Book - Human Embryology and Morphology 3

Keith A. (/embryology/index.php/Embryology_History_-_Arthur_Keith) **Human Embryology and Morphology** (/embryology/index.php/Book_-_Human_Embryology_and_Morphology). (1902) London: Edward Arnold.

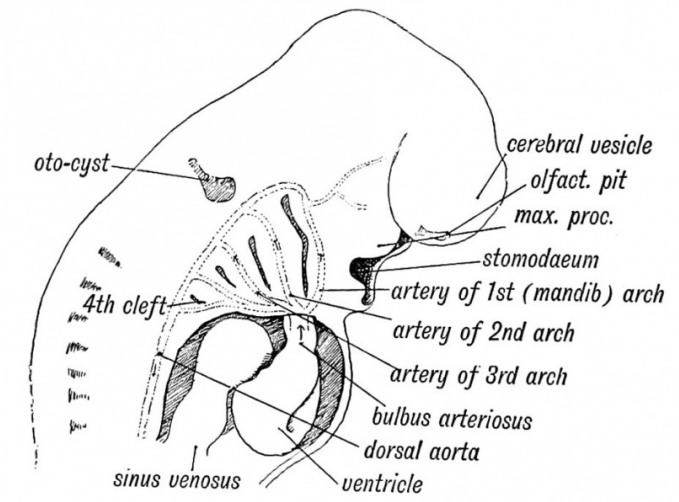
Contents (/embryology/index.php/Book_-_Human_Embryology_and_Morphology): Face (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_1) | Nasal Cavities and Olfactory (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_2) | **Pharynx and Neck** | Organ of Hearing (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_4) | Teeth (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_5) | Skin and Appendages (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_6) | Development of the Ovum (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_7) | Connection between Foetus and Uterus (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_8) | Uro-genital System (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_9) | Pubo-femoral Region, Pelvic Floor and Fascia (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_10) | Spinal Column and Back (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_11) | Body Segmentation (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_12) | Cranium (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_13) | Sight (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_14) | Brain and Spinal Cord (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_15) | Circulatory System (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_16) | Respiratory System (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_17) | Organs of Digestion (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_18) | Body Wall, Ribs, and Sternum (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_19) | Limbs (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_20) | Figures (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_Figures) | Embryology History (/embryology/index.php/Embryology_History)

Contents

Chapter III. Development of the Pharynx and Neck

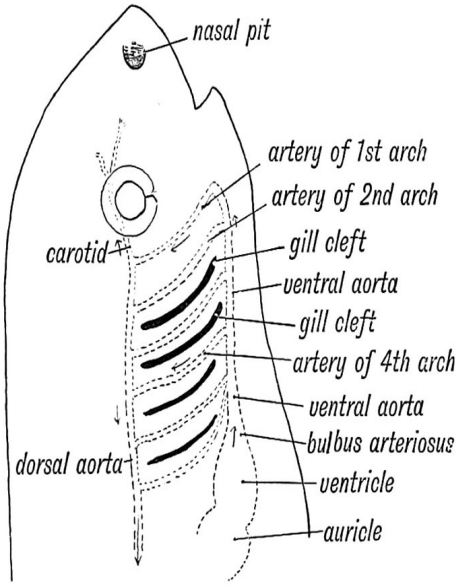
Pharynx of the Embryo

There is very little resemblance between the pharynx and neck of a human foetus in the third week and that of the adult (Figs. 15 A and B (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_1#.23Fig015a)). Indeed, at the third week the human pharynx resembles closely that of a fish (Figs. 21 A and B). In both the human foetus and fish the pharynx is bounded by visceral or branchial arches, which are separated by depressions (human embryoes) or clefts (fishes) ; in both the heart is situated under the pharynx, and from the ventral aorta aortic arches pass up on each side, one in each visceral arch, to terminate in the dorsal aortae. In fishes the aortic arches give off vessels to the gills, in which the blood is arterialized. In the human embryo the blood passes directly through the aortic arches.



(/embryology/index.php/File:Keith1902_fig021a.jpg)

Fig. 21 A. Showing the Visceral Arches and Cleft-depressions in the Pharyngeal Wall of a 4th week human Embryo. Each Visceral Arch contains an Aortic Arch (After Wilhelm His (/embryology/index.php/Embryology_History_-_Wilhelm_His) (1831-1904))



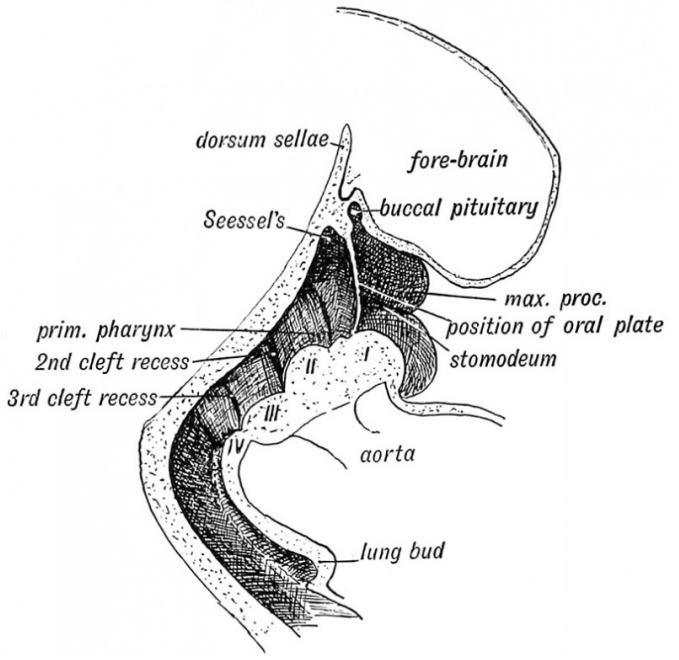
(/embryology/index.php/File:Keith1902_fig021b.jpg)

Fig. 21 B. Showing the position of the Heart, Visceral and Aortic Arches in a fish. (Diagrammatic — after Gegenbaur.)

All that part of the human neck lying in front of the vertebral column and between the mouth above and the thorax and clavicles below, with the bounding walls of the adult pharynx, is formed from the foetal visceral arches. A knowledge of the transformation of the foetal to the adult pharynx is of the utmost practical importance: it explains the occurrence of fistulae and cysts found in the neck ; it accounts for the peculiar courses taken by nerves, such as the recurrent laryngeal and phrenic ; it explains the peculiar distribution of nerves to the pharynx ; and throws light on the nature and anomalies of the thymus, thyroid and tonsil.

The Branchial or Visceral Arches

The visceral arches bound and form the whole thickness of the wall of the primitive pharynx. Four arches, each bounded behind by a depression, are to be recognised superficially on each side of the pharynx of the fourth week human embryo (Fig. 21^4), but behind the 4th cleft is a fifth arch, perhaps also a sixth which, however, never become raised or superficially differentiated from the body wall behind. Sagittal and coronal sections of the primitive pharynx (Figs. 22 and 23) give a better idea of the arrangement and constitution of the visceral arches than can be had from a surface view. They are developed round the most, anterior part of the fore-gut which forms the lining membrane of the primitive pharynx. The pharyngeal lining membrane, therefore, is the same as that of the alimentary canal from which spring all the organs and glands of digestion and assimilation.



(/embryology/index.php/File:Keith1902_fig022.jpg)

Fig. 22. Showing the Primitive Pharynx of a 3rd week embryo in sagittal section, bounded by the Visceral Arches. (After Wilhelm His (/embryology/index.php/Embryology_History_-_Wilhelm_His) (1831-1904)) .

The Visceral Clefts

The epithelium or hypoblast, which lines the primitive pharynx, covers the inner aspects of the arches and passes outwards in the recesses between them and there comes in contact with the epithelial covering of the body (epiblast) which dips in to meet it. The membrane thus formed by the union of the epiblast and hypoblast in the recesses between the arches, may be named the " cleft membrane." It is never ruptured nor disappears in the development of mammals ; in fishes it disappears and real clefts are formed between the arches. On the outer side of the membrane is the cysts and fistulae, which occasionally occur in the neck of the adult " external cleft depression " : on the inner side, the " internal cleft recess" (Fig. 23). From the hypoblastic lining of these cleft recesses we shall see that the tonsil, thyroid and thymus arise ; from the external depressions are formed the various branchial .

Each arch contains, as may be seen from figure 24 :

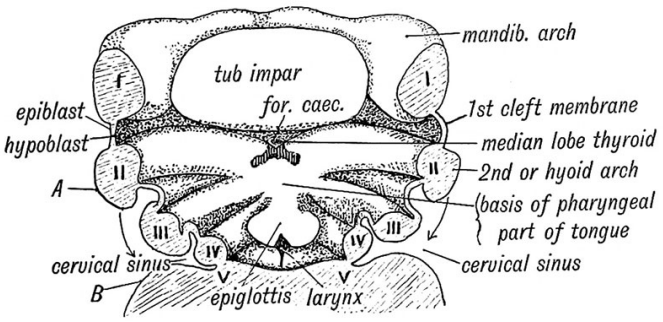
(a) A skeletal basis of cartilage ;

(b) An aortic arch ;

(c) Vein ;

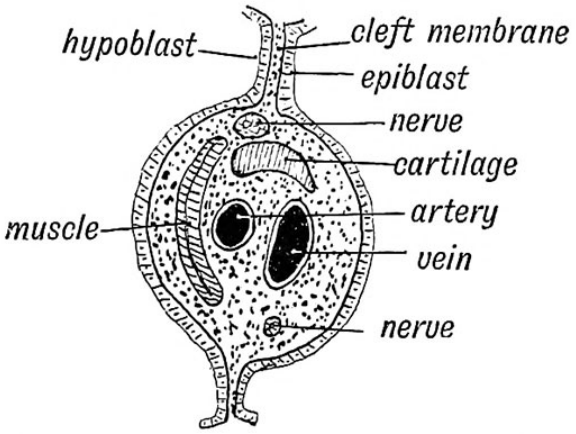
(d) A larger nerve along its anterior border and a smaller along its posterior;

(e) A muscle segment.



(/embryology/index.php/File:Keith1902_fig023.jpg)

Fig. 23. Showing the Floor of the Pharynx of a 4th week human embryo. (After His.)

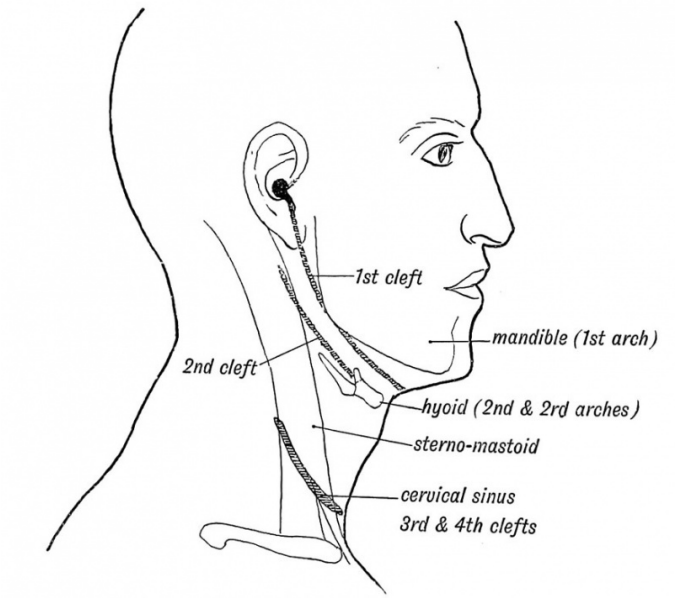


(/embryology/index.php/File:Keith1902_fig024.jpg)

Fig. 24. Schematic Section of a Visceral Arch.

Formation of the Cervical Sinus

The first arch especially, and also the second, grow and increase at a much greater rate than the third and fourth. It is observed that the second arch (hyoid) which in fishes forms the operculum for the gills, grows over and buries the third and fourth. As it covers them over and comes in contact with the body wall behind the fifth arch (see A and B, Fig. 23), the epiblast covering the third and fourth arches and clefts is buried. The epiblast so enclosed forms the lining of the cervical sinus. It usually disappears, but may remain and form a cyst in the neck, which opens some distance above the sternoclavicular joint. If the outer cleft depression in front of or behind the third arch persist, it must open in the cervical sinus.



(/embryology/index.php/File:Keith1902_fig025.jpg)

Fig. 25. Showing the position of the External Cleft Depressions in the Adult.

What becomes of the Visceral Clefts. — By the end of the second month the clefts, or, to be more exact, the representatives of clefts in the human embryo, have 1 disappeared, except the upper part of the first which forms :

1. The external auditory meatus from the external cleft depression ;
2. The Eustachian tube from the internal cleft recess.

These two parts of the first cleft are separated by the cleft membrane which becomes the membrana tympani.

If traces of the other clefts remain as fistulae or cysts they will occur in the positions shown in figure 25. Part of the second cleft is marked in the goat by an opening and auricular appendage.

Within the pharynx traces of inner cleft recesses are to be seen besides the Eustachian opening (Fig. 33, p. 43). The tonsil is developed in the second cleft ; the palatoglossus in the anterior pillar of the fauces represents the second arch. The lateral recess of the pharynx (fossa of Eosenmiiller), behind the Eustachian tube, represents the upper end of the second cleft. The pyriform fossa, at each side of the laryngeal aperture, represents the fourth cleft (See Fig. 33).

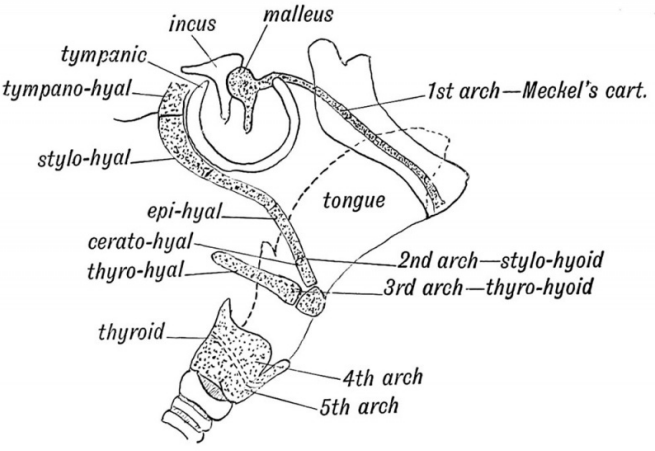
The Cartilages of the Arches

The history of the skeletal basis of the first arch (Meckel's cartilage) has been already traced (Figs. 10 C (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_1#Fig010a-c) and 12 (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_1#Fig012)).

The cartilage of the 2nd or hyoid arch forms (Fig. 26) :

1. The tympano-hyal, which is imbedded in the petro-mastoid.
2. The stylo-hyal (Fig. 26), which ossifies in the early years of life and becomes joined to the tympano-hyal to form the styloid process.
3. The segment below, the epi-hyal, which becomes ligamentous, and forms the stylo-hyoid ligament, but it also may become ossified.
4. The lowest segment, the cerato-hyal, forming the small horn of the hyoid.

The epi-hyal lies behind and outside the tonsil, and when ossified has been excised under the belief that it was a



(/embryology/index.php/File:Keith1902_fig026.jpg)

foreign body. The body of the hyoid (basi-hyal) probably represents the fused ventral parts (copulae) of the 2nd and 3rd arches.

Fig. 26. Showing what become of the Cartilages of the Visceral Arches.

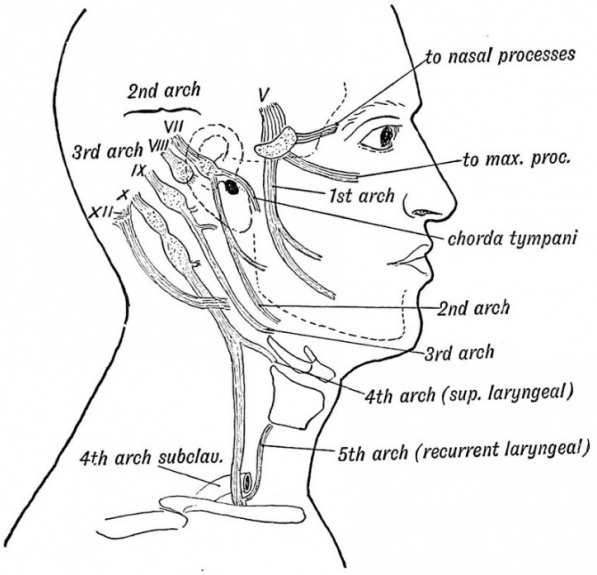
Gadow regards the auditory ossicles as derivatives of the upper or hyomandibular segment of the 2nd arch (Fig. 10 D (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_1#Fig010d)).

It will be seen later that the tongue arises from the floor of the pharynx in the field between the 2nd and 3rd arches. The skeletal bases of the ventral parts of the 2nd and 3rd arches come to form the bone of the tongue. The skeletal part of the hyoid arch suspends the tongue.

The great horn of the hyoid represents the cartilage of the 3rd arch (Fig. 26). The formation of the larynx and lungs from the ventral part (floor) of the pharynx renders it difficult to say what becomes of the cartilage of the 4th arch, but it probably forms the whole or part of the thyroid cartilage. The thyroid in Marsupials is composed of an upper and lower segment, hence it is supposed that it may represent both the cartilages of the 4th and 5th arches. A perforation for vessels near the middle of the thyroid cartilage, on each side, sometimes occurs in man.

The Nerves of the Visceral Arches

The 3rd division of the Vth nerve is, as has been already seen, the principal nerve of the first or mandibular arch. The nerve for the second or hyoid arch is represented by the 7 th and 8 th (facial and auditory, Fig. 27). The nerve of the 3rd arch is the glosso-pharyngeal, that for the 4th is the superior laryngeal branch of the vagus, and for the 5th the inferior laryngeal (Fig. 27).



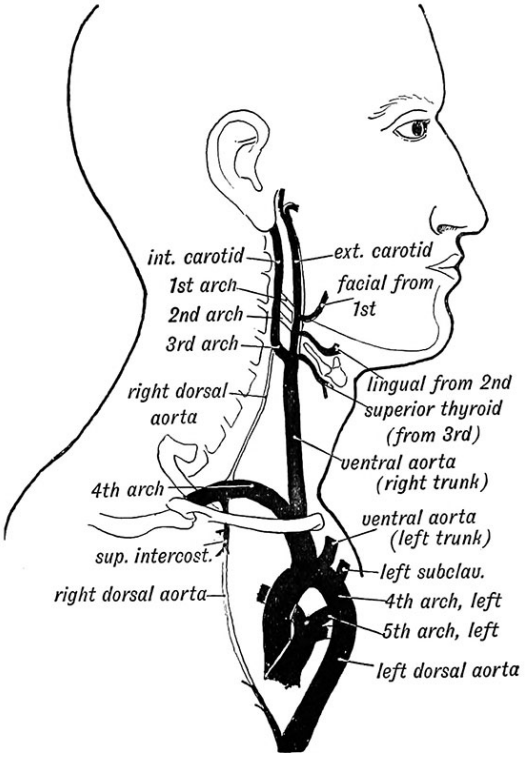
(/embryology/index.php/File:Keith1902_fig027.jpg)

Fig. 27. Showing what become of the Nerves of the Visceral Arches,

Each nerve of a visceral arch, however, sends a branch to the posterior border of the arch in front of it. It would be better, perhaps, to describe them as distributed to the clefts rather than to the arches. The anterior branch of the facial (nerve of the hyoid arch) is represented by the chorda tympani and great superficial petrosal; that of the glosso-pharyngeal by its tympanic branch (Fig. 27).

Aortic Arches

What become of the Aortic Arches — the Arteries of the Visceral Arches. — In figure 21 is given the foetal arrangement of the aortic arches, and in figure 28 the vessels in the adult which are formed from them. The primitive aorta in the embryo divides into two trunks, which run forwards along the floor of the pharynx, one on each side, lying between the ventral ends of the visceral arches. These may be termed the right and left ventral aortic stems. From these stems five arteries (aortic arches) pass upwards, one in each visceral arch, to terminate in the right and left dorsal aortae, which run backwards to join together and form one vessel at the 4th dorsal vertebra — the descending thoracic aorta.



(/embryology/index.php/File:Keith1902_fig028.jpg)

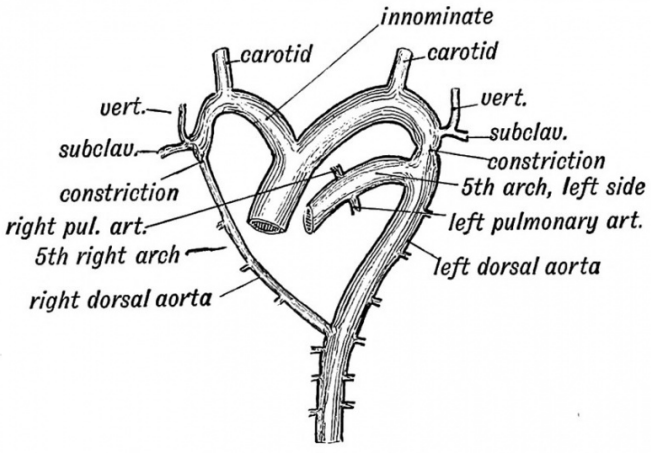
Fig. 28. Showing what become of the Aortic Arches in the adult. Only the shaded parts persist.

As may be seen from figure 28, the first and second arches disappear ; the third remains as the first part of the internal carotid, the fourth forms the 1st and 2nd stages of the right subclavian. On the left side the 4th aortic arch forms that part of the arch of the aorta between the origin of the left carotid and entrance of the ductus arteriosus. The fifth arch on the left side is represented in its entirety by the pulmonary artery and ductus arteriosus. The fifth arch on the right side disappears, in the greater part of its extent at least. Probably the right pulmonary artery is formed from the inner part of this arch.

All the aortic arches are not present at the same time ; some have only a brief period of existence. One of these transient arches is said to appear between what are usually described as the 4th and 5th arches. If this is always the case then the pulmonary arteries should be described as derived not from the 5th but from the 6th aortic arches.

Subclavian Arteries

The visceral arches with their arteries are well developed before the limb buds appear. When, at the end of the third week, the buds grow out to form the upper extremities, the artery which supplies each bud grows out from the dorsal aortae opposite the 4th arches (Fig. 29). This artery forms the entire subclavian on the left side, but only its third stage on the right.



(/embryology/index.php/File:Keith1902_fig029.jpg)

Fig. 29. The condition of the Eight and Left Dorsal Aortae in a 6th week human foetus (After His.) The right arch disappears beyond the origin of the right subclavian ; a constriction may appear at the corresponding point on the left side.

The Arch of the Aorta on the Right Side

In birds it is the 4th right arch which forms the aortic arch, and this occasionally happens in man. In amphibians both the right and left 4th arches persist as aortic arches. The two dorsal aortae in which they end, unite together, as they do in the human embryo, to form the descending thoracic aorta. Probably a communicating arterial twig which runs in the human body from the origin of the intercostal artery of the 3rd or 4th space to join the superior intercostal of the right side represents the right dorsal aorta between the 4th arch and the descending aorta (see Fig. 28).

Cases are found in which the permanent aorta is very much constricted at or near the point of entrance of the ductus arteriosus (5th arch) (see Fig. 29). It will be noticed that the corresponding part of the right dorsal aorta is obliterated. Such a constriction on the left side is to be regarded as corresponding to that on the right side and indicates a partial attempt to produce a right aortic arch ; it may give rise to clinical symptoms.

Dorsal Aortae

It will be noticed that the parts of the dorsal aortae between the 3rd and 4th arches disappear (Fig. 28). The ventral aortae persist as the innominate, the common carotid and external carotid arteries. It will be observed that, while the 1st, 2nd and 3rd vascular arches have almost retained their foetal position, the 4th and 5th arches have been pulled downwards by the descent of the heart. The 4th, which should lie opposite the upper part of the thyroid cartilage, comes to lie on the 1st rib on the right side and within the thorax on the left, while the 5th dragging the nerve of its arch in front of it (the recurrent laryngeal) is pulled right within the thorax from its foetal position at the thyroid cartilage. With the descent of the heart the ventral aortae between the 3rd and 4th arches are drawn out to form the innominate and common carotid arteries on the right side, and the left common carotid on the left.

Muscles of the Visceral Arches

All the muscles supplied by the facial nerve — the platysma, muscles of expression, the stapedius, etc. — are derived from the muscle plate of the 2nd or hyoid arch. The muscles of mastication, with the tensors of the palate and tympanum, are derived from the muscle segment of the mandibular arch. The stylo-pharyngeus is derived from the 3rd arch.

The Platysma and Muscles of the Face and Scalp.— The platysma myoides, the muscles of the face, scalp and external ear, are derived from the muscle plate of the second or hyoid arch.

They are supplied by the facial, the nerve of this arch. The muscle bud, from which the whole platysma sheet is developed, is still confined to the area of the hyoid arch at the end of the second month. During the third month the bud spreads out and forms a continuous muscular hood over the head and neck. To this hood or sheet, which is composed of two layers, a deep and superficial, the name of platysma sheet may be given. It is developed in the superficial fascia.

In man, the platysma sheet has undergone marked retrograde changes in the neck, scalp and external ear, but over the face it has become more highly specialized and differentiated than in any other animal. From this sheet are derived the epicranial aponeurosis, the occipitalis and frontalis. On the face the platysma sheet forms the muscles round the orbit, nose and mouth. The buccinator and levator anguli oris represent parts of the deeper layer of the sheet. The transversus nuchae, fibres occasionally seen in man passing from the middle line of the neck behind, towards the ear and cheek, represent fibres constantly developed in lower primates, and better still in rodents and carnivores as the sphincter colli and sterno-facialis.

The muscles supplied by the facial nerve are peculiar in that they are the physical basis into which many mental states are reflected and in which they are realized. Through them mental conditions are manifested. It is found that the differentiation of

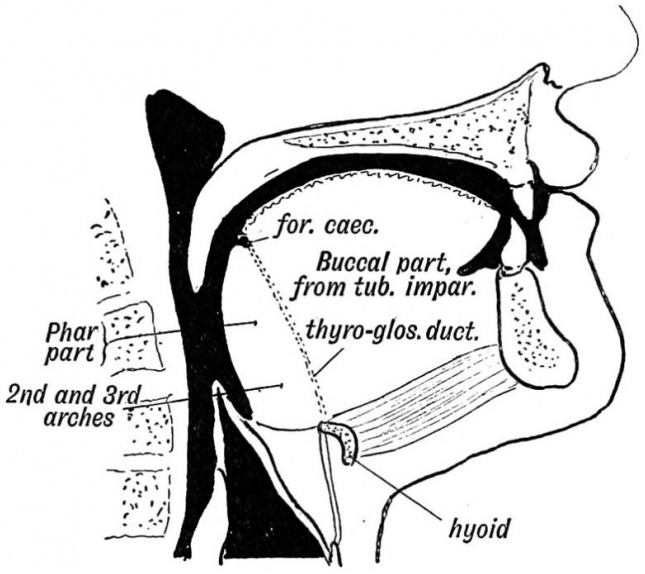
this sheet into well-marked and separate muscles proceeds pari •passu with the development of the brain. The more highly convoluted the brain of any primate, the more highly specialized are its facial muscles.

Structures Developed from the Walls of the Primitive Pharynx

The Tongue and its Development

The tongue is developed in the floor of the primitive pharynx between the ventral parts of the 1st, 2nd and 3rd visceral arches (Fig. 31). Two parts are to be recognised in the tongue. The buccal part (Fig. 30) is situated in front of the foramen caecum and the V-shaped groove. It is covered by papillae, concerned in mastication and liable to cancer. The second or pharyngeal part, bounding the buccal part of the pharynx in front (Fig. 30), is covered by glandular and lymphoid tissue and concerned with swallowing.

The buccal part arises during the 3rd week from the mandibular or 1st arch and the 1st interbranchia'l space by the upgrowth of a tubercle, the tuberculum impar (Fig. 31). Being mandibular in origin, it is supplied by the mandibular nerve (3rd div. of Vth), and its main attachment is to the mandible. Although its bilateral origin is not apparent during development, the lingual septum, the occasional occurrence of cysts in the middle line and its bifid condition in lower vertebrates and occasionally in man, make it extremely probable that it derives a half from each side of the mandibular arch.



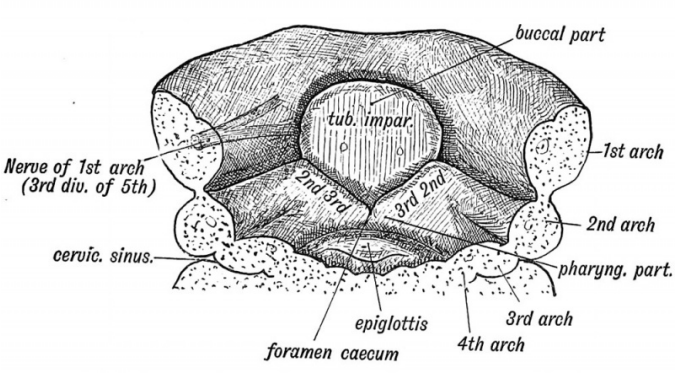
(/embryology/index.php/File:Keith1902_fig030.jpg)

Fig. 30. Showing the Buccal and Pharyngeal parts of the Tongue.

The pharyngeal part of the tongue is derived from the fused ventral ends of the 2nd and 3rd arches in which, as we have already seen, the body of the hyoid is developed. The glossopharyngeal, the nerve of the 3rd arch, or more strictly of the 2nd cleft, supplies it. The V-shaped groove (sulcus terminalis) marks the union of the tuberculum impar with the basal or pharyngeal part. From the hypoblast, which lines the depression between those two parts, arises, by a process of outbudding, the middle lobe or isthmus of the thyroid gland (Fig. 34).

The Musculature of the Tongue

The muscles of the tongue do not arise within the visceral arches, but are of extraneous origin. It will be shown subsequently that the head is probably composed of nine segments, and it is from the muscle plates of the posterior four or five of these segments that the tongue muscles are derived. Processes from the muscle plates of these segments grow downwards and forwards until they reach the basis of the tongue derived from the three visceral arches, carrying their nerves with them — the hypoglossal or 12th cranial nerve, which contains the motor nerve fibres of the posterior segments of the head. Hence, while the sensory nerves of the tongue come from the nerves of the, 1st, 2nd and 3rd visceral arches, its motor fibres are derived from the posterior cephalic segments.



(/embryology/index.php/File:Keith1902_fig031.jpg)

Fig. 31. Showing the origin of the tongue in the floor of the primitive pharynx. The condition represented is from an embryo in the 6th week. (After Wilhelm His (/embryology/index.php/Embryology_History_-_Wilhelm_His) (1831-1904))

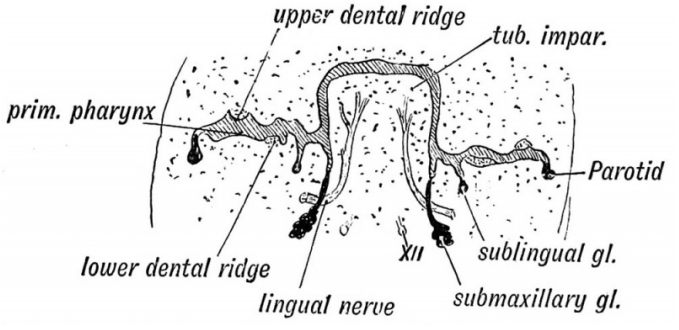
Lingual Papillae

The filiform papillae are the first to appear, then the fungiform, a few of which, along the posterior border of the buccal part, become enlarged and sink to form circumvallate papillae, round the bases of which taste buds are developed. The papillae are confined to the buccal or masticatory part of the tongue. It will be observed that the taste papillae are situated at the brink of the pharnyx (Fig. 30), at which the food is seized and carried away by the involuntary muscles. At the lateral margins of the buccal part of the tongue, just in front of the anterior pillars of the fauces, the fungiform papillae are arranged in a series of laminae, recalling and corresponding to the papillae foliatae of low primates and of rodents. Between the papillae foliatae occur taste buds. On the under surface of the tongue at birth, on each side of the sublingual papillae and over the position of the ranine artery, are two fimbriated folds of mucous membrane, the plicae fimbriatae, vestiges of the tongue-like processes of Lemurs and possibly the entire tongue of lowly Vertebrates. Their function and meaning are unknown, but they may be connected with the sense of taste. A remnant of the plicae fimbriatae can commonly be seen in the adult.

The Lymphatics of the Tongue, the highways for the spread of lingual cancer, run for the greater part with the lingual vein and terminate in the uppermost of the deep cervical glands, over the jugular vein at the angle of the jaw. Many also terminate in the submaxillary lymphatic glands which lie in and around the salivary glands of the same name. The tongue rarely shows any malformation.

The Epiglottis

The origin of the larynx, trachea, bronchi and lungs as a depression and bud from the floor of the pharynx, will be dealt with later (page 256); but the origin at the 3rd week of the furcula (Fig. 34), a process from which the epiglottis is derived, may be noted here. It arises from the 4th visceral arch. The upper part of the thyroid cartilage also arises from the 4th. The superior laryngeal is the nerve of the 4th arch, hence it supplies the epiglottis and upper part of the larynx.



(/embryology/index.php/File:Keith1902_fig032.jpg)

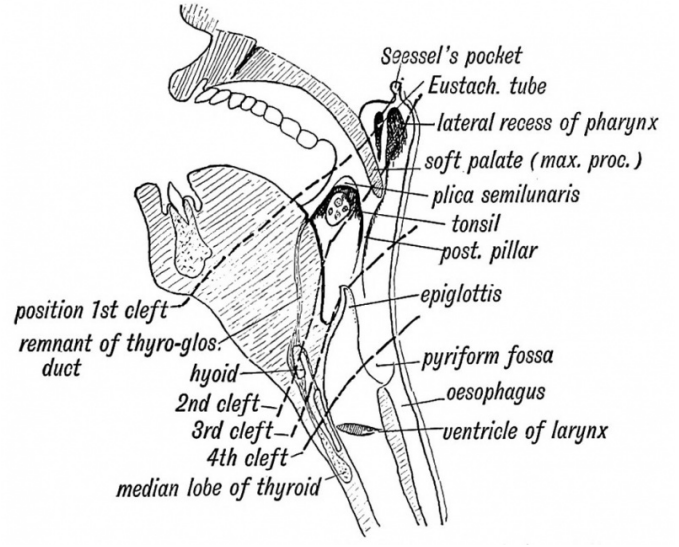
Fig. 32. Showing the origin of the Submaxillary and Sublingual Glands from furrows between the gum and tongue during the flth week. (After Wilhelm His (/embryology/index.php/Embryology_History_-_Wilhelm_His) (1831-1904)) .

Origin of the Salivary Glands

Between the tongue and gum of the foetus there are two furrows (Fig. 32). From the hypoblast of the inner, by a process of budding, arises the submaxillary gland ; the sublingual arises by a number of buds from the outer groove (Fig. 32). The parotid gland springs as a bud from the angle between the mandibular and maxillary processes. It is probably hypoblastic in nature, but it may arise from the epiblast of the stomodaeum, for as yet its exact origin has not been determined. It grows backwards in the connective tissue over the masseter, and at birth is comparatively superficial in position, but as the mandible and external auditory process grow, it sinks inwards to surround the styloid process, pushing the deep cervical fascia beneath it. In this way the stylo-maxillary ligament is formed from the fascia pushed in front of it. Its nerve is derived from the 3rd division of the Fifth (auriculo-temporal).

Seessel's Pocket

In the middle line of the roof of the pharynx (Fig. 33), just under the basi-occipital, there is a depression or recess of mucous membrane which gets this name. It is of no practical importance, and its embryological significance is doubtful. Lymphoid tissue is developed in its walls and in the mucous membrane round it. It may be a remnant of the pharyngeal opening of the notochord (see page 146). It is developed behind the oral plate.



(/embryology/index.php/File:Keith1902_fig033.jpg)

Fig. 33. Showing the position of the Visceral Clefts in the Adult.

The Tonsil

The tonsil arises comparatively late in foetal life. In the 4th month eight or ten isolated buds of hypoblast push out from the second cleft (Fig. 34) into the mesoblastic tissue in the wall of the pharynx above the basal part of the tongue. The buds form the crypts and glandular tissue of the tonsil. Lymphoid tissue — for the tonsil must be regarded as a lymphoid structure — collects round these glandular buds.

Concerning the origin of the lymphoid cells, both of the tonsil and the thymus, there are two quite distinct theories. The more recent (Gulland's) is that the epithelial (hypoblastic) cells, which form the glandular buds of the tonsil, give rise to broods of lymphoid cells ; the older, that these lymphoid cells arise from the blood or surrounding connective tissue, creep in and form follicles round the glandular hypoblastic buds. The tonsil rests on the superior constrictor and the pharyngeal fascia, or inner sheath of the constrictor muscles, which surrounds it and forms its capsule.

Over the tonsil and between the pillars of the fauces is the supra-tonsillar recess (Fig. 33), a remnant of the second cleft. The Plica triangularis is a fold of mucous membrane which is continued from the anterior pillar of the fauces to the under surface of the soft palate, overhanging the supra-tonsillar recess (Fig. 33). It is well marked in the foetus, but commonly disappears before adult life.

The tonsil is part of a great lymphoid system stationed along the alimentary canal. It reaches its fullest growth in youth, as is the case with the lymphoid system generally ; when active growth of the system is over, and especially in the years of decay, it becomes markedly reduced in size.

The Pharyngeal Recess and Pharyngeal Tonsil

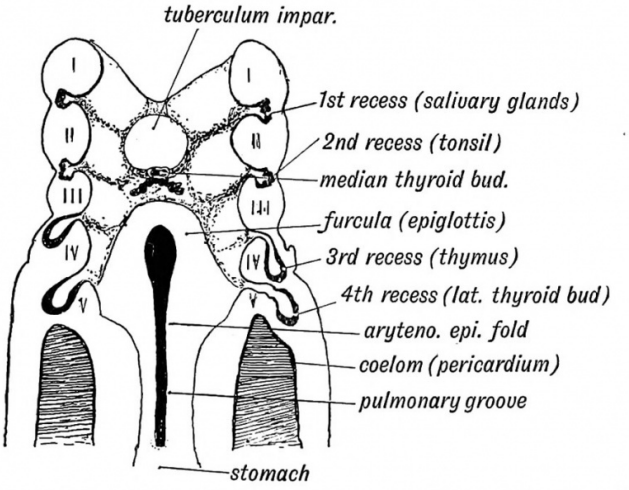
At each side, the roof of the pharynx is produced outwards, behind the Eustachian tube and levator muscles of the palate, to form the lateral recesses of the pharynx. They represent the upper ends of the second cleft, the palate (from the maxillary processes) having grown backwards inside the first and second arches and separated the tonsillar part of the second cleft from the pharyngeal recess. In the recess, and especially on the posterior wall of the pharynx between the recesses and round Seessel's pocket, there is developed much lymphoid tissue, the pharyngeal tonsil, which may become hypertrophoid. The lymphoid tissue of the naso-pharynx, when hypertrophied, may press on and obstruct the Eustachian tube and respiratory space (see Figure 33).

The Lingual Tonsil

That part of the tongue (pharyngeal) produced between the 2nd and 3rd arches is covered by mucous glands which are surrounded by nodules of lymphoid tissue — the collective glandular mass receiving the name of lingual tonsil. It will thus be seen that from the 2nd cleft is produced a circum-pharyngeal ring of lymphoid tissue of great physiological and pathological importance.

The Thymus

The thymus arises in the same manner as the tonsil, only from the 3rd instead of the 2nd cleft (Figs 33 and 34). The 3rd cleft is represented in the adult by the space in front, and on each side of the epiglottis. The hypoblast in the 3rd cleft recess thickens, becomes pushed out as a minute pouch, shaped like a Florence flask[1], between the 3rd (internal carotid) and 4th (arch of aorta) vascular arches. The neck of the glandular hypoblastic pocket disappears. By a species of secondary budding it becomes broken up into islands or separated acini. Either by a production of broods of lymphoid cells within the hypoblastic epithelium or by an invasion of lymphoid cells from the surrounding mesoblast, the thymus becomes an adenoid structure, the epithelial parts becoming compressed into the corpuscles of Hassall. The surrounding mesoblast supplies its connective tissue stroma and capsule. The lateral lobes come together under the ventral aortae, and in the retrogression of the heart are carried backwards to lie in the superior mediastinum. The pointed upper extremity of each lateral lobe can be traced upwards in the fully developed foetus, under the lateral lobes of the thyroid towards the thyro-hyoid membrane. These apical strands represent the stalk of the thymic buds. In its growth backwards it crosses dorsal to the lateral thyroid buds which arise from the 4th cleft.



(/embryology/index.php/File:Keith1902_fig034.jpg)

Fig. 34. Showing the origin of the Tonsil, Thymus, and Thyroid from the Internal Cleft Recesses during the 4th week. (After His.)

The thymus reaches its fullest growth in early childhood (3rd or 4th year), and continues large as long as the body is in a state of active growth. It shrivels up when maturity is reached, and only a remnant is left as a rule, less remaining in men than in woman. It receives its blood supply from the 4th aortic arches through the internal mammary. In manner of origin it resembles the tonsil ; indeed it may be regarded as a buried tonsil.

1. A Florence flask is laboratory glassware to hold liquids. It has a round body with a flat bottom and a single long neck.

The Thyroid

At a very early period (4th week), while the buccal and pharyngeal parts of the tongue are appearing as elevations on the floor of the primitive pharynx, the hypoblast in the mesial part of the furrow between those two parts of the tongue thickens. The bud thus formed grows downwards and backwards and soon bifurcates (Fig. 34). The bifurcated extremity, after redivision to form a

network of acini, becomes the isthmus or median lobe of the thyroid. The stalk of the bud becomes the thyro-glossal duct, the lingual opening of the duct remaining as the foramen caecum. It seems probable that this part of the thyroid, at least, was originally a gland which poured its secretion into the mouth. The connective tissue and vessels of the thyroid are derived from the surrounding mesoblast ; only the glandular elements arise from the hypoblast of the pharynx.

Thyro-glossal Duct

In the great majority of subjects the thyro-glossal duct completely disappears ; the foramen caecum marks one extremity, while a pyramid of thyroid tissue prolonging the isthmus towards the hyoid bone often marks the other extremity. The pyramid of the isthmus may carry on it a detached part of the thyroid-hyoid muscle — the levator glandulae thyroideae. The body of the hyoid bone is developed in the track of the thyro-glossal duct (Fig. 33) and splits it up. Eemnants of the duct or of secondary detached acini of the thyroid may persist and form cysts in the base of the tongue above the hyoid, and commonly between the genio-glossus muscles. They may also occur between the hyoid and thyro-hyoid membrane. The supra-hyoid or infra-hyoid bursae may also become cystic, and may be mistaken for thyro-glossal cysts.

The lateral lobes of the thyroid are developed from the inner recess of the 4th cleft, the position of which is marked in the adult by the pyriform fossae (see Figs. 33 and 34). These pockets, like the thymic of the 3rd cleft, soon lose their connection with the hypoblastic lining of the pharnyx, and become isolated buds which divide and re-divide until a collection of isolated acini is formed. The lateral lobes come in contact as they grow, with the median (lingual) lobe under the laryngeal and tracheal groove in the floor of the primitive pharynx. As they grow outwards the thyroid buds come in contact with the cervical sinus (see page 32), and at one time were supposed to spring from the epiblastic lining of the sinus. They receive their blood supply from the 4th arch (inferior thyroids), while the median lobe is mainly supplied from the ventral aortae, between the 2nd and 3rd arches (superior thyroids). The nerve-supply comes on its arteries from the superior and middle cervical ganglia of the sympathetic. Its nerves appear to have their origin in the upper dorsal segments of the spinal cord.

In the process of development minor buds of the thyroid may become detached. These form accessory thyroid bodies.

In manner of origin and growth the thyroid resembles the tonsil and thymus, but unlike these it is not transformed into a lymphoid structure.

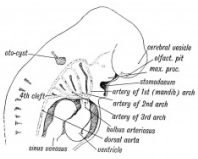
Para-thyroids

These vary in number from three to five on each side (Welsh) and are small bodies of a brownish-red colour, and measuring 6 to 8 mm. in diameter. One or two are situated on the outer side of each lateral lobe amongst the branches of the superior thyroid arteries. They arise with the bud of the thymus from the third cleft. One or two occur constantly on the tracheal aspect of each lateral lobe, amongst the branches of the inferior thyroid arteries. These are derived from the lateral thyroid buds. In structure they are made up of reticulating columns of cells, with vessels arranged between the columns, thus resembling in structure the carotid body, and probably also in nature and origin the medullary part of the supra-renal. Their presence is essential to the function of the thyroid body.

Carotid Bodies

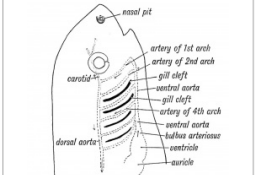
The carotid body occurs at the inner side of the fork, between the internal and external carotid arteries. The commencement of the internal carotid represents the artery of the 3rd arch ; that of the external carotid, the ventral aortic trunk. The body therefore appears to be developed in the wall of the pharynx at the ventral end of the 2nd cleft. It receives a large supply of nerves from the superior cervical ganglion, and it contains a rich network of vessels. Swale- Vincent regards it as similar in nature and origin to the coccygeal body and medulla of the supra-renal (see p. 259).

Chapter Figures



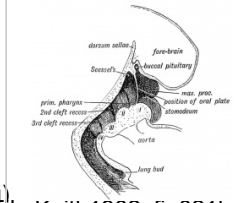
(/embryology/index.php/File:Keith1902_fig021a.jpg)

Fig. 21a. Showing the Visceral Arches and Cleft-depressions in the Pharyngeal Wall of a 4th week human Embryo. Each Visceral Arch contains an Aortic Arch. (After His.)



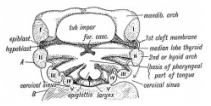
(/embryology/index.php/File:Keith1902_fig021b.jpg)

Fig. 21b. Showing the position of the Heart, Visceral and Aortic Arches in a fish. (Diagrammatic — after Gegenbaur.)



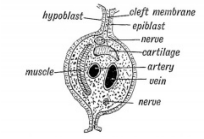
(/embryology/index.php/File:Keith1902_fig022.jpg)

Fig. 22. Showing the Primitive Pharynx of a 3rd week embryo in sagittal section, bounded by the Visceral Arches. (After His.) .



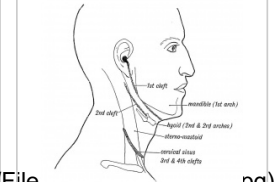
(/embryology/index.php/File:Keith1902_fig023.jpg)

Fig. 23. Showing the Floor of the Pharynx of a 4th week human embryo. (After His.)



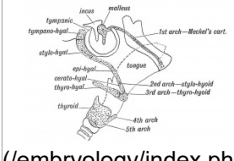
(/embryology/index.php/File:Keith1902_fig024.jpg)

Fig. 24. Schematic Section of a Visceral Arch.



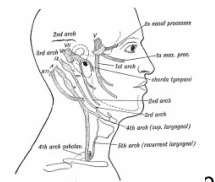
(/embryology/index.php/File:Keith1902_fig025.jpg)

Fig. 25. Showing the position of the External Cleft Depressions in the Adult.



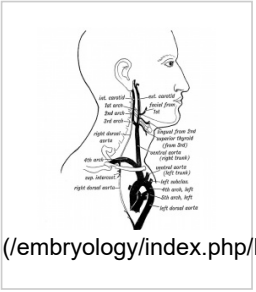
(/embryology/index.php/File:Keith1902_fig026.jpg)

Fig. 26. Showing what become of the Cartilages of the Visceral Arches.



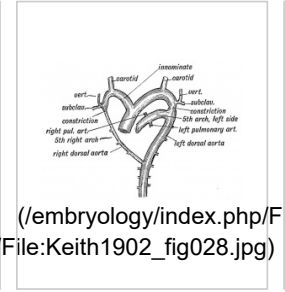
(/embryology/index.php/File:Keith1902_fig027.jpg)

Fig. 27. Showing what become of the Nerves of the Visceral Arches, hyoid arch) is represented by the chorda tympani and great superficial petrosal.



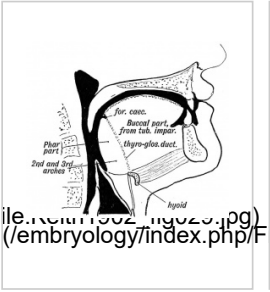
(/embryology/index.php/File:Keith1902_fig028.jpg)

Fig. 28. Showing what become of the Aortic Arches in the adult. Only the shaded parts persist.



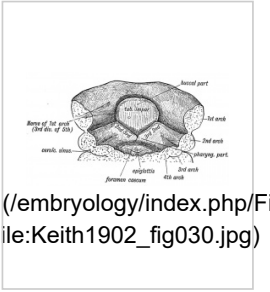
(/embryology/index.php/File:Keith1902_fig029.jpg)

Fig. 29. The condition of the Eight and Left Doral Aortae in a 6th week human foetus.



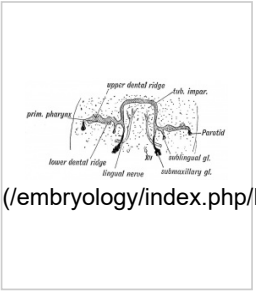
(/embryology/index.php/File:Keith1902_fig030.jpg)

Fig. 30. Showing the Buccal and Pharyngeal parts of the Tongue.



(/embryology/index.php/File:Keith1902_fig031.jpg)

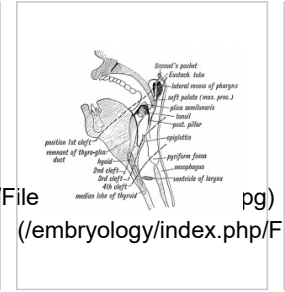
Fig. 31. Showing the origin of the tongue in the floor of the primitive pharynx. (After His.)



(/embryology/index.php/File:Keith1902_fig032.jpg)

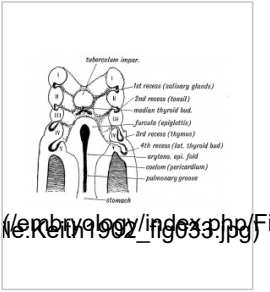
Fig. 32. Showing the origin of the Submaxillary and Sublingual Glands from furrows between the gum and tongue during the flth week. (After His.)

.



(/embryology/index.php/File:Keith1902_fig033.jpg)

Fig. 33. Showing the position of the Visceral Clefts in the Adult.



(/embryology/index.php/File:Keith1902_fig034.jpg)

Fig. 34. Showing the origin of the Tonsil, Thymus, and Thyroid from the Internal Cleft Recesses during the 4th week. (After His.).

Historic Disclaimer - information about historic embryology pages [Expand]

Human Embryology and Morphology (1902) (/embryology/index.php/Book_-_Human_Embryology_and_Morphology): Development or the Face (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_1) | The Nasal Cavities and Olfactory Structures (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_2) | **Development of the Pharynx and Neck** | Development of the Organ of Hearing (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_4) | Development and Morphology of the Teeth (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_5) | The Skin and its Appendages (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_6) | The Development of the Ovum of the Foetus from the Ovum of the Mother (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_7) | The Manner in which a Connection is Established between the Foetus and Uterus (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_8) | The Uro-genital System (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_9) | Formation of the Pubo-femoral Region, Pelvic Floor and Fascia (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_10) | The Spinal Column and Back (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_11) | The Segmentation of the Body (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_12) | The Cranium (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_13) | Development of the Structures concerned in the Sense of Sight (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_14) | The Brain and Spinal Cord (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_15) | Development of the Circulatory System (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_16) | The Respiratory System (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_17) | The Organs of Digestion (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_18) | The Body Wall, Ribs, and Sternum (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_19) | The Limbs (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_20) | Figures (/embryology/index.php/Book_-_Human_Embryology_and_Morphology_Figures) | Embryology History (/embryology/index.php/Embryology_History)

Reference

Keith A. (/embryology/index.php/Embryology_History_-_Arthur_Keith) **Human Embryology and Morphology** (/embryology/index.php/Book_-_Human_Embryology_and_Morphology). (1902) London: Edward Arnold.
