Hashemite University
H · U · M
Medical School Committee

Scientific Team
الفريق العلمي

ANATOMY

DONE BY : Volunteer

FASCIA OF THE NECK :

<table>
<tr>
<td>Superficial fascia</td>
<td>Contents :
<table>
<tr><th>Platysma</th><th>Superficial veins</th><th>Cutaneous branches of cervical plexus</th></tr>
<tr><td>subcutanous muscle
• It is supplied by the facial nerve (cervical branch)
• It is one of the muscles of facial expression (depresses mandible & angle of the mouth)</td><td>– External jugular veins
– Anterior jugular veins</td><td>--</td></tr>
</table>
</td>
</tr>
<tr>
<td>Deep fascia</td>
<td>It is condensed to form the following four layers:
<table>
<tr><th>Investing layer</th><th>Pretracheal fascia</th><th>Prevertebral fascia</th><th>Carotid sheath</th></tr>
<tr><td>• It surrounds the neck like a Collar.
• Invest the sternomastoid muscles and trapezius. Invest the parotid and submandibular gland, its thickening forms stylomandibular ligament between the two glands</td><td>• It lies anterior to the trachea & attached to the thyroid cartilage.

• Encloses viscera of neck: pharynx, larynx, trachea, esophagus.

• It invest thyroid gland and parathyroid glands.</td><td>• Lies anterior to bodies of cervical vertebrae and prevertebral muscles.

• Forms the floor of posterior triangle</td><td>It is a condensation of fibro -areolar tissue, surrounds common & internal carotid arteries, internal jugular vein & vagus nerve.

• Ansa cervicalis is embedded in its anterior wall.
• Sympathetic chain lies behind the sheath.</td></tr>
</table>
Thyroid gland & its swelling moves with deglutition</td>
</tr>
</table>

TRIANGLES OF THE NECK :

Sternomastoid muscle:

▪ **Actions :**	One muscle bends the head to its own side & turns face to opposite side. Both muscles acting together pull the head forwards & flex the neck.
▪ **Nerve supply**	1. Motor → Spinal accessory 2. Proprioceptive → C2,3
▪ **Torticollis of sternomastoid**	▪ congenital as a result of excessive stretching of sternomastoid during a difficult labour. ▪ Spasmodic due to repeated inflammations (myositis)

ACCESSORY NERVE (XI):

formed of 2 separate parts spinal &cranial

Cranial Part	**Exit from brain:** (Medulla) groove between olive and inferior cerebellar peduncle below vagus nerve. It runs to jugular foramen where it unites with spinal part. **Exit from skull:** Through jugular foramen with vagus and glossopharyngeal nerves. After its exit from jugular foramen, it separates from spinal part and unites with vagus. It is d**istributed to pharynx, palate and larynx through pharyngeal and recurrent laryngeal branches of vagus**
Spinal Part	Axons of nerve cells in spinal accessory nucleus (found in upper 5 cervical segments). Ascend and enter cranial cavity through foramen magnum. Joins cranial root as they pass to jugular foramen. Separates from cranial root and supplies sternomastoid and trapezius

The Neck is divided by sternomastoid muscle into two Triangles : Posterior triangle and Anterior triangle.

Posterior triangle

Boundaries

Anterior	posterior border of sternomastoid
Posterior	anterior border of trapezius
Base	clavicle
Apex	meeting of sternomastoid & trapezius.
Roof	▪ Skin ▪ superficial fascia containing (platysma) ▪ The investing layer of deep fascia of neck
Floor	Muscular floor 3 muscles 1. Scalenus medius 2. Levator scapulae 3. Splenius capitis((All muscles are covered by prevertebral fascia))

Contents

muscle	Inferior belly of omohyoid It divides the posterior triangle into : Large occipital triangle (above it) Small supra -clavicular triangle (below it)
Lymph Nodes	Along posterior border of sternomastoid: • Supraclavicular L.N. • Occipital L.N.
Nerves	Roots & trunks of brachi al plexus Four cutaneous branches of cervical plexus Spinal accessory nerve
Arteris	

In the lower part	**At the apex**
1. 3rd part of subclavian artery 2. Suprascapular artery 3. Transverse cervical artery	3rd part of occipital artery

Veins	1. Subclavian vein 2. Suprascapar vein 3. Transverse cervical vein 4. Lower part of external jugular v

Anterior triangle	
Definition :	A large triangular space on each side of the neck situated in front of sternomastoid muscle The triangle is inverted with its apex down its base up
Boundaries	

Apex	down manubrium sterni
Base	up by the lower border of the body of mandible, and a line extending from the angle of mandible to the mastoid process.
Anterior	midline of the neck from chin to manubrium sterni
Posterior	sternocleidomastoid. Its anterior margin

Division of the Anterior triangle	divided by Y shaped hyoid bone . -3 muscles attached to it (2 digastric + superior belly of omohyoid) into 4 triangles on each side: **1. Digastric triangle** **2. Carotid triangle** **3. Muscular triangle** **4. ½ submental triangle**

	1. Digastric triangle
Boundaries	

Anteriorly	Anterior belly of digastric muscle
Posteriorly	Posterior belly of digastric and stylohyoid muscles.
Superiorly (base)	Inferior border of mandible and a line drawn from angle of mandible to mastoid process.
Roof	1-Skin 2-Superficial fascia, 3-deep fascia ***(investing layer***), which splits to enclose submandibular salivary gland
Floor	1. Mylohyoid and 2. Hyoglossus muscles.

Contents

Glands and lymph nodes	1-Submandibular Gland. and submandibular LN 2-Parotid Gland	
Nerves	Cranial	1- vagus nerve x 2- spinal accessory XI 3- hypoglossal nerve XII
	Muscula	Nerve to mylohyiod
Vessels	ECA, ICA, IJV, Facial artery , Jugular vein	

	2- Submental triangle
Definiton	A median triangle that is formed by meeting of the two triangles superiorly between the chin and hyoid bone
Boundaries	**on right side**: Anterior belly of digastric **on left side**: Anterior belly of digastric **inferiorly**: Hyoid bone **Floor**: 2 mylohyoid muscles meeting at mylohyoid raphe
Contents	1. Submental arteries 2. Submental veins 3. Submental lymph nodes

	3- Carotid triangle
Boundarie	**Superiorly**: Posterior belly of the digastric **Anteriorly**: Superior belly of omohyoid. **Posteriorl**: Anterior border of sternomastoid **Roof**: 1. Skin 2. Superfisial fascia 3. Investing layer of the deep fascia **Floor**: Ant: Hyoglossus and thyrohoid ms. Post: pharyngeal wall middle and inferior constrictor muscles
Contents	**Arteries**: ICA, ECA, CCA . Carotid sinus 5 Branches of ECA : a)Superior thyroid b) Ascending pharyngeal c) Lingual d)Facial e) Occipital **veins**: Internal jugular veins (IJV) and 4 tributaries 1- pharyngeal veins 2- lingual vein 3- common facial vein 4- superior thyroid vein **Carotid sheath**: with its vascular and nervous contents **LN**: Deep cervical lymph nodes / situated along the IJV **Nerves**: **Within the carotid sheath**: Last 3 cranial ns X , XI, XII. **Anterior to the carotid sheath**: Ansa cervicalis **Posterior to the carotid sheath**: Sympathetic ch

4- Muscular Triangle

Boundaries

Anteriorly	median line of neck
Postero-superiorly	Superior belly of omohyoid
Postero-inferiorly	Anterior border of sternomastoid
Roof	Skin, superficial fascia & investing deep cervical fascia
Floor	Pre-tracheal fascia

Contents

The infrahyoid muscles : Lie under hyoid bone

• Arranged into 2 layers:

Superficial

1. sternohyoid	Arise from the posterior surface of manubrium sterni to the lower border of hyoid bone
2. omohyoid	Has 2 bellies: superior & inferior • Origin of superior belly from hyoid bone • Origin of inferior belly from scapula • Insertion →both bellies join an intermediate tendon kept in position by a fibrous loop connecting it to clavicle

Deep

1.sternothyroid	Arise from the manubrium sterni to thyroid cartilage
2. thyrohyoid	Arise thyroid cartilage to the hyoid bone

• All infrahyoid muscles are supplied by ansa cervicalis C1,2,3, except **thyrohyoid** which is supplied directly by <u>C1 joining hypoglossal n</u>

• All infrahyoid muscles depress the hyoid bone ONLY except the **Thyrohyoid** <u>CAN elevate larynx also</u>.

Development of head & neck

After formation of the head fold, the buccopharyngeal membrane is buried at the bottom of an ectodermal depression called stomodeum "primitive mouth" in between the forebrain cranially and the primitive heart caudally.

In the 4th and 5th weeks

<table>
<tr><td></td><td>six elevated bars appear, on each side, in the region between the stomodeum and the primitive heart.
They contribute in the development of the neck and face. It surrounds the primitive pharynx so it is called Pharyngeal arches
They are also called "branchial arches" because they resemble the gills (branchia) of fishes however, the term pharyngeal is better</td></tr>
<tr><td>Each arch has 3 elements</td><td>1. an ectodermal covering,
2. an endodermal lining
3. a mesenchymal core which is derived from 2 sources:<table><tr><td>The paraxial mesoderm</td><td>which forms the arch musculature (a group of striated muscles which may migrate)</td></tr><tr><td>Migrating neural crest cells</td><td>migrate from the hindbrain into the mesenchyme of future head which form a skeletal element (an arch cartilage).</td></tr></table></td></tr>
<tr><td>Branchial (pharyngeal) apparatus</td><td>• 5 grooves are seen internally and externally between the arches.
• The internal grooves, lined by endoderm, are called "pharyngeal pouches"
• The external grooves, lined by ectoderm, are called "pharyngeal clefts".
• The endoderm and ectoderm in the bottom of the grooves are in contact, with no intervening mesoderm.
These thin membranes rupture in fishes but remain intact in man.</td></tr>
</table>

During 5th week of development

<table>
<tr><td></td><td>
<table>
<tr><td>The 1st pharyngeal arch</td><td>(primordium of the jaws)
on each side, divides into 2 prominences :
<table>
<tr><td>Smaller upper maxillary prominence</td><td>which gives rise to the maxilla (upper jaw), zygomatic , palatine & temporal bones</td></tr>
<tr><td>Larger lower mandibular prominence</td><td>which forms the mandible (lower jaw</td></tr>
</table>
</td></tr>
<tr><td>mesoderm of the 2nd arch</td><td>proliferates causing its surface overgrows 3 rd & 4 th arches
cover the 2nd, 3rd & 4th clefts & finally it fuses with the ectodermal covering of the 6th arch. forming an ectodermal depression known as the cervical sinus
A temporary cavity lined with ectoderm “the cervical sinus” is formed and buried beneath the surface ectoderm. It soon disappears</td></tr>
</table>
</td></tr>
<tr><td></td><td>
<table>
<tr><td>The 1st cleft</td><td>persists & gives the external auditory meatus + the outer surface of the tympanic membrane.
The auricle develops from 6 hillocks (elevations) that appear around the external auditory meatus and later fuse together.</td></tr>
<tr><td>2 nd – 4 th pharyngeal clefts & cervical sinus</td><td>disappear, giving the neck a smooth contour.</td></tr>
</table>
</td></tr>
<tr><td></td><td>mesenchyme of each arch is invaded by:
<table>
<tr><td>An aortic arch</td><td>which connects the aortic sac with the corresponding dorsal aorta</td></tr>
<tr><td>A cranial nerve</td><td>derived from the adjacent hind brain. The arches appear in a cranio-caudal sequence</td></tr>
</table>
</td></tr>
</table>

Components of pharyngeal arches

Artery (aortic arch)	that arises from the truncus arteriosus of the primordial heart & runs around the primordial pharynx to enter the dorsal aorta
Cartilage	that forms the skeleton of the arch
Muscular	component which gives rise to the muscles in head & neck
Nerve	that supplies the muscles derived from the arch

CARTILAGE :

<table>
<tr><td>1st arch</td><td>
<table>
<tr><td>(Mandibular arch) :</td><td>Its cartilage is called Meckel ’ s cartilage It disappears leaving 2 remnants (incus & malleus) in middle ear
The mesenchyme around Meckel ’ s cartilage gives : Neural crest
1. Mandible, by membranous ossification
2. Sphenomandibular ligament .
3. Spine of sphenoid .
4. Anterior ligament of malleus</td></tr>
<tr><td>maxillary process</td><td>Maxilla, zygomatic, palatine & squamous temporal bones, by membranous ossification .</td></tr>
</table>
</td></tr>
<tr><td>2nd arch</td><td>(Hyoid arch):
Its cartilage is called Reichert’s cartilage.
It gives: 1. Stapes. 2. Styloid process. 3. Stylohyoid ligament. 4. Lesser cornu & upper part of the body of hyoid bone.</td></tr>
<tr><td>3rd arch</td><td>Its cartilage ossifies to form the greater cornu & inferior part of the body of the hyoid bone. 2nd & 3rd</td></tr>
<tr><td>4th & 6th</td><td>They fuse (as the 5th arch disappears) to form all laryngeal cartilages (e.g. thyroid & cricoid cartilages), EXCEPT the epiglottis.</td></tr>
</table>

Derivatives of pharyngeal arch muscles:

-1st pharyngeal arch	→ Muscles of mastication (4) + 4 other muscles: 2 tensor (palati & tympani) and 2 adjacent muscles (mylohyoid & anterior belly of digastric)
-2nd pharyngeal arch	Muscles of facial expression + 4 other muscles: Stapedius (in middle ear), platysma and 2 adjacent muscles (stylohyoid & posterior belly of digastric)
-3rd pharyngeal arch	Only one muscle (Stylopharyngeus muscle).
-4th pharyngeal arch	Cricothyroid - Pharyngeal constrictors – Levator palati.
-6th pharyngeal arch	All muscles of the larynx EXCEPT cricothyroid muscle.

Nerve supply of pharyngeal arches: 5 – 7 – 9 – 10 & 11 [1975]

Each arch is supplied by a cranial nerve (CN) which supplies the muscles derived from this arch (Motor)

-1st pharyngeal arch	Mandibular division of trigeminal N. 5
-2nd pharyngeal arch	Facial N. 7
-3rd pharyngeal arch	Glossopharyngeal N. 9
-4th pharyngeal arch	Superior laryngeal branch of vagus nerve. 10 (+ 11th CN)
-6th pharyngeal arch	Recurrent laryngeal branch of vagus nerve. 10 (+ 11th CN)

NOTES :

The mesenchyme of 1 st pharyngeal arch contributes widely to the dermis & the mucous membranes of the head & neck, thus, *the trigeminal nerve (5 th CN) [nerve of 1 st arch] is the main sensory nerve of the head & neck*.

Nerves of 2 nd – 6 th arches have little sensory distribution.

Pharyngeal pouches: 4

<table>
<tr><td></td><td>The endoderm of primordial pharynx lines the inner aspect of the pharyngeal arches & passes into diverticula known as the pharyngeal pouches.
The pharyngeal pouches lie in-between the pharyngeal arches (e.g. 1 st pouch lie between 1 st & 2 nd arches). .
4 pairs of pharyngeal pouches are well defined & the 5th pair is absent or rudimentary
The endoderm of pharyngeal pouches contacts the ectoderm of pharyngeal clefts & together they form the double layered pharyngeal membranes</td></tr>
<tr><td>1st pouch</td><td>Tympanic cavity (middle ear) & auditory tube.
The 1 st pharyngeal membrane forms the tympanic membrane (eardrum).
Thin layer of mesenchyme
1 st pharyngeal cleft forms the external auditory meatus.</td></tr>
<tr><td>2nd pouch</td><td>Palatine tonsil. .The endoderm gives tonsillar sinus & crypts while, surrounding mesenchyme forms the lymphoid tissue</td></tr>
<tr><td>3rd pouch</td><td><table><tr><td>Dorsal part</td><td>Inferior parathyroid glands (parathyroid III)</td></tr><tr><td>Ventral part</td><td>Thymus gland</td></tr></table>Both lose their connections with the pharynx, separate from each other & migrate downwards to lower part of the neck & superior mediastinum respectively</td></tr>
<tr><td>4th pouch:</td><td><table><tr><td>Dorsal part</td><td>Superior parathyroid glands (parathyroid IV)</td></tr><tr><td>Ventral part</td><td>Parafollicular C cells of thyroid gland. (Ultimobrachial body)</td></tr></table>-C cells secretes calcitonin to regulate blood Ca level. They are derived from migrating neural crest cells</td></tr>
</table>

Pharyngeal grooves or clefts: 4

4 pairs of ectodermal grooves that separate the pharyngeal arches externally.
Only 1 st cleft persists to form the external acoustic meatus on each side.
Other clefts Lie within cervical sinus which disappears at 7 th week.
Only 1 st pharyngeal membrane persists --> Tympanic membrane... Other membranes disappear.

Congenital anomalies of pharyngeal apparatus :

<table>
<tr><td>1.Auricular pits & cysts:</td><td>Anterior to the auricle. These are remnants of the 1st pharyngeal groove.</td></tr>
<tr><td>2.Failure of the cervical sinus to obliterate results in:</td><td>Branchial (lateral cervical) sinuses, cysts & fistula.
They open on the side of the neck, along the anterior border of the sternocleidomastoid muscle in inferior 1/3 of the neck.
<table>
<tr><td>Branchial or lateral cervical cysts</td><td>are slowly enlarged, painless swelling on the side of the neck.</td></tr>
<tr><td>Branchial fistula</td><td>opens internally at tonsillar sinus 2nd pharyngeal groove</td></tr>
</table></td></tr>
<tr><td>3.Ectopic parathyroid:</td><td>Inferior parathyroid may descend into thorax with thymus.</td></tr>
<tr><td>4.1 st arch syndromes</td><td>These syndromes result from insufficient migration of neural crest cells into 1 st arch.
<table>
<tr><td>Treacher Collins syndrome</td><td>Malar hypoplasia (under development of zygomatic bone) & deformed external ears.</td></tr>
<tr><td>Pierre Robin syndrome</td><td>Mandibular hypoplasia & cleft palate.</td></tr>
</table></td></tr>
<tr><td>DiGeorge syndrome</td><td>(3 rd & 4 th pharyngeal pouches syndrome):
-Absence of thymus & parathyroids.
Immune deficiency & Increase Ca
-Anomalies of the heart.
-Facial defects as fish mouth & cleft lip.</td></tr>
</table>

Cranial nerves IX and X

Attachment to brain stem	• Hypoglossal XII at groove between pyramid (P) & olive (O) • IX , X , XI at groove between olive &Inferior cerebellar peduncle
Exit from skull	• IX , X , XI through jugular foramen • XII through hypoglossal canal

last 4 cranial nerves are enclosed in carotid sheath at base of skull

Glossopharyngeal nerve IX

Superiorly, glossopharyngeal nerve shows 2 ganglia

Extracranial course:	Passes between I.J.V. & I.C.A. (within carotid sheath). Passes between I.C.A. & E.C.A. It curves forwards to pass between superior and middle constrictors of pharynx and deep to hyoglossus muscle to be distributed to tonsil, tongue (posterior 1/3 and vallate papillae) and pharynx (mucous membrane).
	<table><tr><td>**N ambiguous**</td><td>-> IX -> motor fibers -> stylopharyngeous ms (*3rd arch*)</td></tr><tr><td>**Inf. Salivar N**</td><td>-> IX -> parasymp fibers (*along fascial & trigeminal n*) -> parotid gland (*secretion*) by otic ganglia</td></tr><tr><td>**Solitary N**</td><td>-> IX -> special sensitive fibers (taste, carotid sinus)--> tongue(*post 1/3*), carotid, pharynx, tonsil, ear -> general sensitive fibers (*along IX*) -- > trigeminal spinal tract/ trigeminal nucleus</td></tr></table>
Branches	<table><tr><td>**Tympanic branch**</td><td>enters middle ear & share in forming tympanic plexus gives the lesser petrosal n. (for parotid gland)+ sensory supply to mucosa of middle ear</td></tr><tr><td>**Carotid branch**</td><td>supply the carotid sinus & carotid body</td></tr><tr><td>**Pharyngeal branch**</td><td>share in pharyngeal plexus supply pharynx by sensory fibres (*vagus + cranial accessory – motor fibers*)</td></tr><tr><td>**Muscular**</td><td>branch to stylopharyngeusm</td></tr><tr><td>**Tonsillar**</td><td>supply palatine tonsil & soft palate</td></tr><tr><td>**Lingual**</td><td>(terminal): to mucosa of posterior 1/3 of tongue, carry general sensation &taste sensation.</td></tr></table>
Applied anatomy	• **Gag reflex:** touch mucous membrane of tonsil with a wooden spatula…..the patient gags (the pharyngeal muscles contract) It is a test for both IX & X cranial nerves • **Test for taste** on posterior 1/3 of tongue

Vagus nerve X

Longest cranial nerve

Supplies structures in head & neck, thorax & abdomen

Extracranial course	• Superiorly ,vagus n shows 2 ganglia • is joined by cranial part of accessory nerve, which is distributed through its pharyngeal and recurrent laryngeal branches • Pass vertically down (Between IJV & ICA // Between IJV & CCA) • crosses Rt subclavian artery to enter thorax (on Rt. Side), but passes between Lt. subclavian artery & Lt. C.C.A. to enter thorax (on left. side).
Branches	1-**Meningeal** br. 2-**Auricular** br. 3-**Pharyngeal** nerve: reach middle constrictor to share in pharyngeal plexus. 4-**Superior laryngeal** nerve: it divides into 2 branches: External laryngeal n.& Internal laryngeal n., 5-**2 cardiac** branches 6-**Br to carotid** body 7- **Recurrent laryngeal** nerves • Right one arise in neck & hooks around right subclavian artery, • left one hooks around aortic arch – Both ascend in tracheoesophageal groove – Nerves enter larynx 8-**Pulmonary** branches 9- Vagus n **enters abdomen** to supply abdominal viscera till junction of right2/3 with left 1/3 of transverse colon

Pharynx

Defintion	A muscular tube extending from the base of skull to the lower border of cricoidcartilage (6 cervical vert.) • It lacks the presence of anterior wall • Length : 5 inches
Relations	**Ant** : nose , oral cavity & larynx **post** vertebral column **lat** common carotid , internal & external carotid **sup** base of skull **inf** esophagus
Divided into	nasopharynx, oropharynx & laryngopharynx

Nasopharynx

It lies behind nasal cavities

Roof	Body of sphenoid and basilar part of occipital bone
Floor	Soft palate
anteriorly	It communicates with nasal cavity
inferiorly	It communicates inferiorly with oropharynx through pharyngeal isthmus which lies between posterior wall of pharynx and soft palate

Features

Pharyngeal tonsils	aggregations of lymphoid tissue at roof , atrophies with age if enlarged it is called adenoids it obstructs posterior nasal openings& causes oral breathing & over crowding of teeth
Opening of auditory tube	in lateral wall
Tubal elevation	formed by posterior margin of auditory tube
Salpingopharyngeal fold	extends from the tubal elevation containing salpingopharyngeal muscle
Pharyngeal recess	behind the tubal elevation it is related to internal carotid artery
Tubal tonsil	lymphoid tissue around opening of auditory tube

Oropharynx

Lies behind oral cavity

Roof	soft palate
Floor	posterior part of tongue
Anterior wall	absent it communicates with oral cavity via oropharyngeal isthmus
Posterior wall	2&3 cervical vertebrae
Lateral wall	it shows palatoglossal and palato pharyngeal arches with palatine tonsils in between

Palatine Tonsils :

Lymphoid tissue in lateral wall of oropharynx oval in shape

<table>
<tr><td>it has</td><td>
<table>
<tr><td>Ant border</td><td>related to palatoglossal arch</td></tr>
<tr><td>Post border</td><td>related to palatopharyngeal arch</td></tr>
<tr><td>Upper pole</td><td>related to soft palate</td></tr>
<tr><td>Lower pole</td><td>related to tongue</td></tr>
<tr><td>Lateral surface</td><td>has capsule& resting on tonsillar bed</td></tr>
<tr><td>Medial surface</td><td>free surface which shows tonsillar crypts</td></tr>
</table>
</td></tr>
<tr><td>Tonsillar bed</td><td>1. Superior constrictor muscle
2. Styloglossus
3. Tonsillar artery & ascending palatine branches of facial artery
4. Glossopharyngeal nerve
5. Paratonsillar vein which causes bleeding after tonsillectomy</td></tr>
<tr><td>Blood Supply</td><td>• Tonsillar artery, from facial main supply
• Dorsal Lingual artery
• Greater palatine
• Ascending palatine
• Ascending pharyngeal</td></tr>
<tr><td>Venous drainage</td><td>paratonsillar vein& pharyngeal vein & facial vein</td></tr>
<tr><td>Lymph drainage</td><td>juglodiagatric</td></tr>
<tr><td>Nerve supply</td><td>tonsillar branch of glossopharyngeal nerve</td></tr>
</table>

Laryngopharynx

<table>
<tr><td></td><td>It extends from epiglottis to lower border of cricoid cartilage</td></tr>
<tr><td></td><td>
<table>
<tr><td>Anterior wall:</td><td>inlet of larynx and cricoid cartilage</td></tr>
<tr><td>Posterior wall:</td><td>3-6 cervical vertebrae</td></tr>
<tr><td>Lateral wall</td><td>it shows piriform fossa
<table>
<tr><td>piriform fossa</td><td>aryepiglottic fold</td></tr>
<tr><td>Medial</td><td>thyrohyoid membrane</td></tr>
<tr><td>Lateral</td><td></td></tr>
</table>
Site of foreign body impact that causes cough due to irritation of internal laryngeal nerve</td></tr>
</table>
</td></tr>
</table>

Larynx

	Lies in midline of neck ❑ extending from Epiglottis (root of tongue) to (lower border of cricoid cartilage = C6 where it Continues as Trachea
Relations	**Anteriorly**: Skin - Superficial fascia - deep fascia – infrahyoid muscles **Posteriorly**: laryngeo pharynx - upper part of esophagus
Cartilages	**Single**: Epiglottis - Thyroid cartilage - cricoid cartilage **Paired**: Arytenoid - Corniculate - cuneiform
Extrinsic ligaments	1-Thyrohyoid membrane 2- Cricotracheal ligament
Intrinsic ligaments	**quadrangular membrane**: • It extends between epiglottis • to arytenoid and corniculate cartilage on the same side • The free upper margin form Aryepiglotic fold • The free lower margin form the vestibular ligament under the vestibular fold (***false vocal cord***) **CricoThyroid Ligament**: • It has a free upper margin which form → vocal fold (***true vocal cord***) • It is attached to arch of cricoid cartilage • Extented between thyroid cartilage and arytenoid cartilages (vocal processes)

THE TONGUE

Muscular organ lying in oral cavity used in: 1. Tasting 2. Swallowing (deglutition) 3. Speech

Tongue has :

Root	posterior end, attached to mandible & hyoid bone by muscles
Tip	free anterior end of tongue
Dorsum of tongue	divided by sulcus terminalis into : Anterior 2 /3 --> (oral part) Posterior 1 /3 --> (pharyngeal part) At apex of V shaped sulcus terminalis lies a pit called foramen caecum
Inferior surface	**Lingual frenulum**: mucus membrane fold connecting tongue to mucosa of floor of mouth **Deep lingual vein**: lateral to frenulum **Sublingual folds**: overlying sublingual salivary glands **.Sublingual papilla**: on both sides of frenulum, where submandibular ducts open

Muscles of Tongue

<table>
<tr><td>Intrinsic</td><td>They change the shape of the tongue
They are not attached to bones but lie inside the tongue.
<table>
<tr><td>TRANSVERSE</td><td>Narrow tongue</td></tr>
<tr><td>LONGITUDINAL</td><td>Shorten tongue</td></tr>
<tr><td>VERTICAL</td><td>Flatten tongue</td></tr>
</table></td></tr>
<tr><td>Extrinsic</td><td>
<table>
<tr><td>Palatoglossus</td><td>elevator</td></tr>
<tr><td>Hyoglossus</td><td>depressor</td></tr>
<tr><td>Genioglossus</td><td>protractor</td></tr>
<tr><td>Styloglossus</td><td>retractor</td></tr>
</table>
If genioglossusis paralyzed, tongue falls posteriorly & obstructs the airway➔ suffocation During general anesthesia, there is total relaxation of genioglossus➔ tongue must be prevented from falling backward by inserting an airway (oropharyngeal tube)</td></tr>
<tr><td>Nerve supply</td><td>ALL intrinsic & extrinsic muscles of tongue are supplied by HYPOGLOSSAL NERVE (12th cranial nerve)
EXCEPT <u>PALATOGLOSSUS</u> supplied by CRANIAL ACCESSORY N (11th cranial n) through pharyngeal plexus { like muscles of the palate }</td></tr>
</table>

<table>
<tr><td>Sensory nerve supply of tongue</td><td>
<table>
<tr><td>Ant 2/3</td><td>1. General sensations : lingual n (from trigeminal 5th cranial n)
2. Taste sensation: chorda tympani (from facial 7th cranial n)</td></tr>
<tr><td>Post 1/3</td><td>General & taste by glossopharyngeal nerve (9th cranial n)</td></tr>
<tr><td>Most post part</td><td>infront of epiglottis by internal laryngeal n (from vagus 10th cranial n)</td></tr>
</table></td></tr>
<tr><td>Artery of tongue:</td><td>Lingual artery (branch from external carotid)</td></tr>
<tr><td>Veins of tongue</td><td>Lingual veins: a)Dorsal lingual veins accompany lingual artery b) Deep lingual vein runs on inferior surface of tongue * Lingual veins drain into internal jugular vein</td></tr>
<tr><td>Lymphatic Drainage</td><td>Tip of tongue: to submental L.N. of both sides
<table>
<tr><td>Ant 2/3</td><td>(Margin & body of tongue) : to submandibular L.N. then to deep cervical L.N. (jugulo-digastric or juguloomohyoid L.N.)</td></tr>
<tr><td>Post 1/3</td><td>jugulo-digastric & juguloomohyoid L.N. of both sides</td></tr>
</table></td></tr>
</table>

When quick absorption of a drug is desired, they are placed under the tongue where they dissolve and enter the deep lingual veins in less than a minute

Hypoglossal nerve

<table>
<tr><td></td><td>• Pass between IJV& ICA
• Crosses ICA ,ECA, & lingual artery
• Descends till the lower border of post. belly of digastric& passes forward to enter digastricΔ, running over hyoglossus m. to pass to undersurface of the tongue.</td></tr>
<tr><td></td><td><table>
<tr><td>The first group</td><td>fibres from C 1" related anatomically to hypoglossal
a-Meningeal nerve.: contains sensory & sympathetic fibres supplying bone & meninges of anterior part of posterior cranial fossa.
b-Nerve to thyrohyoid.
c-Nerve to geniohyoid.
d-Descending hypoglossior upper root of ansacervicalis</td></tr>
<tr><td>The second group</td><td>from hypoglossal itself
supplies the following:- -Styloglossus, hyoglossus& genioglossus
+All intrincic muscles. EXCEPT PALATOGLOSSUS</td></tr>
</table></td></tr>
<tr><td>APPLIED ANATOMY</td><td>Complete section of the hypoglossal nerve on one side ➔ unilateral paralysis of tongue
If for a long time➔ atrophy of muscles of the affected half of tongue
If you ask the patient to protrude his tongue ➔ tongue deviates towards the affected side due to the unopposed action of the normal half TONGUE POINTS TOWARDS THE SIDE OF INJURY</td></tr>
</table>

Submandibular region

Submandibular (Suprahyoid) region includes structures in the area between mandible and hyoid bone.

Contents:

Muscles	a) Suprahyoid muscles: digastric, stylohyoid, mylohyoid and geniohyoid . b) Extrinsic muscles of tongue: styloglossus, hyoglossus and genioglossus.
Glands	Submandibular and sublingual salivary glands.
Nerves	Lingual (Submandibular ganglion), glossopharyngeal and hypoglossal nerves
Blood vessels	Lingual and facial vessels

	Digartric	Stylohyoid	Mylohyoid	Geniohyoid	Hyoglossus	Geniogloss
Origin	a) Anterior belly: Digastric fossa of the mandible b) Posterior belly: Digastric notch on medial surface of mastoid process.	Posterior surface of styloid process	Mylohyoid line of the mandible	Inferior genial tubercle of body of mandible	Hyoid bone	Upper genial tubercle of mandible
Insertion	Intermediate tendon which is held to hyoid bone by a fibrous loop	Hyoid bone where its tendon is perforated by the posterior belly of digastric m	a) Anterior & middle fibers inserted into the mylohyoid raphe b) Posterior fibers into hyoid bone	body of hyoid bone	Its fibers run upward deep to mylohyoid to end in posterior ½ of the side of the tongue	Whole length of under surface of tongue
Nerve supply	a) Anterior belly: n. to mylohyoid b) Posterior belly: Facial n.	Facial n	Nerve to Mylohyoid	C1 via Hypoglossal n	Hypoglossal nerve	
Action	a. If the hyoid bone is fixed, it depresses the mandible (helping lateral pterygoid m.). b. Elevate hyoid bone during swallowing.	pulls hyoid bone upward & backward.	a. Elevates the floor of mouth during the early stage of swallowing. b. Helps in depression of the mandible (if the hyoid bone is fixed). c. Supports the floor of the mouth (called diaphragm aoris).	Elevates hyoid bone, or depresses the mandible (if the hyoid bone is fixed)	Depression of the tongue during swallowing	

Problems occur in the digastic because of habitual mouth breathing, which often occurs from chronic sinus problems, nasal blockage such as from nasal polyps, or a deviated septum.

Each belly of the digastric has its own referred pain patterns. The most widespread and common pain is referred from the posterior belly and this causes pain in the upper part of the Sternocleidomastoid.

Lingual artery

Origin	from anterior aspect of ECA in carotid triangle
	Its course is tortuous & is divided by hyoglossusm. into 3 parts :

1st part	(before the m.): forms a loop opposite the greater cornu of hyoid bone, crossed superficially by the hypoglossal n
2nd part	(behind the m.)
3rd part	(beyond the m.) : ascends along the anterior border of hyoglossus then runs on the under surface of tongue to end by anastomosing with its fellow of the opposite side

Submandibular & Sublingual gland

Submandibular gland

It lies deep to the body of mandible in digastric triangle.

Superiorly	up to mylohyoid line
Inferiorly	overlaps intermediate tendon of the digastric
Anteriorly	reaches anterior belly of digastric
Posteriorly	reaches Stylomandibular ligament which separates it from the parotid gland

Parts:
1.Superficial part 2. Post free border 3. Deep part

Relation between lingual nerve & Submandibular duct :
1. Lingual nerve is lateral to the duct. 2. Then inferior. 3. Finally medial.

Site of opening of Submandibular duct : Sublingual papilla
Blood supply :-Facial artery.
Venous drainage :- Common facial vein.
Lymph drainage:- Submandibular L.N

Sublingual gland

Site	1. It occupies sublingual fossa of the mandible. 2. It lies below the mucosa of the floor of the mouth forming the sublingual fold
Shape	Almond shaped with a wide anterior end & a narrow posterior end
Relations	

Superiorly	mucosa of the floor of mouth
Inferiorly	mylohyoid m
Medially	genioglossus (separated from it by lingual n. & Submandibular duct)
Laterally	sublingual fossa of mandible

Blood S	Sublingual branches of lingual a. + Submental branches of facial a
Nerve S	similar to the Submandibular gland

❑Sublingual ducts: 8-20 small ducts that open separately on the summit of the sublingual fold in the floor of the mouth on the side of the frenulum

HISTOLOGY :

Neuron

= nerve cell It is the building unit of the nervous system;
it consists of:

1. cell body (soma):
containing the nucleus and cell organelles

2. processes:
Many short dendrites (receiving inputs) One long axon (conducting outputs) that terminates by making synapses with dendrites of other neurons.
The axons are generally called nerve fibers.

	Types of neurons
According to the number of processes	**1. Unipolar (pseudounipolar):** as in posterior root ganglion. **2. Bipolar:** as in the retina, cochlear & vestibular ganglia **3. Multipolar:** as in most parts of the brain & spinal cord
According to the length of the axon	**1. Golgi type I neuron:** of long axon as in long tracts of brain &spinal cord as in (pyramidal cells of cerebral cortex, Purkinje cells of cerebellar cortex & motor cells of spinal cord) **2. Golgi type II neuron:** of short axon (inhibitory in function), numerous in all parts of the CNS.

1. Nerve cell body (perikaryon) :

<table>
<tr><td>A. The nucleus</td><td>The nerve cell nucleus is spherical, large and open face or (vesicular). It has prominent nucleolus. It is usually central in position.
In autonomic ganglion cells and in Clarke’s column, the nucleus is not central, but is eccentric in position</td></tr>
<tr><td>B. The cytoplasm</td><td>Contains :
<table>
<tr><td>1. Organelles</td><td>
<table>
<tr><td>a.Mitochondria</td><td>abundant in the cytoplasm and in the processes.</td></tr>
<tr><td>b. Golgi complex</td><td>is scattered all around the nucleus (perinuclear).</td></tr>
<tr><td>c. Lysosomes</td><td></td></tr>
<tr><td>D. Nissl bodies or granules</td><td>This is a characteristic feature of the nerve cell. They are large basophilic granules or clumps of basophilic material present in the cytoplasm and dendrites, but absent from the axon and axon hillock. By EM they are formed of cisternae of rER, free ribosomes and polysomesscattered between adjacent cisternae.</td></tr>
<tr><td>e. Neurofilaments</td><td>They are intermediate filaments, 10 nm in diameter present in the nerve cell body and its processes. Neurofilaments of the axon are associated with a system of cross linkers to connect them with microtubules, axolemma.
The neurofilaments provide internal support for the nerve cell. Bundles of neurofilamentsform the neurofibrilsthat are seen by the LM in nerve cells stained by silver.</td></tr>
<tr><td>f. Neurotubules</td><td>are found among the neurofilaments. They keep the shape of the cell and its processes and help in the transport of materials within the cell</td></tr>
<tr><td>g. Centrioles</td><td>are also found in adult cells, although they do not divide. They have an important role in the maintenance of microtubules</td></tr>
</table>
</td></tr>
<tr><td>2. Inclusions</td><td>
<table>
<tr><td>a. Lipofuscin pigment:</td><td>This is a yellow brown pigment which increases with age</td></tr>
<tr><td>b. Melanin pigment:</td><td>This is present in the substantia nigra of midbrain.</td></tr>
</table>
</td></tr>
</table>
Medical application :
Immature nerve cells may produce tumors (medulloblastomas) but adult neurons do not produce tumors because they do not divide</td></tr>
</table>

NOTE:

Nissl bodies, also called “chromatophilic substances”, are large and prominent in motor than in sensory neurons.
Injury to the nerve cell body or of the axon causes disintegration or temporary
Disappearance of Nissl granules which is known as chromatolysis.
*Function of ribosomes: they synthesize new cytoplasmic proteins.

2. The nerve cell processes

They include the axon and the dendrites.

A.The axon	• It arises from the nerve cell body at a region termed the axon hillock. • Axon and axon hillock lack of Nissl bodies. • Axon contains: • thread-like mitochondria • abundant neurotubules, neurofilaments • some elements of sER known as axoplasmic reticulum. • The axon does not contain ribosomes. • The cell membrane of the axon is called axolemma • its cytoplasm is called axoplasm. • The axon is single, of uniform diameter. • It runs more or less a straight course, with a length varying from fraction of a millimeter to one meter or more. • It branches at its end forming terminal arborizations. • The surface of axon is smooth. • The function of the axon is conduction of nerve impulses away from the cell body i.e. centrifugal
B. The dendrites	• These are usually thick and short with tapering ends. • They contain neurofilaments, neurofibrils, mitochondria and Nissl granules. • They show extensive branching like a tree branching, which arise at acute angles. • The surface of the dendrites is rough due to the presence of spines on the surface known as dendritic spines. • The function: dendrites conduct nerve impulses towards the cell body i.e. centripetal conduction.

Axoplasmic (Axonal transport)	**Transport**	
	1.Anterograde transport:	Proteins, glycoproteins and some other macromolecules, together with certain organelles are *transported along the axon away from the cell body*.
	2. Retrograde transport:	This takes place in the axon and dendrites to *transport some of the cytoplasmic components to the cell body* so that they do not accumulate at the fiber terminal. If the axon has become damaged, retrograde flow of substances that normally would not enter the axoplasm, is believed to signal to the cell body the need for axon regeneration. Retrograde flow can also carry infective viruses as rabies and herpes' viruses, or toxins as tetanus toxins from the peripheral tissues to the CNS.
Dendritict	Certain proteins e.g. acetyl choline esterase, which destroys acetyl choline, are transported towards the dendritic terminals.	

The Nerve Fibers

<table>
<tr><td>Definition</td><td>The nerve fiber is the nerve cell process usually the axon.
It may be naked or sheathed.
• In PNS, nerve fibers could be sheathed by one or two types of nerve sheathes (the myelin sheath and or the neurolemma sheath)
• while in the CNS, the nerve fibers could be only sheathed by myelin sheath</td></tr>
<tr><td>Types</td><td>
<table>
<tr><td>1. Myelinated nerve fibers with neurolemma</td><td>These are commonly seen in peripheral nerves.</td></tr>
<tr><td>2. Myelinated nerve fibers without neurolemma</td><td>nerve fibers in the white matter of CNS.</td></tr>
<tr><td>3.Unmyelinated fibers with neurolemma</td><td>nerve fibers of autonomic nervous system and some peripheral nerve fibers.
• Single Schwann cell can envelope several unmeylinated peripheral nerve fibers.
• The nerve fibers were seen to lie singly or in groups in deep longitudinal invaginations of a Schwann cell.
• The original line of invagination is called mesaxon</td></tr>
<tr><td>4. Unmyelinated fibers without neurolemma</td><td>1- grey matter of CNS
2- nerve fibers at their origin or at the nerve terminals</td></tr>
</table>
</td></tr>
</table>

The myelin sheath or medullary sheath

<table>
<tr><td></td><td>This forms a tubular sheath covering the axon.
It is formed of lipoprotein complex material derived from the cell membrane of Schwann cell.
Multiple Schwann cells are needed to form myelin around a single peripheral nerve fiber. The lipid material usually dissolves in ordinary preparations , leaving a network of protein material called neurokeratin.
The myelin can be stained black with osmic acid.
It is interrupted along its course by constrictions called nodes of Ranvier.
The part between 2 nodes is called the internodal segment.
Oblique clefts are seen in the myelin sheath as seen after osmic acid staining, called Schmidt Lantermann clefts.
They may represent tapered cytoplasm between the rolling cell membranes.</td></tr>
<tr><td>Function</td><td>It is an electrical insulator. Conduction of impulses is faster in axons with large diameters and thicker myelin sheath.</td></tr>
<tr><td>Formation of myelin sheath in the peripheral nerve</td><td>(The jelly-roll theory) During development, Schwann cells become arranged along the axon.
Each cell wraps a part of the axon and turns around it.
The internal surface of the opposed regions of Schwann cell membrane comes in contact with each other, while the cytoplasm is squeezed away.
This leads to formation of several turns of the double cell membrane around the axon.
The remaining cytoplasm of Schwann cell forms an outer thin layer containing the nucleus representing the neurolemmal sheath of nerve fiber.</td></tr>
</table>

<table>
<tr><td>The neurolemmal or Schwann cell sheath</td><td>
<table>
<tr><td>Function:</td><td>1. Formation of myelin.
2. Regeneration of damaged axon.
3. Insulation of nerve impulse</td></tr>
<tr><td>cells forming sheathes around nerve fibers are ectodermal in origin and are called</td><td>
<table>
<tr><td>Schwann cell</td><td>in PNS which can form myelin and or neurolemmal sheath</td></tr>
<tr><td>Oligodendrocyte</td><td>n CNS which can only form myelin sheath</td></tr>
</table>
</td></tr>
</table>
</td></tr>
<tr><td>Structure of Peripheral Nerve (Nerve trunk)</td><td>• It is formed of bundles of longitudinally arranged nerve fibers with a connective tissue covering.
• The nerve as a whole is surrounded by fibrous connective tissue sheath called epineurium.
Within the epineurium, nerve fibers form bundles (fascicles), each surrounded by perineurium.
• Each individual nerve fiber within the bundle is surrounded by a delicate sheath of vascular loose connective tissue called endoneurium</td></tr>
</table>

Ganglia

<table>
<tr><td></td><td colspan="2">They are encapsulated ovoid structures containing aggregations of nerve fibers and nerve cell bodies outside the CNS.
Ganglion cells and fibers are supported by connective tissue matrix and are surrounded by CT capsule</td></tr>
<tr><td>Types</td><td colspan="2">
<table>
<tr><td>1. Craniosomatic ganglia</td><td>spinal ganglia and trigeminal ganglia.
• Spinal ganglia :
are fusiform swellings of the dorsal roots of spinal nerves.
• The nerve cells are pseudounipolar rounded in shape having one process which becomes convoluted when leaving the cell, forming branches.
• Both branches have the appearance of axons and are myelinated.
• The nerve cells are relatively few in number arranged in groups separated by bundles of myelinated nerve fibers.
• The ganglion cells have central large vesicular nuclei with prominent nucleoli (Owl’s eye) and the cytoplasm contains prominent Nissl bodies.</td></tr>
<tr><td>2. Autonomic ganglia</td><td>sympathetic and parasympathetic
• They are represented by sympathetic and parasympathetic ganglia.
Sympathetic ganglia are swellings along the sympathetic chain.
• The ganglion cells are stellate multipolar nerve cells with irregular outlines.
They are numerous and scattered throughout the ganglion without grouping and are separated by unmyelinated nerve fibers.
• The nuclei of nerve cells are eccentric in position.
• The ganglion cells are surrounded by discontinuous capsule of satellite cells.</td></tr>
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</td></tr>
</table>

The Synapse

<table>
<tr><td></td><td>It is the site at which nerve impulses are transmitted from one neuron to another
Parts:

<table><tr><td>1. The presynaptic terminal</td><td>is the part of the neuron that delivers impulses at the synapse. It is expanded to form the end bulb, end foot or terminal button</td></tr><tr><td>2. The postsynaptic terminal</td><td>is the part receiving impulses, and its membrane is the postsynaptic membrane</td></tr><tr><td>3. The synaptic cleft</td><td>t is a narrow space separating the pre- and postsynaptic membranes, with is seen only with the EM</td></tr></table></td></tr>
<tr><td>Types</td><td>Synapses are classified according to the site of termination of the axon on the other neuron, into the following types:

<table><tr><td>1. Axodendritic</td><td>the axon of the first neuron makes synapse with the dendrites of the 2nd neuron.</td></tr><tr><td>2. Axosomatic:</td><td>the axon of the first neuron makes synapse with the cell body of the second neuron.</td></tr><tr><td>3. Axoaxonic:</td><td>the axon of the first neuron makes synapse with the axon of the second neuron. Other types of synapses</td></tr></table></td></tr>
<tr><td>Function</td><td>The arrival of a nerve impulse at the synapse leads to depolarization of the presynaptic membrane, which becomes permeable to calcium ions (calcium influx) which enter the cell.
This causes fusion of the synaptic vesicles with the presynaptic membrane, discharging their content of chemical transmitter into the synaptic cleft.
This causes either a wave of depolarization of the postsynaptic membrane in excitatory synapses, or hyperpolarization of the postsynaptic membrane in inhibitory synapses</td></tr>
<tr><td>Medical application</td><td>1. The myelin sheath may be damaged by an autoimmune mechanism e..g .in multiple sclerosis where the microglia phagocyte the myelin debris by lysosomal activity. This leads to various neurologic consequences.

2. The microglias may be infected by HIV-1 virus. A number of cytokines, such as interleukin-1, activates and enhances HIV replication in the microglia.

3. Glial cells may produce tumors e.g gliomas and schwannomas</td></tr>
</table>

Cervical Plexus

Is formed by **ventral rami** (*mixed nerves*) of upper four cervical nerves.

The rami are joined together to make 3 loops that lie between Scalenous medius anteriorly & Prevertebral fascia posteriorly. (*midpoint behind sternomastoid ms*)

• It supplies skin & muscles of the head & neck

	Branches of cervical Plexus:
A) Cutaneous branches	appear at middle of posterior border of sternomastoid muscle then radiate in different directions : 1) Lesser occiptal n (C2) 2) Great auricular n (C2&3) 3) Transverse cervical n (C2&3) 4) Supraclavicular ns (C3&4)
B) Muscular branches	1) Pre-vertebral muscles & Scalenei (Ant, Mid, Post) 2) Sternomastoid & Trapezius (sensory fibers/*proprioception*) *(motor fibers by spinal accessory*) 3) Levator scapulae 4) Infra hyoid muscles (by ansa cervicalis) • Sternohyoid • Sternothyroid • Omohyoid • {Thyrohyoid + Geniohyoid = C1 fibers within hypoglossal nerve } 5) Diaphragm