas
- ⑧ Spinous process of axis
- ⑨ Posterior tubercle of atlas
- ⑩ Lateral mass of atlas
- ⑪ Transverse foramen
- ⑫ Superior articular facet
- ⑬ Median atlantoaxial joint



Note the transverse lig. of the atlas (part of the cruciform lig.) contributing to the median atlantoaxial joint.

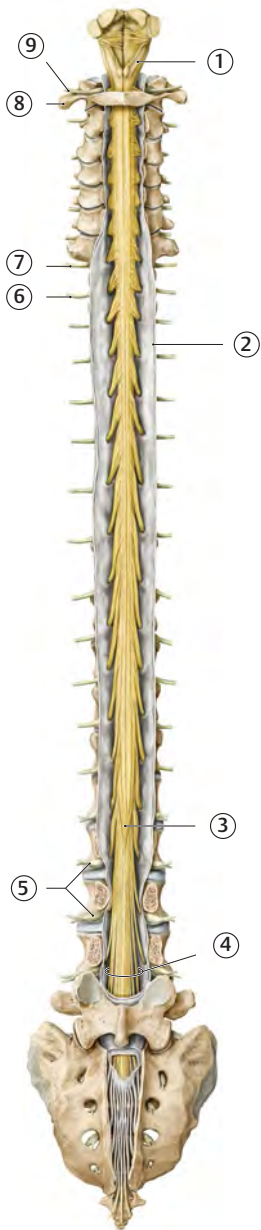
Atlantoaxial Joint: Oblique Anterior View

- ① Tectorial membrane
- ② Apical lig. of dens
- ③ Longitudinal fascicles
- ④ Dens
- ⑤ Median atlantoaxial joint
- ⑥ Anterior tubercle of atlas
- ⑦ Body of axis
- ⑧ Lateral atlantoaxial joint
- ⑨ Anterior arch of atlas
- ⑩ Alar lig.
- ⑪ Posterior atlanto-occipital membrane

Brain and Spinal Cord

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Spinal Cord: Posterior View



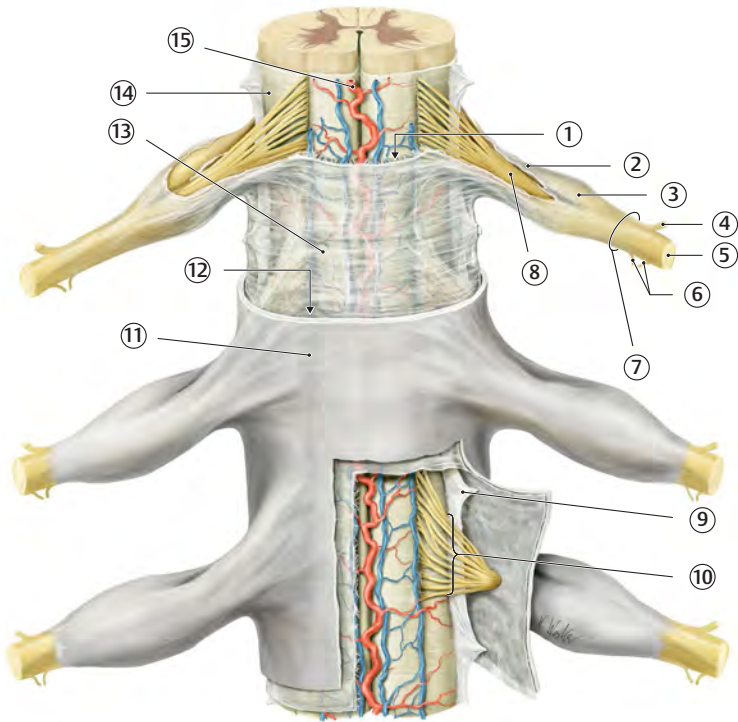
Spinal Cord: Posterior View

- ① Medulla oblongata
- ② Dural (thecal) sac (opened)
- ③ Conus medullaris
- ④ Cauda equina
- ⑤ Spinal ganglia
- ⑥ T1 spinal n.
- ⑦ C8 spinal n.
- ⑧ Atlas (C1)
- ⑨ C1 spinal n.



The spinal cord tapers inferiorly and ends as the conus medullaris at the L1–L2 vertebral level. Ventral (motor) and dorsal (sensory) nerve roots that extend inferiorly within the dural sheath beyond the conus medullaris are collectively referred to as the cauda equina.

Spinal Cord and Meninges: Anterior View



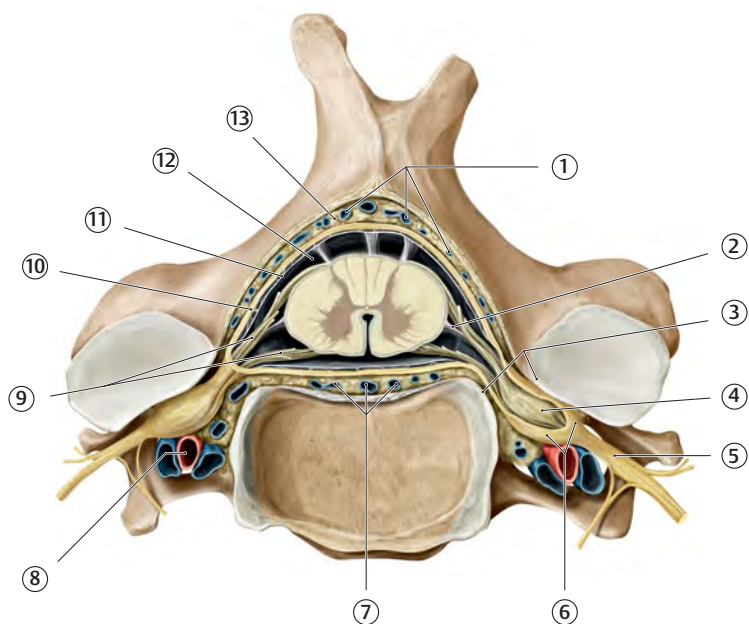
Spinal Cord and Meninges: Anterior View

- ① Subarachnoid space
- ② Posterior root
- ③ Spinal (dorsal root) ganglion
- ④ Posterior ramus
- ⑤ Anterior ramus
- ⑥ White and gray rami communicantes
- ⑦ Spinal n.
- ⑧ Anterior root
- ⑨ Denticulate lig.
- ⑩ Anterior rootlets
- ⑪ Dura mater
- ⑫ Subdural space
- ⑬ Arachnoid mater
- ⑭ Pia mater
- ⑮ Anterior spinal a.



There are three layers of meninges surrounding the spinal cord: dura mater, arachnoid mater, and pia mater on the surface of the spinal cord. Note the subdural and subarachnoid spaces. It is within the subarachnoid space that the cerebrospinal fluid is found. Denticulate ligs. are extensions of pia mater that pass laterally from the spinal cord through the arachnoid mater to stabilize the spinal cord within the dura.

Cross Section of Spinal Cord: Superior View



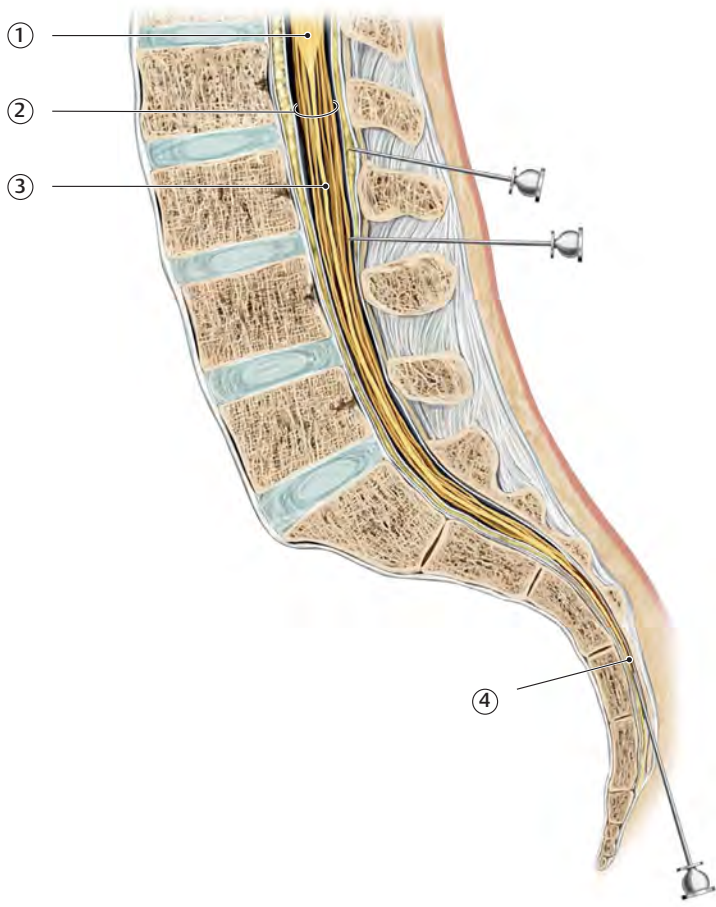
Cross Section of Spinal Cord: Superior View

- ① Posterior internal vertebral venous plexus
- ② Denticulate lig.
- ③ Intervertebral foramen
- ④ Spinal (dorsal root) ganglion
- ⑤ Spinal n.
- ⑥ Root sleeve
- ⑦ Anterior internal vertebral plexus
- ⑧ Vertebral a.
- ⑨ Anterior and posterior roots
- ⑩ Dura mater
- ⑪ Arachnoid mater
- ⑫ Subarachnoid space
- ⑬ Epidural space



The anterior and posterior internal vertebral venous plexuses (which lack valves) are potential conduits for the spread of infection and metastases from the pelvic region to the head and neck. Note that the sensory spinal (dorsal root) ganglia are located within the intervertebral foramina.

Lower Vertebral Canal: Midsagittal View



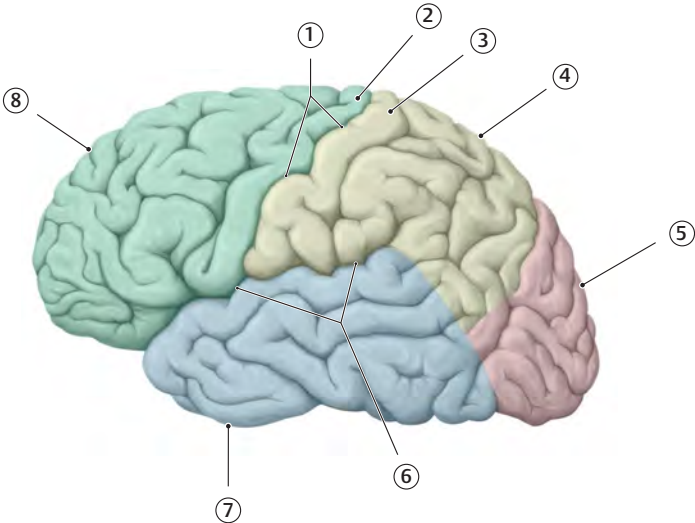
Lower Vertebral Canal: Midsagittal View

- ① Conus medullaris
- ② Cauda equina
- ③ Filum terminale
- ④ Sacral hiatus

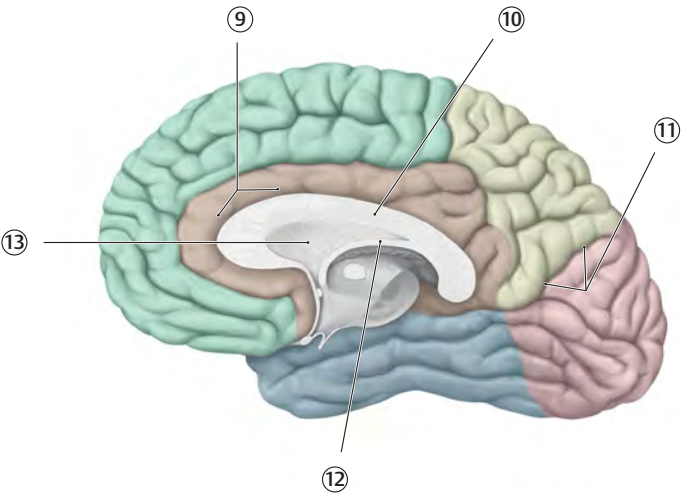


The filum terminale is pia mater that extends from the tip of the conus medullaris, pierces the lowermost extent of the dural sac (at S2 vertebral level), and anchors on the coccyx. It functions to stabilize the spinal cord, much like the denticulate ligaments. The part that extends from the tip of the conus medullaris to the end of the dural sac is referred to as the filum terminale internum. The part that is external to the dural sac is referred to as the filum terminale externum, or sacrococcygeal ligament. Epidural anesthesia and lumbar puncture are performed inferior to the conus medullaris to avoid puncturing the spinal medulla.

Lobes of the Cerebrum



A. Lateral view



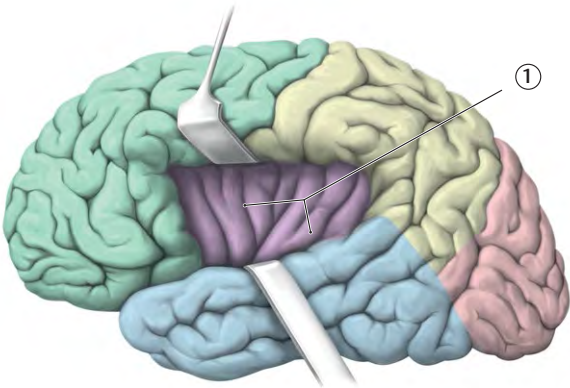
B. Medial view

Lobes of the Cerebrum

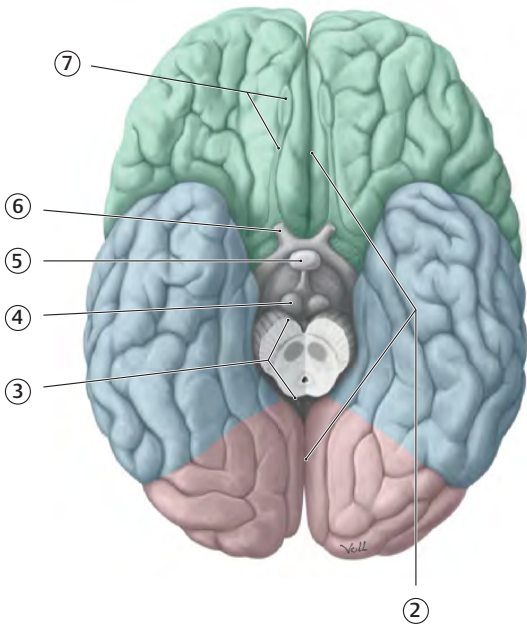
- ① Central sulcus
- ② Precentral gyrus
- ③ Postcentral gyrus
- ④ Parietal lobe
- ⑤ Occipital lobe
- ⑥ Lateral sulcus
- ⑦ Temporal lobe
- ⑧ Frontal lobe
- ⑨ Cingulate gyrus
- ⑩ Corpus callosum
- ⑪ Parieto-occipital sulcus
- ⑫ Fornix
- ⑬ Septum pellucidum

 The central sulcus separates the precentral (motor) gyrus from the postcentral (sensory) gyrus. The corpus callosum connects the right and left cerebral hemispheres. The midline septum pellucidum separates the two lateral ventricles.

Lobes of the Cerebrum



A. Lateral view



B. Inferior view

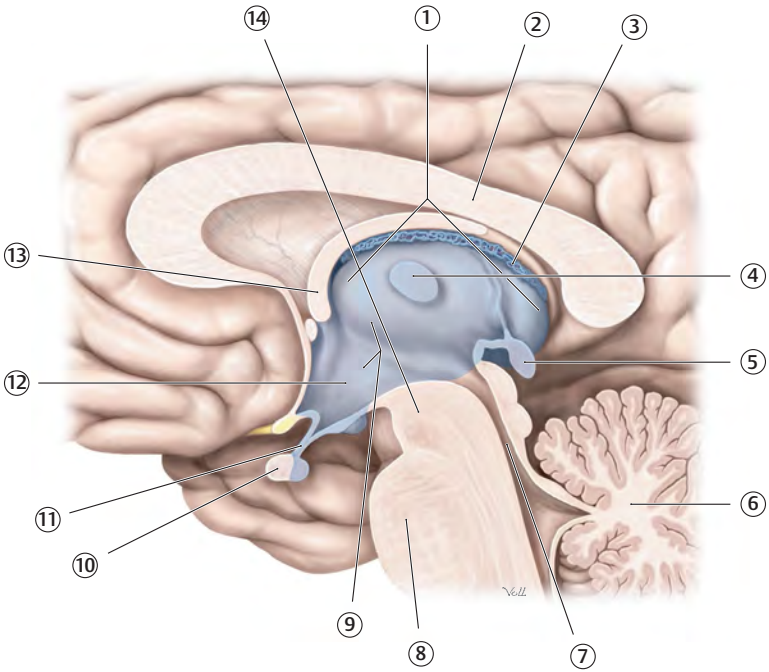
Lobes of the Cerebrum

- ① Insula
- ② Longitudinal cerebral fissure
- ③ Mesencephalon
- ④ Mammillary body
- ⑤ Pituitary gland
- ⑥ Optic n. (CN II)
- ⑦ Olfactory bulb and tract



The insula can be exposed by spreading the lateral sulcus. The pituitary gland sits posterior to the optic chiasma. Within the cranial cavity, the pituitary gland is located within the hypophyseal fossa of the sella turcica.

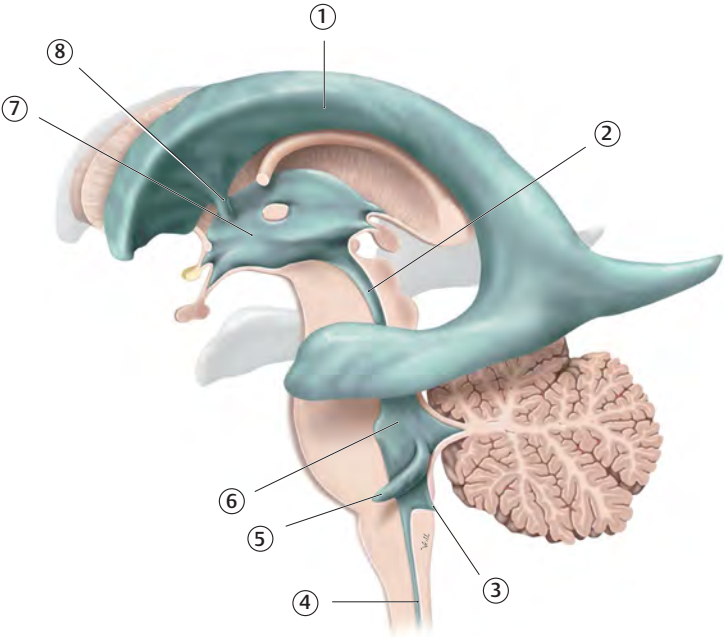
Brain Hemisection: Medial View



Brain Hemisection: Medial View

- ① Thalamus
- ② Corpus callosum
- ③ Choroid plexus
- ④ Interthalamic adhesion
- ⑤ Pineal gland
- ⑥ Cerebellum
- ⑦ Cerebral aqueduct
- ⑧ Pons
- ⑨ Third ventricle
- ⑩ Pituitary gland
- ⑪ Infundibulum
- ⑫ Hypothalamus
- ⑬ Fornix
- ⑭ Midbrain

Ventricular System: Lateral View

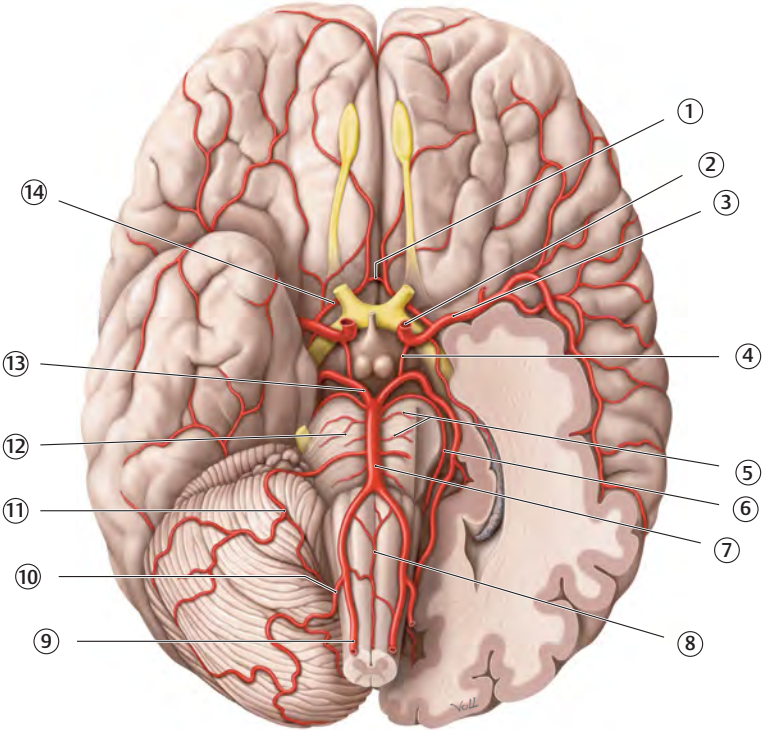


Ventricular System: Lateral View

- ① Lateral ventricle
- ② Cerebral aqueduct
- ③ Median aperture
- ④ Central canal
- ⑤ Lateral aperture
- ⑥ 4th ventricle
- ⑦ 3rd ventricle
- ⑧ Interventricular foramen

 Cerebrospinal fluid is produced by the choroid plexuses within the ventricles. In addition to flowing within the ventricular system and into the central canal of the spinal cord, the cerebrospinal fluid is released into the subarachnoid space via the median aperture of the 4th ventricle (foramen of Magendie) and the two lateral apertures of the 4th ventricle (foramina of Luschka).

Arteries of the Brain: Inferior View



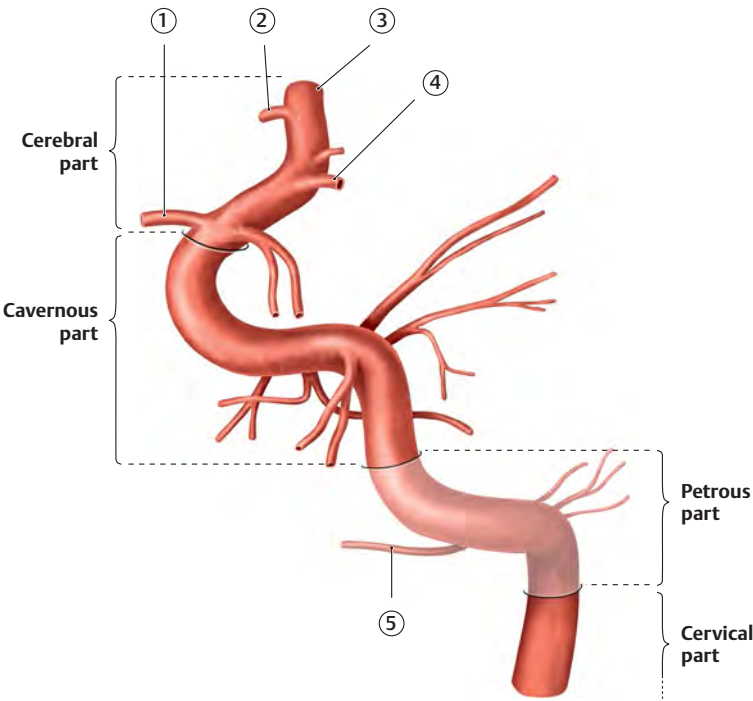
Arteries of the Brain: Inferior View

- ① Anterior communicating a.
- ② Internal carotid a.
- ③ Middle cerebral a.
- ④ Posterior communicating a.
- ⑤ Pontine aa.
- ⑥ Superior cerebellar a.
- ⑦ Basilar a.
- ⑧ Anterior spinal a.
- ⑨ Vertebral a.
- ⑩ Posterior inferior cerebellar a.
- ⑪ Anterior inferior cerebellar a.
- ⑫ Labyrinthine a.
- ⑬ Posterior cerebral a.
- ⑭ Anterior cerebral a.



There are two supplies of blood to the brain: the vertebral and the internal carotid aa. Note the posterior communicating aa., which connect the posterior cerebral and internal carotid aa., and the anterior communicating a., which connects the anterior cerebral aa., completing the Circle of Willis.

Internal Carotid Artery: Lateral View

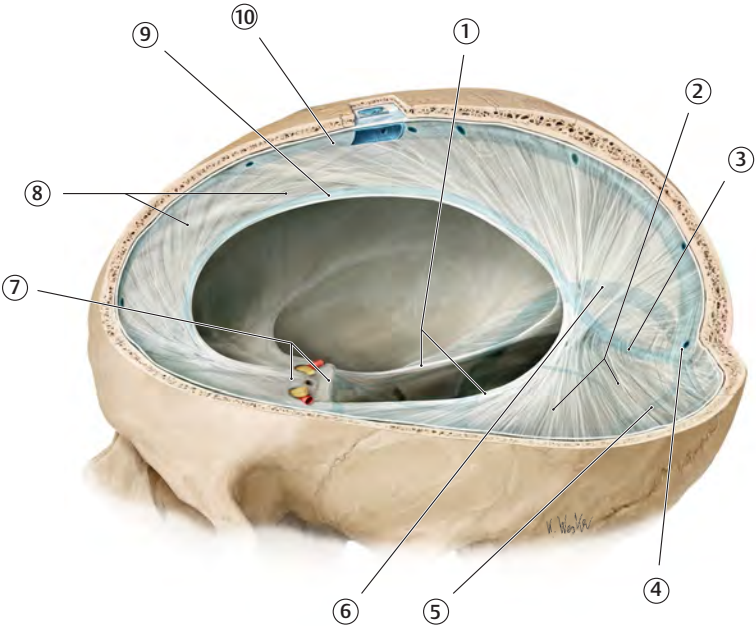


Internal Carotid Artery: Lateral View

- ① Ophthalmic a.
- ② Anterior cerebral a.
- ③ Middle cerebral a.
- ④ Posterior communicating a.
- ⑤ Artery of pterygoid canal

 The internal carotid a. is composed of four parts. Arising from the petrous part is the artery of the pterygoid canal, which anastomoses within the pterygoid canal with a branch of the maxillary a., also named the artery of the pterygoid canal. As the internal carotid a. emerges from the cavernous sinus, it gives rise to the ophthalmic a., which passes into the orbit via the optic canal along with the optic n. (CN II). Note the termination of the internal carotid a. where it branches into the anterior cerebral and middle cerebral aa.

Dural Reflections and Sinuses: Oblique View

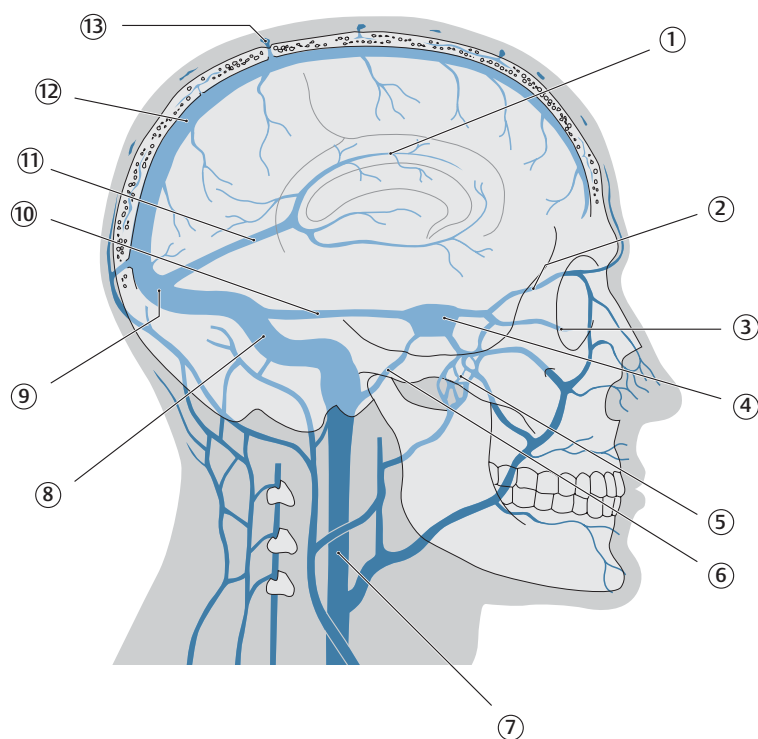


Dural Reflections and Sinuses: Oblique View

- ① Tentorial notch
- ② Tentorium cerebelli
- ③ Straight sinus
- ④ Confluence of sinuses
- ⑤ Occipital sinus
- ⑥ Transverse sinus
- ⑦ Diaphragma sellae
- ⑧ Falx cerebri
- ⑨ Inferior sagittal sinus
- ⑩ Superior sagittal sinus

 The dura surrounding the brain consists of two layers adherent to each other: an outer endosteal layer and an inner meningeal layer. Dural venous sinuses are spaces where the two layers separate. These contain cerebral venous blood. The confluence of sinuses is a point where a number of dural venous sinuses meet: superior sagittal, straight, transverse, and occipital. Most of the dural sinus blood ultimately passes through the jugular foramen into the internal jugular v. Dural reflections (folds) are double layers of meningeal dura that extend away from the cranial bones and into the cranial cavity, separating brain structures.

Venous Drainage of the Brain and Cranial Cavity: Lateral View



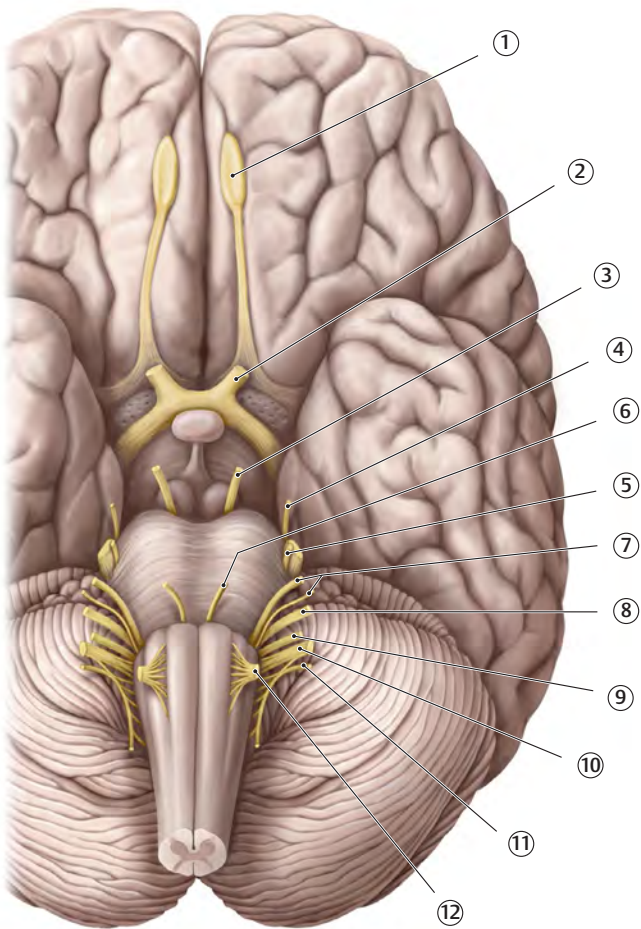
Venous Drainage of the Brain and Cranial Cavity: Lateral View

- ① Inferior sagittal sinus
- ② Superior ophthalmic v.
- ③ Inferior ophthalmic v.
- ④ Cavernous sinus
- ⑤ Pterygoid plexus
- ⑥ Inferior petrosal sinus
- ⑦ Internal jugular v.
- ⑧ Sigmoid sinus
- ⑨ Confluence of sinuses
- ⑩ Superior petrosal sinus
- ⑪ Straight sinus
- ⑫ Superior sagittal sinus
- ⑬ Parietal emissary v.



The dural venous sinuses lack valves, as do most of the veins of the head and neck. Infection can thus pass from veins outside the skull, via communications such as emissary vv. and ophthalmic vv., to the dural venous sinuses inside the skull and then on to cerebral veins.

Cranial Nerves: Inferior View

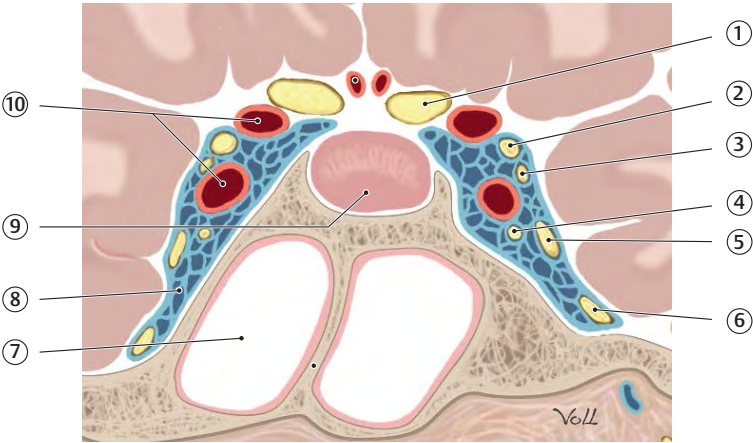


Cranial Nerves: Inferior View

- ① CN I
- ② CN II
- ③ CN III
- ④ CN IV
- ⑤ CN V
- ⑥ CN VI
- ⑦ CN VII
- ⑧ CN VIII
- ⑨ CN IX
- ⑩ CN X
- ⑪ CN XI
- ⑫ CN XII

 The olfactory bulb (which communicates with CN I) attaches to the telencephalon. CN II attaches to the diencephalon. CN III and CN IV attach to the mesencephalon (mid-brain). CN V, CN IV, CN VII, and CN VIII attach to the pons. (CN VI, CN VII, and CN VIII emerge, however, from the pontomedullary junction.) CN IX, CN X, CN XI, and CN XII attach to the medulla oblongata. Note that CN XII emerges between the pyramid and the olive of the medulla oblongata.

Cavernous Sinus: Coronal Section



Cavernous Sinus: Coronal Section

- ① Optic n. (CN II)
- ② Oculomotor n. (CN III)
- ③ Trochlear n. (CN IV)
- ④ Abducent n. (CN VI)
- ⑤ Ophthalmic division (CN V1)
- ⑥ Maxillary division (CN V2)
- ⑦ Sphenoid sinus
- ⑧ Cavernous sinus
- ⑨ Pituitary gland (hypophysis)
- ⑩ Internal carotid a.

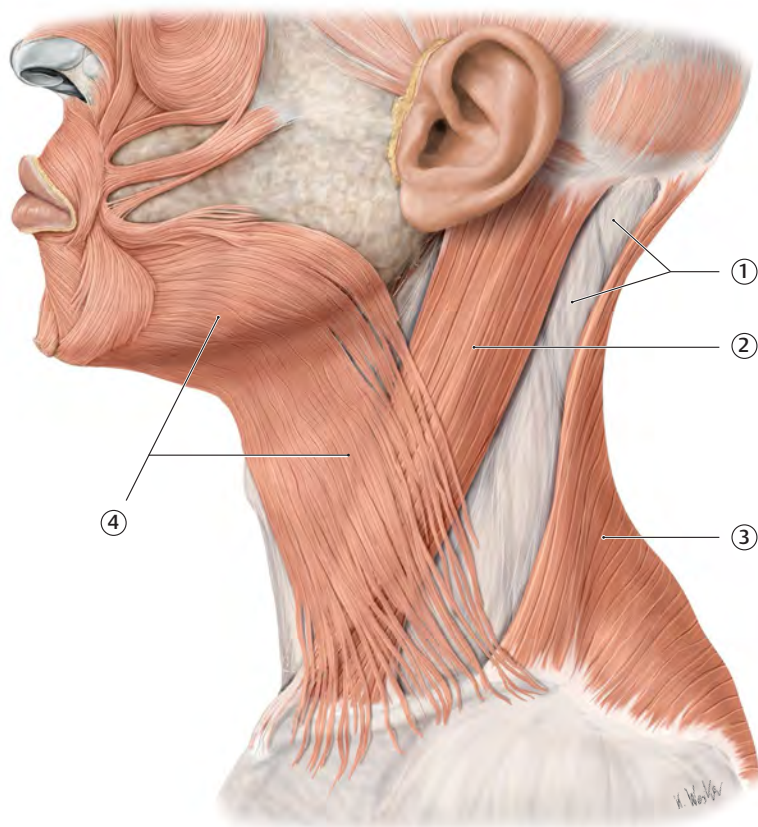


Passing through the lateral walls of the cavernous sinuses are CN III, CN IV, CN V1, and CN V2. Traveling through the middle of each cavernous sinus are the internal carotid a. and CN VI. The cavernous sinuses communicate with veins of the face via the ophthalmic vv. and the pterygoid plexus by way of the sphenoidal emissary vv. Infections traveling to the cavernous sinus by these routes can induce cavernous sinus thrombosis, affecting the nerves that pass through the cavernous sinus.

Neck

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Superficial Neck Muscles: Lateral View

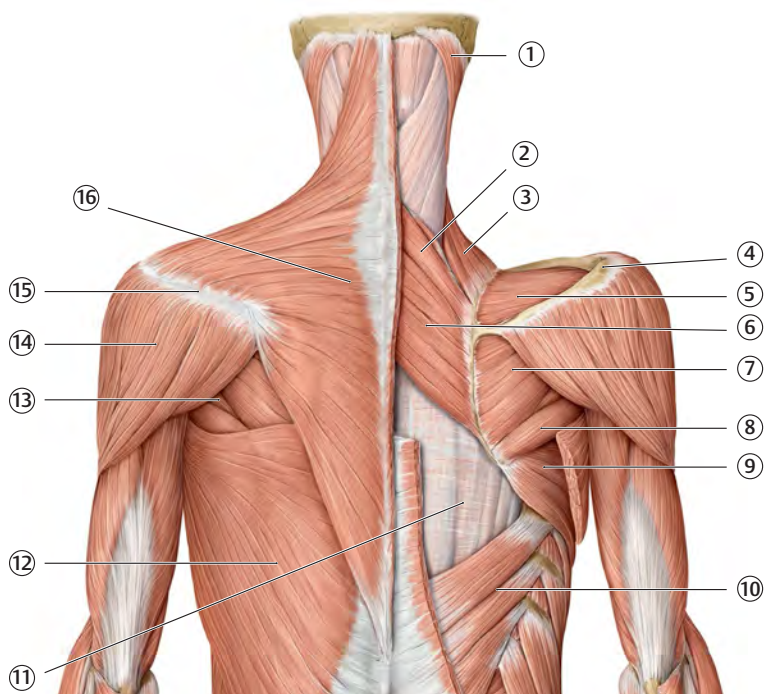


Superficial Neck Muscles: Lateral View

- ① Deep cervical fascia
- ② Sternocleidomastoid
- ③ Trapezius
- ④ Platysma

 The platysma, the most superficial muscle in the anterior neck, is a muscle of facial expression and as such is innervated by the facial n. (CN VII, specifically the cervical branch). Both the sternocleidomastoid and the trapezius muscles are innervated by the accessory n. (CN XI).

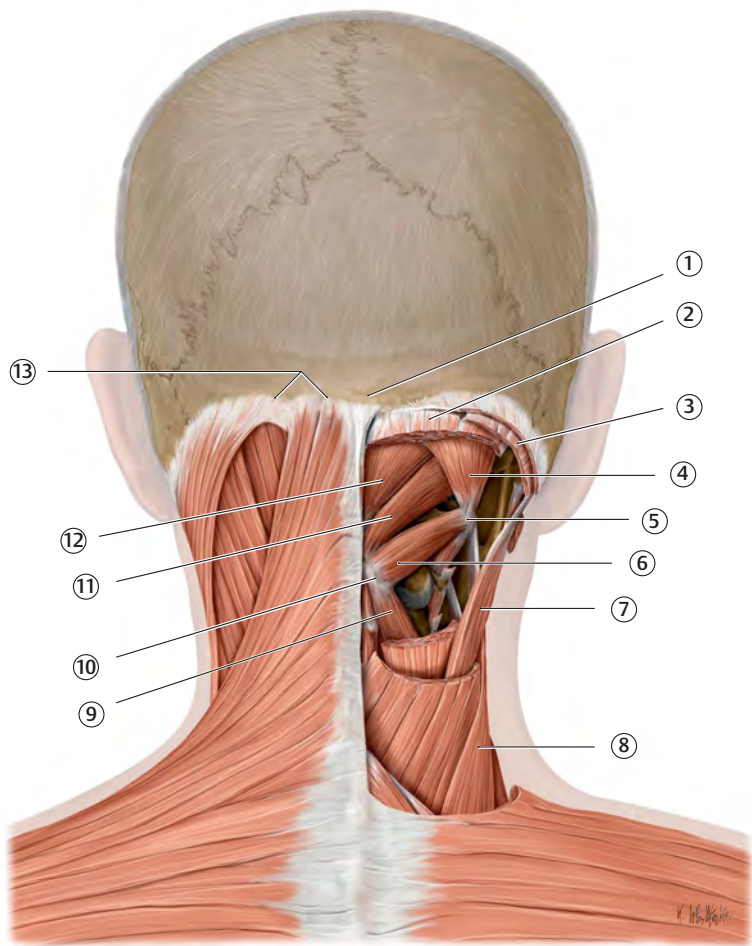
Muscles of the Neck and Upper Back: Posterior View



Muscles of the Neck and Upper Back: Posterior View

- ① Sternocleidomastoid
- ② Rhomboid minor
- ③ Levator scapulae
- ④ Acromion, scapula
- ⑤ Supraspinatus
- ⑥ Rhomboid major
- ⑦ Infraspinatus
- ⑧ Teres major
- ⑨ Serratus anterior
- ⑩ Serratus posterior inferior
- ⑪ Thoracolumbar fascia covering erector spinae muscles
- ⑫ Latissimus dorsi
- ⑬ Teres minor
- ⑭ Deltoid
- ⑮ Scapular spine
- ⑯ Trapezius

Posterior Neck: Posterior View



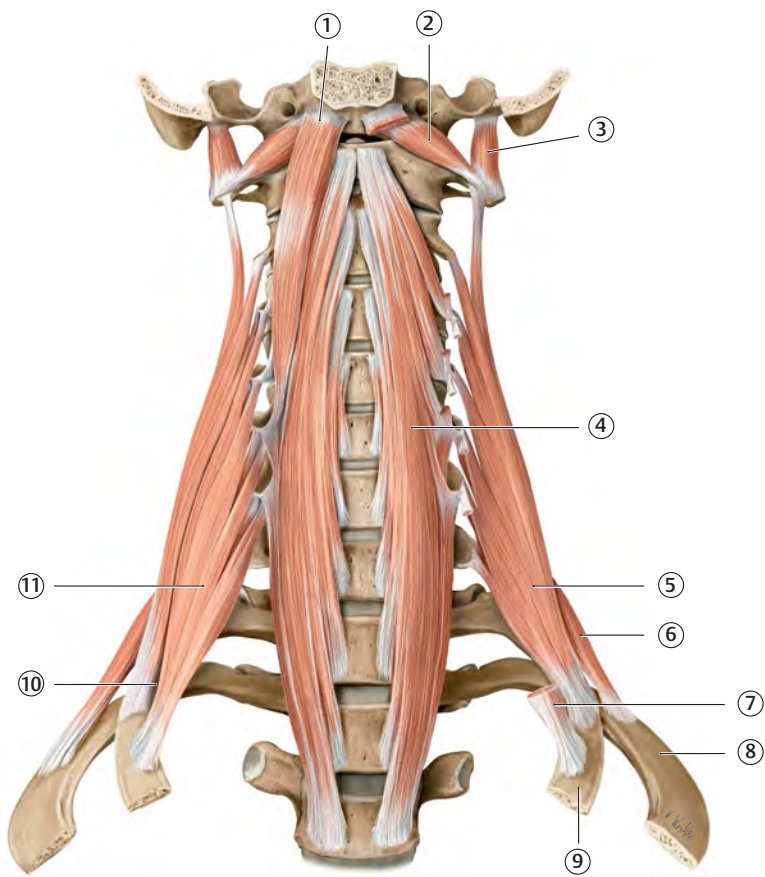
Posterior Neck: Posterior View

- ① External occipital protuberance
- ② Semispinalis capitis (cut)
- ③ Splenius capitis (cut)
- ④ Obliquus capitis superior
- ⑤ Transverse process of atlas (C1)
- ⑥ Obliquus capitis inferior
- ⑦ Longissimus capitis
- ⑧ Splenius cervicis
- ⑨ Semispinalis cervicis
- ⑩ Spinous process of axis (C2)
- ⑪ Rectus capitis posterior major
- ⑫ Rectus capitis posterior minor
- ⑬ Superior nuchal line



The intrinsic muscles of the deep posterior neck are innervated by dorsal rami of spinal nerves. Note that the trapezius and sternocleidomastoid do not fall into this category.

Prevertebral and Scalene Muscles: Anterior View



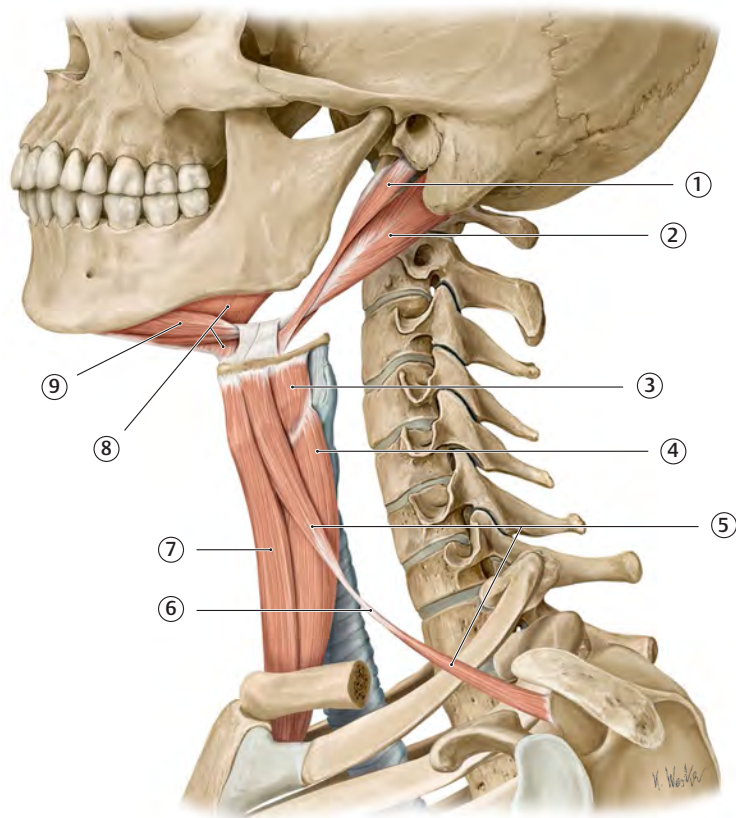
Prevertebral and Scalene Muscles: Anterior View

- ① Longus capitis
- ② Rectus capitis anterior
- ③ Rectus capitis lateralis
- ④ Longus colli
- ⑤ Middle scalene
- ⑥ Posterior scalene
- ⑦ Anterior scalene (cut)
- ⑧ 2nd rib
- ⑨ 1st rib
- ⑩ Interscalene triangle
- ⑪ Anterior scalene



Prevertebral and scalene muscles are innervated by ventral rami of spinal nerves. Note that the anterior and middle scalenes have an inferior attachment to the 1st rib, whereas the posterior scalene has an inferior attachment to the 2nd rib. The interscalene triangle is a space bounded by the anterior scalene, middle scalene, and 1st rib. The subclavian a. and brachial plexus pass through this space.

Suprahyoid and Infrahyoid Muscles: Lateral View

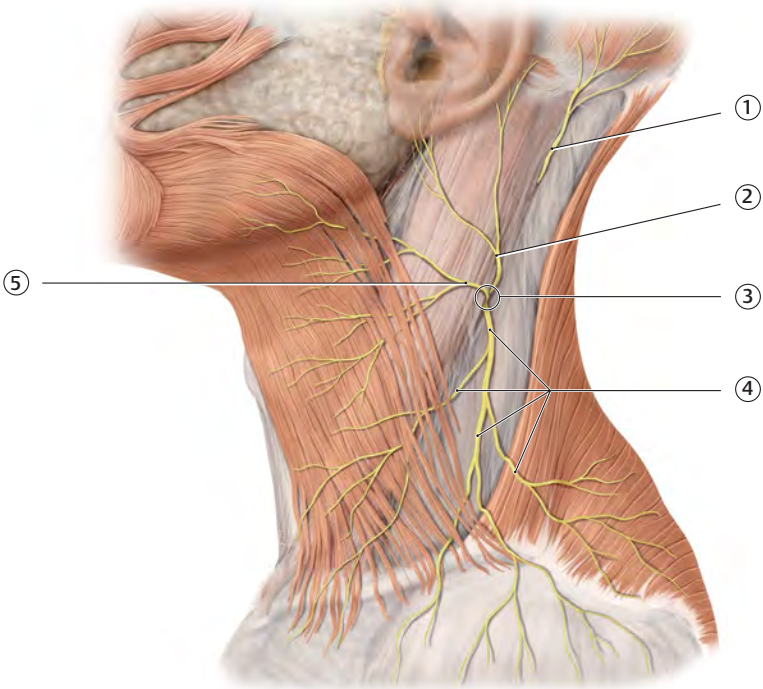


Suprahyoid and Infrahyoid Muscles: Lateral View

- ① Stylohyoid
- ② Digastric, posterior belly
- ③ Thyrohyoid
- ④ Sternothyroid
- ⑤ Omohyoid, superior and inferior belly
- ⑥ Intermediate tendon of omohyoid
- ⑦ Sternohyoid
- ⑧ Mylohyoid
- ⑨ Digastric, anterior belly

 The infrahyoid muscles are the sternohyoid, sternothyroid, thyrohyoid, and omohyoid. With the exception of the thyrohyoid, all are innervated by the ansa cervicalis (ventral rami of C1–C3). The thyrohyoid is innervated by the ventral ramus of C1 traveling with CN XII. The suprahyoid muscles are the digastric, mylohyoid, stylohyoid, and geniohyoid (not shown). The mylohyoid and anterior belly of the digastric are innervated by the mylohyoid n. (a branch of the inferior alveolar n. of CN V3). The posterior digastric and stylohyoid are innervated by CN VII. The geniohyoid is innervated by C1 traveling with CN XII.

**Cutaneous Nerves of the Cervical Plexus:
Lateral View**

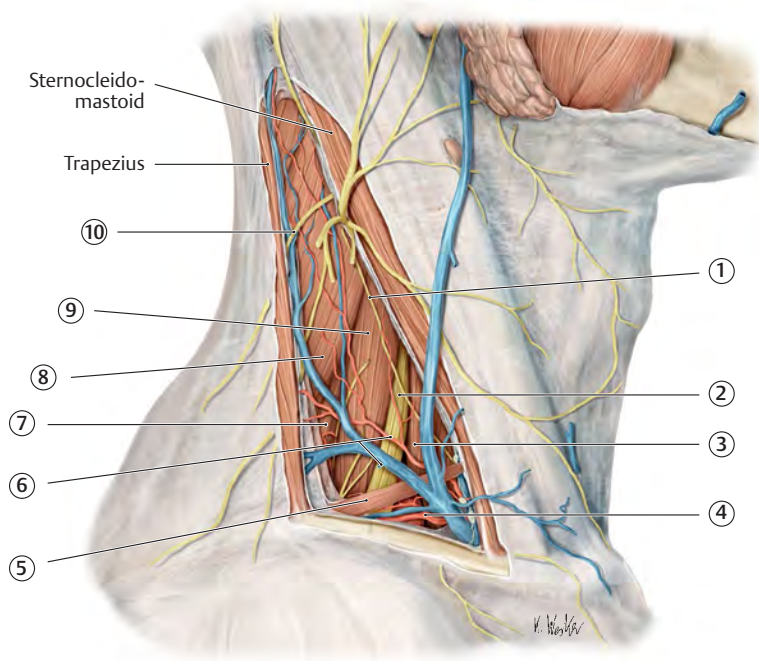


Cutaneous Nerves of the Cervical Plexus: Lateral View

- ① Lesser occipital n. (C2)
- ② Great auricular n. (C2–C3)
- ③ Erb's point
- ④ Supraclavicular nn. (C3–C4)
- ⑤ Transverse cervical n. (C2–C3)

 The cutaneous nerves in the lateral and anterior neck are derived from the cervical plexus. The cervical plexus is formed from the ventral rami of C1–C4. The majority of these cutaneous nerves emerge at the Erb's point, located posterior to the sternocleidomastoid muscle. Innervation of the skin of the posterior neck is via branches of dorsal rami.

Posterior Triangle of the Neck: Lateral View



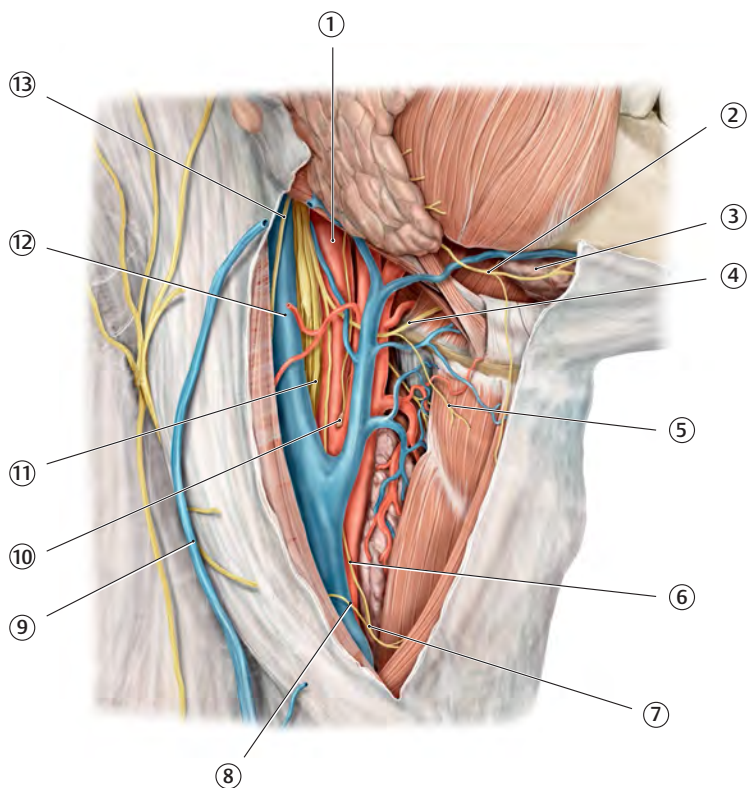
Posterior Triangle of the Neck: Lateral View

- ① Phrenic n. (C3–C5)
- ② Brachial plexus
- ③ Anterior scalene
- ④ Suprascapular a.
- ⑤ Omohyoid, inferior belly
- ⑥ Transverse cervical a. and v.
- ⑦ Posterior scalene
- ⑧ Levator scapular
- ⑨ Middle scalene
- ⑩ Accessory n. (CN XI)



The posterior triangle of the neck is bounded by the sternocleidomastoid, trapezius, and clavicle. The contents of the posterior triangle include scalene muscles, the levator scapulae muscle, the brachial plexus (ventral rami of C5–T1), and the accessory n. (CN XI).

Carotid Triangle of the Neck: Lateral View

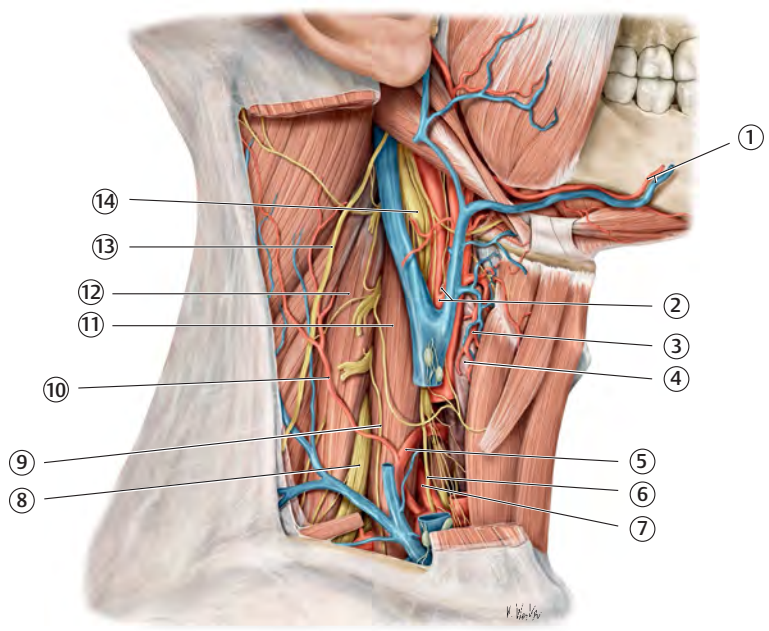


Carotid Triangle of the Neck: Lateral View

- ① Internal carotid a.
- ② Facial n. (CN VII), mandibular branch
- ③ Submandibular gland
- ④ Hypoglossal n. (CN XII)
- ⑤ Nerve to the thyrohyoid (C1)
- ⑥ Superior root of ansa cervicalis (C1)
- ⑦ Ansa cervicalis (C1–C3)
- ⑧ Inferior root of ansa cervicalis (C2–C3)
- ⑨ External jugular v.
- ⑩ Carotid body
- ⑪ Vagus n. (CN X)
- ⑫ Internal jugular v.
- ⑬ Accessory n. (CN XI)

 The carotid triangle is bounded by the sternocleidomastoid, the superior belly of the omohyoid, and the posterior belly of the digastric along with the stylohyoid. It is a subdivision of the anterior triangle of the neck. Within the carotid triangle, the common carotid a. typically bifurcates into the internal and external carotid aa.

Deep Lateral Neck: Lateral View



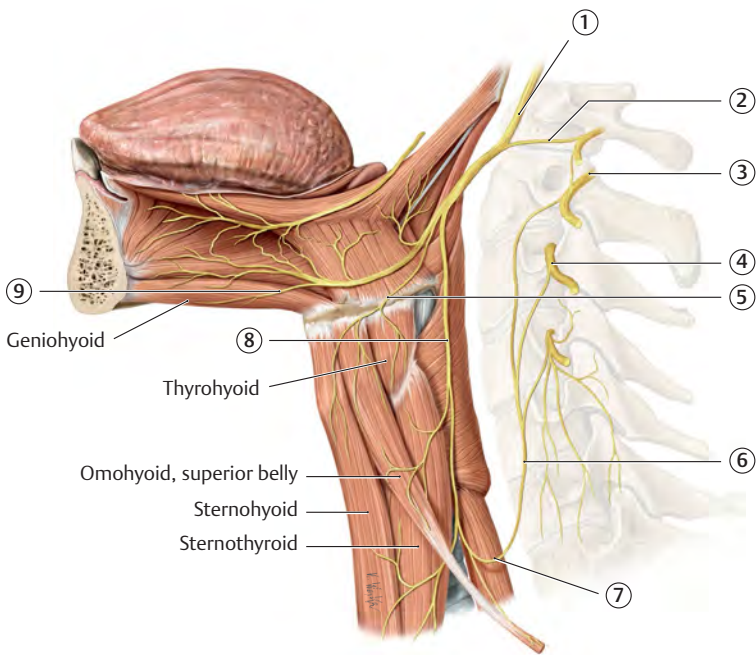
Deep Lateral Neck: Lateral View

- ① Facial a. and v.
- ② Carotid bifurcation with carotid sinus and body
- ③ Superior thyroid a.
- ④ Thyroid gland
- ⑤ Inferior thyroid a.
- ⑥ Vagus n. (CN X)
- ⑦ Vertebral a.
- ⑧ Brachial plexus
- ⑨ Phrenic n.
- ⑩ Ascending cervical a.
- ⑪ Anterior scalene
- ⑫ Middle scalene
- ⑬ Accessory n. (CN XI)
- ⑭ Superior cervical ganglion



Note the phrenic n. (C3--5) descending through the neck on the anterior surface of the anterior scalene muscle on its way to the thorax and diaphragm.

**CN XII and Motor Nerves of the Cervical Plexus:
Lateral View**



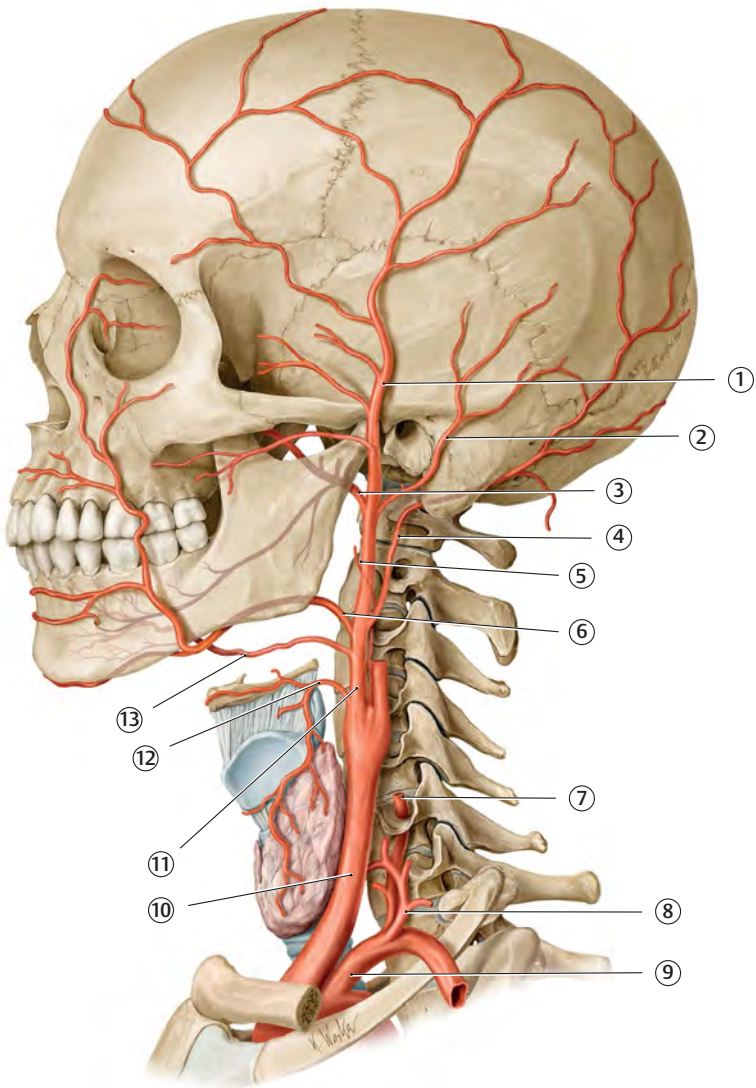
CN XII and Motor Nerves of the Cervical Plexus: Lateral View

- ① Hypoglossal n. (CN XII)
- ② Anterior ramus of C1
- ③ C2
- ④ C3
- ⑤ Thyrohyoid branch (C1)
- ⑥ Inferior root of ansa cervicalis (C2–C3)
- ⑦ Ansa cervicalis
- ⑧ Superior root of ansa cervicalis (C1)
- ⑨ Geniohyoid branch (C1)



C1 motor fibers join and briefly travel with the hypoglossal n. (CN XII). These fibers then leave the hypoglossal n. at different points to do one of three things: contribute to the ansa cervicalis as the superior root (descendens hypoglossi), provide innervation to the thyrohyoid muscle, and provide innervation to the geniohyoid muscle. The ansa cervicalis is a loop of C1–C3 motor fibers. Whereas the superior root is formed by C1, the inferior root (descendens cervicalis) is formed by C2–C3 fibers.

Arteries of the Neck: Lateral View



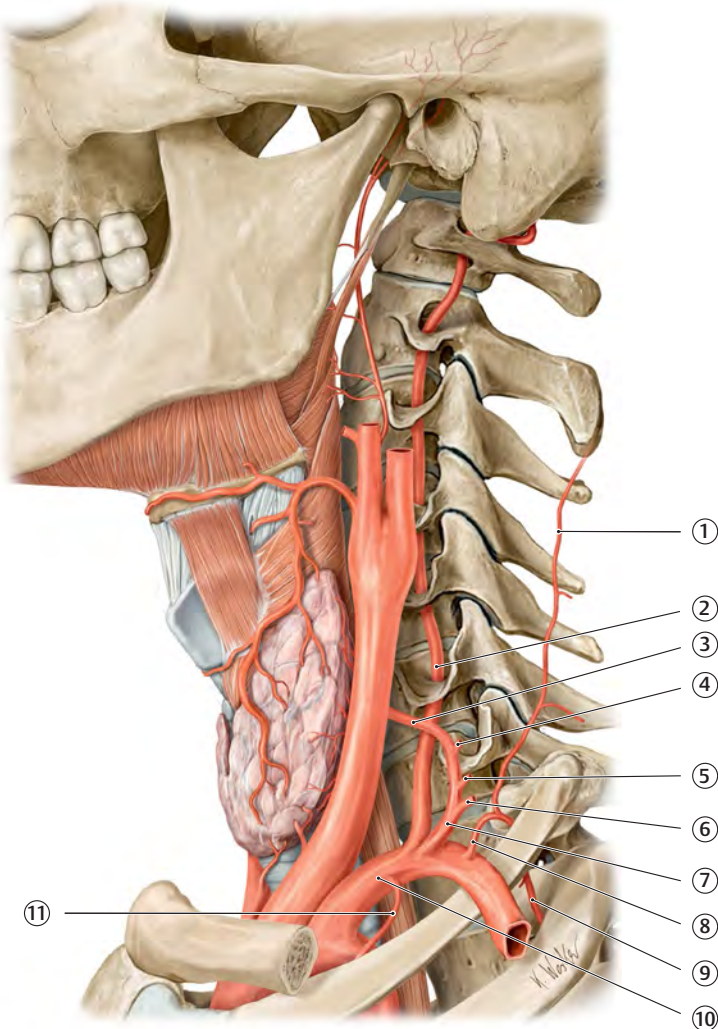
Arteries of the Neck: Lateral View

- ① Superficial temporal a.
- ② Posterior auricular a.
- ③ Maxillary a.
- ④ Occipital a.
- ⑤ Ascending pharyngeal a.
- ⑥ Facial a.
- ⑦ Vertebral a.
- ⑧ Thyrocervical trunk
- ⑨ Subclavian a.
- ⑩ Common carotid a.
- ⑪ External carotid a.
- ⑫ Superior thyroid a.
- ⑬ Lingual a.



The external carotid a. has eight direct branches: superior thyroid, ascending pharyngeal, lingual, facial, occipital, posterior auricular, maxillary, and superficial temporal. The maxillary and superficial temporal aa. are the terminal branches of the external carotid a.

Arteries Derived from the Subclavian Artery:
Lateral View



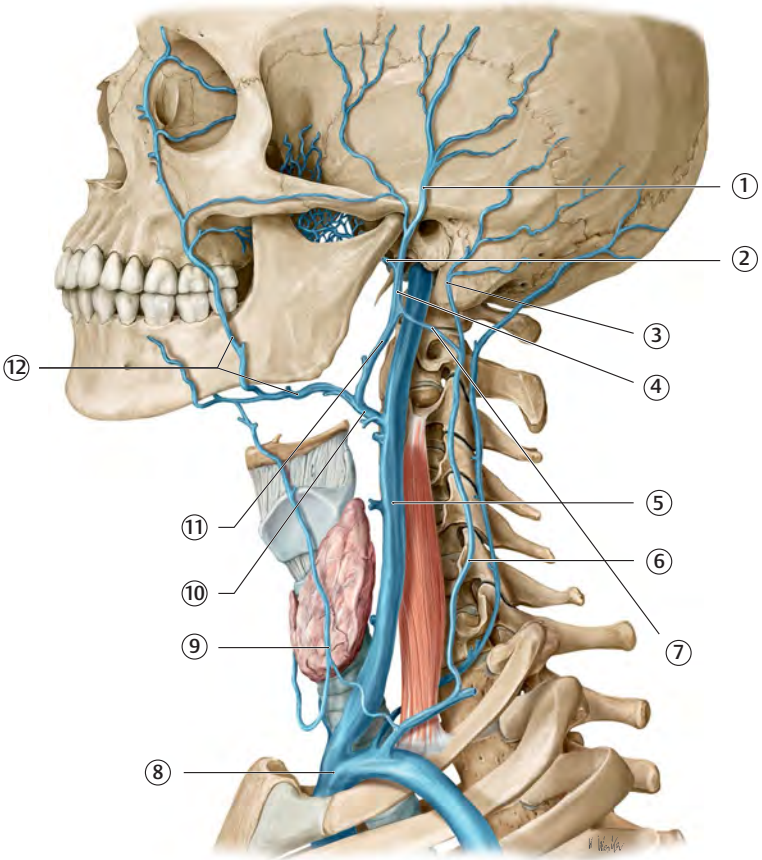
Arteries Derived from the Subclavian Artery: Lateral View

- ① Deep cervical a.
- ② Vertebral a.
- ③ Inferior thyroid a.
- ④ Ascending cervical a.
- ⑤ Transverse cervical a.
- ⑥ Suprascapular a.
- ⑦ Thyrocervical trunk
- ⑧ Costocervical trunk
- ⑨ Supreme intercostal a.
- ⑩ Subclavian a.
- ⑪ Internal thoracic a.



The subclavian a. runs through the root of the neck. It has four direct branches: internal thoracic, vertebral, thyrocervical, and costocervical. Note that the vertebral a. passes through the transverse foramen of the C6 vertebrae and all vertebrae superior to it on its pathway to the foramen magnum. Although C7 also contains a transverse foramen, the vertebral a. does not typically go through it. After passing the lateral border of the 1st rib, the subclavian a. is called the axillary a.

Veins of the Neck: Lateral View

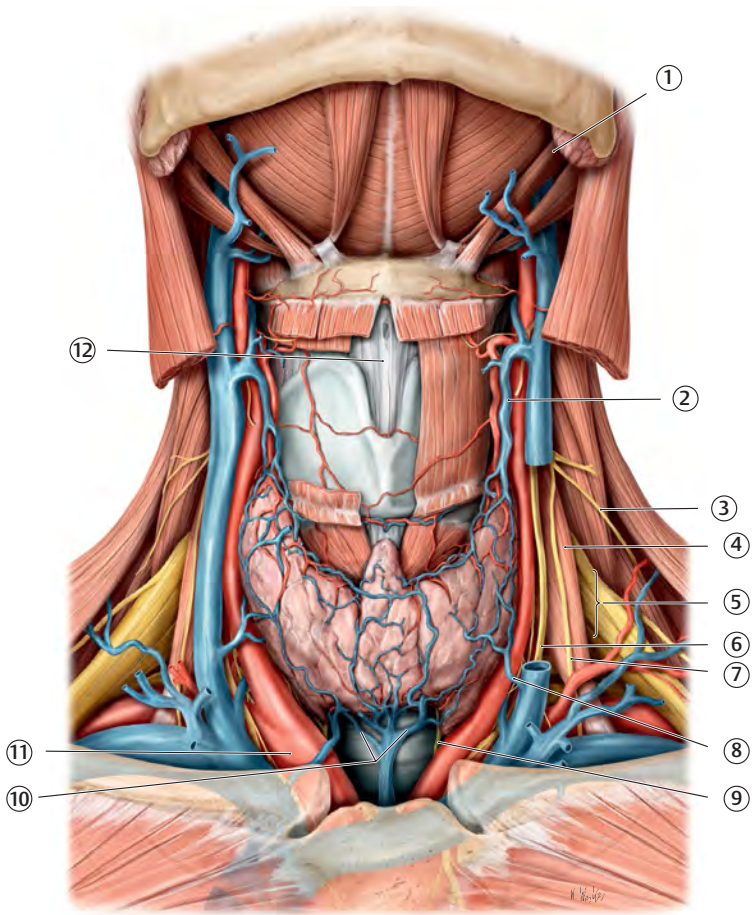


Veins of the Neck: Lateral View

- ① Superficial temporal v.
- ② Maxillary v.
- ③ Posterior auricular v.
- ④ Retromandibular v.
- ⑤ Internal jugular v.
- ⑥ External jugular v.
- ⑦ Retromandibular v., posterior division
- ⑧ Left brachiocephalic v.
- ⑨ Anterior jugular v.
- ⑩ Common facial v.
- ⑪ Retromandibular v., anterior division
- ⑫ Facial v.

 The maxillary v. is formed from a posterior coalescence of the pterygoid plexus of veins. It joins with the superficial temporal v. to form the retromandibular v. The retromandibular v. divides inferiorly into anterior and posterior divisions. The posterior division joins the posterior auricular v. to form the external jugular v. The anterior division joins the facial v. to form the common facial v., which drains into the internal jugular v.

Root of the Neck I: Anterior View



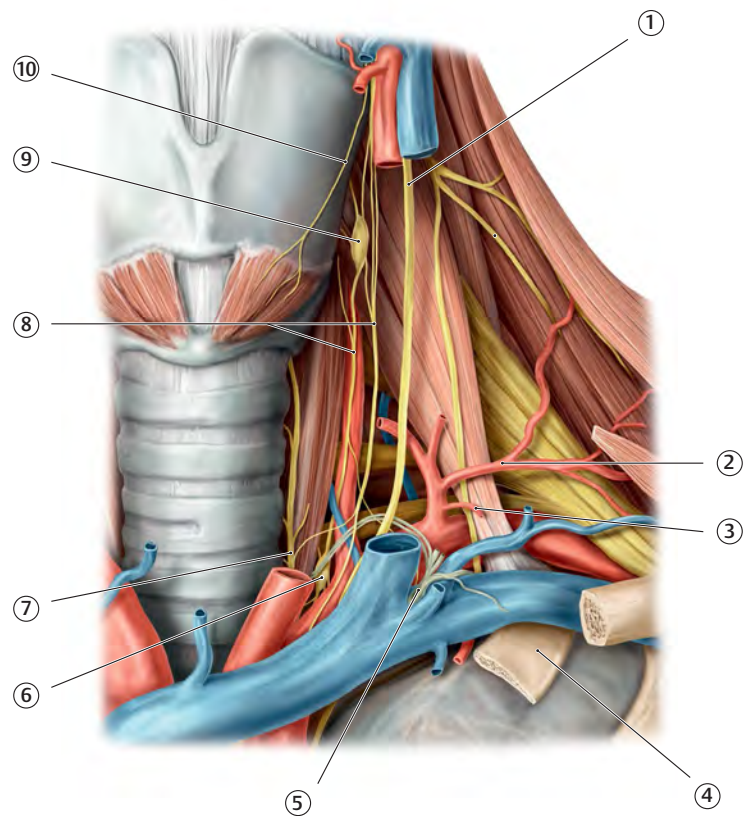
Root of the Neck I: Anterior View

- ① Stylohyoid
- ② Superior thyroid v.
- ③ Accessory n.
- ④ Anterior scalene
- ⑤ Brachial plexus
- ⑥ Vagus n.
- ⑦ Phrenic n.
- ⑧ Middle thyroid a.
- ⑨ Left recurrent laryngeal n.
- ⑩ Inferior thyroid vv.
- ⑪ Brachiocephalic trunk
- ⑫ Thyrohyoid membrane



The anterior scalene muscle is key to understanding the relationships among structures in the root of the neck. Passing immediately posterior to it (through the interscalene triangle) is the brachial plexus and the subclavian a. Passing anterior to it is the subclavian v. as well as branches derived from the thyrocervical trunk (transverse cervical and suprascapular aa.). Note that the phrenic n., motor supply to the diaphragm, descends in the neck on the anterior surface of the anterior scalene.

Root of the Neck II: Anterior View

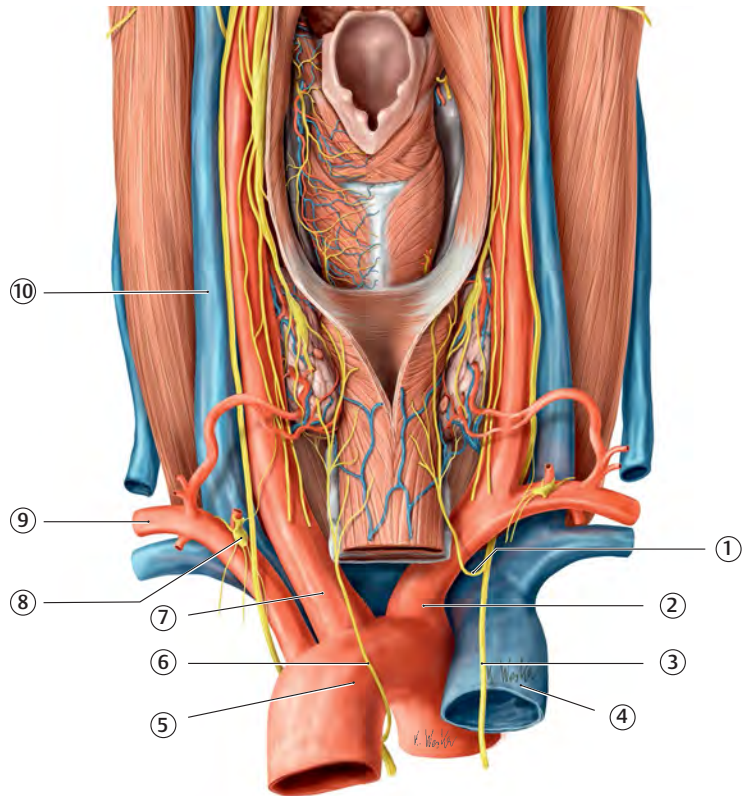


Root of the Neck II: Anterior View

- ① Vagus n. (CN X)
- ② Transverse cervical a.
- ③ Suprascapular a.
- ④ 1st rib
- ⑤ Thoracic duct
- ⑥ Stellate (cervicothoracic) ganglion
- ⑦ Left recurrent laryngeal n.
- ⑧ Sympathetic trunk
- ⑨ Middle cervical ganglion
- ⑩ External laryngeal n.

 The thoracic duct, which begins in the abdomen as the cisterna chyli, empties into the venous system at the junction of the left internal jugular and left subclavian vv. The external laryngeal n., derived from the superior laryngeal n. (a branch of CN X) provides motor supply to the cricothyroid muscle. The recurrent laryngeal n. (a branch of CN X carrying motor and sensory fibers) ascends in the neck lateral to the posterior border of the trachea and the anterior esophagus. Note the relationships of the subclavian a. and v. to the anterior scalene muscle.

Posterior Root of the Neck: Posterior View



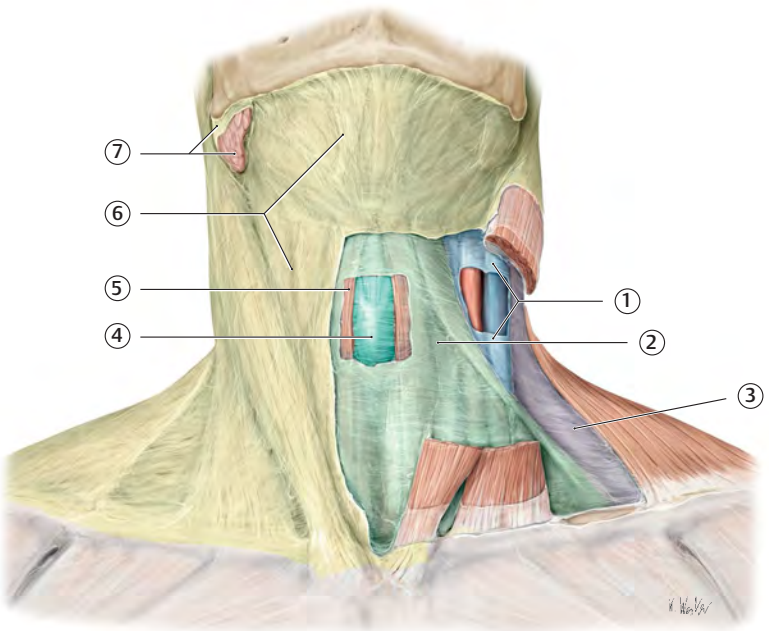
Posterior Root of the Neck: Posterior View

- ① Right recurrent laryngeal n.
- ② Brachiocephalic trunk
- ③ Vagus n. (CN X)
- ④ Superior vena cava
- ⑤ Aortic arch
- ⑥ Left recurrent laryngeal n.
- ⑦ Left common carotid a.
- ⑧ Vertebral ganglion
- ⑨ Left subclavian a.
- ⑩ Internal jugular v.



Note the difference in origin of the right and left recurrent laryngeal nn., where the left recurs (loops) under the arch of the aorta, and the right recurs under the right subclavian artery. The brachiocephalic trunk gives rise to the right subclavian and right common carotid aa., whereas the left subclavian and left common carotid aa. are direct branches of the aortic arch.

Fascia of the Neck: Anterior View

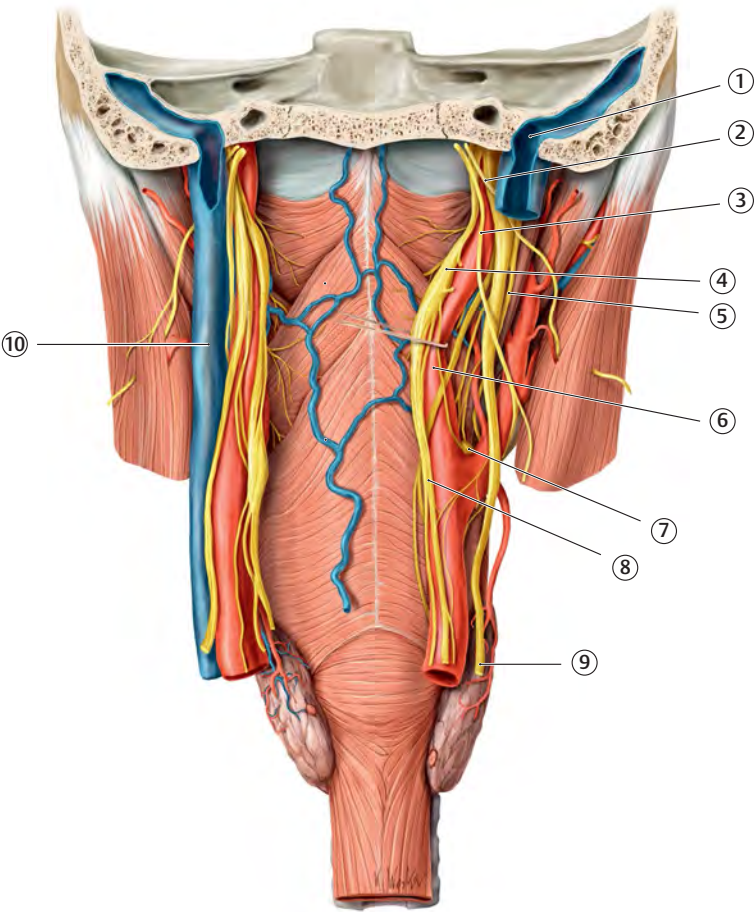


Fascia of the Neck: Anterior View

- ① Carotid sheath (cut)
- ② Muscular pretracheal fascia (cut)
- ③ Prevertebral fascia
- ④ Visceral pretracheal fascia
- ⑤ Sternohyoid
- ⑥ Superficial layer, deep cervical fascia
- ⑦ Parotid gland with opened capsule

 The carotid sheath extends from the base of the skull to the mediastinum. At the base of the skull, for a limited extent, the carotid sheath contains CN IX, CN X, CN XI, and CN XII as well as the internal carotid a. and internal jugular v. More inferiorly, the sheath contains CN X, the internal carotid a., and the internal jugular v. Below the carotid bifurcation, the carotid sheath contains CN X, the common carotid a., and the internal jugular v. Note that although the external carotid a. is a branch of the common carotid a., it exits the sheath and is not considered to be contained in it. Although the sympathetic trunk is intimately related to the sheath, it is located posterior to it and is also not considered to be contained in it.

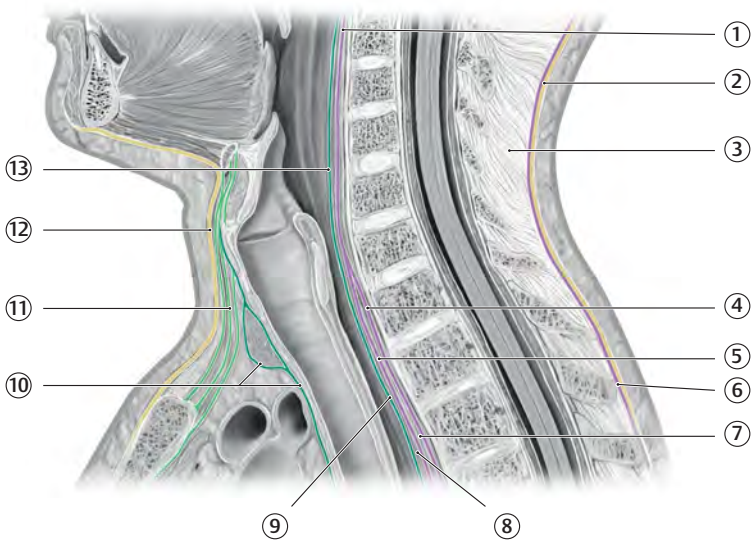
Contents of the Carotid Sheath and Adjacent Structures: Posterior View



Contents of the Carotid Sheath and Adjacent Structures: Posterior View

- ① Sigmoid sinus
- ② Accessory n. (CN XI)
- ③ Hypoglossal n. (CN XII)
- ④ Superior cervical ganglion
- ⑤ Glossopharyngeal n. (CN IX)
- ⑥ Internal carotid a.
- ⑦ Carotid body
- ⑧ Sympathetic trunk
- ⑨ Vagus n. (CN X)
- ⑩ Internal jugular v.

Fascia of the Neck: Sagittal View



Fascia of the Neck: Sagittal View

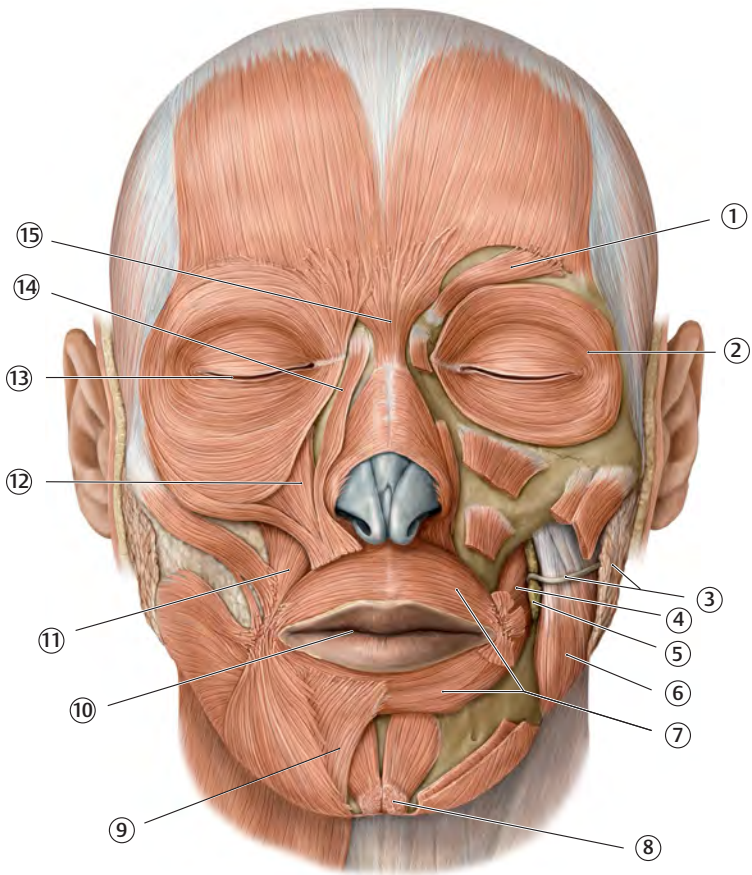
- ① Prevertebral fascia
- ② Superficial layer, deep cervical fascia (superficial nuchal fascia)
- ③ Nuchal lig.
- ④ Posterior layer, prevertebral fascia
- ⑤ Anterior (alar) layer, prevertebral fascia
- ⑥ Deep nuchal fascia
- ⑦ "Danger space"
- ⑧ Retropharyngeal space
- ⑨ Retrovisceral fascia
- ⑩ Visceral pretracheal fascia
- ⑪ Muscular pretracheal fascia
- ⑫ Superficial layer, deep cervical fascia
- ⑬ Buccopharyngeal fascia

 The pharynx is covered posteriorly by buccopharyngeal fascia. Inferior to the pharynx this fascia is called the retrovisceral fascia. The vertebral and prevertebral muscles are covered anteriorly by prevertebral fascia. The retropharyngeal space is located between the buccopharyngeal fascia and the prevertebral fascia. Note that the prevertebral fascia has two layers: an anterior (alar) layer and a posterior layer. The danger space is located between these two. The retropharyngeal and danger spaces communicate inferiorly with the mediastinum and are potential pathways for the spread of infection.

Face

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Muscles of the Face: Anterior View



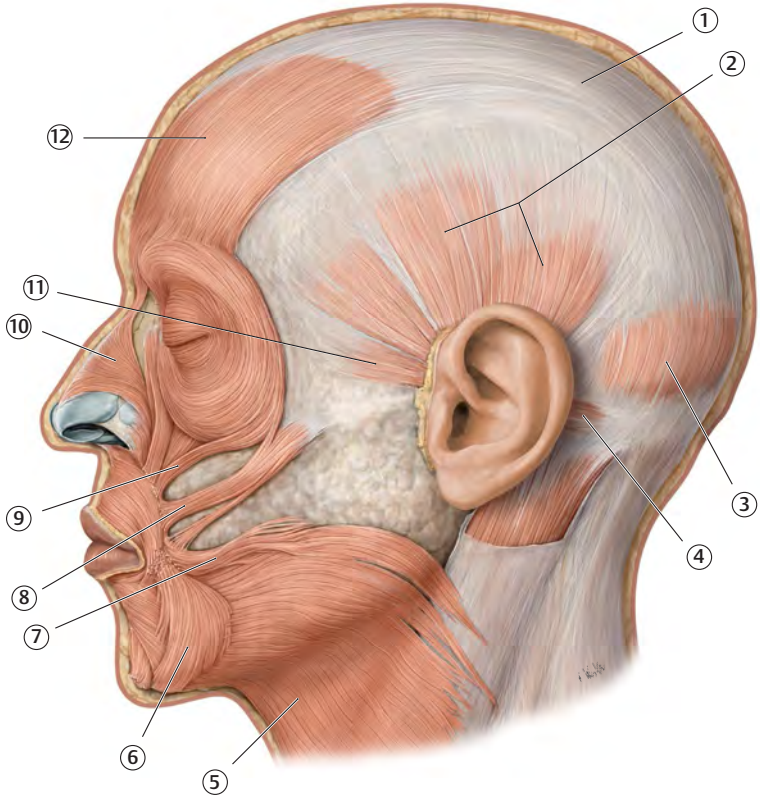
Muscles of the Face: Anterior View

- ① Corrugator supercilii
- ② Orbicularis oculi
- ③ Parotid duct and gland
- ④ Buccinator
- ⑤ Buccal fat pad
- ⑥ Masseter (muscle of mastication)
- ⑦ Orbicularis oris
- ⑧ Mentalis
- ⑨ Depressor labii inferioris
- ⑩ Labial fissure
- ⑪ Levator anguli oris
- ⑫ Levator labii superioris
- ⑬ Palpebral fissure
- ⑭ Levator labii superioris alaeque nasi
- ⑮ Procerus



The muscles of facial expression (those derived from the 2nd branchial arch and innervated by branches of CN VII) are found in the superficial fascia of the face and scalp. The majority of these muscles are associated with openings on the face, including the palpebral and labial fissures.

Muscles of the Face: Lateral View



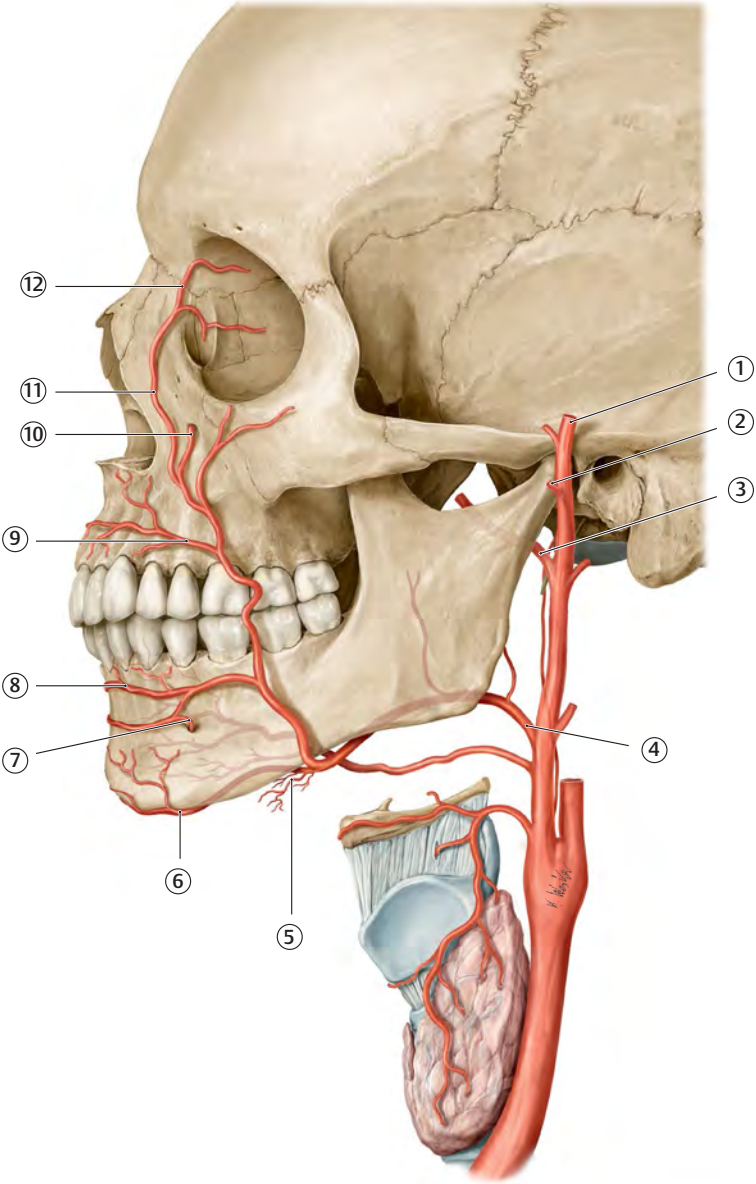
Muscles of the Face: Lateral View

- ① Epicranial aponeurosis
- ② Superior auricular muscle
- ③ Occipitofrontalis, occipital belly (occipitalis)
- ④ Posterior auricular muscle
- ⑤ Platysma
- ⑥ Depressor anguli oris
- ⑦ Risorius
- ⑧ Zygomaticus major
- ⑨ Zygomaticus minor
- ⑩ Nasalis
- ⑪ Anterior auricular muscle
- ⑫ Occipitofrontalis, frontal belly (frontalis)



The frontalis muscle is connected to the occipitalis muscle by way of the epicranial aponeurosis (galea aponeurotica). The aponeurosis is one of the five layers of the scalp. From external to internal, the layers of the scalp are **s**kin, **c**onnective tissue, **a**poneurosis, **l**oose areolar tissue, **p**erosteum (SCALP).

External Carotid Artery Branches to the Face: Lateral View



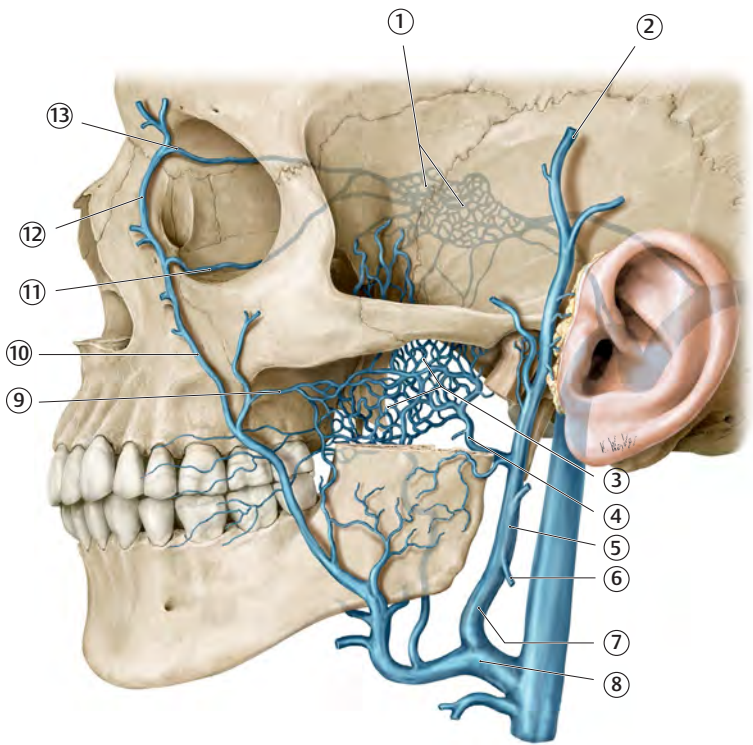
External Carotid Artery Branches to the Face: Lateral View

- ① Superficial temporal a.
- ② Transverse facial a.
- ③ Maxillary a.
- ④ Facial a.
- ⑤ Glandular branches
- ⑥ Submental a.
- ⑦ Mental a.
- ⑧ Inferior labial a.
- ⑨ Superior labial a.
- ⑩ Infraorbital a.
- ⑪ Angular a.
- ⑫ Dorsal nasal a.



Branches of the external carotid a. are the primary arterial supply to the face. As the facial a. traverses the face, its branches may anastomose with those derived from the maxillary a. and its branches (e.g., the inferior labial a. with the mental a. and the facial a. with the infraorbital a.). In addition, there are anastomotic points between the external and the internal carotid systems, including the angular a. with the dorsal nasal a. (a branch of the ophthalmic branch of the internal carotid).

Veins of the Face: Lateral View



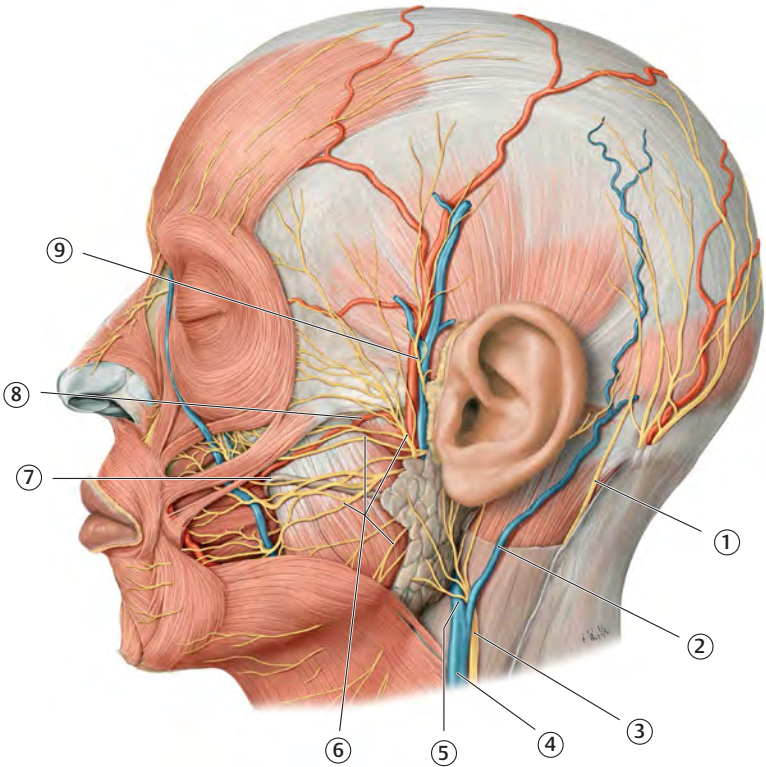
Veins of the Face: Lateral View

- ① Cavernous sinus
- ② Superficial temporal v.
- ③ Pterygoid plexus
- ④ Maxillary v.
- ⑤ Retromandibular v.
- ⑥ Posterior division of retromandibular v.
- ⑦ Anterior division of retromandibular v.
- ⑧ Common facial v.
- ⑨ Deep facial v.
- ⑩ Facial v.
- ⑪ Inferior ophthalmic v.
- ⑫ Angular v.
- ⑬ Superior ophthalmic v.



Due to the valveless nature of the veins in the face, infection may travel from the face into the dural venous system. The deep facial v. is a communication between the facial v. and the pterygoid plexus of veins, which in turn communicates with the cavernous sinus via emissary vv. In addition, the superior and inferior ophthalmic vv. communicate between the angular v. and the cavernous sinus.

Neurovasculature of the Face and the Parotid Gland: Lateral View

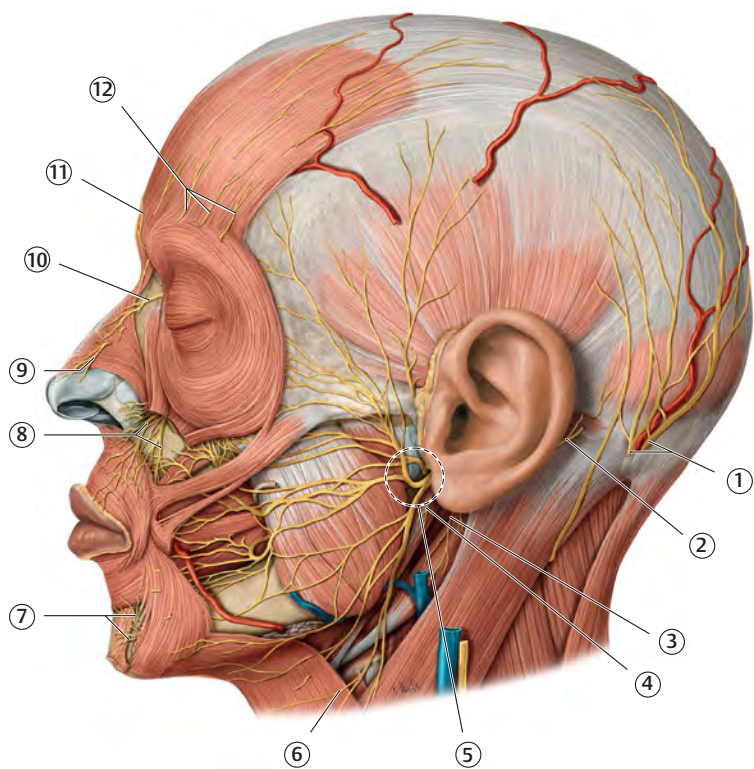


Neurovasculature of the Face and the Parotid Gland: Lateral View

- ① Lesser occipital n. (C2)
- ② Posterior auricular v.
- ③ Great auricular n. (C2–C3)
- ④ External jugular v.
- ⑤ Retromandibular v., posterior division
- ⑥ Branches of parotid plexus of facial n.
- ⑦ Parotid duct
- ⑧ Transverse facial a.
- ⑨ Auriculotemporal n. (CN V3)

 The parotid gland is a major salivary gland. Its duct traverses the lateral aspect of the masseter muscle, dives deep at its anterior border to pierce the buccinator, and opens into the oral cavity opposite the 2nd maxillary molar. The auriculotemporal n., a sensory branch of the mandibular n. (CN V3) courses through the parotid gland and ascends with the superficial temporal vessels anterior to the auricle. Because motor branches of the facial n. (CN VII) travel through the parotid gland, these must be taken into consideration during surgical procedures.

Nerves of the Face: Lateral View

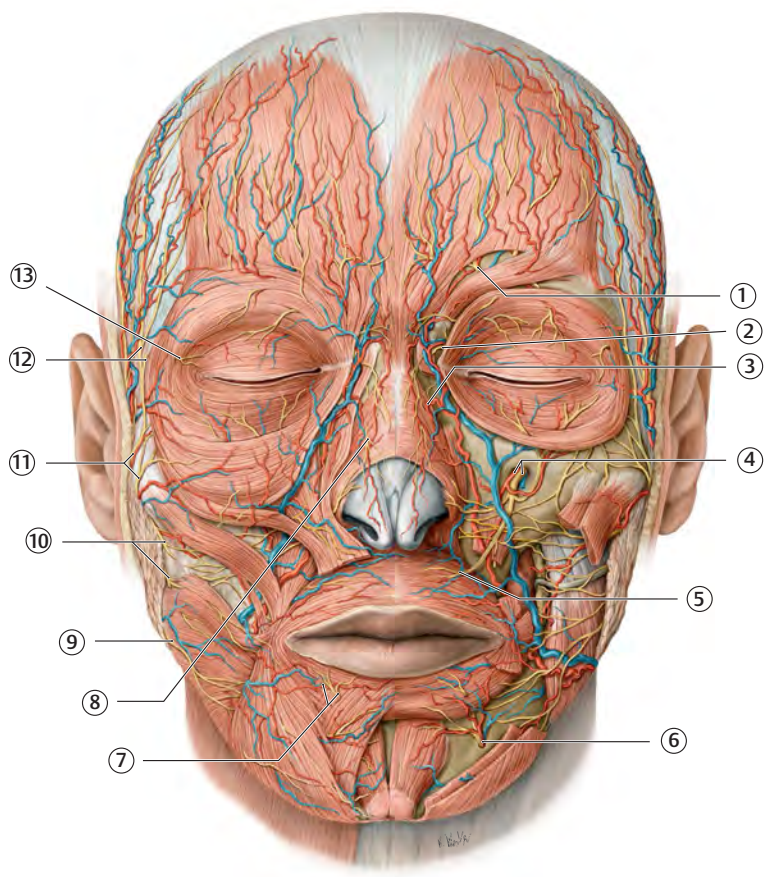


Nerves of the Face: Lateral View

- ① Greater occipital n. (posterior ramus of C2)
- ② Posterior auricular n. (CN VII)
- ③ Nerve to digastric, posterior belly (CN VII)
- ④ Nerve to stylohyoid (CN VII)
- ⑤ Intraparotid plexus of the facial n. (CN VII)
- ⑥ Facial n., cervical branch (CN VII)
- ⑦ Mental n. (CN V3)
- ⑧ Infraorbital n. (CN V2)
- ⑨ External nasal n. (CN V1)
- ⑩ Infratrochlear n. (CN V1)
- ⑪ Supratrochlear n. (CN V1)
- ⑫ Supraorbital n. (CN V1)

 The facial n. (CN VII) emerges from the facial canal through the stylomastoid foramen. Inflammation of the facial n. within the facial canal may result in a condition referred to as facial palsy (sometimes termed Bell's palsy), by which the muscles of facial expression on the side of the face with the inflammation are paralyzed, typically temporarily.

Neurovasculature of the Face: Anterior View



Neurovasculature of the Face: Anterior View

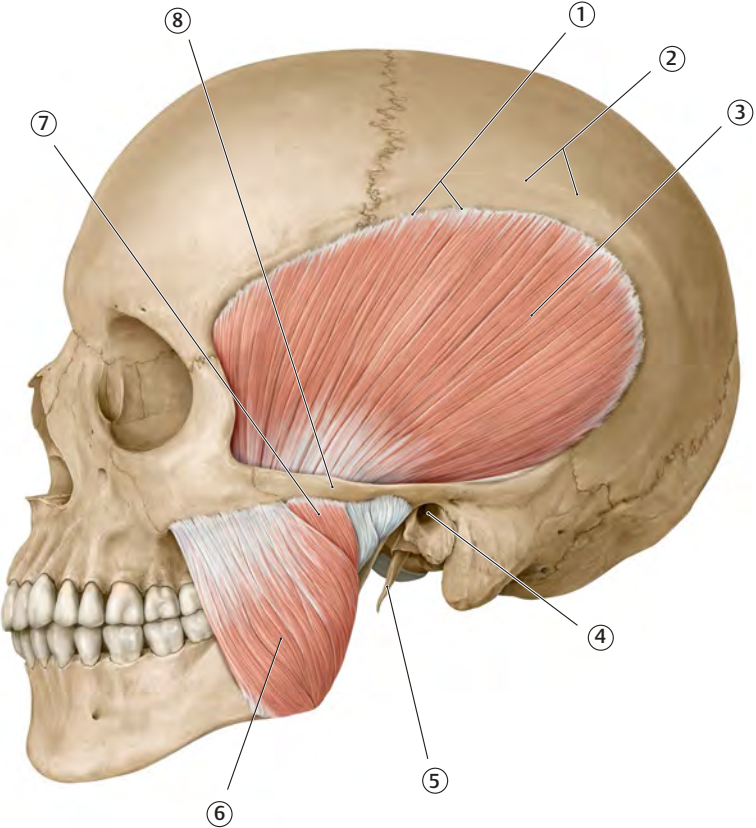
- ① Supraorbital n. (CN V1)
- ② Dorsal nasal a. and infratrochlear n. (CN V1)
- ③ Lateral nasal a.
- ④ Infraorbital a. and n. (CN V2)
- ⑤ Superior labial n. (CN V2)
- ⑥ Mental a. and n. (CN V3)
- ⑦ Inferior labial n. (CN V3)
- ⑧ External nasal n. (CN V1)
- ⑨ Facial n., marginal mandibular branch
- ⑩ Facial n., buccal branches
- ⑪ Facial n., zygomatic branches
- ⑫ Facial n., temporal branches
- ⑬ Lacrimal n. (CN V1)

 The primary sensory supply to the face is derived from the divisions of the trigeminal n.: the ophthalmic (CN V1), maxillary (CN V2), and mandibular (CN V3) nn. However, a small region of skin covering the posterior mandible and earlobe is supplied by the cervical plexus. The motor supply to muscles of facial expression is from the six branches of the facial n. (CN VII): temporal, zygomatic, buccal, marginal mandibular, cervical (not shown), and posterior auricular (not shown).

Temporal and Infratemporal Fossae

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Temporalis and Masseter I: Lateral View



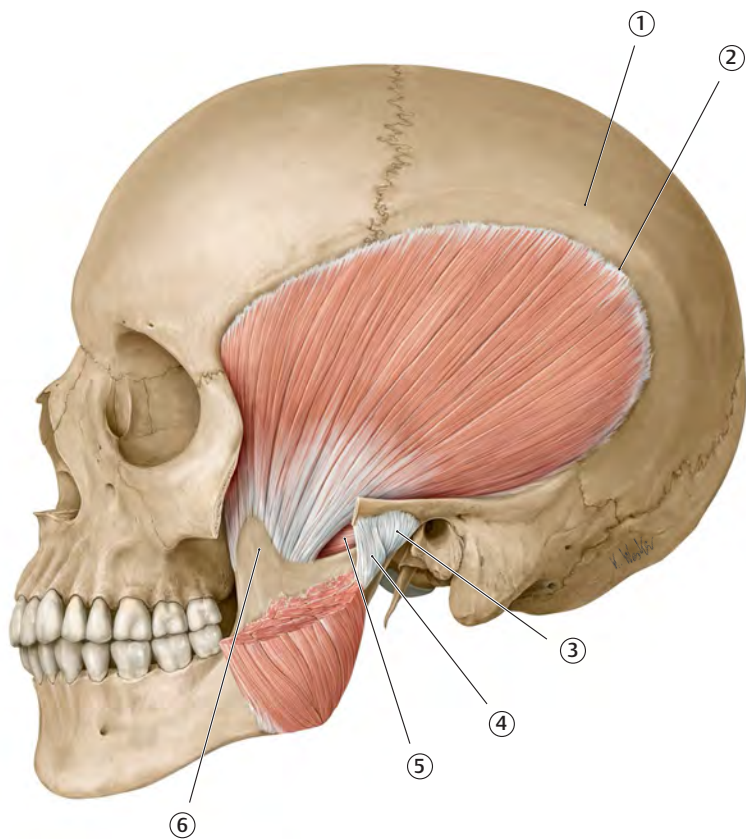
Temporalis and Masseter I: Lateral View

- ① Inferior temporal line
- ② Superior temporal line
- ③ Temporalis
- ④ External acoustic meatus
- ⑤ Styloid process
- ⑥ Masseter, superficial part
- ⑦ Masseter, deep part
- ⑧ Zygomatic arch



The masseter arises from the zygomatic bone and zygomatic arch and attaches to the lateral surface and angle of the mandible. Although the masseter is primarily a muscle that elevates the mandible, its superficial fibers can also assist in protrusion of the mandible, and its deep fibers can assist in retrusion of the mandible. Note, however, that the primary muscle responsible for protrusion of the mandible is the lateral pterygoid.

Temporalis and Masseter II: Lateral View



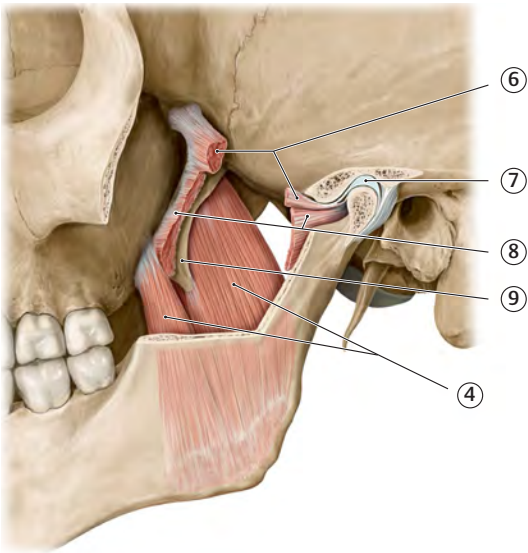
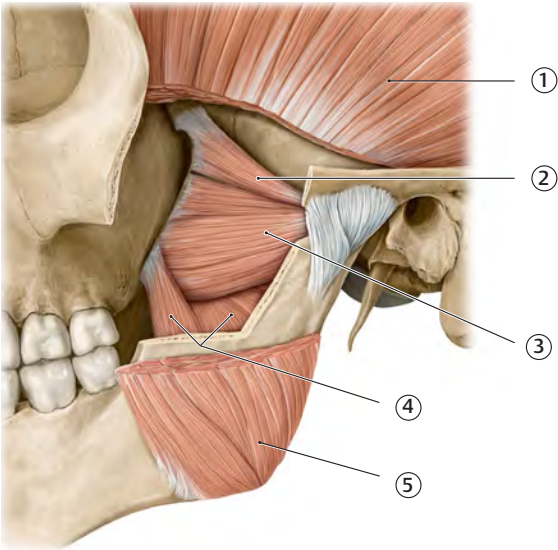
Temporalis and Masseter II: Lateral View

- ① Superior temporal line
- ② Inferior temporal line
- ③ Joint capsule of temporomandibular joint
- ④ Lateral (temporomandibular) lig.
- ⑤ Lateral pterygoid
- ⑥ Coronoid process



The temporalis muscle arises from the temporal fossa up to the inferior temporal line. The temporalis fascia (not shown) attaches to the superior temporal line. The temporalis inserts onto the coronoid process of the mandible. The primary function of the temporalis muscle is elevation and retrusion of the mandible.

Pterygoid Muscles: Lateral View

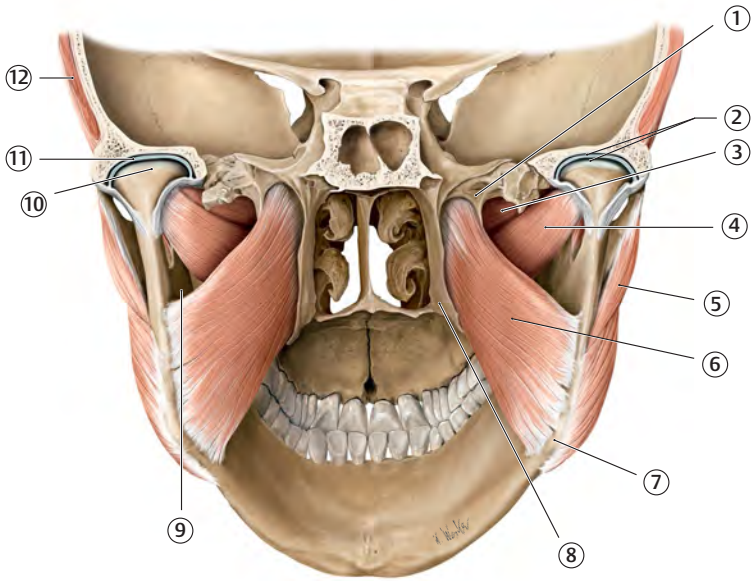


Pterygoid Muscles: Lateral View

- ① Temporalis (cut)
- ② Lateral pterygoid, superior head
- ③ Lateral pterygoid, inferior head
- ④ Medial pterygoid, superficial (external) and deep (internal) heads
- ⑤ Masseter (cut)
- ⑥ Lateral pterygoid, superior head (cut)
- ⑦ Articular disk
- ⑧ Lateral pterygoid, inferior head (cut)
- ⑨ Pterygoid process, lateral plate

 The superior (upper) head of the lateral pterygoid muscle arises from the infratemporal crest and inserts on the articular disk of the temporomandibular joint (TMJ). Its inferior (lower) head arises on the lateral surface of the lateral pterygoid plate and inserts into the pterygoid fovea of the neck of the mandible. The lateral pterygoid protrudes and assists in depression of the mandible. The superficial (external) head of the medial pterygoid muscle arises at the maxillary tuberosity, while the deep (internal) head arises on the medial surface of the lateral pterygoid plate. Both heads of the medial pterygoid insert onto the medial surface of the angle of the mandible. The medial pterygoid elevates and assists in protrusion of the mandible. When the pterygoids act unilaterally, they contribute to side-to-side movements of the mandible.

Muscles of Mastication: Posterior View

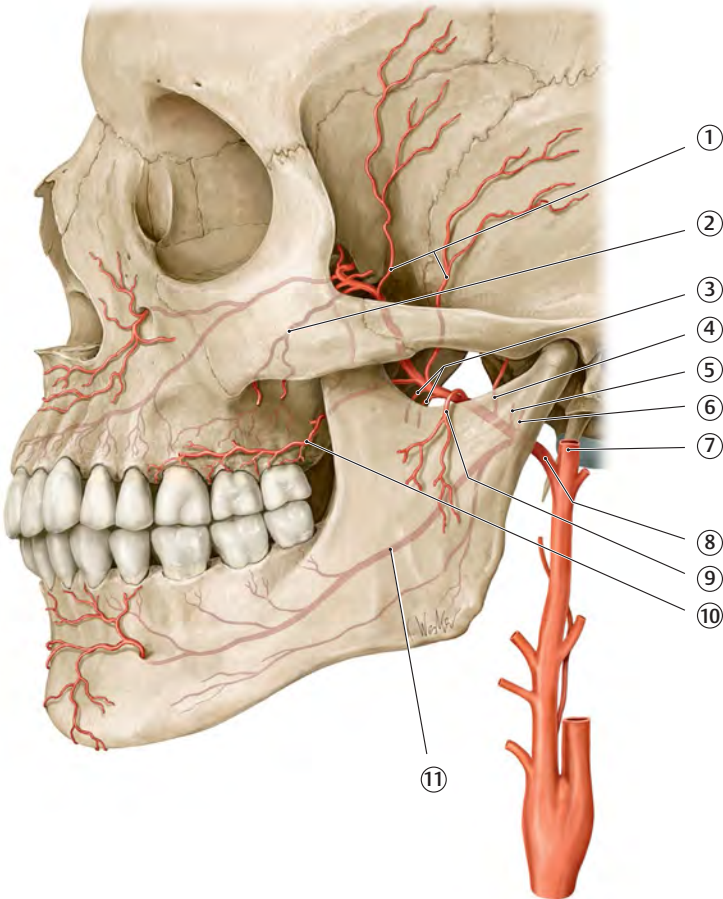


Muscles of Mastication: Posterior View

- ① Lateral pterygoid plate
- ② Upper and lower compartments
- ③ Lateral pterygoid, superior head
- ④ Lateral pterygoid, inferior head
- ⑤ Masseter
- ⑥ Medial pterygoid, deep (internal) head
- ⑦ Angle of mandible
- ⑧ Medial pterygoid plate
- ⑨ Pterygomandibular space
- ⑩ Head (condyle) of mandible
- ⑪ Articular disk
- ⑫ Temporalis

 The space between the medial pterygoid muscle and the ramus of the mandible is referred to as the pterygomandibular space (a subdivision of the infratemporal fossa). Located within this space is the mandibular foramen into which the inferior alveolar n. (CN V3) enters. Notice that the masseter and the medial pterygoid form a muscular sling around the ramus and angle of the mandible, contributing to elevation of the mandible as well as side-to-side movements when acting unilaterally.

Arteries of the Temporal and Infratemporal Fossae: Lateral View

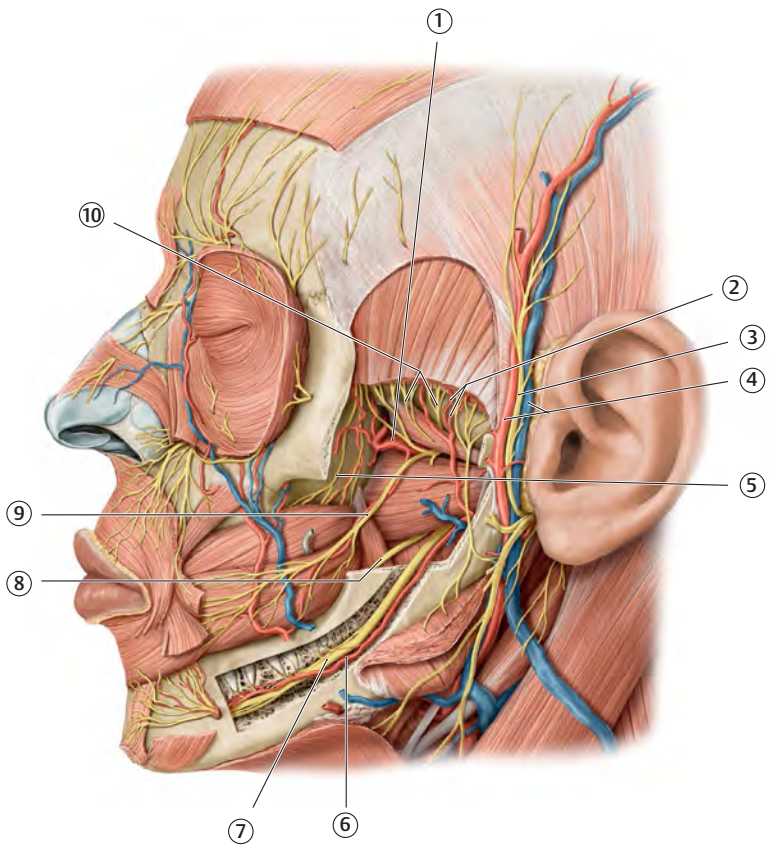


Arteries of the Temporal and Infratemporal Fossae: Lateral View

- ① Deep temporal aa. (2nd part)
- ② Posterior superior alveolar a. (3rd part)
- ③ Pterygoid (muscular) branches (2nd part)
- ④ Middle meningeal a. (1st part)
- ⑤ Deep auricular a. (1st part)
- ⑥ Anterior tympanic a. (1st part)
- ⑦ Superficial temporal a.
- ⑧ Maxillary a.
- ⑨ Masseteric a. (2nd part)
- ⑩ Buccal a. (2nd part)
- ⑪ Inferior alveolar a. (1st part)

 The maxillary a. is the source of blood supply to both the maxillary and mandibular dentition. As it courses through the infratemporal fossa on its way to the pterygomaxillary fissure, its first part gives off five branches that pass through bony openings. Its second part then gives rise to branches that supply muscles. Note that the accessory meningeal a., one of the five branches off the first part of the maxillary a., is not shown. Also note that the posterior superior alveolar a., while present in the infratemporal fossa, arises from the third part of the maxillary a. in the pterygopalatine fossa.

Neurovasculature of the Infratemporal Fossae I: Lateral View

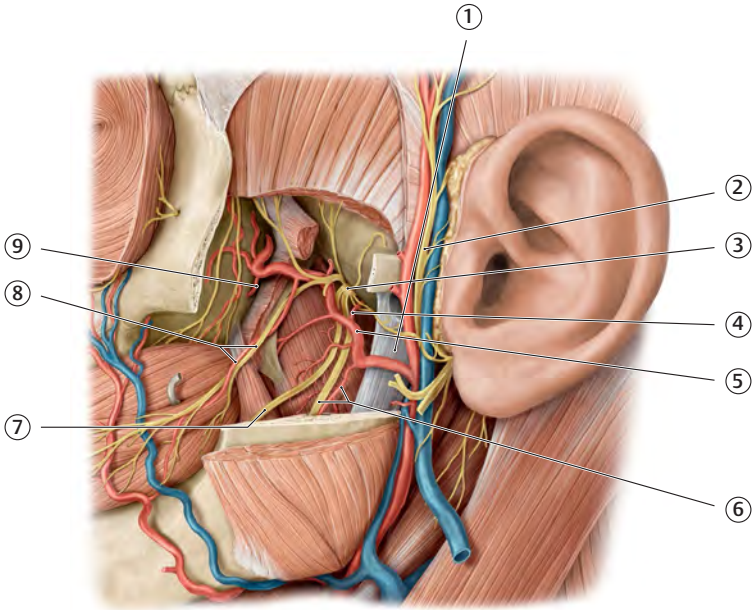


Neurovasculature of the Infratemporal Fossae I: Lateral View

- ① Maxillary a.
- ② Deep temporal aa.
- ③ Auriculotemporal n. (CN V3)
- ④ Superficial temporal a. and v.
- ⑤ Posterior superior alveolar n. (CN V2)
- ⑥ Inferior alveolar a.
- ⑦ Inferior alveolar n. (CN V3)
- ⑧ Lingual n. (CN V3)
- ⑨ Buccal a. and long buccal n. (CN V3)
- ⑩ Deep temporal nn. (CN V3)

 Within the infratemporal fossa, the pterygoid muscles serve as landmarks for the emergence of branches of the mandibular n. (CN V3). The deep temporal nn. primarily emerge above the superior border of the superior head of the lateral pterygoid muscle. The long buccal n. emerges between the superior and inferior heads of the lateral pterygoid muscle. The lingual and inferior alveolar nn. emerge between the lateral and the medial pterygoid muscles.

Neurovasculature of the Infratemporal Fossae II: Lateral View

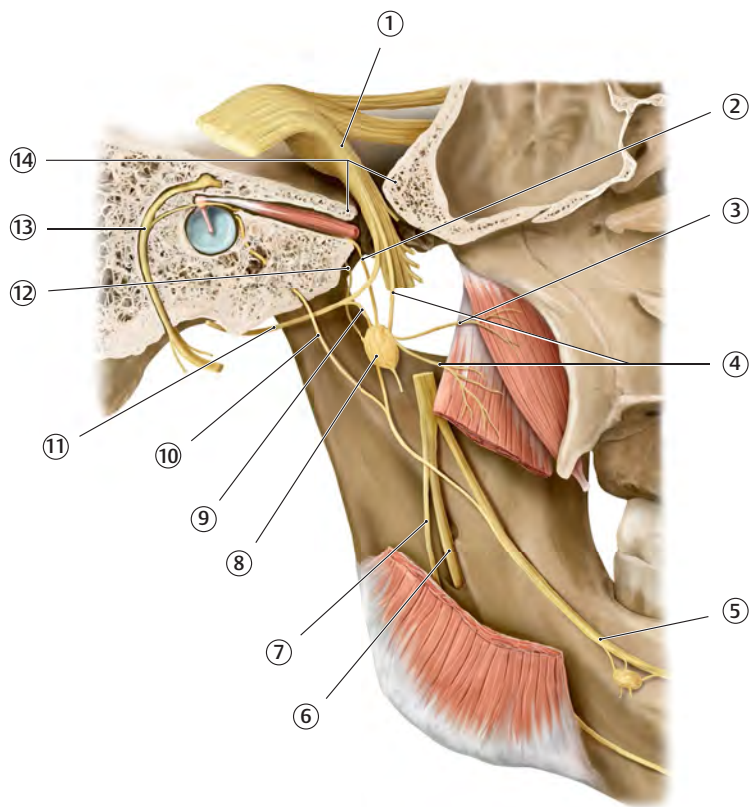


Neurovasculature of the Infratemporal Fossae II: Lateral View

- ① Sphenomandibular lig.
- ② Auriculotemporal n. (CN V3)
- ③ Trigeminal n., mandibular division (CN V3)
- ④ Middle meningeal a.
- ⑤ Maxillary a.
- ⑥ Inferior alveolar a. and n. (CN V3)
- ⑦ Lingual n. (CN V3)
- ⑧ Buccal a. and long buccal n. (CN V3)
- ⑨ Posterior superior alveolar a.

 As the maxillary a. enters the infratemporal fossa it passes between the sphenomandibular lig. and the neck of the mandible. The maxillary a. then travels either superficial or deep to the lateral pterygoid muscle as it traverses the infratemporal fossa. The posterior superior alveolar a. arises from the maxillary a. in the pterygopalatine fossa and passes laterally through the pterygomaxillary fissure to reach its foramen in the infratemporal fossa. Note that the middle meningeal a. passes between the two roots of the auriculotemporal n. before entering into foramen spinosum.

Nerves of the Infratemporal Fossa: Medial View

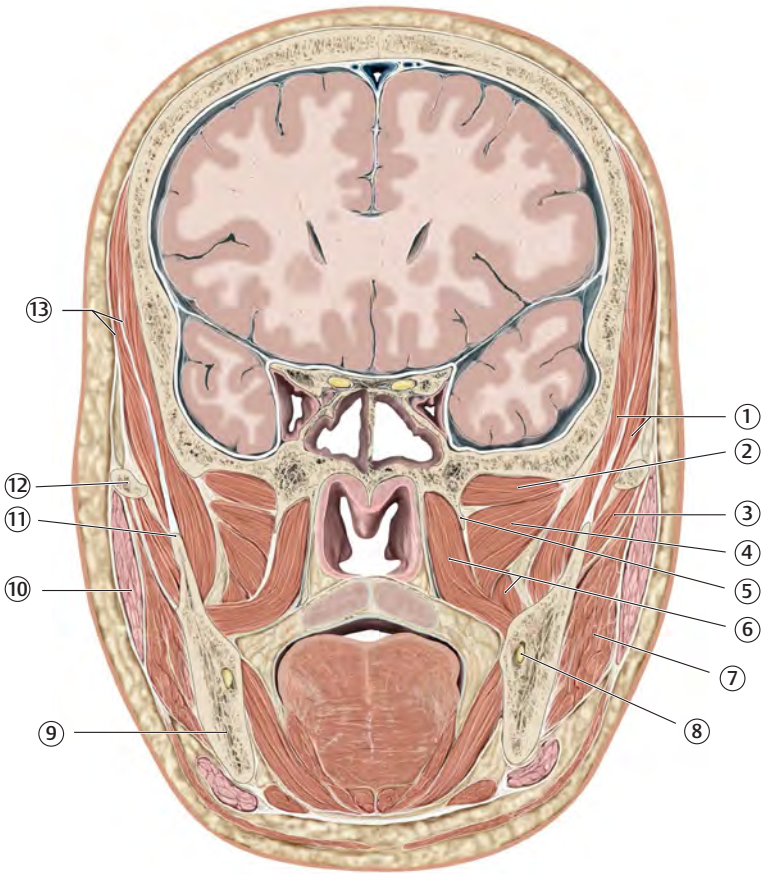


Nerves of the Infratemporal Fossa: Medial View

- ① CN V3 (mandibular n.)
- ② Nerve of tensor tympani
- ③ Nerve of tensor veli palatini
- ④ Nerve of medial pterygoid
- ⑤ Lingual n.
- ⑥ Inferior alveolar n.
- ⑦ Nerve to mylohyoid
- ⑧ Otic ganglion
- ⑨ Communicating branch to auriculotemporal n.
- ⑩ Chorda tympani
- ⑪ Auriculotemporal n.
- ⑫ Lesser petrosal n.
- ⑬ Facial n.
- ⑭ Foramen ovale

 The chorda tympani (CN VII), carrying preganglionic parasympathetic and taste fibers, joins the lingual n. in the infratemporal fossa. The lesser petrosal n. (CN IX), carrying preganglionic parasympathetic fibers, enters into the otic ganglion inferior to foramen ovale. Postganglionic fibers from the otic ganglion join and travel with the auriculotemporal n. to the parotid gland.

Temporal and Infratemporal Fossa: Coronal Section



Temporal and Infratemporal Fossa, Coronal Section

- ① Temporalis (deep and superficial heads)
- ② Lateral pterygoid, superior head
- ③ Masseter, deep head
- ④ Lateral pterygoid, inferior head
- ⑤ Lateral pterygoid plate
- ⑥ Medial pterygoid (deep and superficial heads)
- ⑦ Masseter, superficial head
- ⑧ Inferior alveolar n. (from posterior division of CN V3) in mandibular canal
- ⑨ Mandible
- ⑩ Parotid gland
- ⑪ Coronoid process
- ⑫ Zygomatic arch
- ⑬ Superficial and deep temporal fascia

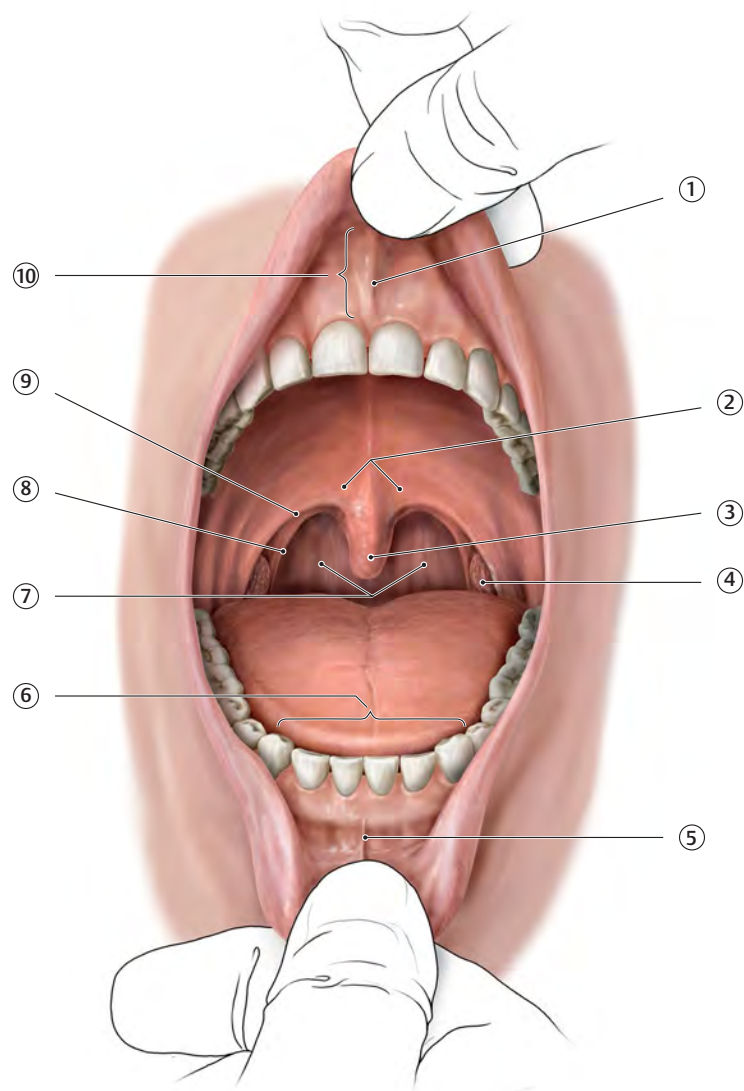


Note that the temporalis muscle passes medial to the zygomatic arch. The superficial temporal fascia extends from the superior temporal line to the zygomatic arch.

Oral Cavity

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Oral Cavity: Anterior View



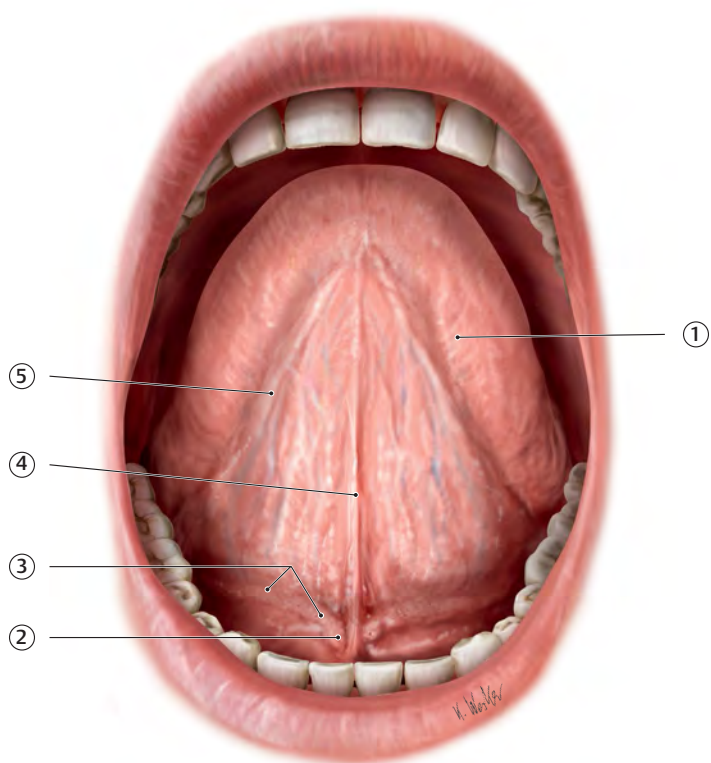
Oral Cavity: Anterior View

- ① Frenulum of upper lip
- ② Soft palate
- ③ Uvula
- ④ Palatine tonsil
- ⑤ Frenulum of lower lip
- ⑥ Oral cavity proper
- ⑦ Oropharyngeal isthmus
- ⑧ Palatopharyngeal arch
- ⑨ Palatoglossal arch
- ⑩ Oral vestibule



The oral vestibule is the space between the dental arcade and the lips and cheeks. The oral cavity proper is found within the dental arcade and is bounded posteriorly by the palatoglossal arches, which form the oropharyngeal isthmus. The oropharyngeal isthmus is the boundary between the oral cavity and the oropharynx. Note that the palatine tonsils are located between the palatoglossal and palatopharyngeal arches, in the oropharynx rather than the oral cavity.

Inferior Tongue and Oral Cavity Floor: Anterior View



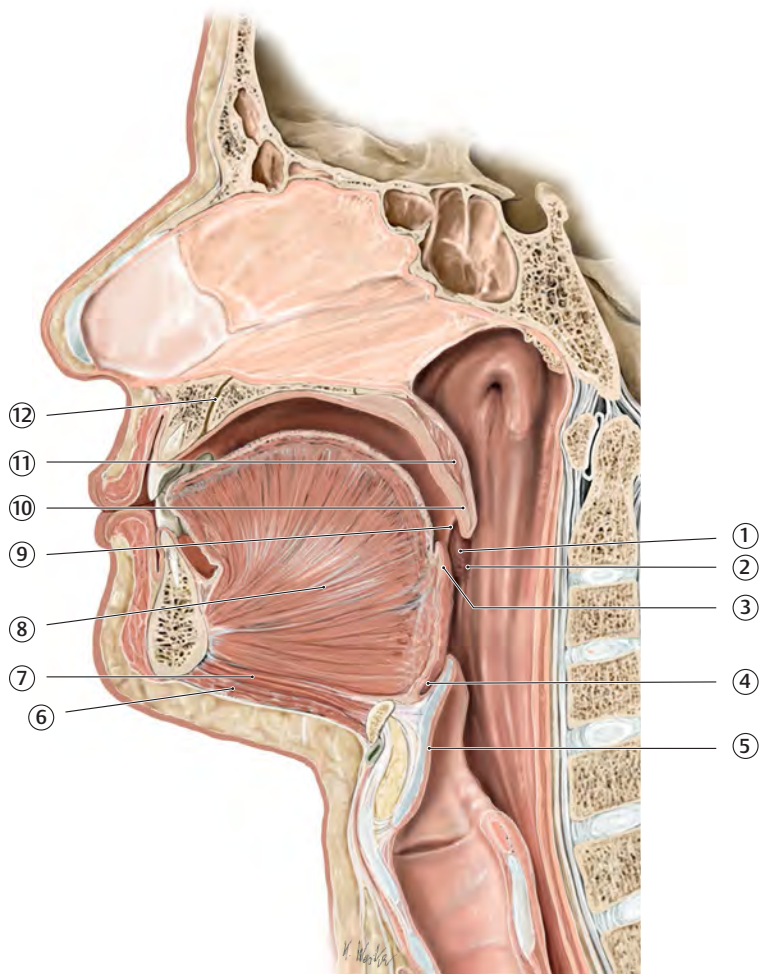
Inferior Tongue and Oral Cavity Floor: Anterior View

- ① Ventral surface of tongue
- ② Sublingual papilla (caruncle)
- ③ Sublingual fold
- ④ Lingual frenulum
- ⑤ Fimbriated fold



The lingual frenulum connects the ventral surface of the tongue and lingual mucosa covering the floor of the oral cavity. When the lingual frenulum is short and/or thickened—a condition termed ankyloglossia—the mobility of the tongue is decreased. The sublingual papillae (caruncles) are located on either side of the lingual frenulum. These are the openings of the submandibular ducts.

Oral Cavity and Oropharynx: Midsagittal View

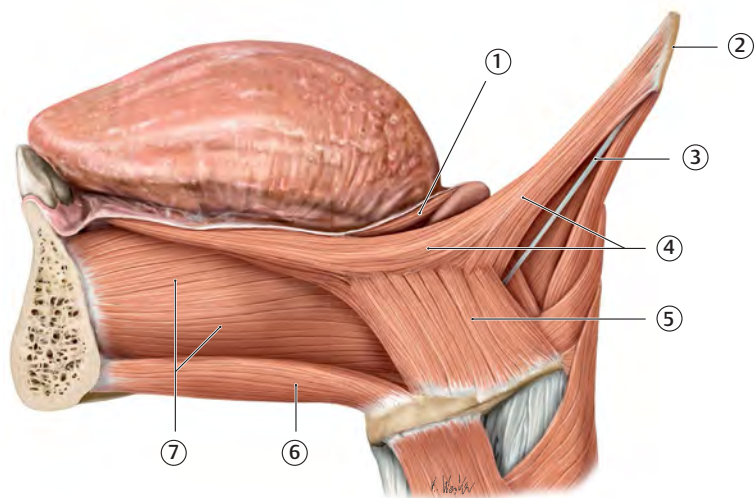


Oral Cavity and Oropharynx: Midsagittal View

- ① Palatine tonsil in oropharynx
- ② Palatopharyngeal arch
- ③ Lingual tonsil (on postsulcal portion of the tongue)
- ④ Vallecula
- ⑤ Epiglottis
- ⑥ Mylohyoid
- ⑦ Geniohyoid
- ⑧ Genioglossus
- ⑨ Palatoglossal arch
- ⑩ Uvula
- ⑪ Soft palate
- ⑫ Incisive canal

 The genioglossus, a large fan-shaped muscle, is one of the four extrinsic muscles of the tongue and is innervated by the hypoglossal n. (CN XII). Its primary function is protrusion of the tongue. Note that the posterior third of the tongue is located in the oropharynx. The oral cavity communicates superiorly with the nasal cavity via the incisive canal.

Extrinsic Muscles of the Tongue: Lateral View

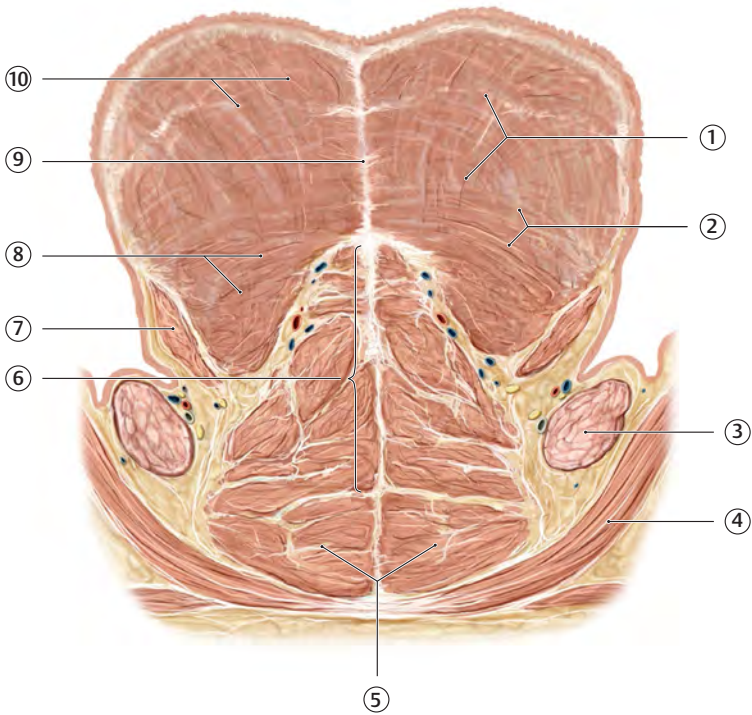


Extrinsic Muscles of the Tongue: Lateral View

- ① Palatoglossus (cut)
- ② Styloid process
- ③ Stylomandibular lig.
- ④ Styloglossus
- ⑤ Hyoglossus
- ⑥ Geniohyoid
- ⑦ Genioglossus

 There are four extrinsic muscles of the tongue: the genioglossus, hyoglossus, styloglossus, and palatoglossus. The palatoglossus is the only muscle of the tongue not innervated by the hypoglossal n. (CN XII). The genioglossus primarily protrudes the tongue, the hyoglossus primarily depresses the tongue, and the styloglossus primarily retrudes and elevates the tongue. The palatoglossus, innervated by the pharyngeal plexus (CN X motor fibers), approximates the soft palate to the dorsum of the tongue, narrowing the oropharyngeal isthmus.

Intrinsic and Extrinsic Muscles of the Tongue: Coronal Section

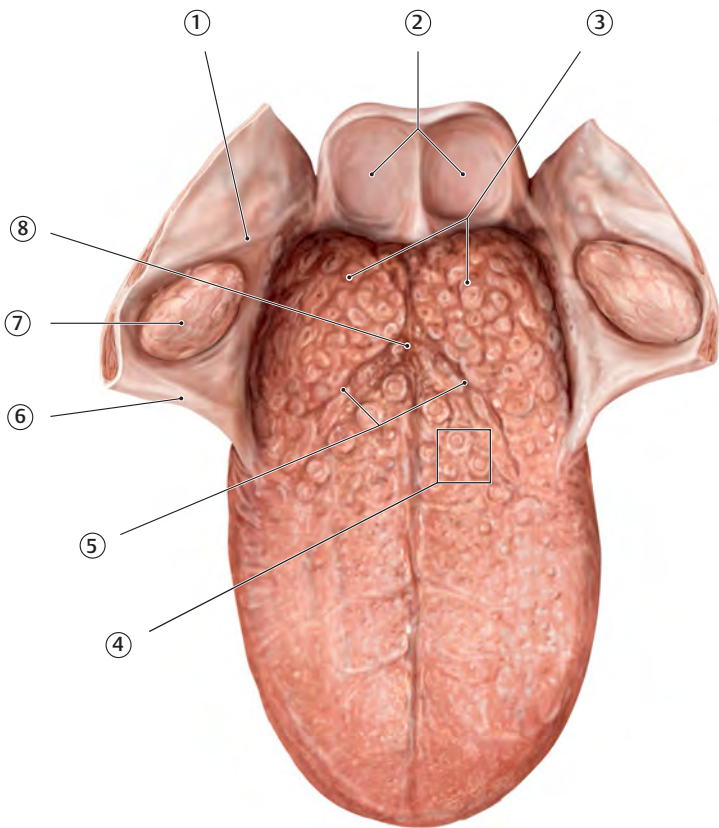


Intrinsic and Extrinsic Muscles of the Tongue: Coronal Section

- ① Vertical muscle of the tongue
- ② Transverse muscle of the tongue
- ③ Sublingual gland
- ④ Mylohyoid
- ⑤ Geniohyoid
- ⑥ Genioglossus
- ⑦ Hyoglossus
- ⑧ Inferior longitudinal muscle
- ⑨ Lingual septum
- ⑩ Superior longitudinal muscle

 The lingual septum separates the tongue into right and left sides inferior to the submucosa. There are four intrinsic muscles of the tongue: the superior and inferior longitudinal muscles, the vertical muscle, and the transverse muscle. Working together, these muscles function to change the shape of the tongue. The longitudinal muscles shorten the tongue, the vertical muscle flattens and widens the tongue, and the transverse muscle narrows and elongates the tongue. All four of these muscles are innervated by the hypoglossal n. (CN XII).

Tongue: Superior View



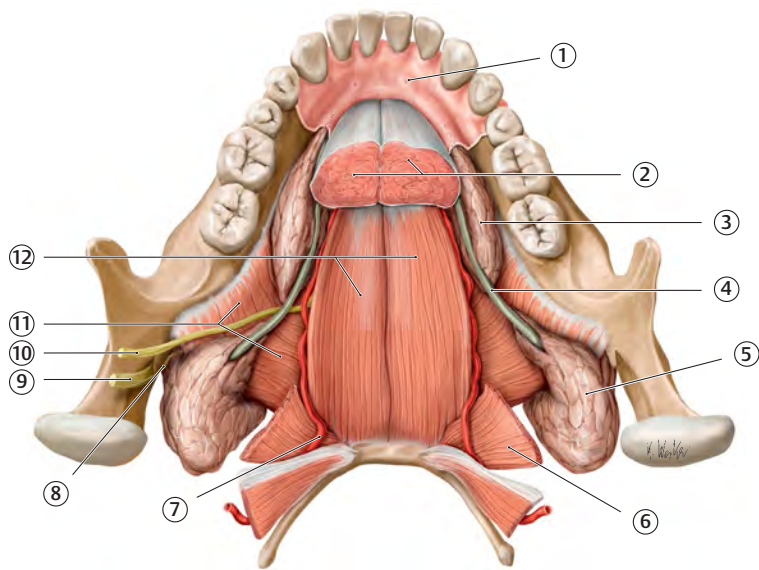
Tongue: Superior View

- ① Palatopharyngeal arch
- ② Epiglottis
- ③ Lingual tonsil
- ④ Circumvallate papillae
- ⑤ Sulcus terminalis
- ⑥ Palatoglossal arch
- ⑦ Palatine tonsil
- ⑧ Foramen cecum



The tongue is divided into an anterior two thirds and a posterior one third by the sulcus terminalis. The foramen cecum, a remnant of the descent of the thyroid gland, is located at the apex of the sulcus terminalis. Circumvallate (vallate) papillae are located in a line parallel and anterior to the sulcus terminalis. The lingual tonsils are located on the posterior third of the tongue, in the oropharynx.

Floor of Oral Cavity: Superior View



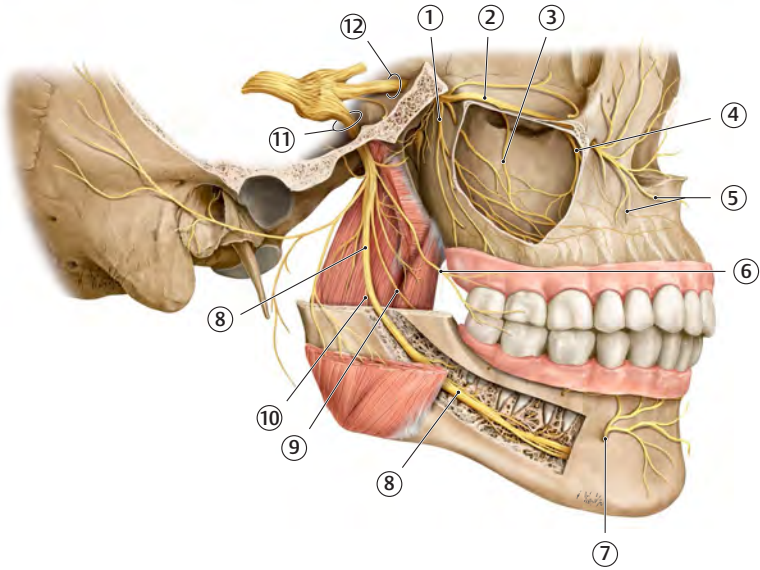
Floor of Oral Cavity: Superior View

- ① Sublingual papilla (caruncle)
- ② Genioglossus (cut)
- ③ Sublingual gland
- ④ Submandibular duct
- ⑤ Submandibular gland
- ⑥ Hyoglossus (cut)
- ⑦ Lingual a.
- ⑧ Mylohyoid n.
- ⑨ Inferior alveolar n.
- ⑩ Lingual n.
- ⑪ Mylohyoid
- ⑫ Geniohyoid



The mylohyoid forms the muscular floor of the oral cavity. Wrapping around its posterior free border is the submandibular gland, whose duct runs anteriorly to open at the sublingual papilla. The mylohyoid muscle separates the intra- and extra-oral lobes of the submandibular gland. The sublingual gland, located on the floor of the oral cavity, has numerous tiny openings directly into the oral cavity or submandibular duct. The lingual n. loops beneath the submandibular duct on its way to the anterior two thirds of the tongue.

Nerves of the Oral Cavity: Lateral View

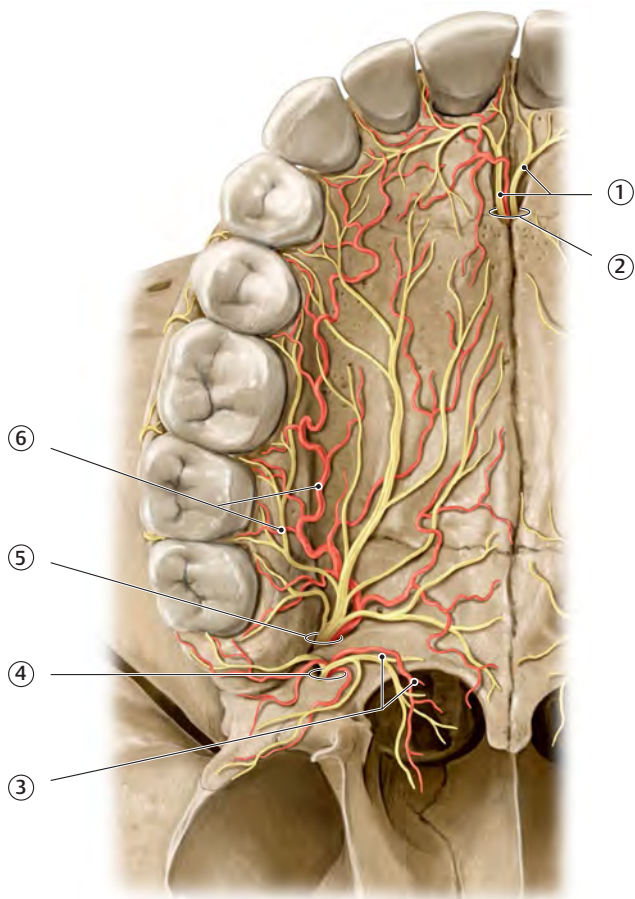


Nerves of the Oral Cavity: Lateral View

- ① Posterior superior alveolar n.
- ② Infraorbital n.
- ③ Middle superior alveolar n.
- ④ Anterior superior alveolar n.
- ⑤ Superior labial nn.
- ⑥ Long buccal n.
- ⑦ Mental n. (and foramen)
- ⑧ Inferior alveolar n.
- ⑨ Lingual n.
- ⑩ Mylohyoid n.
- ⑪ Mandibular division (CN V3, via foramen ovale)
- ⑫ Maxillary division (CN V2, via foramen rotundum)

 The maxillary and mandibular dentition are supplied with sensory fibers by branches of the trigeminal n. (CN V). The maxillary n. (CN V2) supplies the upper dentition by way of the posterior, middle, and anterior superior alveolar nn. The middle and anterior superior alveolar nn. arise from the infraorbital n., whereas the posterior superior alveolar n. is a direct branch of the maxillary n. The mandibular n. (CN V3) supplies the inferior dentition via the inferior alveolar n.

Innervation of the Palate: Inferior View

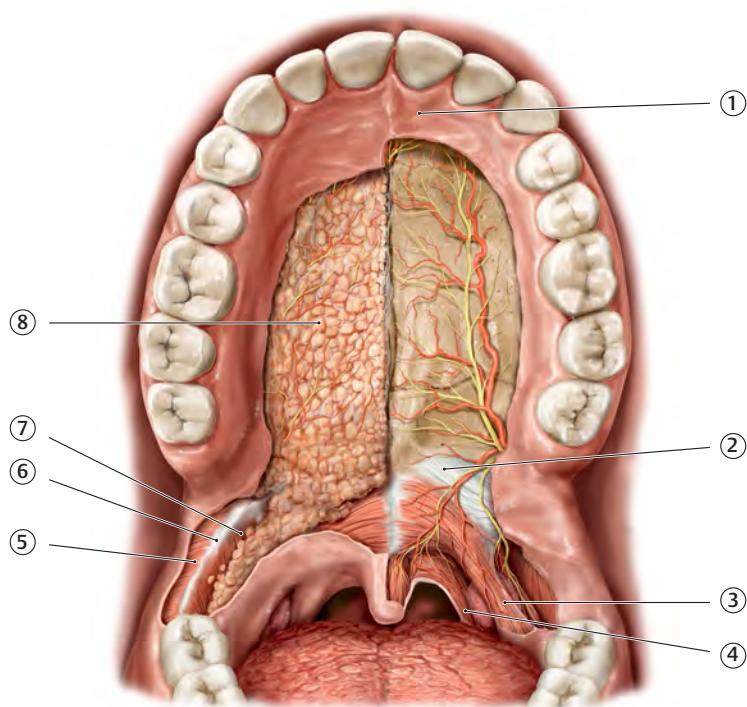


Innervation of the Palate: Inferior View

- ① Nasopalatine n.
- ② Incisive foramen
- ③ Lesser palatine n. and a.
- ④ Lesser palatine foramen
- ⑤ Greater palatine foramen
- ⑥ Greater palatine n. and a.

 The sensory supply to the lingual gingiva and mucosa of the hard and soft palate is by branches derived from the maxillary n. The greater and lesser palatine nn. travel from the pterygopalatine fossa to the oral cavity by way of the greater palatine canal. This canal opens into the oral cavity via the greater and lesser palatine foramina. The greater palatine n. supplies the mucosa of the hard palate and the lingual gingiva of the molars and premolars. The lesser palatine n. supplies sensory fibers to the mucosa of the soft palate. The nasopalatine n. travels from the nasal cavity into the oral cavity via the incisive canal and foramen. It then supplies sensory branches to the lingual gingiva of the upper incisors and canines.

Hard and Soft Palate: Inferior View

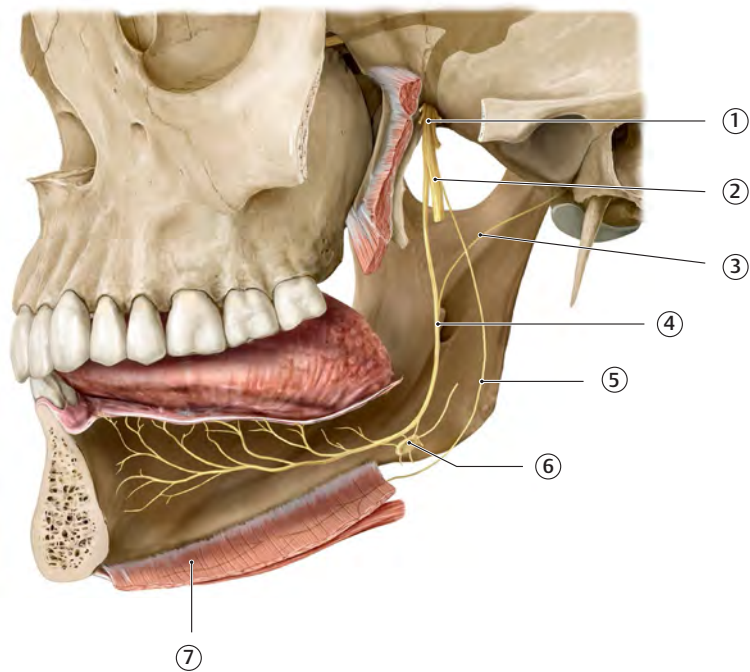


Hard and Soft Palate: Inferior View

- ① Rugae
- ② Palatine aponeurosis
- ③ Palatoglossus
- ④ Palatopharyngeus
- ⑤ Buccinator
- ⑥ Pterygomandibular raphe
- ⑦ Superior pharyngeal constrictor
- ⑧ Palatine glands

 The pterygomandibular raphe extends from the hamulus of the medial pterygoid plate to the posterior edge of the mylohyoid line on the mandible. The buccinator has an attachment to it anteriorly, and the superior pharyngeal constrictor has an attachment posteriorly. Clinically, the pterygomandibular raphe serves as a landmark for the administration of anesthetics that will be deposited in the pterygomandibular space of the infratemporal fossa. In these cases, a needle will pass from the oral cavity into the infratemporal fossa by piercing the buccinator directly anterior to the pterygomandibular raphe.

Nerves of the Oral Cavity I: Internal View

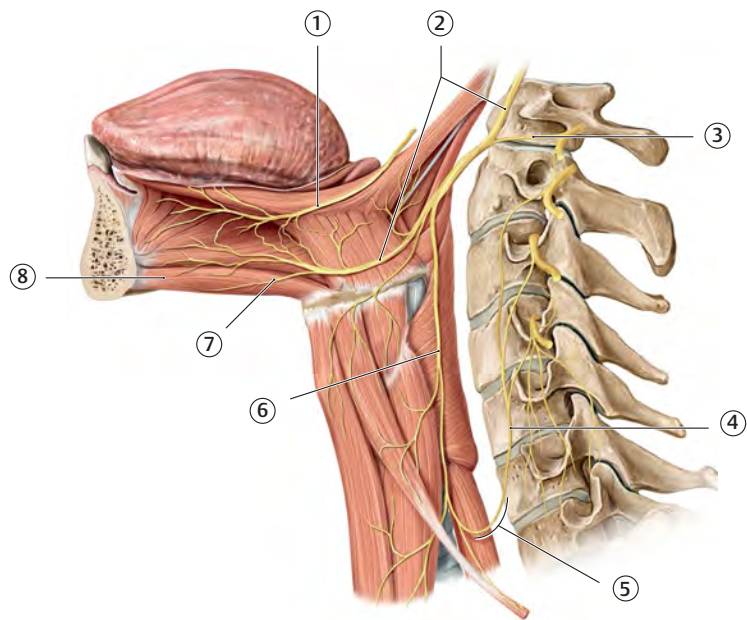


Nerves of the Oral Cavity I: Internal View

- ① Mandibular division (CN V3)
- ② Inferior alveolar n. (cut)
- ③ Chorda tympani (CN VII)
- ④ Lingual n.
- ⑤ Mylohyoid n.
- ⑥ Submandibular ganglion
- ⑦ Mylohyoid

 The lingual n. supplies sensory fibers to the anterior two thirds of the tongue. The chorda tympani, a branch of the facial n. (CN VII) exits the skull via the petrotympanic fissure and joins the lingual n. in the infratemporal fossa. The chorda tympani carries taste fibers, which are distributed by the lingual n. to the anterior two thirds of the tongue. In addition, it carries preganglionic parasympathetic fibers, which synapse in the submandibular ganglion. Postganglionic fibers from the submandibular ganglion descend to supply the submandibular gland. Other postganglionic fibers rejoin the lingual n. and course anteriorly in the oral cavity to supply the sublingual gland and anterior lingual glands. Therefore, at different points, the lingual n. carries both pre- and postganglionic hitchhiking parasympathetic fibers.

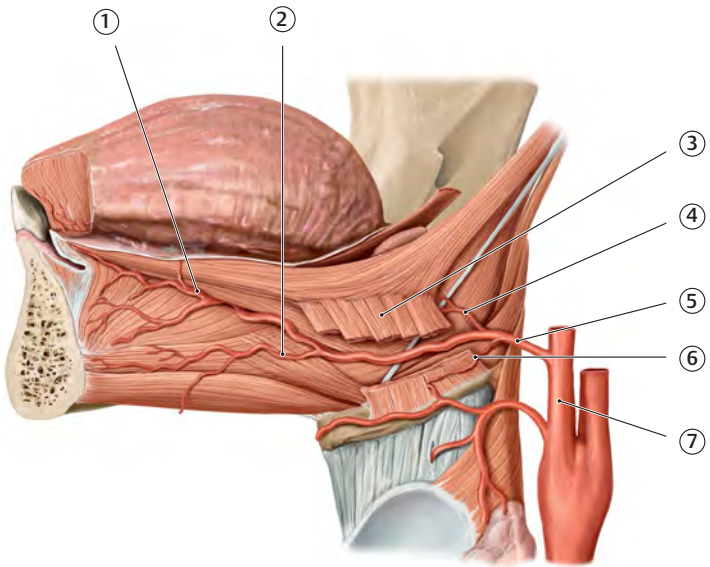
Nerves of the Oral Cavity II: Lateral View



Nerves of the Oral Cavity II: Lateral View

- ① Lingual n.
- ② Hypoglossal n. (CN XII)
- ③ C1 spinal n. (anterior ramus)
- ④ Inferior root of ansa cervicalis (descendens cervicalis)
- ⑤ Ansa cervicalis
- ⑥ Superior root of ansa cervicalis (descendens hypoglossi)
- ⑦ Geniohyoid branch (C1)
- ⑧ Geniohyoid

Lingual Artery and Its Branches: Lateral View

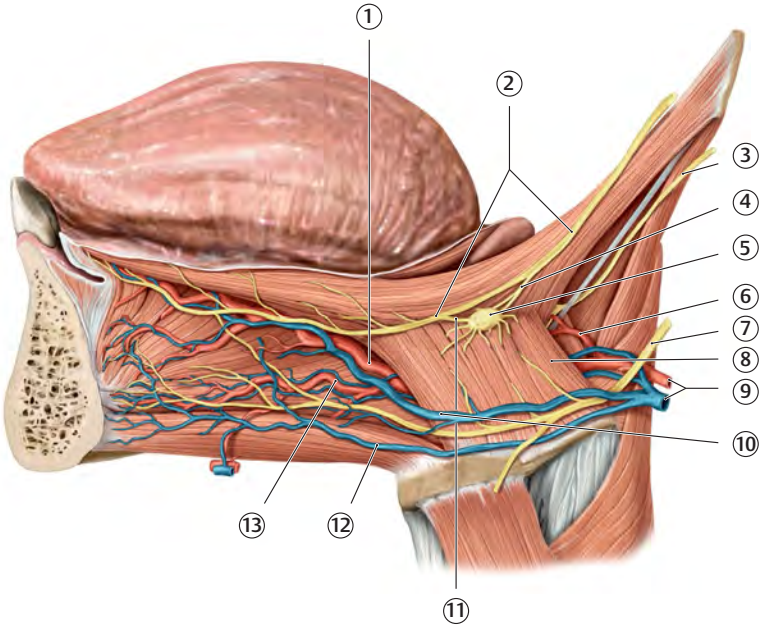


Lingual Artery and Its Branches: Lateral View

- ① Deep lingual a.
- ② Sublingual a.
- ③ Hyoglossus (cut)
- ④ Dorsal lingual branches
- ⑤ Lingual a.
- ⑥ Suprahyoid branch
- ⑦ External carotid a.

 The lingual a. is the primary supply to structures in the floor of the oral cavity. The four direct branches of the lingual a. are the suprahyoid, dorsal lingual, sublingual, and deep lingual aa. After giving rise to the dorsal lingual a., the lingual a. passes medial to the hyoglossus muscle on its way into the oral cavity. It terminates by dividing into the deep lingual and sublingual aa.

Neurovasculature of the Tongue: Lateral View



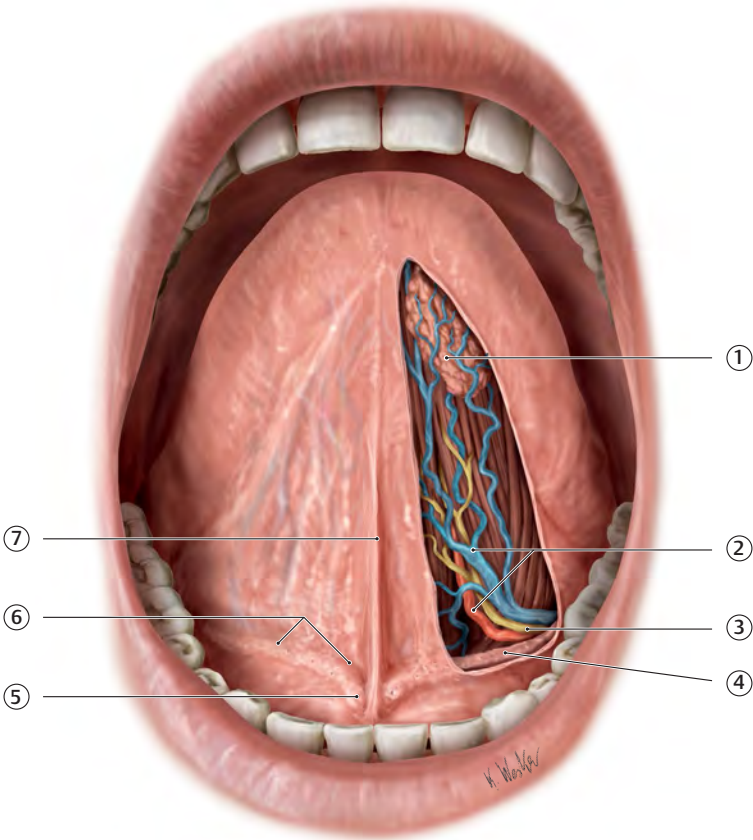
Neurovasculature of the Tongue: Lateral View

- ① Deep lingual a.
- ② Lingual n.
- ③ Glossopharyngeal n.
- ④ Preganglionic branches
- ⑤ Submandibular ganglion
- ⑥ Dorsal lingual a.
- ⑦ Hypoglossal n.
- ⑧ Hyoglossus
- ⑨ Lingual a. and v.
- ⑩ Deep lingual v.
- ⑪ Postganglionic branches
- ⑫ Sublingual v.
- ⑬ Sublingual a.



To reach the tongue, the lingual n. (from CN V3) and hypoglossal n. (CN XII) pass lateral to the hyoglossus muscle, whereas the glossopharyngeal n. (CN IX) passes medial to it.

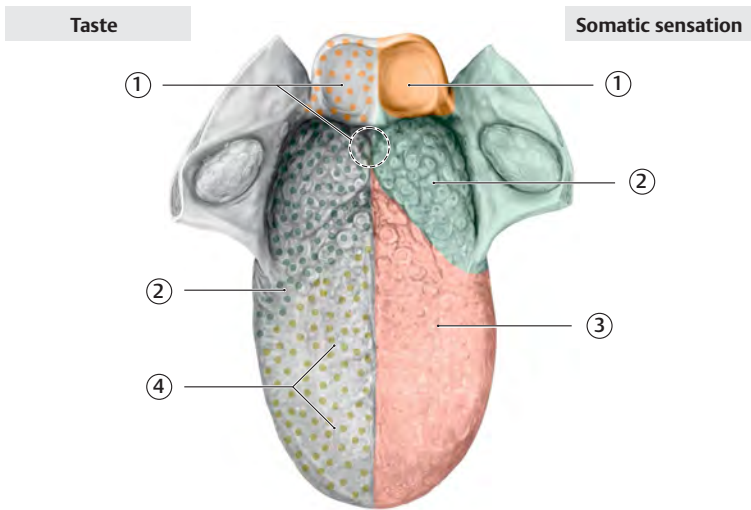
Sublingual Structures: Anterior View



Sublingual Structures: Anterior View

- ① Anterior lingual glands
- ② Deep lingual a. and v.
- ③ Lingual n.
- ④ Submandibular duct
- ⑤ Sublingual papilla
- ⑥ Sublingual fold
- ⑦ Lingual frenulum

Sensory Innervation of the Tongue: Superior View



Sensory Innervation of the Tongue: Superior View

- ① Vagus n. (CN X)
- ② Glossopharyngeal n. (CN IX)
- ③ Lingual n. (mandibular n., CN V3)
- ④ Facial n. (CN VII via chorda tympani)

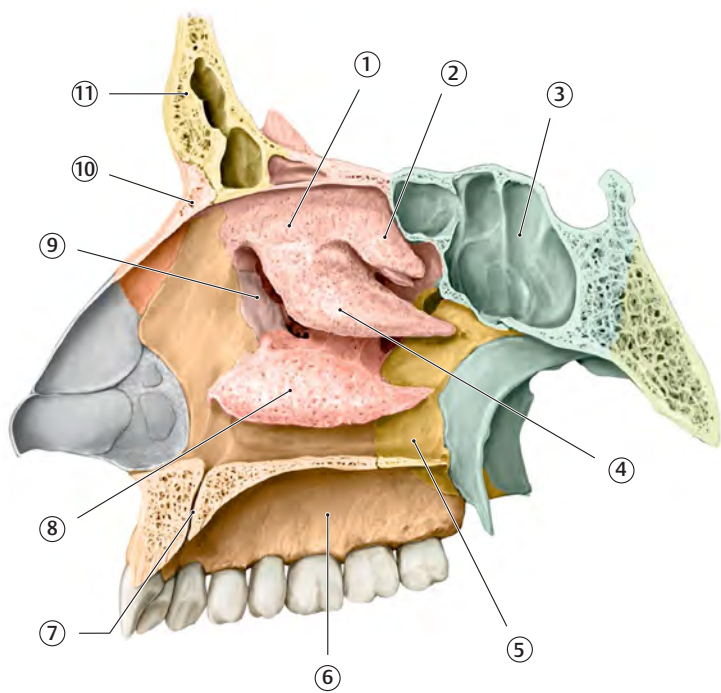


The lingual n. supplies general sensory fibers to the anterior two thirds of the tongue. In contrast the glossopharyngeal n. (CN IX) supplies general sensory fibers to the posterior third of the tongue. The vagus n. (CN X), via the internal laryngeal branch, supplies general sensory fibers to the vallecula and epiglottis. The chorda tympani branch of the facial n. (CN VII) carries taste fibers that are distributed by the lingual nerve to the anterior two thirds of the tongue. Taste to the rest of the tongue is primarily supplied by the glossopharyngeal n., with a small area supplied by the vagus n. In addition, the vagus n., via the internal laryngeal branch, supplies taste fibers to the vallecula and the epiglottis.

Nasal Cavity

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Bones of Lateral Nasal Wall: Lateral View



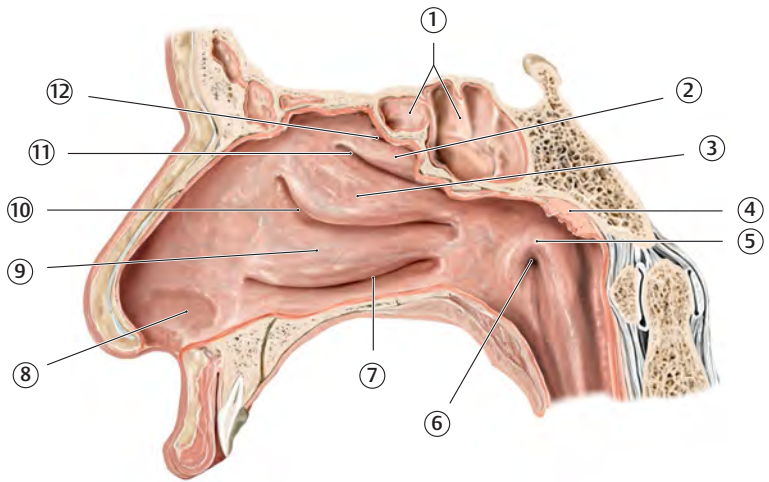
Bones of Lateral Nasal Wall: Lateral View

- ① Ethmoid
- ② Superior concha
- ③ Sphenoid bone
- ④ Middle concha
- ⑤ Palatine bone, perpendicular plate
- ⑥ Maxilla
- ⑦ Incisive canal
- ⑧ Inferior nasal concha
- ⑨ Lacrimal bone
- ⑩ Nasal bone
- ⑪ Frontal bone



The nasal conchae (turbinates) are located on the lateral nasal wall. The inferior nasal concha is a separate bone that articulates primarily with the maxilla and to a lesser degree with the ethmoid and palatine bones. The remaining conchae (including middle, superior, and the occasional supreme) are parts of the ethmoid bone. Lateral to each concha is its associated meatus, a space that communicates with other regions of the skull (see subsequent **Unit 8 cards** for more detail).

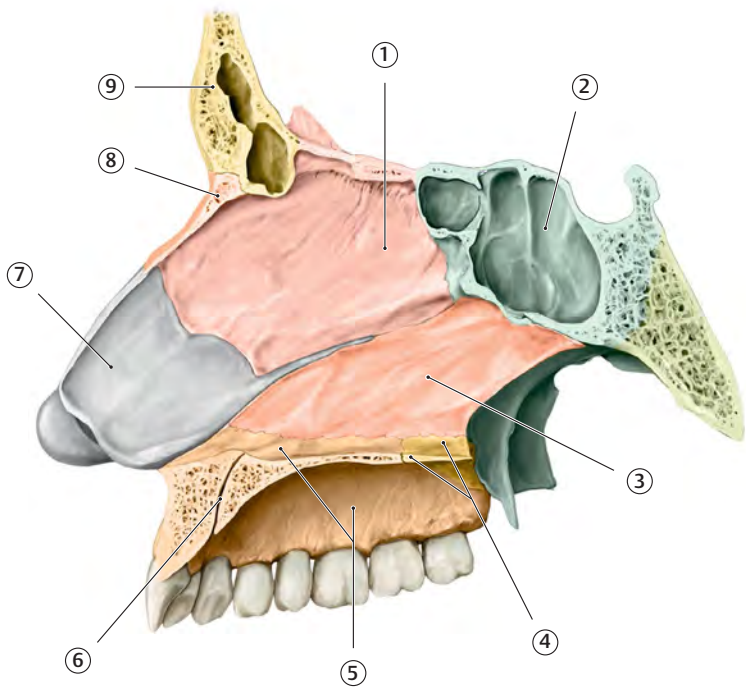
Lateral Nasal Wall: Lateral View



Lateral Nasal Wall: Lateral View

- ① Sphenoid sinus
- ② Superior nasal concha
- ③ Middle nasal concha
- ④ Pharyngeal tonsil
- ⑤ Torus tubarius
- ⑥ Pharyngeal orifice of pharyngotympanic (auditory) tube
- ⑦ Inferior meatus
- ⑧ Nasal vestibule
- ⑨ Inferior nasal concha
- ⑩ Middle meatus
- ⑪ Superior meatus
- ⑫ Sphenoethmoidal recess

Bones of Nasal Septum: Lateral View



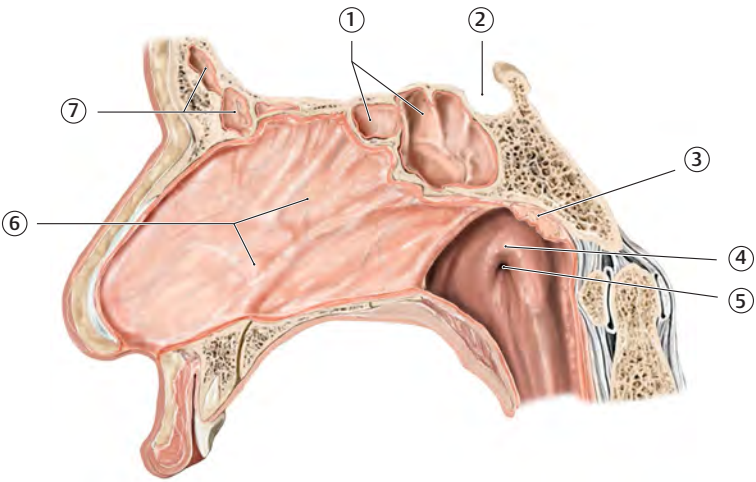
Bones of Nasal Septum: Lateral View

- ① Ethmoid bone, perpendicular plate
- ② Sphenoid bone
- ③ Vomer
- ④ Palatine bone, horizontal plate
- ⑤ Maxilla, palatine process
- ⑥ Incisive canal
- ⑦ Septal cartilage
- ⑧ Nasal bone
- ⑨ Frontal bone



The nasal septum is composed of cartilage and bone. The bony nasal septum is primarily formed by the perpendicular plate of the ethmoid and the vomer. However, the maxilla and palatine bones make small contributions to the bony nasal septum inferiorly. Note the incisive canal, which transmits the nasopalatine n. from the nasal cavity into the oral cavity. In addition, it transmits the greater palatine a. from the oral cavity into the nasal cavity.

Nasal Septum: Lateral View

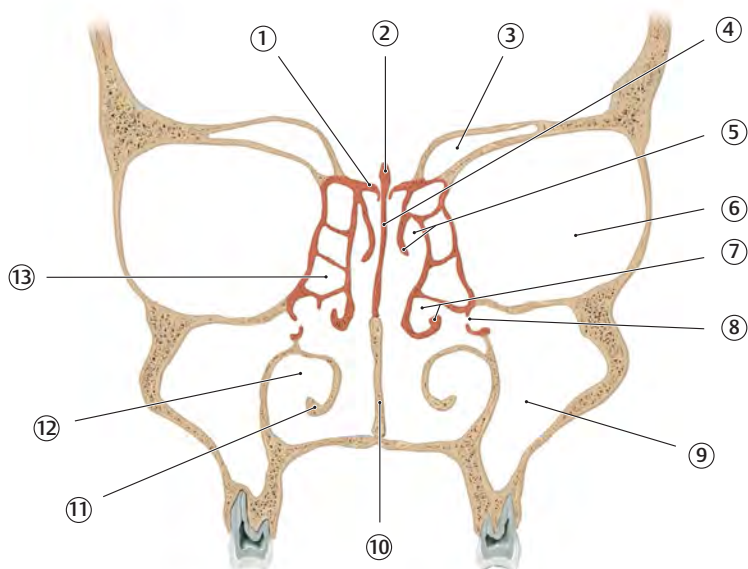


Nasal Septum: Lateral View

- ① Sphenoid sinus
- ② Hypophyseal fossa
- ③ Pharyngeal tonsil
- ④ Torus tubarius
- ⑤ Pharyngeal orifice of pharyngotympanic (auditory) tube
- ⑥ Nasal septum
- ⑦ Frontal sinus

 The nasal cavity communicates posteriorly with the nasopharynx. Of clinical significance is the pharyngeal opening of the pharyngotympanic (auditory, eustachian) tube. This allows for the potential transmission of infection from the nasal cavity into the tympanic cavity (middle ear). Note the pharyngeal tonsils in the roof of the nasopharynx. When inflamed (then referred to as adenoids), they may partially obstruct the air flow from the posterior nasal aperture (choanae) into the nasopharynx.

Cross-Section of Nasal Cavity and Paranasal Sinuses: Coronal Section



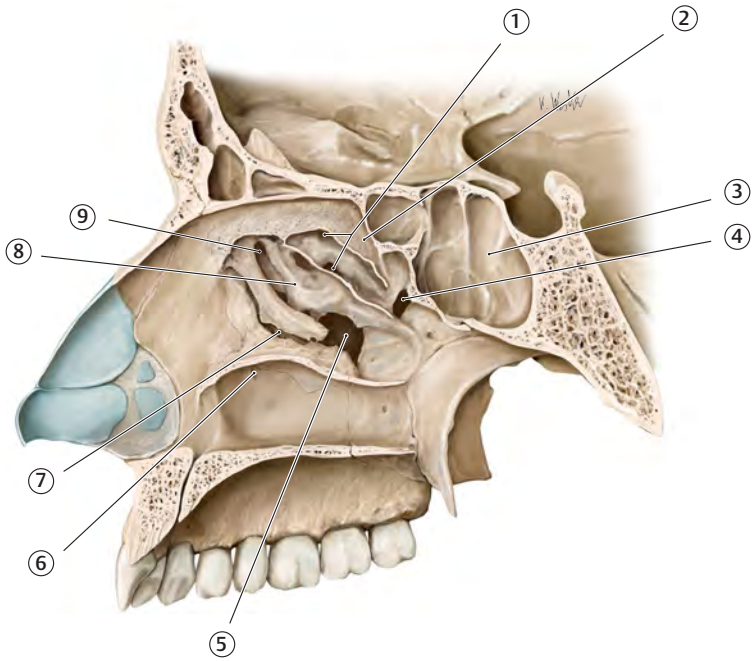
Cross-Section of Nasal Cavity and Paranasal Sinuses: Coronal Section

- ① Cribriform plate
- ② Crista galli
- ③ Frontal sinus
- ④ Ethmoid bone, perpendicular plate
- ⑤ Superior meatus and concha
- ⑥ Orbit
- ⑦ Middle meatus and concha
- ⑧ Ostium of maxillary sinus
- ⑨ Maxillary sinus
- ⑩ Vomer
- ⑪ Inferior concha
- ⑫ Inferior meatus
- ⑬ Middle ethmoid air cells



The ethmoid bone is a central bone in the superior nasal cavity. Surrounding the nasal cavity are other spaces with which the nasal cavity communicates, including the maxillary sinus, ethmoidal air cells, frontal sinus, orbit, anterior cranial fossa, and oral cavity. In addition, the sphenoid sinus (not shown) has a communication with the nasal cavity.

**Lateral Nasal Wall with Conchae Removed:
Lateral View**



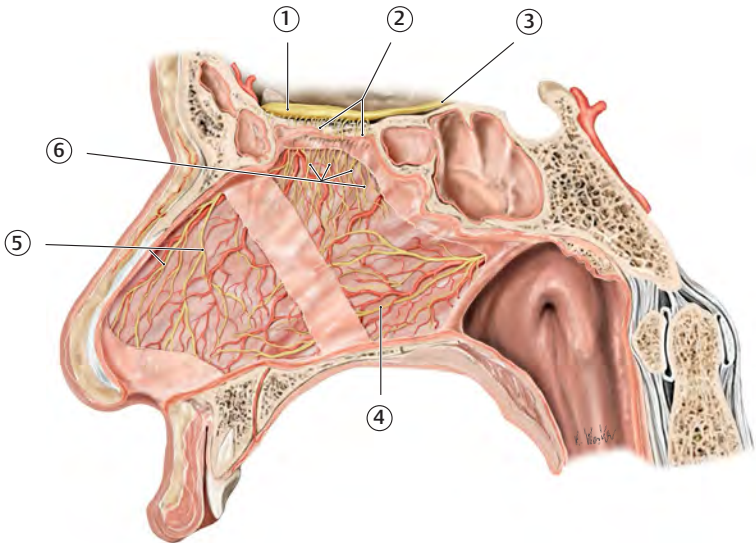
Lateral Nasal Wall with Conchae Removed: Lateral View

- ① Orifices of posterior ethmoid air cells
- ② Sphenoethmoidal recess
- ③ Sphenoid sinus
- ④ Sphenopalatine foramen
- ⑤ Maxillary hiatus
- ⑥ Opening of nasolacrimal canal
- ⑦ Semilunar hiatus
- ⑧ Ethmoid bulla
- ⑨ Frontonasal duct



Mucus produced in the paranasal sinuses drains via specific pathways into the nasal cavity. The sphenoid sinus drains into the sphenoethmoidal recess, which is located superior and posterior to the superior concha. The posterior ethmoidal air cells drain into the superior meatus. The middle and anterior ethmoidal air cells, maxillary sinus, and frontal sinus all drain into the middle meatus. Tears drain from the orbit through the nasolacrimal canal into the inferior meatus. Note that the nasal cavity communicates laterally with the pterygopalatine fossa via the sphenopalatine foramen.

Nerves of the Nasal Septum: Lateral View

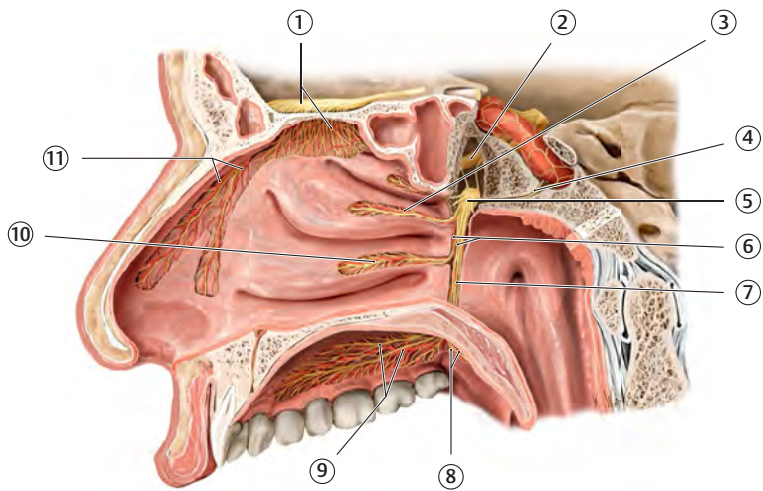


Nerves of the Nasal Septum: Lateral View

- ① Olfactory bulb
- ② Cribriform plate
- ③ Olfactory tract (CN I)
- ④ Nasopalatine n. (from CN V2)
- ⑤ Medial nasal branches (from CN V1)
- ⑥ Olfactory fibers (from CN I)

 Olfactory nn. (CN I) travel from the mucosa of the superior nasal cavity (both septal and lateral walls) superiorly through the foramina of the cribriform plate to the olfactory bulb located in the anterior cranial fossa. General sensory innervation of the nasal septum mucosa is from branches of both ophthalmic (CN V1) and maxillary (CN V2) divisions of the trigeminal n. The nasopalatine branch of the maxillary n. enters the nasal cavity from the pterygopalatine fossa via the sphenopalatine foramen. It traverses the nasal septum and enters the oral cavity via the incisive canal. Medial nasal branches arise from the anterior ethmoidal branch of the nasociliary n. (CN V1).

Nerves and Arteries of the Lateral Nasal Wall: Lateral View

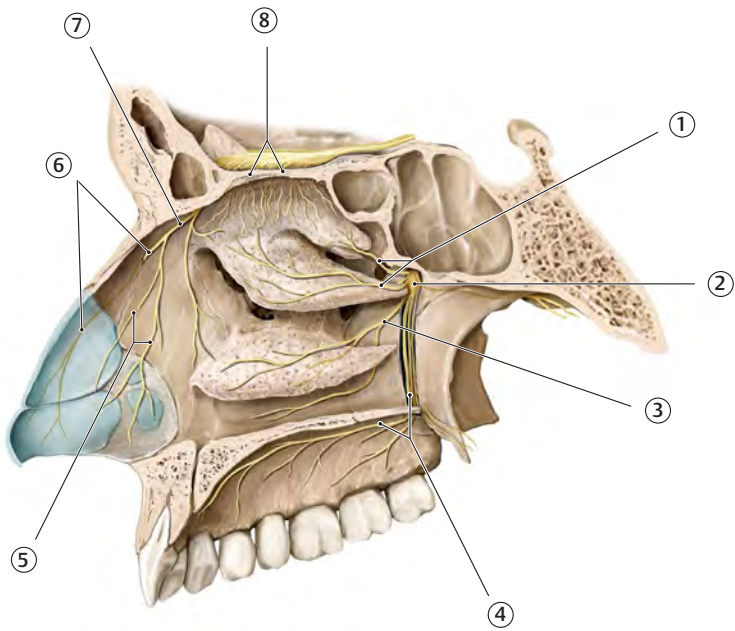


Nerves and Arteries of the Lateral Nasal Wall: Lateral View

- ① Olfactory bulb and olfactory fibers (CN I)
- ② Maxillary n.
- ③ Posterior superior lateral nasal nn.
- ④ Nerve of the pterygoid canal
- ⑤ Pterygopalatine ganglion
- ⑥ Descending palatine a. and n.
- ⑦ Greater and lesser palatine nn.
- ⑧ Lesser palatine a. and n.
- ⑨ Greater palatine a. and n.
- ⑩ Posterior inferior lateral nasal n.
- ⑪ Anterior ethmoidal a. and n.

 General sensory innervation of the lateral wall mucosa is from branches of both ophthalmic (CN V1) and maxillary (CN V2) divisions of the trigeminal n. The posterior superior lateral nasal nn., which supply the mucosa of the superior and middle conchae, are branches of the maxillary n. that enter the nasal cavity through the sphenopalatine foramen. The posterior inferior lateral nasal n. to the inferior concha is a branch of the descending palatine n. that arises within the greater palatine canal and enters the nasal cavity through an unnamed canaliculus. The anterior ethmoidal n. (from CN V1) supplies the anterior lateral nasal mucosa.

Nerves of the Lateral Nasal Wall: Lateral View



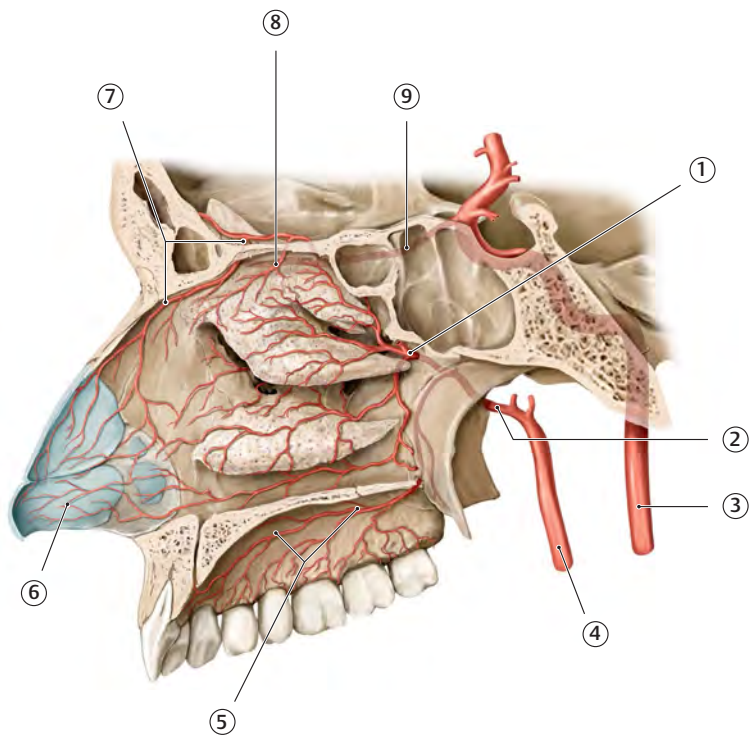
Nerves of the Lateral Nasal Wall: Lateral View

- ① Posterior superior lateral nasal nn.
- ② Pterygopalatine ganglion
- ③ Posterior inferior lateral nasal n.
- ④ Greater palatine n.
- ⑤ Lateral nasal branches
- ⑥ External nasal n.
- ⑦ Anterior ethmoidal n. (CN V1)
- ⑧ Cribriform plate



The external nasal n. is a branch of the anterior ethmoidal n. (from CN V1). It arises in the nasal cavity, emerges onto the face, and supplies the dorsum of the nose.

Arteries of the Lateral Nasal Wall: Lateral View



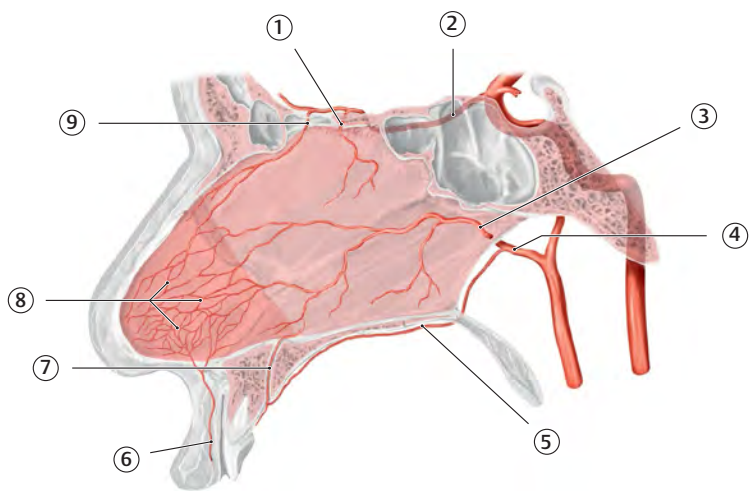
Arteries of the Lateral Nasal Wall: Lateral View

- ① Sphenopalatine a.
- ② Maxillary a.
- ③ Internal carotid a.
- ④ External carotid a.
- ⑤ Greater palatine a.
- ⑥ Alar branches of lateral nasal a.
- ⑦ Anterior ethmoidal a.
- ⑧ Posterior ethmoidal a.
- ⑨ Ophthalmic a.



The arterial supply to the nasal cavity is primarily from branches of the maxillary a. The sphenopalatine a. enters the nasal cavity through the sphenopalatine foramen (along with the nasopalatine n.). The lateral nasal a. (a branch of the facial a.) supplies alar branches to the nasal cavity. In addition, blood derived from the internal carotid a. reaches the nasal cavity via the anterior and posterior ethmoidal branches of the ophthalmic a.

Arteries of the Nasal Septum: Lateral View



Arteries of the Nasal Septum: Lateral View

- ① Posterior ethmoidal a.
- ② Ophthalmic a.
- ③ Sphenopalatine a. via sphenopalatine foramen
- ④ Maxillary a.
- ⑤ Greater palatine a.
- ⑥ Septal branch of superior labial a. (facial a.)
- ⑦ Nasal branch of greater palatine a.
- ⑧ Kiesselbach's area
- ⑨ Anterior ethmoidal a.

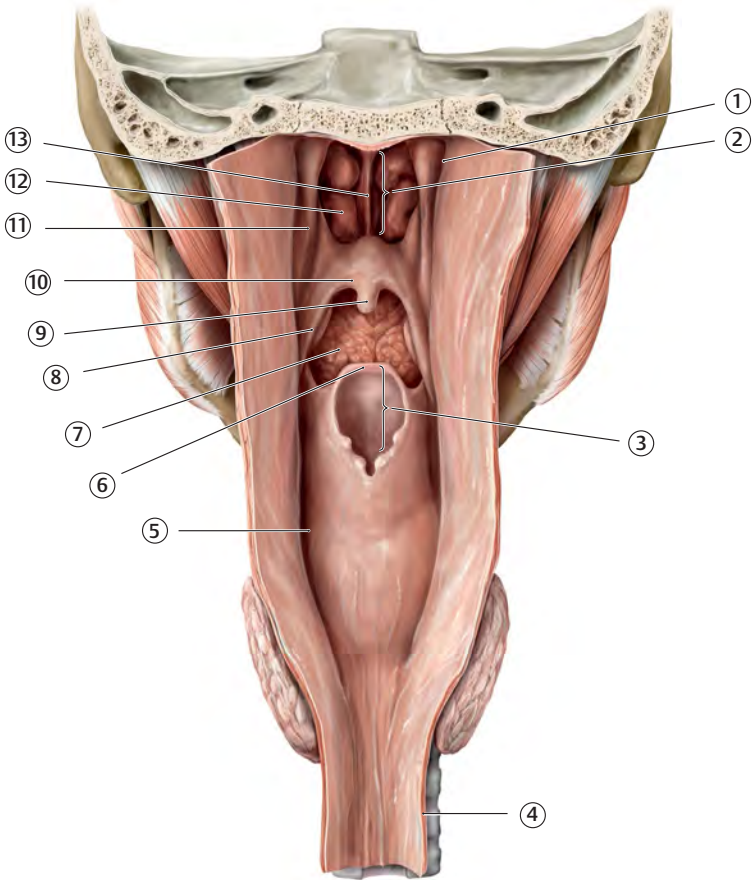


The nasal cavity has a rich arterial supply. A region of the anterior nasal septum, referred to as Kiesselbach's area, is the frequent site of epistaxis (nose bleeds). Blood to this area, where there are extensive arterial anastomoses, comes from both internal and external carotid systems (branches of the sphenopalatine, facial, anterior ethmoidal, and greater palatine aa.). The greater palatine a. gives rise to a nasal branch that enters into the nasal cavity through the incisive canal.

Pharynx and Larynx

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Opened Pharynx: Posterior View



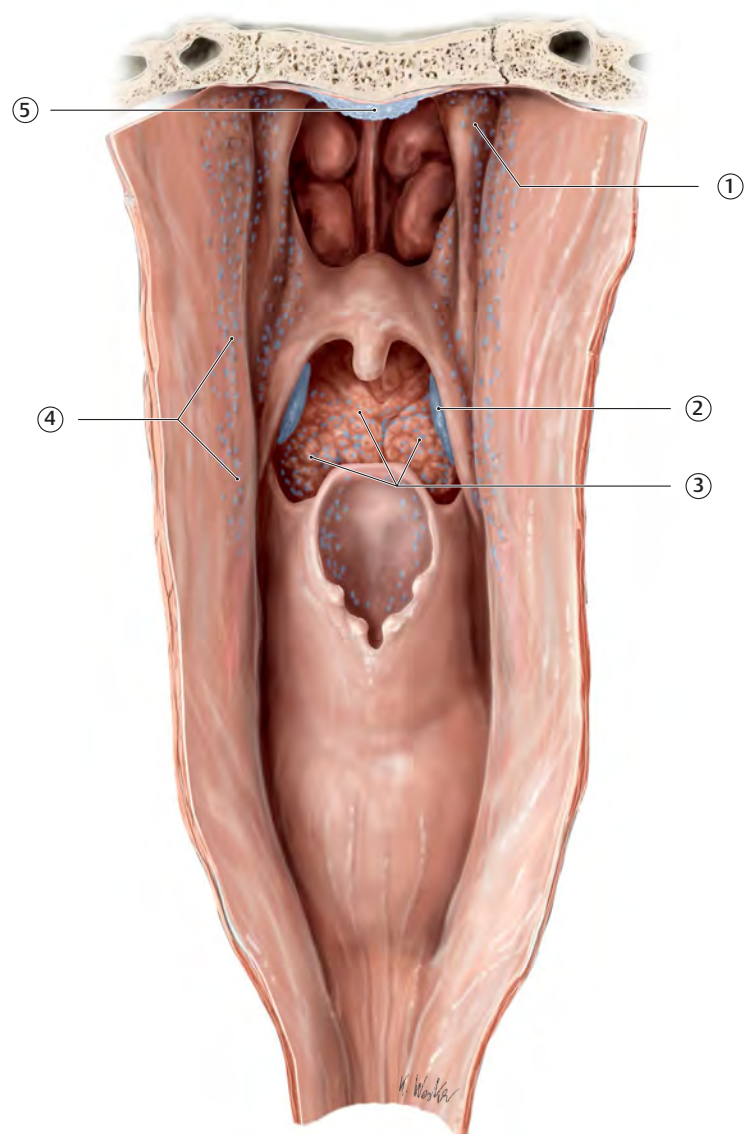
Opened Pharynx: Posterior View

- ① Pharyngeal recess
- ② Choanae
- ③ Laryngeal inlet
- ④ Esophagus
- ⑤ Piriform recess
- ⑥ Epiglottis
- ⑦ Root of tongue
- ⑧ Palatopharyngeal arch
- ⑨ Uvula
- ⑩ Soft palate
- ⑪ Salpingopharyngeal fold
- ⑫ Inferior nasal turbinate
- ⑬ Nasal septum



In this posterior opened view of the pharynx it is possible to observe the communications between the pharynx and the nasal cavity, oral cavity, and larynx. Inferiorly, at the level of the C6 vertebra, the pharynx is continuous with the esophagus.

Lymphatics of the Pharynx: Waldeyer's Lymphatic Ring: Posterior View

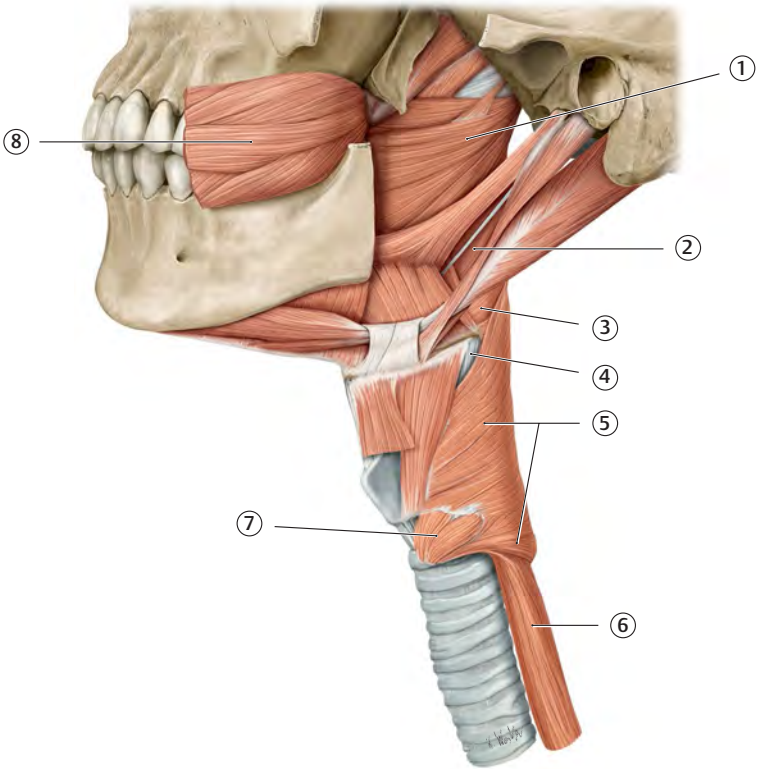


Lymphatics of the Pharynx: Waldeyer's Lymphatic Ring: Posterior View

- ① Tubal tonsil
- ② Palatine tonsil
- ③ Lingual tonsil (postsulcal portion of tongue)
- ④ Lateral bands of lymphatic tissue
- ⑤ Pharyngeal tonsil

 Waldeyer's lymphatic ring is a circular band of lymphatic tissue that surrounds the passageway into the nasopharynx and oropharynx. It is primarily composed of collections of lymphatic tissue referred to as tonsils. These include the pharyngeal tonsils at the roof of the nasopharynx, the tubal tonsils on the torus tubarius, the palatine tonsils between the palatoglossal and the palatopharyngeal arches, and the lingual tonsils on the posterior third of the tongue. Positioned in intermediate areas between these tonsils are collections of lymphatic tissue referred to as lateral bands. Inflammation of the pharyngeal tonsils is referred to as adenoids, whereas inflammation of the palatine tonsils is tonsillitis.

Muscles of the Pharynx: Lateral View

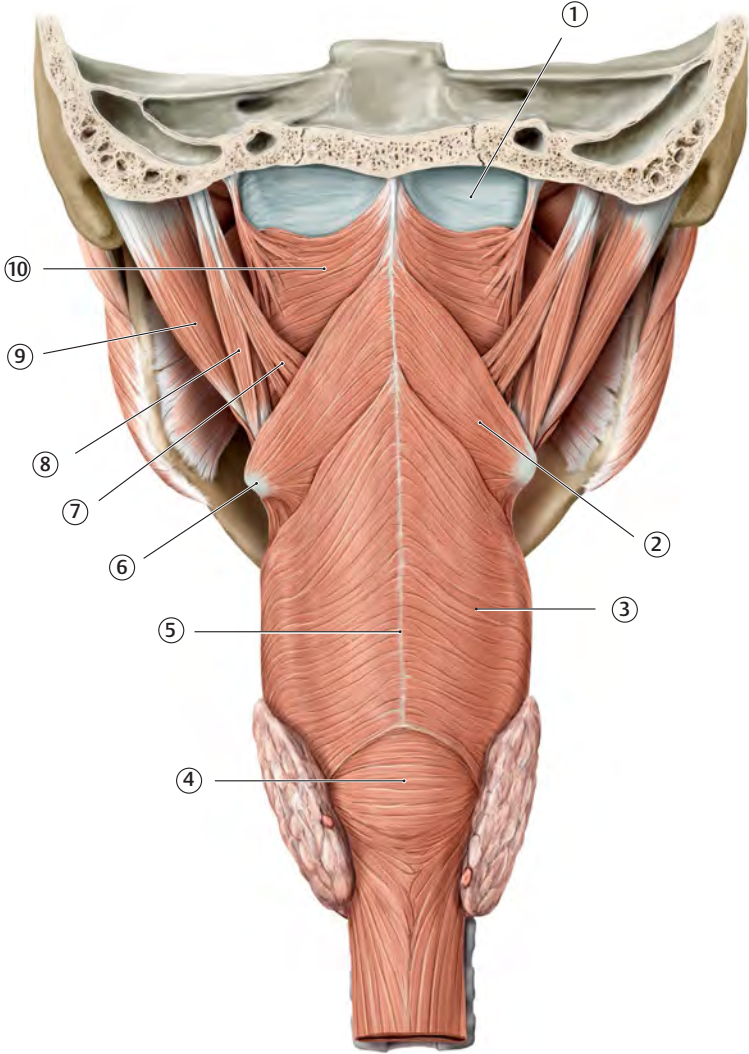


Muscles of the Pharynx: Lateral View

- ① Superior pharyngeal constrictor
- ② Stylopharyngeus
- ③ Middle pharyngeal constrictor
- ④ Thyrohyoid membrane
- ⑤ Inferior pharyngeal constrictor
- ⑥ Esophagus
- ⑦ Cricothyroid
- ⑧ Buccinator

 The muscles of the pharynx consist of a constrictor group and a longitudinal group (elevators). There are three constrictor muscles: the superior constrictor, the middle constrictor, and the inferior constrictor (each with multiple heads). There are three longitudinal muscles: the palatopharyngeus (not shown), the salpingopharyngeus (not shown), and the stylopharyngeus. The motor fibers to all the muscles of the pharynx are distributed by the vagus n. (CN X), with the exception of the stylopharyngeus. The stylopharyngeus is unique in that it is the only muscle derived from the third branchial arch and as such is the only muscle that receives motor fibers from the glossopharyngeal n. (CN IX).

Muscles of the Pharynx: Posterior View

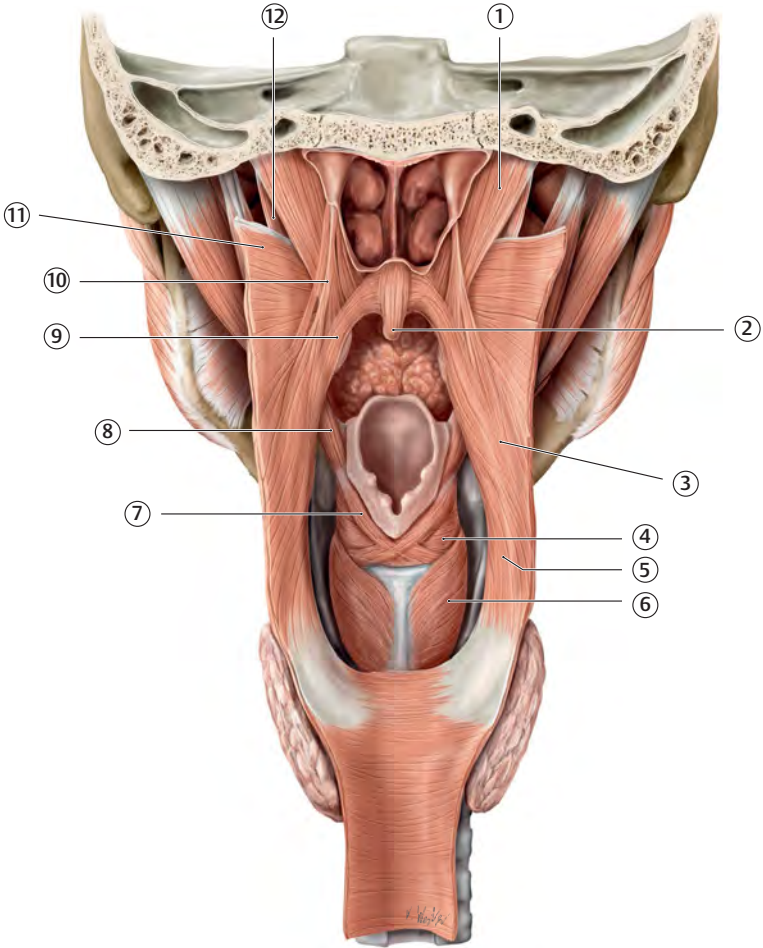


Muscles of the Pharynx: Posterior View

- ① Pharyngobasilar fascia
- ② Middle pharyngeal constrictor
- ③ Thyropharyngeus (inferior pharyngeal constrictor)
- ④ Cricopharyngeus (inferior pharyngeal constrictor)
- ⑤ Pharyngeal raphe
- ⑥ Hyoid bone, greater horn
- ⑦ Stylopharyngeus
- ⑧ Stylohyoid
- ⑨ Digastric, posterior belly
- ⑩ Superior pharyngeal constrictor

 The pharyngeal constrictors partially overlap one another. The superior constrictor does not fully attach to the base of the skull, leaving a gap that is filled by the pharyngobasilar fascia. This thick fascia imparts rigidity to the superior aspect of the nasopharynx, maintaining an open respiratory pathway. The constrictor muscles insert at the posterior midline into the pharyngeal raphe, with the exception of the cricopharyngeus portion of the inferior constrictor. The constrictor muscles are innervated by the pharyngeal plexus, with motor fibers distributed by the vagus n. (CN X). However, although the cricopharyngeus may occasionally receive motor fibers from the pharyngeal plexus, it is more commonly innervated by the external laryngeal n. and/or the recurrent laryngeal n. (CN X).

Muscles of the Pharynx and Larynx: Posterior View (Opened Pharynx)



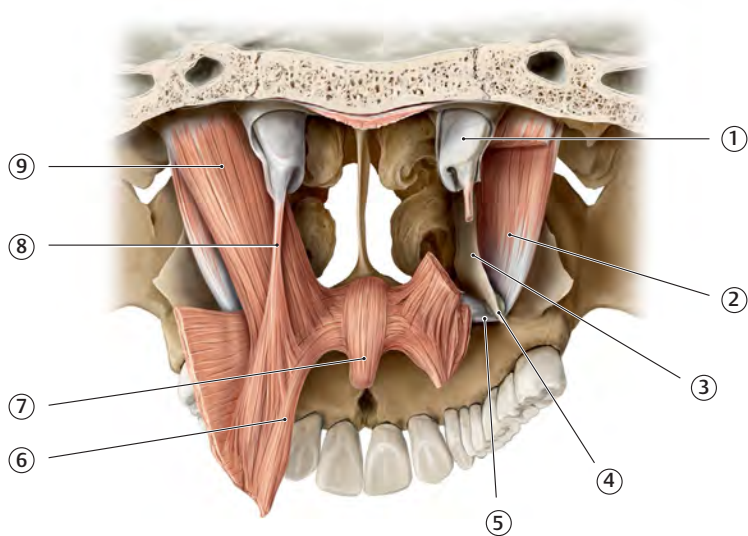
Muscles of the Pharynx and Larynx: Posterior View (Opened Pharynx)

- ① Levator veli palatini
- ② Uvular muscle
- ③ Middle pharyngeal constrictor
- ④ Transverse arytenoid
- ⑤ Inferior pharyngeal constrictor
- ⑥ Posterior cricoarytenoid
- ⑦ Oblique arytenoid
- ⑧ Stylopharyngeus
- ⑨ Palatopharyngeus
- ⑩ Salpingopharyngeus
- ⑪ Superior pharyngeal constrictor
- ⑫ Tensor veli palatini



Note the three longitudinal muscles of the pharynx: the salpingopharyngeus, arising from the pharyngotympanic tube; the palatopharyngeus, arising from the posterior border of the hard palate; and the stylopharyngeus, arising from the styloid process. The stylopharyngeus enters into the pharynx by passing between the middle and superior constrictor muscles.

Muscles of the Soft Palate: Posterior View



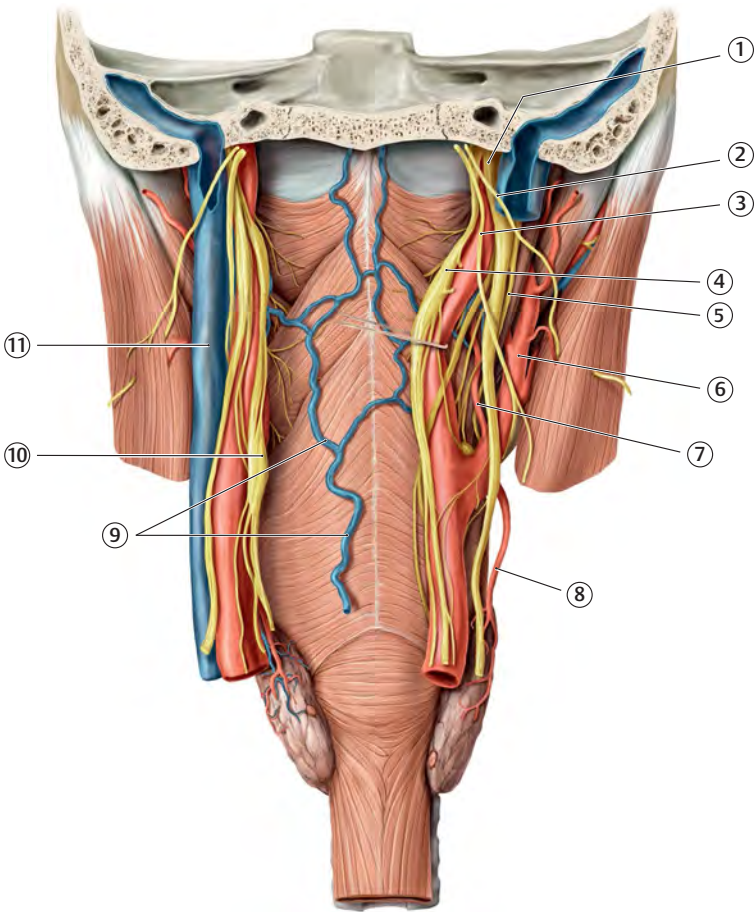
Muscles of the Soft Palate: Posterior View

- ① Cartilaginous part of pharyngotympanic (auditory) tube
- ② Tensor veli palatini
- ③ Medial pterygoid plate
- ④ Pterygoid hamulus
- ⑤ Tendon of tensor veli palatini
- ⑥ Palatopharyngeus
- ⑦ Uvular muscle
- ⑧ Salpingopharyngeus
- ⑨ Levator veli palatini



The uvular muscle and the levator veli palatini muscle receive motor fibers from the vagus n. (CN X) via the pharyngeal plexus, whereas the tensor veli palatini muscle is innervated by the mandibular division of the trigeminal n. (CN V3). The tendon of the tensor veli palatini muscle wraps around the hamulus of the medial pterygoid plate on its way to insert into the palatine aponeurosis.

Neurovasculature of the Posterior Pharynx: Posterior View

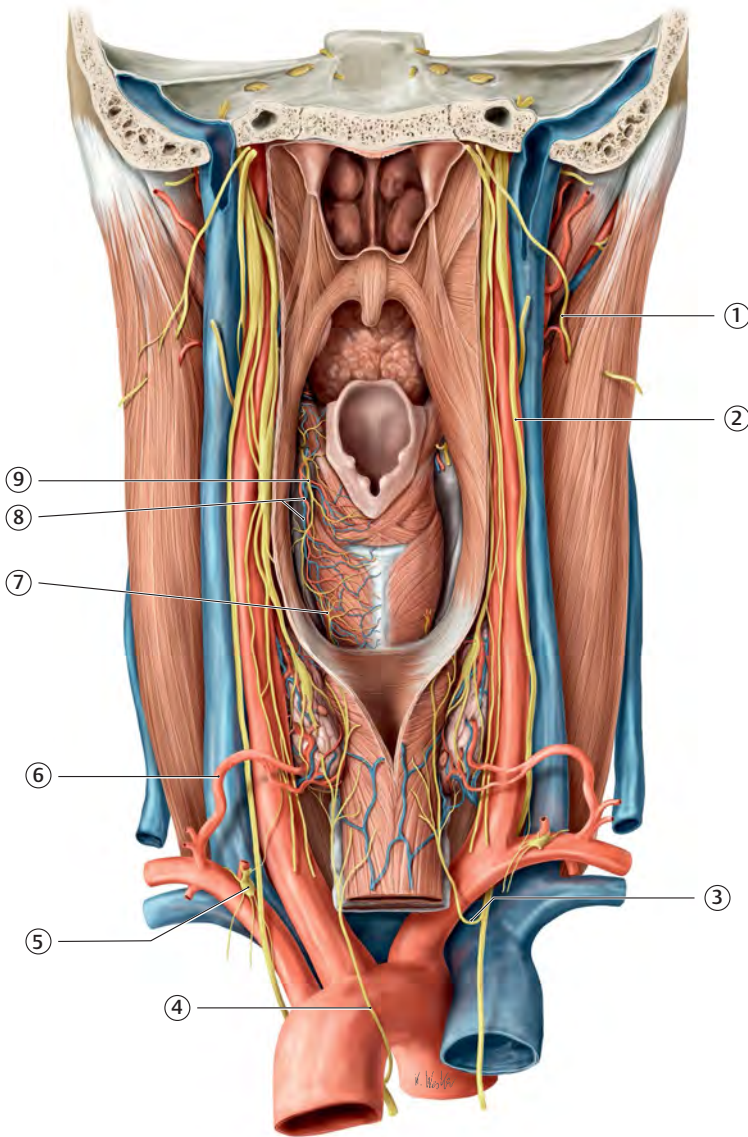


Neurovasculature of the Posterior Pharynx: Posterior View

- ① Vagus n. (CN X)
- ② Accessory n. (CN XI)
- ③ Hypoglossal n. (CN XII)
- ④ Superior cervical ganglion
- ⑤ Glossopharyngeal n. (CN IX)
- ⑥ External carotid a.
- ⑦ Ascending pharyngeal a.
- ⑧ Superior thyroid a.
- ⑨ Pharyngeal venous plexus
- ⑩ Middle cervical ganglion
- ⑪ Internal jugular v.

 The pharyngeal nerve plexus is formed by sensory fibers from the glossopharyngeal n. (CN IX) as well as motor and sensory fibers distributed by the vagus n. (CN X). The pharyngeal venous plexus drains into both the internal jugular v. and the pterygoid plexus of veins.

Neurovasculature of the Posterior Opened Pharynx and Larynx: Posterior View



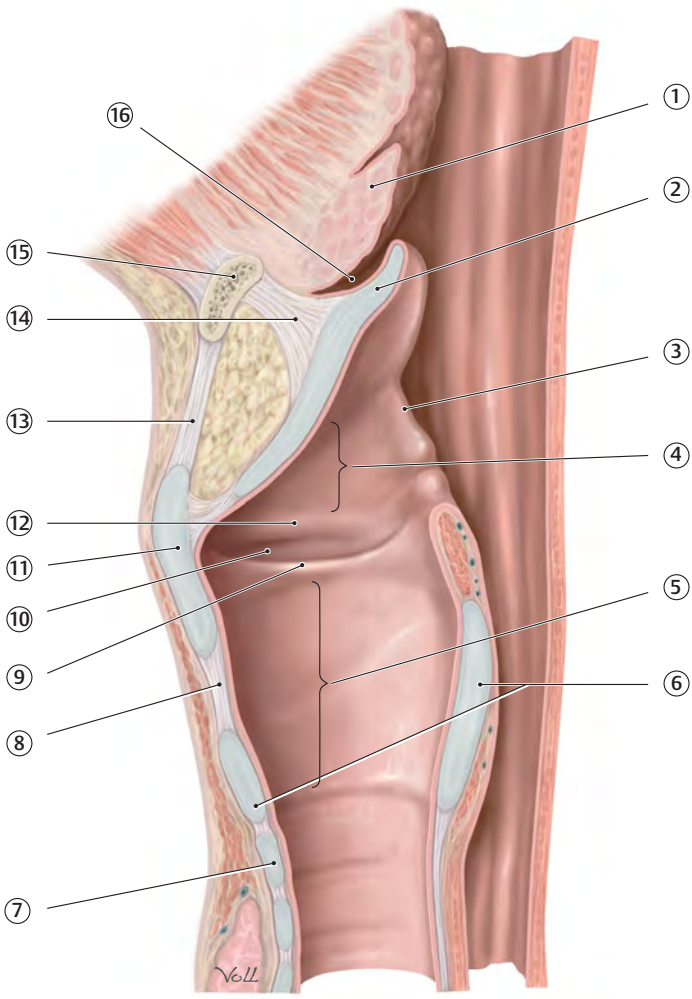
Neurovasculature of the Posterior Opened Pharynx and Larynx: Posterior View

- ① Accessory n. (CN XI)
- ② Vagus n. (CN X)
- ③ Right recurrent laryngeal n.
- ④ Left recurrent laryngeal n.
- ⑤ Vertebral ganglion
- ⑥ Inferior thyroid a.
- ⑦ Left recurrent laryngeal n. and inferior laryngeal a. and v.
- ⑧ Superior laryngeal a. and v.
- ⑨ Internal laryngeal n.



The recurrent laryngeal nn. are mixed nerves with motor and sensory fibers. They are the motor supply to all the intrinsic muscles of the larynx, with the exception of the cricothyroid, innervated by the external laryngeal n. Note that the recurrent laryngeal nn. pass posterior to the thyroid gland and are susceptible to injury during thyroid surgery.

Structures of the Larynx: Midsagittal View



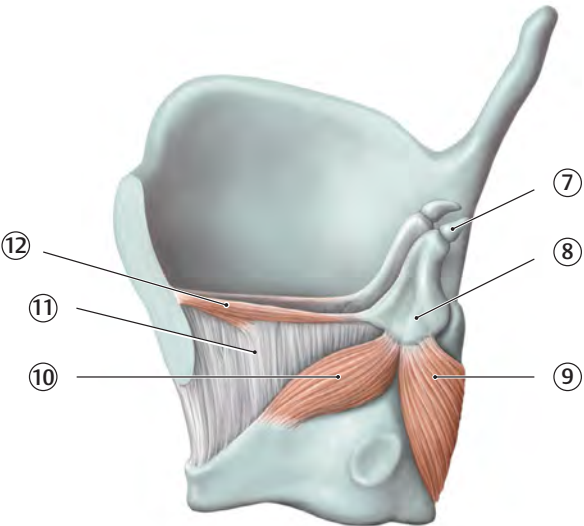
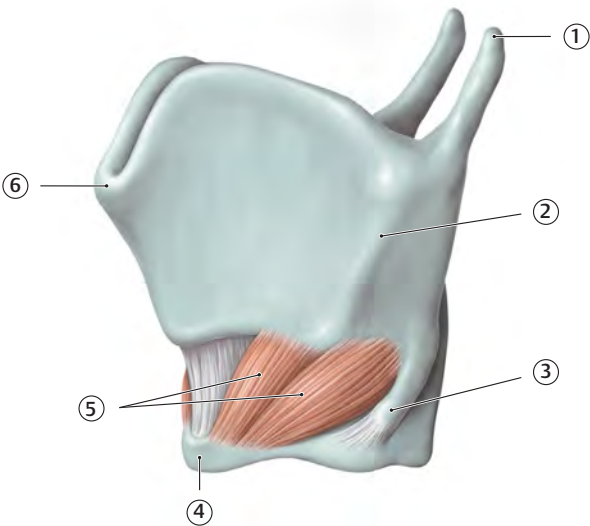
Structures of the Larynx: Midsagittal View

- ① Lingual tonsil
- ② Epiglottis
- ③ Aryepiglottic fold
- ④ Vestibule
- ⑤ Infraglottic space
- ⑥ Cricoid cartilage
- ⑦ Tracheal cartilage
- ⑧ Median cricothyroid lig.
- ⑨ Vocal fold
- ⑩ Ventricle
- ⑪ Thyroid cartilage
- ⑫ Vestibular fold
- ⑬ Thyrohyoid lig.
- ⑭ Hyoepiglottic lig.
- ⑮ Hyoid bone
- ⑯ Vallecula



The mucosa of the larynx is supplied by sensory fibers from the internal and recurrent laryngeal nn. (CN X). The internal laryngeal n. supplies the mucosa above the vocal fold, including the epiglottis and the vallecula. The recurrent laryngeal n. supplies the mucosa below the vocal fold.

Muscles and Cartilages of the Larynx I: Lateral View



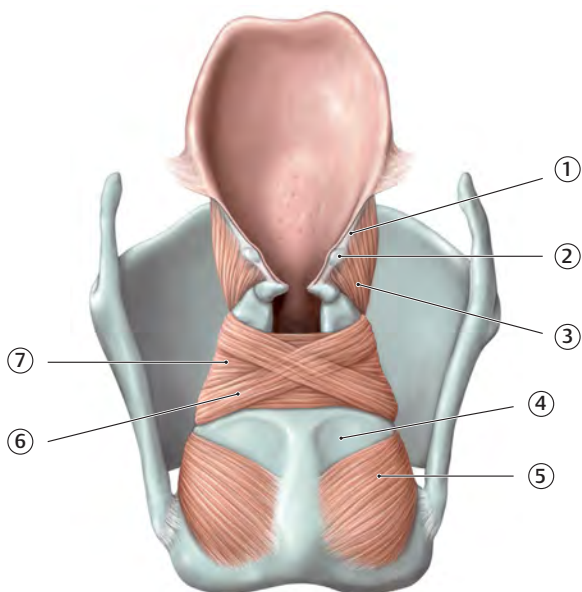
Muscles and Cartilages of the Larynx I: Lateral View

- ① Superior horn of thyroid cartilage
- ② Oblique line
- ③ Inferior horn of thyroid cartilage
- ④ Arch of cricoid cartilage
- ⑤ Straight and oblique parts of cricothyroid
- ⑥ Laryngeal prominence
- ⑦ Corniculate cartilage
- ⑧ Arytenoid cartilage
- ⑨ Posterior cricoarytenoid
- ⑩ Lateral cricoarytenoid
- ⑪ Conus elasticus
- ⑫ Vocalis

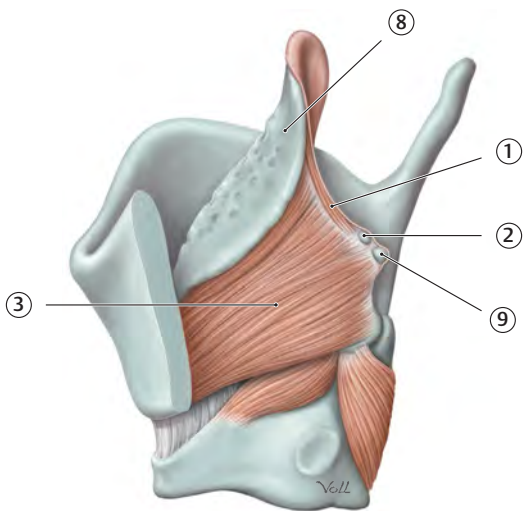


The cricothyroid muscle functions to lengthen and thus tense the vocal folds, whereas the vocalis muscle shortens and hence relaxes the vocal folds.

Muscles and Cartilages of the Larynx II



A. Posterior View



B. Lateral View

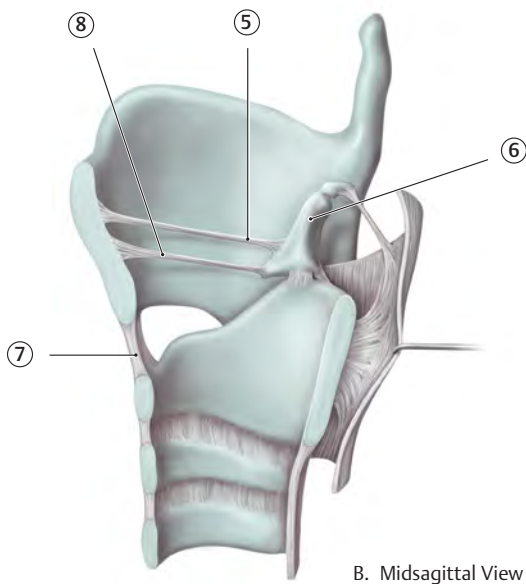
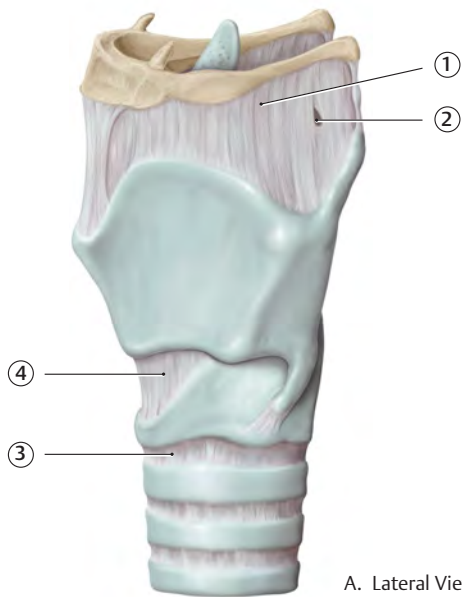
Muscles and Cartilages of the Larynx II

- ① Aryepiglottic fold
- ② Cuneiform cartilage
- ③ Thyroarytenoid
- ④ Lamina of cricoid cartilage
- ⑤ Posterior cricoarytenoid
- ⑥ Oblique arytenoid
- ⑦ Transverse arytenoid
- ⑧ Epiglottic cartilage
- ⑨ Corniculate cartilage



The posterior cricoarytenoid muscle is the sole muscle that opens the rima glottidis (space between the right and the left vocal folds), which it accomplishes by abducting the vocal folds through rotation of the arytenoid cartilages.

Ligaments of the Larynx



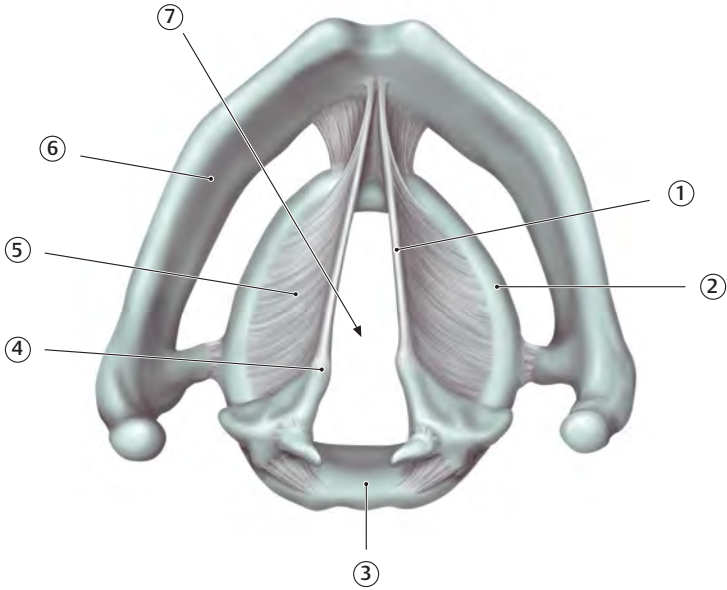
Ligaments of the Larynx

- ① Thyrohyoid lig.
- ② Foramen for superior laryngeal a. and internal laryngeal n.
- ③ Cricotracheal lig.
- ④ Cricothyroid lig.
- ⑤ Vestibular lig.
- ⑥ Arytenoid cartilage
- ⑦ Median cricothyroid lig.
- ⑧ Vocal lig.



The internal laryngeal n. and superior laryngeal a. and v. pass through the foramen in the thyrohyoid lig. In cases of laryngeal obstruction, emergency airway opening is performed by piercing the cricothyroid lig. (cricothyrotomy). In a hospital setting, airways may be opened directly into the trachea (tracheotomy).

Larynx: Superior View



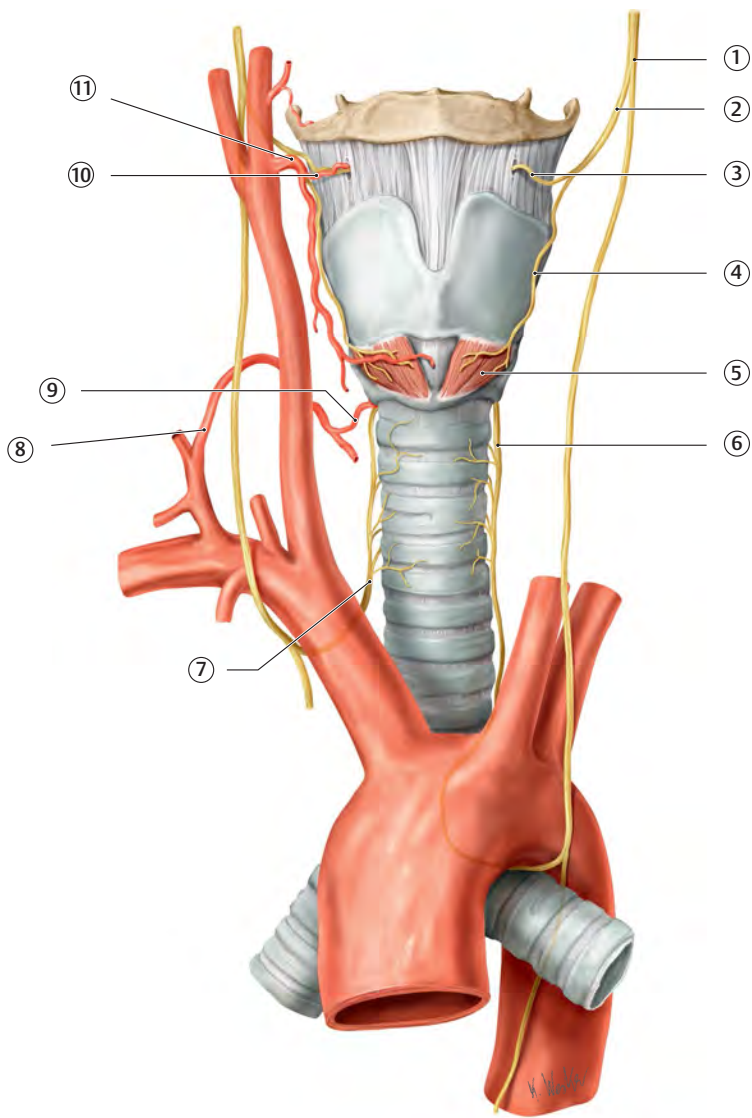
Larynx: Superior View

- ① Vocal lig.
- ② Arch of cricoid cartilage
- ③ Lamina of cricoid cartilage
- ④ Vocal process of arytenoid cartilage
- ⑤ Conus elasticus
- ⑥ Thyroid cartilage
- ⑦ Rima glottidis



The closing of the rima glottidis during phonation is achieved by the actions of the lateral cricoarytenoid muscles, which rotate the vocal processes toward each other, and the transverse arytenoid muscle, which closes the gap between arytenoid cartilages.

Nerves and Arteries of the Larynx: Anterior View



Nerves and Arteries of the Larynx: Anterior View

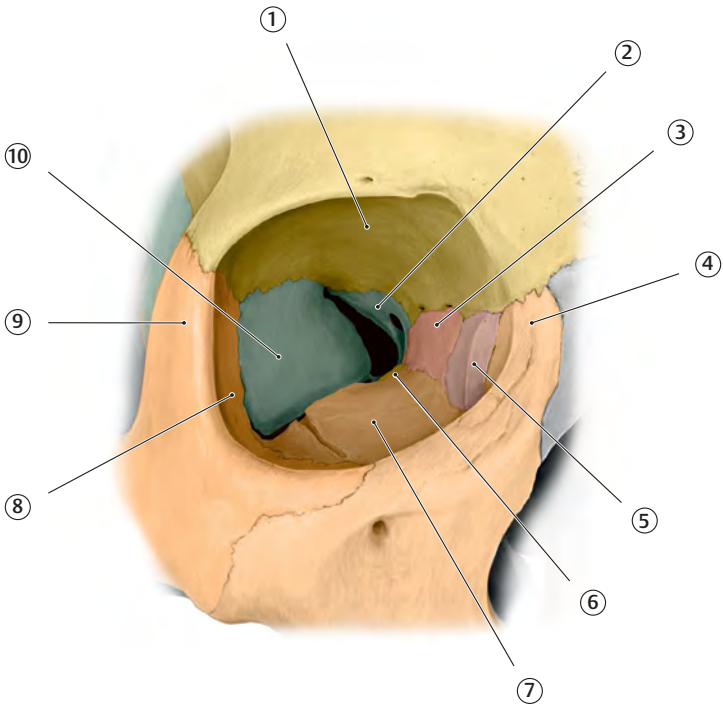
- ① Vagus n. (CN X)
- ② Superior laryngeal n.
- ③ Internal laryngeal n. (sensory)
- ④ External laryngeal n. (motor to cricothyroid)
- ⑤ Cricothyroid
- ⑥ Left recurrent laryngeal n.
- ⑦ Right recurrent laryngeal n.
- ⑧ Inferior thyroid a.
- ⑨ Inferior laryngeal a.
- ⑩ Superior laryngeal a.
- ⑪ Superior thyroid a.

 The vagus n. is the motor and sensory supply to the larynx through its superior laryngeal and recurrent laryngeal branches. Both of these nerves contain motor and sensory fibers. The superior laryngeal n. gives rise to the internal laryngeal n. (sensory) and the external laryngeal n. (motor). The left recurrent laryngeal n. arises from the vagus n. in the thorax and loops under the arch of the aorta to ascend into the neck and supply the larynx. The right recurrent laryngeal n. arises from the right vagus within the neck and loops under the right subclavian a. before ascending toward the larynx.

Orbit

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Bones of the Orbit: Anterior View



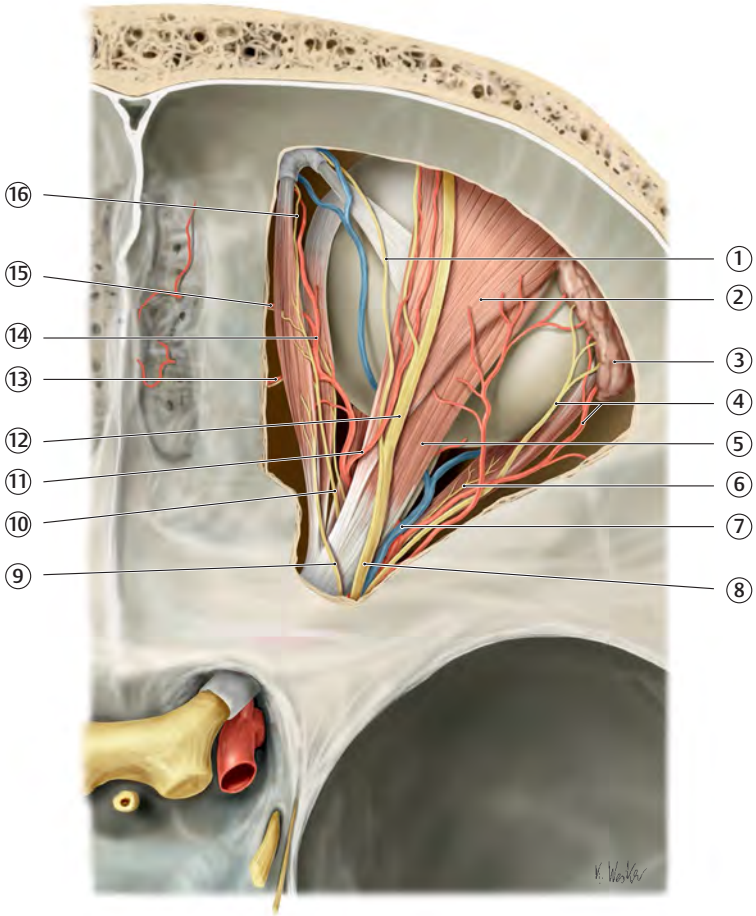
Bones of the Orbit: Anterior View

- ① Frontal bone, orbital surface
- ② Sphenoid bone, orbital surface of lesser wing
- ③ Ethmoid bone, orbital plate (lamina papyracea)
- ④ Maxilla, frontal process
- ⑤ Lacrimal bone, orbital surface
- ⑥ Palatine bone, orbital process
- ⑦ Maxilla, orbital surface
- ⑧ Zygomatic bone, orbital surface
- ⑨ Zygomatic bone, frontal process
- ⑩ Sphenoid bone, orbital surface of greater wing



There are seven bones contributing to the bony orbit: the frontal, sphenoid, ethmoid, maxilla, lacrimal, palatine, and zygomatic bones.

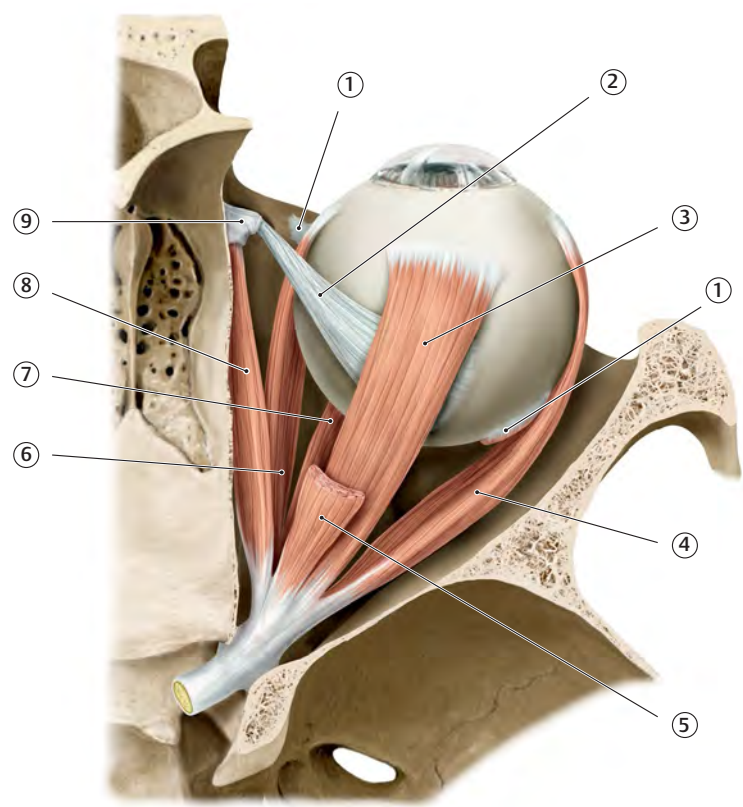
Structures of the Superior Orbital Region: Superior View



Structures of the Superior Orbital Region: Superior View

- ① Supratrochlear n.
- ② Levator palpebrae superioris
- ③ Lacrimal gland
- ④ Lacrimal a. and n. (CN V1)
- ⑤ Superior rectus
- ⑥ Abducent n. (CN VI)
- ⑦ Superior ophthalmic v.
- ⑧ Frontal n. (CN V1)
- ⑨ Trochlear n. (CN IV)
- ⑩ Nasociliary n. (CN V1)
- ⑪ Supraorbital a.
- ⑫ Supraorbital n.
- ⑬ Posterior ethmoidal a. and n.
- ⑭ Supratrochlear a.
- ⑮ Anterior ethmoidal a. and n.
- ⑯ Infratrochlear n.

Extraocular Muscles I: Superior View



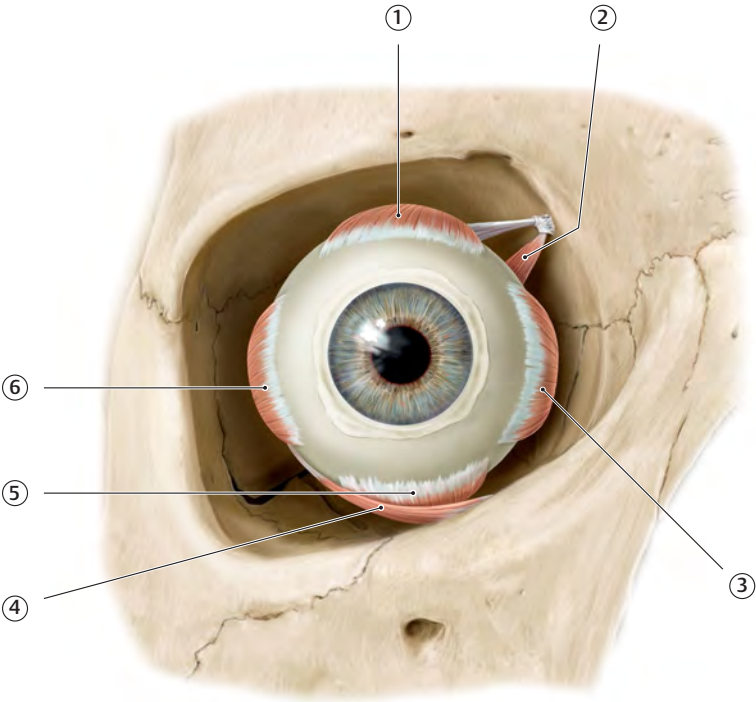
Extraocular Muscles I: Superior View

- ① Inferior oblique
- ② Tendon of superior oblique
- ③ Superior rectus
- ④ Lateral rectus
- ⑤ Levator palpebrae superioris (cut)
- ⑥ Medial rectus
- ⑦ Inferior rectus
- ⑧ Superior oblique
- ⑨ Trochlea



The extraocular muscles work together to move the eyeball within the orbit. The levator palpebrae superioris muscle inserts into the superior palpebra and functions to open the palpebral fissure.

Extraocular Muscles II: Anterior View



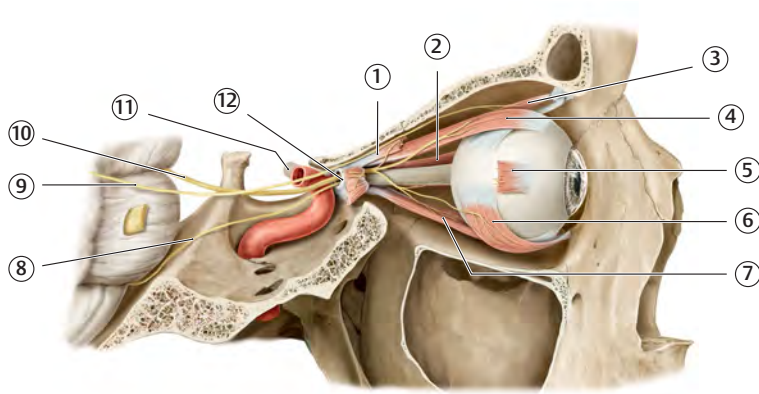
Extraocular Muscles II: Anterior View

- ① Superior rectus
- ② Superior oblique
- ③ Medial rectus
- ④ Inferior oblique
- ⑤ Inferior rectus
- ⑥ Lateral rectus



The tendon of the superior oblique muscle passes through the trochlea in the superior medial orbit before traveling posteriorly and laterally to reach the eyeball. Note that the inferior rectus muscle arises from the anterior medial floor of the orbit and travels laterally to insert on the eyeball.

Extraocular Muscles and Nerves of the Orbit: Lateral View



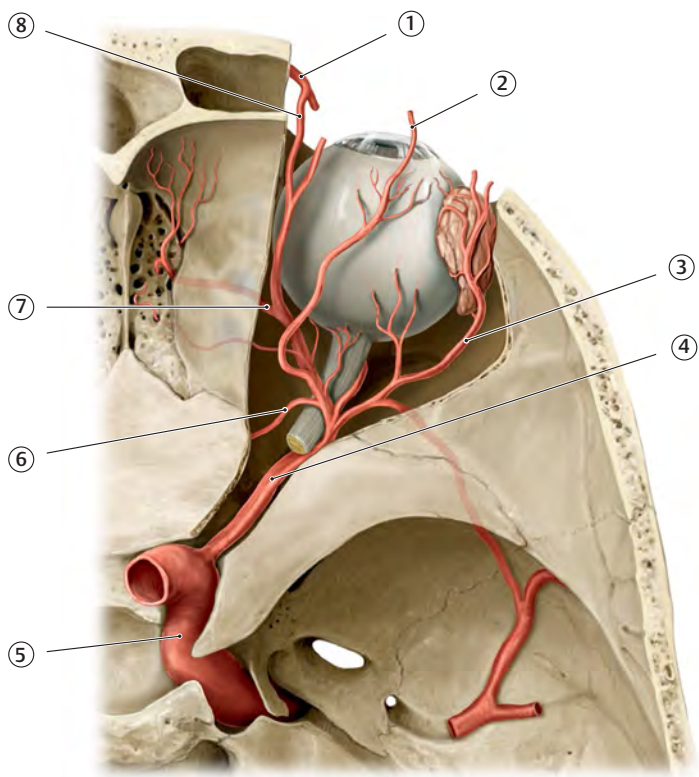
Extraocular Muscles and Nerves of the Orbit: Lateral View

- ① Levator palpebrae superioris (cut)
- ② Medial rectus
- ③ Superior oblique
- ④ Superior rectus
- ⑤ Lateral rectus (cut)
- ⑥ Inferior oblique
- ⑦ Inferior rectus
- ⑧ Abducent n. (CN VI)
- ⑨ Trochlear n. (CN IV)
- ⑩ Oculomotor n. (CN III)
- ⑪ Optic n. (CN II)
- ⑫ Common tendinous ring



The extraocular muscles of the orbit (and levator palpebrae superioris) are innervated by the oculomotor n. (CN III) with the exception of the superior oblique muscle, which is innervated by the trochlear n. (CN IV), and the lateral rectus muscle, which is innervated by the abducent n. (CN VI).

Arteries of the Orbit: Superior View



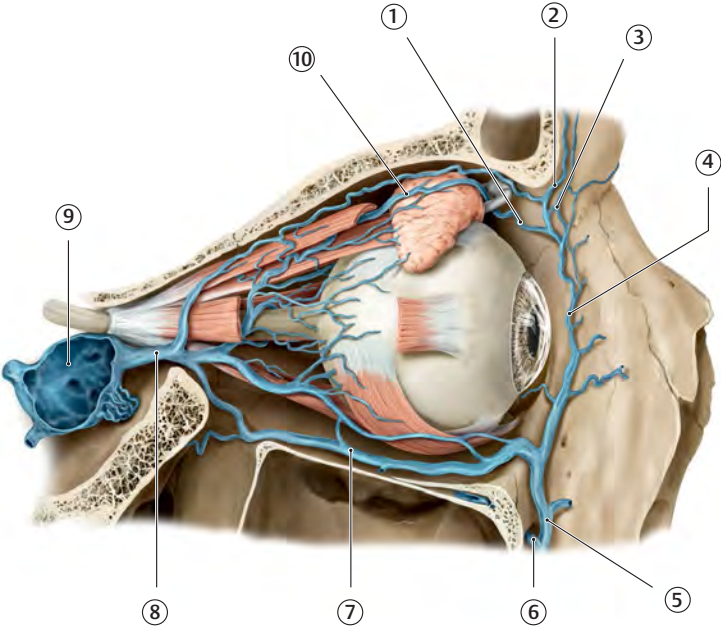
Arteries of the Orbit: Superior View

- ① Dorsal nasal a.
- ② Supraorbital a.
- ③ Lacrimal a.
- ④ Ophthalmic a.
- ⑤ Internal carotid a.
- ⑥ Posterior ethmoidal a.
- ⑦ Anterior ethmoidal a.
- ⑧ Supratrochlear a.



The primary blood supply to the structures of the orbit and eye is derived from the ophthalmic branch of the internal carotid a. The ophthalmic a. enters into the orbit with the optic n. (CN II) through the optic canal. Some of the arteries of the orbit, including the dorsal nasal, supraorbital, supratrochlear, and lacrimal, continue on to the face after supplying the contents of the orbit.

Veins of the Orbit: Lateral View



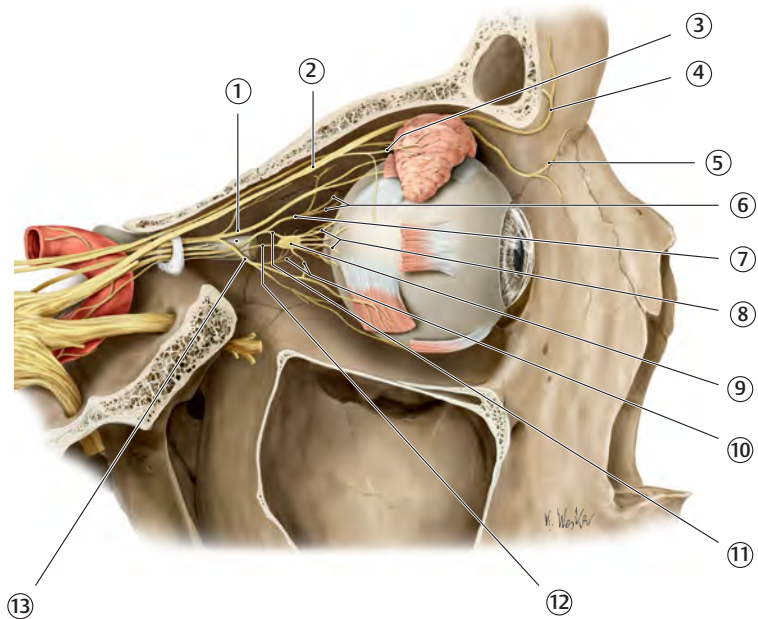
Veins of the Orbit: Lateral View

- ① Dorsal nasal v.
- ② Supraorbital v.
- ③ Supratrochlear v.
- ④ Angular v.
- ⑤ Facial v.
- ⑥ Infraorbital v.
- ⑦ Inferior ophthalmic v.
- ⑧ Ophthalmic v.
- ⑨ Cavernous sinus
- ⑩ Superior ophthalmic v.



The superior and inferior ophthalmic vv. communicate anteriorly with the veins of the face and posteriorly with the cavernous sinus. This pathway allows for the potential spread of infections from the face into the dural venous system.

Nerves of the Orbit and Ciliary Ganglion: Lateral View



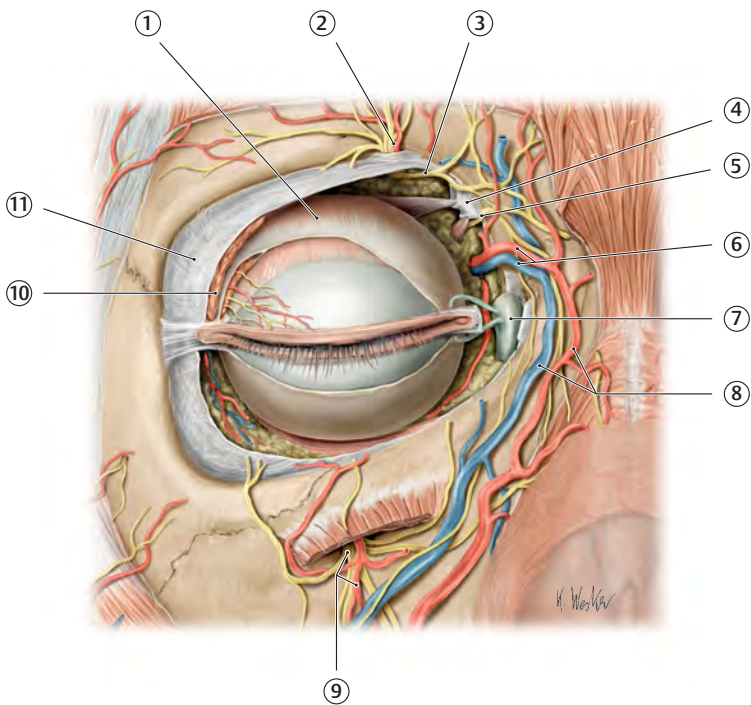
Nerves of the Orbit and Ciliary Ganglion: Lateral View

- ① CN III, superior branch
- ② Frontal n. (CN V1)
- ③ Lacrimal n. (CN V1)
- ④ Supraorbital n. (CN V1)
- ⑤ Infratrochlear n. (CN V1)
- ⑥ Long ciliary nn.
- ⑦ Nasociliary n. (CN V1)
- ⑧ Short ciliary nn. (from ciliary ganglion)
- ⑨ Ciliary ganglion
- ⑩ Parasympathetic (motor) roots of ciliary ganglion (from CN III)
- ⑪ Sensory root of ciliary ganglion (to nasociliary n.)
- ⑫ Sympathetic root of ciliary ganglion (from superior cervical ganglion)
- ⑬ CN III, inferior branch



Preganglionic parasympathetic fibers from the oculomotor n. (CN III) synapse in the ciliary ganglion. Postganglionic parasympathetic fibers travel as the short ciliary nn. to the back of the eyeball. Sensory and postganglionic sympathetic fibers may also pass through the ciliary ganglion (where they do not synapse) and therefore may also be a component of a short ciliary n. Long ciliary nn. are sensory branches of the nasociliary n. (CN V1) and may also carry postganglionic sympathetic fibers.

**Structures of the Anterior Orbital Region:
Anterior View**



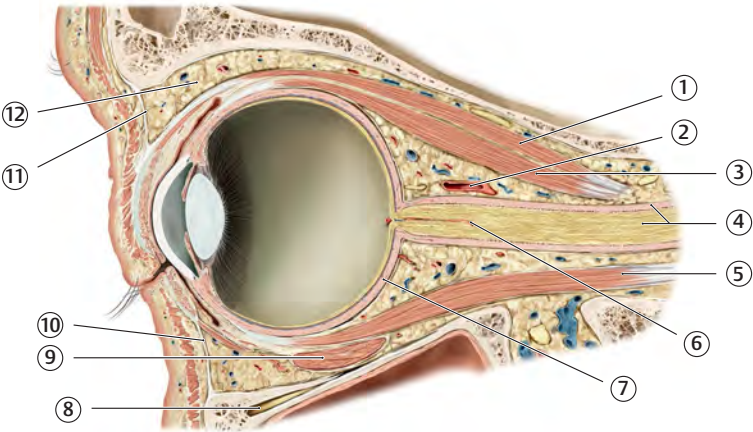
Structures of the Anterior Orbital Region: Anterior View

- ① Levator palpebrae superioris
- ② Supraorbital a. and n.
- ③ Supratrochlear n.
- ④ Trochlea
- ⑤ Infratrochlear n.
- ⑥ Dorsal nasal a. and v.
- ⑦ Lacrimal sac
- ⑧ Angular a. and v.
- ⑨ Infraorbital n. and a.
- ⑩ Lacrimal gland
- ⑪ Orbital septum



The supraorbital and supratrochlear nn. are sensory branches of the frontal n. (CN V1) that emerge from the orbit onto the face. The infratrochlear n., a sensory branch of the nasociliary n. (CN V1), also emerges onto the face. The dorsal nasal a. passes out of the orbit, where it anastomoses with the angular a. on the face.

Orbit Sagittal Section: Lateral View



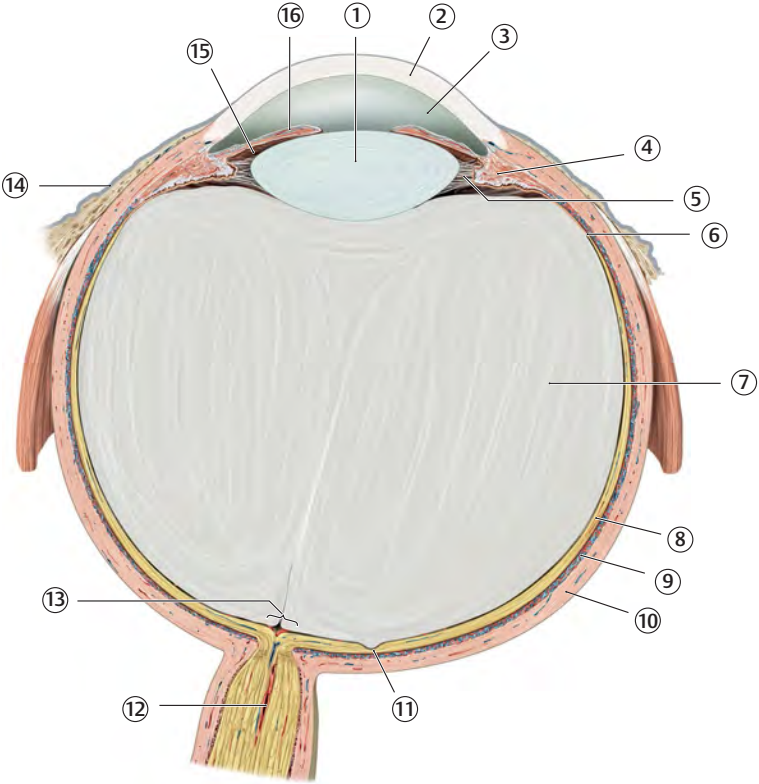
Orbit Sagittal Section: Lateral View

- ① Levator palpebrae superioris
- ② Ophthalmic a.
- ③ Superior rectus
- ④ Optic n. (CN II) with dural sheath
- ⑤ Inferior rectus
- ⑥ Central retinal a.
- ⑦ Sclera
- ⑧ Infraorbital n. (CN V2)
- ⑨ Inferior oblique
- ⑩ Inferior orbital septum
- ⑪ Superior orbital septum
- ⑫ Periorbital fat



The central retinal a., a branch of the ophthalmic a., pierces the optic n. and travels within it in to reach the retina. It is an end artery that does not anastomose with other arteries, such that its occlusion can lead to retinal damage.

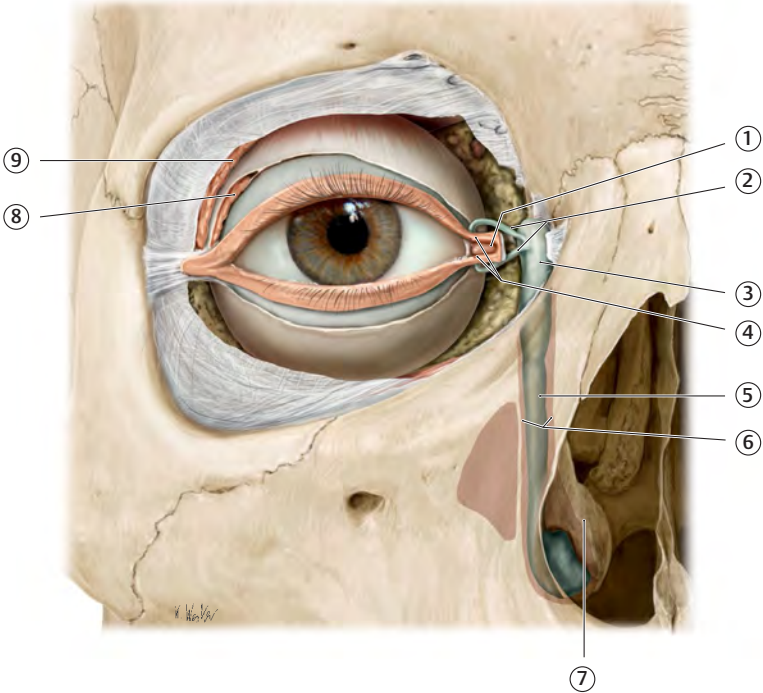
Eyeball: Transverse Section



Eyeball: Transverse Section

- ① Lens
- ② Cornea
- ③ Anterior chamber
- ④ Ciliary body, ciliary muscle
- ⑤ Zonular fibers
- ⑥ Ora serrate
- ⑦ Vitreous body
- ⑧ Retina
- ⑨ Choroid
- ⑩ Sclera
- ⑪ Fovea centralis
- ⑫ Central retinal a. (from ophthalmic a.)
- ⑬ Optic disk
- ⑭ Ocular conjunctiva
- ⑮ Posterior chamber

Lacrimal Apparatus: Anterior View



Lacrimal Apparatus: Anterior View

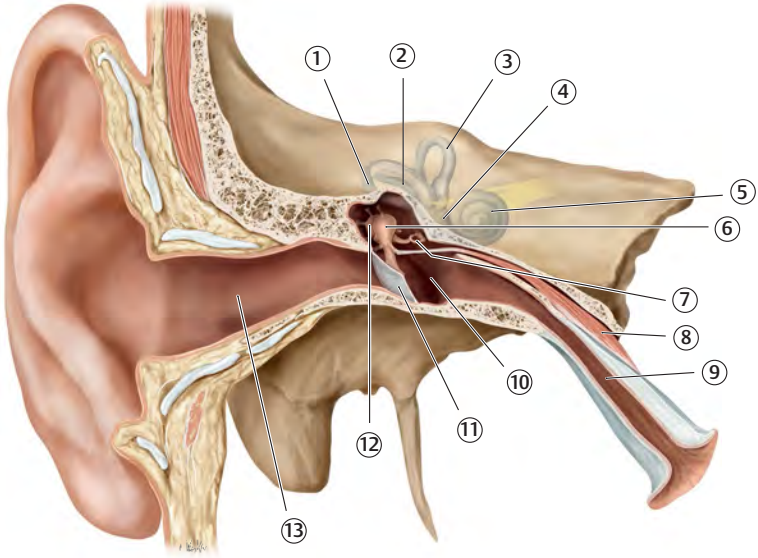
- ① Lacrimal caruncle
- ② Superior and inferior lacrimal canaliculi
- ③ Lacrimal sac
- ④ Superior and inferior puncta
- ⑤ Nasolacrimal duct
- ⑥ Nasolacrimal canal
- ⑦ Inferior nasal concha
- ⑧ Lacrimal gland, palpebral part
- ⑨ Lacrimal gland, orbital part

 Tears (lacrimations) are produced in the lacrimal gland in the superior lateral aspect of the orbit. They are spread across the cornea by the closure of the orbicularis oculi (blinking). The lacrimations are drained from the medial aspect of the orbit into the inferior meatus of the nasal cavity by traveling through the puncta, canaliculi, lacrimal sac, and nasolacrimal duct.

Ear

- Ear: Coronal Section..... 287
- Middle Ear: Anterior View..... 289
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- Cochlea: Cross Section 295

Ear: Coronal Section

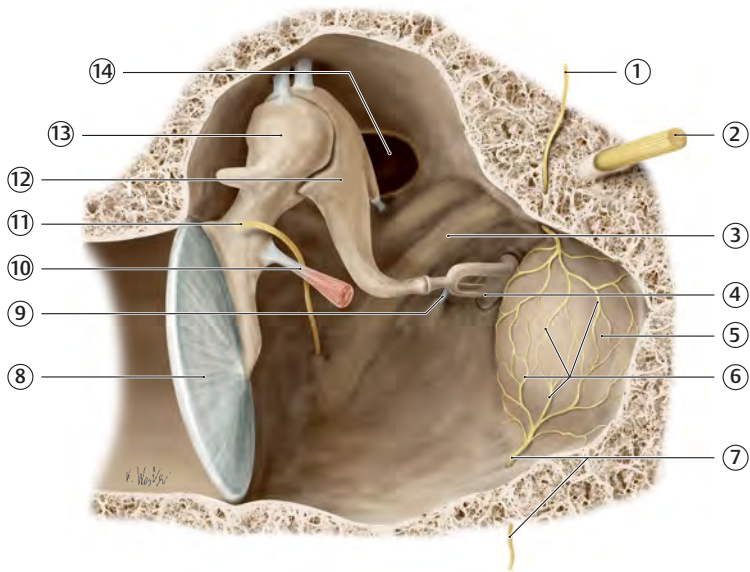


Ear: Coronal Section

- ① Posterior semicircular canal
- ② Lateral semicircular canal
- ③ Anterior semicircular canal
- ④ Vestibule
- ⑤ Cochlea
- ⑥ Malleus, head
- ⑦ Stapes
- ⑧ Tensor tympani
- ⑨ Pharyngotympanic (eustachian or auditory) tube
- ⑩ Tympanic cavity
- ⑪ Tympanic membrane
- ⑫ Incus
- ⑬ External auditory canal

 The external auditory canal is separated from the middle ear (tympanic cavity) by the tympanic membrane. Sound hitting the tympanic membrane is transmitted to the auditory ossicles of the middle ear and from there to the cochlea of the inner ear. The middle ear communicates with the nasopharynx via the pharyngotympanic tube and with the mastoid air cells posteriorly via the aditus of the mastoid antrum (see **Middle Ear: Anterior View**).

Middle Ear: Anterior View

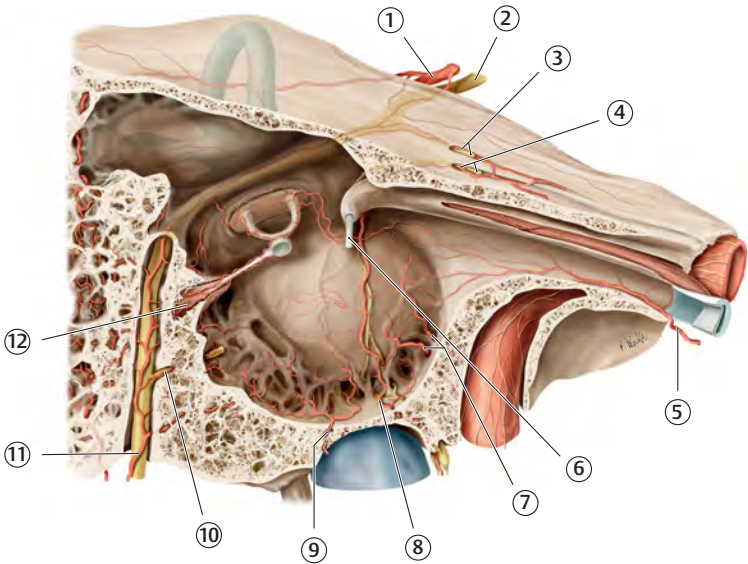


Middle Ear: Anterior View

- ① Lesser petrosal n. (from tympanic plexus)
- ② Facial n. (CN VII)
- ③ Prominence of facial canal
- ④ Stapes
- ⑤ Promontory
- ⑥ Tympanic plexus
- ⑦ Tympanic n. (from CN IX) via tympanic canaliculus
- ⑧ Tympanic membrane
- ⑨ Tendon of stapedius
- ⑩ Tensor tympani (cut)
- ⑪ Chorda tympani (CN VII)
- ⑫ Incus
- ⑬ Malleus
- ⑭ Aditus (inlet) to mastoid antrum

 The tympanic n. (CN IX), containing preganglionic parasympathetic and sensory fibers, enters the middle ear via the tympanic canaliculus, where it forms the tympanic plexus. The lesser petrosal n., consisting of preganglionic parasympathetic fibers, passes from the plexus into the middle cranial fossa on its way to the infratemporal fossa.

Arteries of the Middle Ear: Anterior View



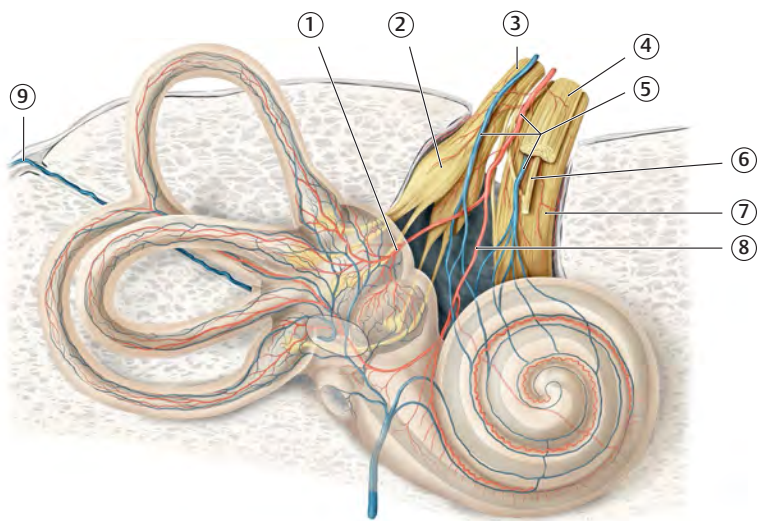
Arteries of the Middle Ear: Anterior View

- ① Labyrinthine a.
- ② Facial n. (CN VII)
- ③ Superficial petrosal a. with greater petrosal n.
- ④ Superior tympanic a. with lesser petrosal n.
- ⑤ Tubal a.
- ⑥ Tendon of tensor tympani (cut)
- ⑦ Caroticotympanic aa.
- ⑧ Inferior tympanic a.
- ⑨ Deep auricular a.
- ⑩ Posterior tympanic a. (from stylomastoid a.)
- ⑪ Stylomastoid a.
- ⑫ Stapedius muscle



The tympanic cavity receives a rich arterial supply from numerous sources. The stapedius and tensor tympani muscles function to dampen sound. Stapedius is innervated by a branch of the facial n. (CN VII) while tensor tympani is innervated by a branch of the mandibular n. (CN V3).

Inner Ear: Anterior View



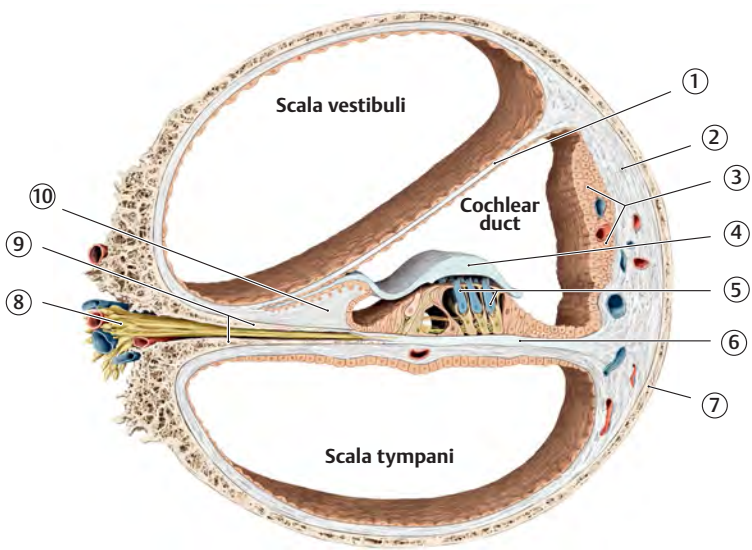
Inner Ear: Anterior View

- ① Vestibular a.
- ② Vestibular ganglion, superior part
- ③ Vestibular n. (CN VIII)
- ④ Facial nerve (CN VII)
- ⑤ Labyrinthine a. and vv.
- ⑥ Nervus intermedius (CN VII)
- ⑦ Cochlear n. (CN VIII)
- ⑧ Cochlear a.
- ⑨ Vein of vestibular aqueduct



The vestibulocochlear n. (CN VIII) consists of two parts: the vestibular n. and the cochlear n. The vestibular n. is the nerve of equilibrium (body position and balance), and the cochlear n. is the nerve of hearing. Each has its own sensory ganglion (see also **Cochlea: Cross Section**).

Cochlea: Cross Section



Cochlea: Cross Section

- ① Vestibular membrane
- ② Spiral lig.
- ③ Stria vascularis
- ④ Tectorial membrane
- ⑤ Outer hair cells
- ⑥ Basilar membrane
- ⑦ Bony wall
- ⑧ Spiral ganglion
- ⑨ Bony spiral lamina
- ⑩ Spiral limbus

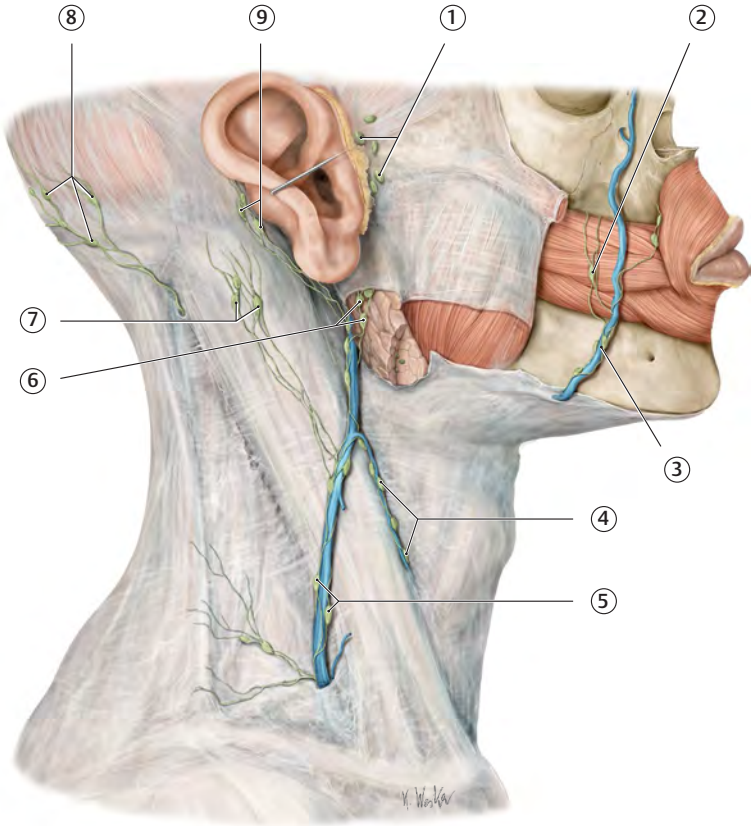


The scala vestibuli and scala tympani are filled with perilymph, whereas the cochlear duct is filled with endolymph. Acoustic waves are transmitted by the basilar membrane to structures within the cochlear duct. There, the hair cells translate them into electrical impulses that are received and relayed by the spiral ganglion.

Lymphatics

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Superficial Lymph Nodes of the Neck: Lateral View



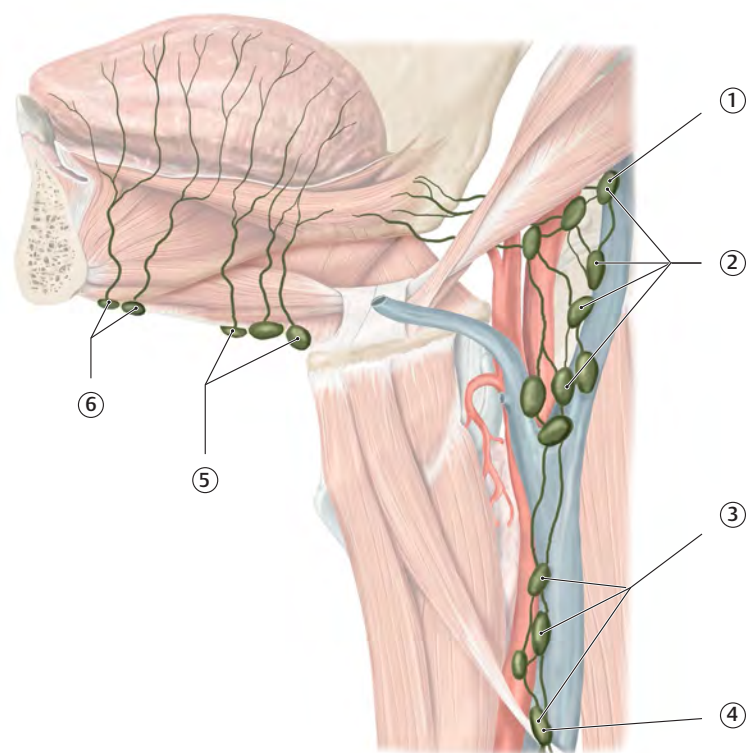
Superficial Lymph Nodes of the Neck: Lateral View

- ① Superficial parotid lymph nodes
- ② Buccal lymph node
- ③ Mandibular lymph nodes
- ④ Anterior superficial cervical lymph nodes
- ⑤ Lateral superficial cervical lymph nodes
- ⑥ Deep parotid lymph nodes
- ⑦ Mastoid lymph nodes
- ⑧ Occipital lymph node
- ⑨ Retroauricular lymph nodes



Lymph nodes are distributed throughout the head and neck. Anatomical regions have distinct collections of lymph nodes that drain those regions.

Deep Lymph Nodes of the Neck: Lateral View



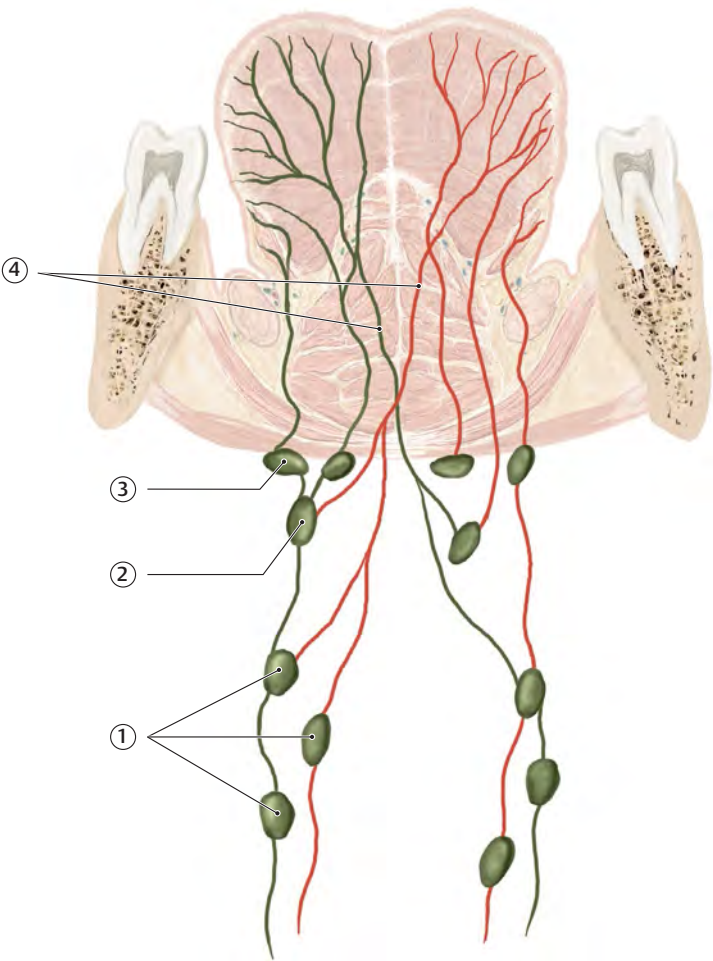
Deep Lymph Nodes of the Neck: Lateral View

- ① Jugulodigastric lymph node
- ② Superior deep cervical lymph nodes
- ③ Inferior deep cervical lymph nodes
- ④ Juguloomohyoid lymph node
- ⑤ Submandibular lymph nodes
- ⑥ Submental lymph nodes



Lymph in the head and neck ultimately drains into the deep cervical lymph nodes. From there, lymph is returned to the venous system at the right and left junctions of the subclavian and internal jugular vv.

Lymphatic Drainage of the Tongue: Anterior View



Lymphatic Drainage of the Tongue: Anterior View

- ① Inferior cervical lymph nodes
- ② Superior cervical lymph nodes
- ③ Submandibular lymph nodes
- ④ Central lymphatic vessels of the tongue

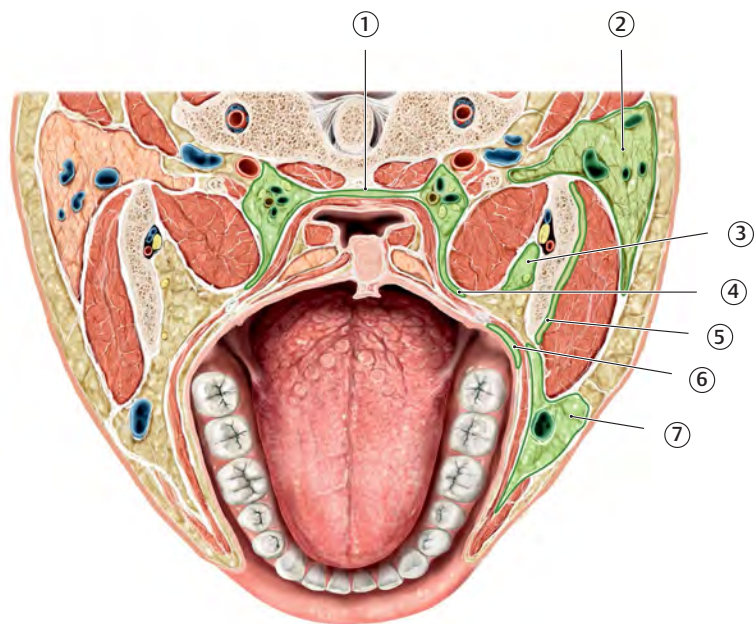


Due to a crossover from side to side of the central lymphatic vessels of the tongue, metastases can spread across the midline.

Potential Spaces and Spread of Infection

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Potential Spaces: Transverse Section



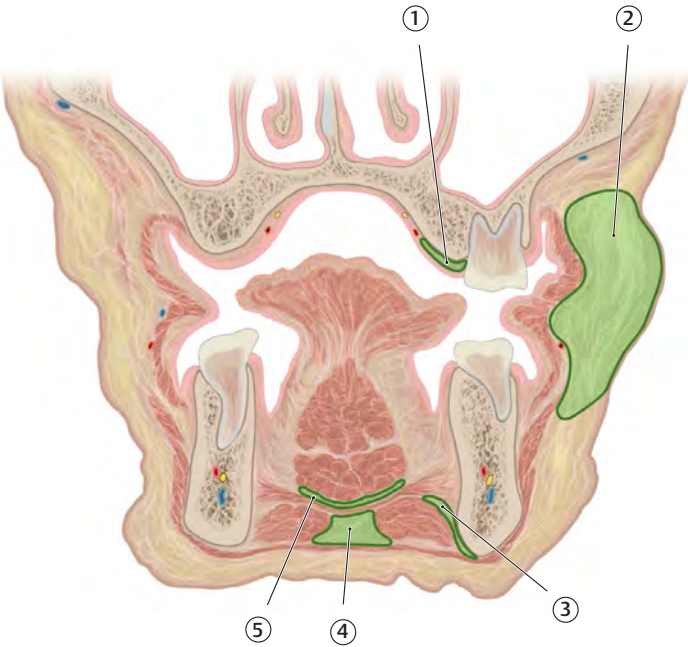
Potential Spaces: Transverse Section

- ① Retropharyngeal space
- ② Parotid space
- ③ Pterygomandibular space
- ④ Parapharyngeal space
- ⑤ Submasseteric space
- ⑥ Peritonsillar space
- ⑦ Buccal (vestibular) space



Potential spaces of the head and neck are possible routes for the spread of infection. These spaces, here outlined in green, are the retropharyngeal space, parapharyngeal space, parotid space, pterygomandibular space, submasseteric space, peritonsillar space, and buccal space. The spaces have communications with each other and with different regions of the body. For example, the retropharyngeal space begins at the base of the skull and continues as the retrovisceral space leading into the thorax. It communicates laterally with the parapharyngeal spaces.

Potential Spaces: Coronal Section

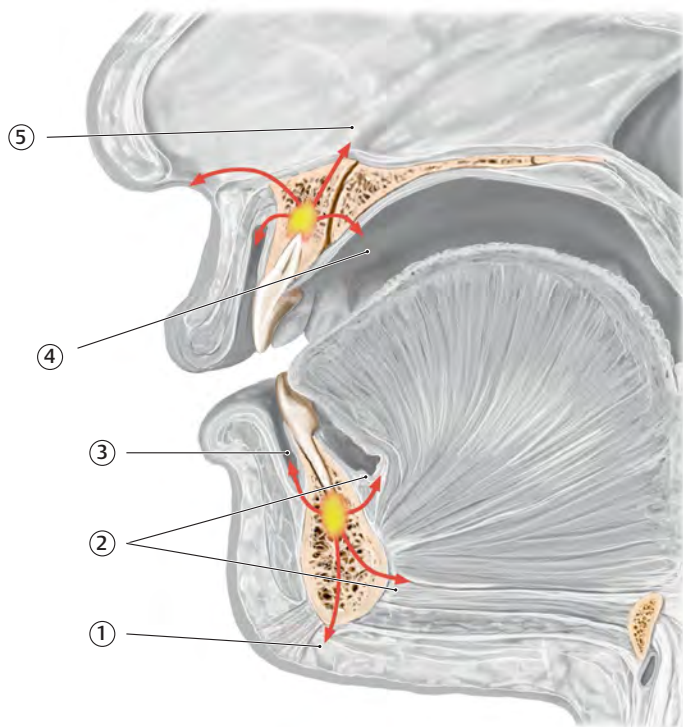


Potential Spaces: Coronal Section

- ① Palatal space
- ② Buccal (vestibular) space
- ③ Submandibular space
- ④ Submental space
- ⑤ Sublingual space

 The sublingual space lies above the mylohyoid muscle within the oral cavity, whereas the submandibular space is inferior to the mylohyoid and external to the oral cavity. However, these spaces communicate with each other behind the posterior free edge of the mylohyoid. In addition, these spaces communicate with the parapharyngeal spaces.

Potential Routes for Spread of Infection I: Sagittal Section



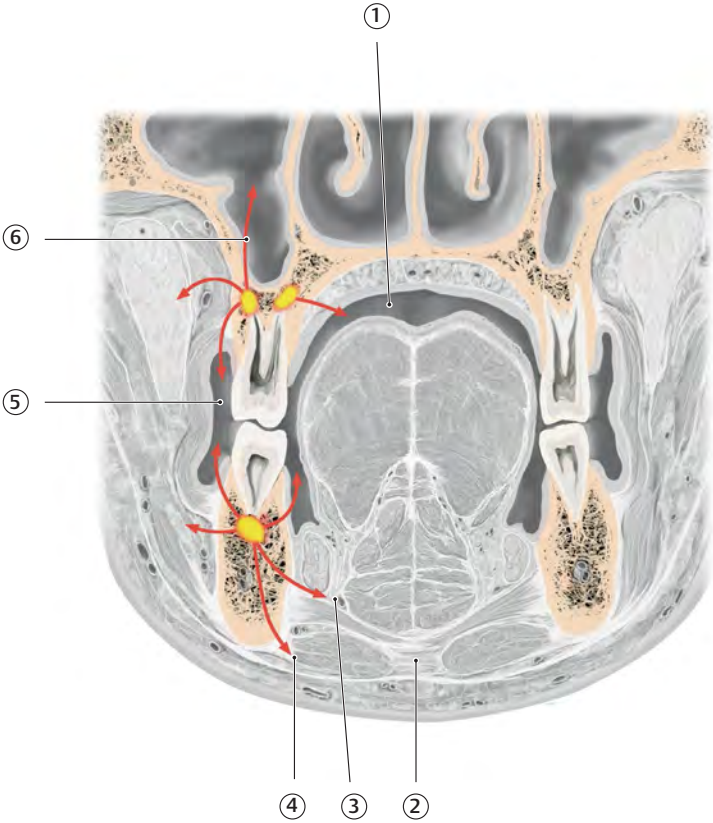
Potential Routes for Spread of Infection I: Sagittal Section

- ① Submental space
- ② Sublingual space
- ③ Lingual (vestibular) space
- ④ Palatal space
- ⑤ Nasal cavity



A dental abscess can rupture, and infection can spread into various spaces within and surrounding the oral cavity. For example, an infection from the dental abscess of a lower incisor can spread into the vestibular space, the sublingual space, or the submental space.

Potential Routes for Spread of Infection II:
Coronal Section



Potential Routes for Spread of Infection II: Coronal Section

- ① Palatal space
- ② Submental space
- ③ Sublingual space
- ④ Submandibular space
- ⑤ Buccal (vestibular) space
- ⑥ Maxillary sinus



Note the possible different routes for the spread of infection from dental apical abscesses. For example, an infection from an abscess of the dental roots in a mandibular molar can spread to the submandibular space and from there into the neck, potentially resulting in Ludwig's angina (a compromise of the respiratory pathway).