

Pharyngeal arches(branchial arches)

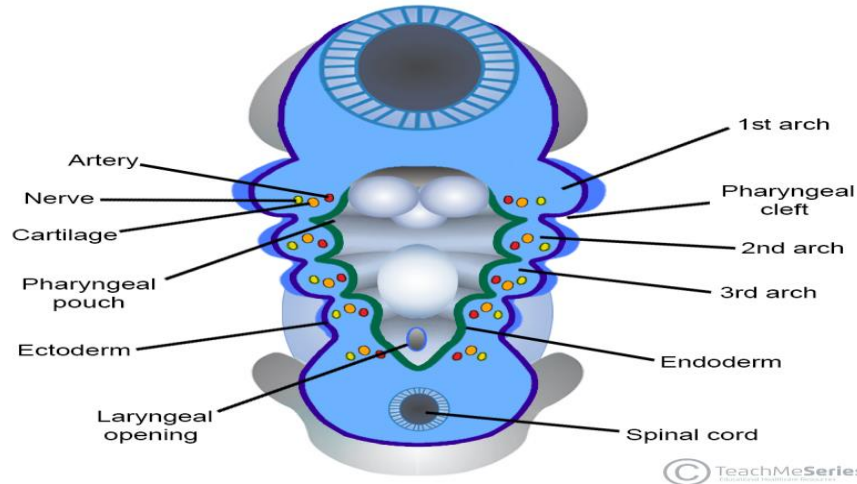
They are series of five paired swellings that surround the embryonic foregut, they are wedged between the developing heart and brain and give rise to the structures of the head and neck . The pharyngeal arches are formed by cells that are derived from ectoderm, endoderm, mesoderm and neural crest.

They develop in a rostral to caudal sequence,during human and all vertebrate development, pharyngeal arch pairs project forward from the back of the embryo toward the front of the face and neck. Each arch develops its own artery, nerve that controls a distinct muscle group, and skeletal tissue. These arches grow and join in the ventral midline.

The first arch, as the first to form, separates the mouth pit or stomodeum from the pericardium. The 1st pharyngeal arch appears at about the beginning of the 4th week and others are added more caudally later such that there are ultimately 5 arches by the end of the 4th week.

During embryological development, the pharyngeal arches appear as C-shaped rolls in a stack, separated by clefts. There are initially six arches, but only four are externally visible on the embryo.

The fifth arch regresses before development is complete.These arches are numbered 1,2,3,4, and 6,the reason for this numbering is that some vascular component of a fifth pharyngeal arch occasionally develops transiently and then is lost.

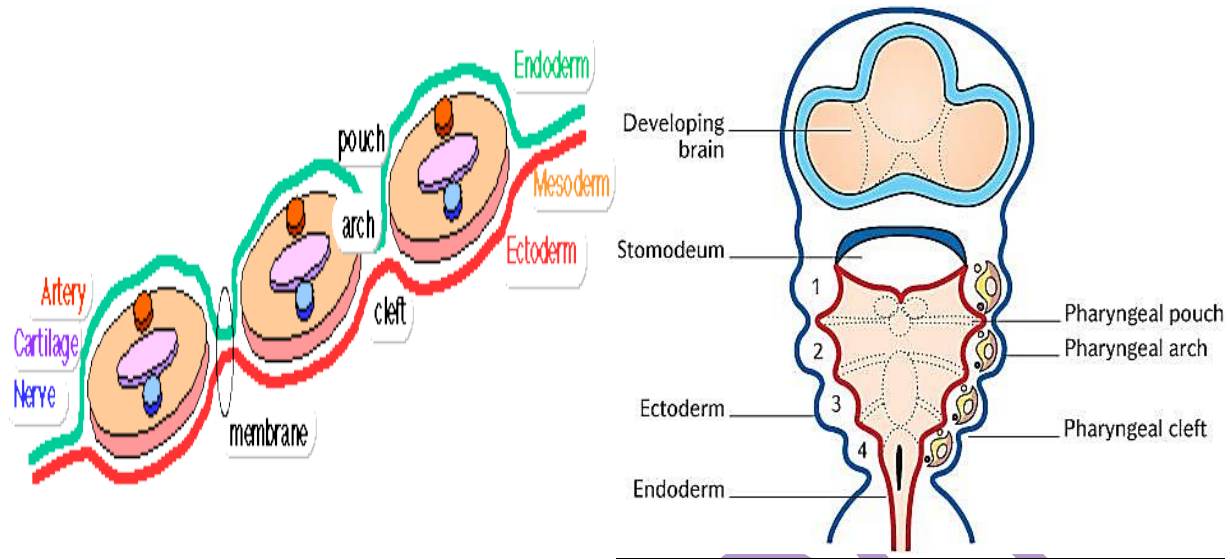


The Pharyngeal Arches - Clefts - Pouches -

Pharyngeal pouches are developed from the endoderm and they open towards the pharyngeal clefts. The external surface is composed of ectoderm and the internal surface is lined with endoderm.



- The entire pharyngeal apparatus consists of paired pharyngeal arches, pharyngeal pouches, pharyngeal clefts (or grooves), and pharyngeal membranes .
- The arches are covered by ectoderm, the ectoderm between the arches form clefts called pharyngeal clefts (grooves).
- Medially each of the pharyngeal arches is separated by a pharyngeal pouch, which approaches the corresponding branchial cleft
- The arches are bordered medially by the pharynx which is lined by endoderm.
- The approximation of the ectoderm of the pharyngeal cleft with the endoderm of the pharyngeal pouch forms the *pharyngeal membrane*.
- The grooves and pouches are named (numbered) the same as the preceding arch.



Derivatives of pharyngeal archs:

1-The first pharyngeal arch(mandibular arch)

Skeletal elements

- Malleus & Incus of the middle ear
- maxilla & mandible

Muscles

- Muscles of mastication (chewing)
- Mylohyoid muscle
- Digastric muscle, anterior belly
- Tensor palati muscle
- Tensor tympani muscle

Nerve

Trigeminal nerve

Artery

Maxillary artery

2-The second pharyngeal arch

The second pharyngeal arch or hyoid arch (or second branchial arch) assists in forming the side and front of the neck.

Skeletal elements

- Stapes
- Temporal styloid process,
- Stylohyoid ligament
- Lesser horn of the hyoid bone.

Muscles

- Muscles of face
- Occipitofrontalis muscle
- Platysma
- Stylohyoid muscle
- Posterior belly of digastric
- Stapedius muscle
- Auricular muscles

Nerve supply

Facial nerve

3-The third pharyngeal arch

Skeletal elements

- Hyoid (greater horn),and lower part of body),thymus,inferior parathyroids.

Muscles

Stylopharyngeus

Nerve

Glossopharyngeal nerve(IX)

Artery

Common carotid ,internal carotid artery.

4-The fourth pharyngeal arch

Skeletal elements

Thyroid cartilage , parathyroid ,Epiglottic cartilage.

Muscles

- Cricothyroid muscle
- All intrinsic muscles of the soft palate

Artery

- Right 4th aortic arch: subclavian artery
- Left 4th aortic arch .

5-The sixth pharyngeal arch

Skeletal elements

- Cricoid cartilage
- Arytenoid cartilage
- Corniculate cartilage

Muscles

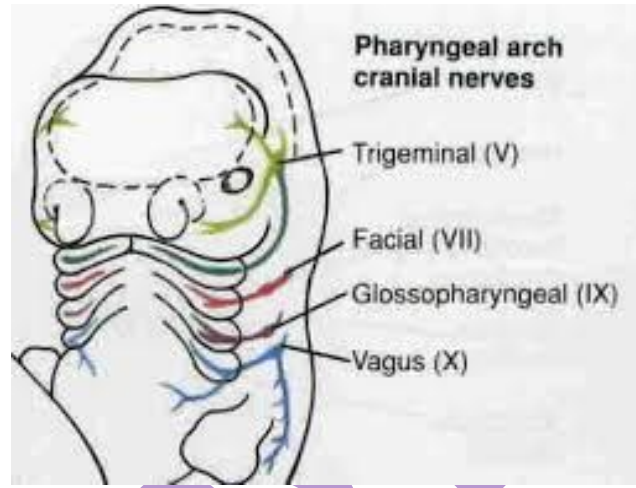
- All intrinsic muscles of larynx except the cricothyroid muscle

Nerve

- All the pharyngeal muscles of the fourth and sixth arches are innervated by the superior laryngeal and the recurrent laryngeal branches of the vagus nerve.

Artery

- Right 6th aortic arch :pulmonary artery
- Left 6th aortic arch: pulmonary artery, ductus arteriosus.



Nerves of PhA

Pharyngeal pouches

Pharyngeal or branchial pouches form on the endodermal side between the branchial arches.

- First pouch

The endoderm lines the future auditory tube (Pharyngotympanic Eustachian tube), middle ear, mastoid antrum, and inner layer of the tympanic membrane.

- Second pouch

Contributes to the middle ear, palatine tonsils, supplied by the facial nerve.

- Third pouch

Third pouch possesses dorsal and ventral wings. Derivatives of the dorsal wings include the inferior parathyroid glands, while the ventral wings fuse to form the cytotreticular cells of the thymus. The main nerve supply to the derivatives of this pouch is glossopharyngeal nerve.

➤ Fourth pouch:

Superior parathyroid glands and ultimobranchial body which forms the parafollicular C-Cells of the thyroid gland.

Musculature and cartilage of larynx (along with the sixth pharyngeal pouch).

➤ Fifth pouch

Rudimentary structure, becomes part of the fourth pouch contributing to thyroid C-cells.

➤ Sixth pouch

Along with the fourth pouch, the contributes to the formation of the musculature and cartilage of the larynx.

Pharyngeal clefts

Ectodermal lined recesses that appear on the outside of the pharynx between the arches .

- Pharyngeal cleft1

Develops into the external auditory meatus(the corresponding 1st pharyngeal pouch develops into the auditory or eustacian tube, and the intervening membrane develops into the typanic membrane.

- Pharyngeal cleft 2,3 and 4 are overgrown by expansion of the 2nd pharyngeal arch and usually obliterated.

Fate of pharyngeal arches

- The pharyngeal arches contribute exclusively to the formation of the face, nasal cavities, mouth, larynx, pharynx and neck.
- During the fifth week, the second pharyngeal arch enlarges and overgrows the third and fourth arches, forming the ectodermal depression called cervical sinus.
- By the end of seventh week the second to fourth pharyngeal grooves and the cervical sinus have disappeared, giving the neck a smooth contour

Branchial arch anomalies:

Branchial cysts are the most common branchial arch anomaly and usually arise from the second and third arches. They often present with cutaneous drainage tracts and most commonly present in childhood.

Branchial cyst is a congenital epithelial cyst that arises on the lateral part of the neck usually due to failure from an incompletely closed branchial cleft.

Remnants of pharyngeal clefts 2-4 can appear in the form of cervical cysts or fistulas found along the anterior border of the sternocleidomastoid muscle.

Most branchial cleft fistulae are asymptomatic, but they may become infected.

Treatment: Conservative (i.e. no treatment), or surgical excision. With surgical excision, recurrence is common, usually due to incomplete excision. Often, the tracts of the cyst will pass near important structures, such as the internal jugular vein, carotid artery, or facial nerve, making complete excision impractical.

