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Pharyngeal arches definition

Overview Relations TreeImage Browser Development Tree pharyngeal arch pharyngeal arch 3-7 trunk bone post-hyoid pharyngeal arch branchial arch (synonym,)pharyngeal arches (synonym,)visceral arch (synonym,)branchial arches (synonym,)branchial bar (synonym,)branchial bars (synonym,)gill arch (synonym,)gill arches 1-5 (synonym,)visceral arches 3-7 (synonym,)arcus pharyngei (related synonym,)bone of torso (exact synonym,)bone of trunk (exact synonym,)bone organ of torso (exact synonym,)bone organ of trunk (exact synonym,)torso bone (exact synonym,)torso bone organ (exact synonym,)trunk bone organ (exact synonym,)gill bar (related synonym,)pharyngeal arch 3-7 (exact synonym,) /www.ebi.ac.uk/efo/EFO_0003694 //purl.obolibrary.org/obo/UBERON_0003463 One of a series of bony or cartilaginous arches that develop in the walls of the mouth cavity and pharynx of a vertebrate embryo, consist typically of a curved segmented bar or rod on each side meeting the contralateral bar or rod at the ventral end, and correspond to the gill arches of fishes and amphibians. One of a series of bony or cartilaginous arches that develop in the walls of the mouth cavity and pharynx of the embryo.[AAO] A bone that is part of a trunk [Automatically generated definition]. A pharyngeal arch that is posterior to the hyoid arch. i.e. any pharyngeal arch with a number 3 or higher. Posterior-most stream of cranial neural crest, which sub-divides during migration.[AAO] Thank you for submitting comments. Your input has been emailed to ZFIN curators who may contact you if additional information is required. Oops. Something went wrong. Please try again later. The branchial apparatus (branchial, meaning gills) consists of the branchial arches, the pharyngeal pouches, the branchial grooves, and the branchial membranes. Modeling and development of the cephalic end and face of the embryo result in a complex form for the pharyngeal segment of the digestive tract. The lateral walls of the developing pharyngeal gut form the branchial system or apparatus Branchial or pharyngeal arches are masses of mesoderm covered by ectoderm and lined by endoderm. Within these masses, muscular and skeletal components develop, as well as aortic arches and nerve networks. The arches are separated by grooves, visible on the surface of the embryo as pharyngeal clefts and in the interior as the pharyngeal pouches THE BRANCHIAL SYSTEM is only transitory. Continuous modification of the cephalic end of the embryo, during brain development, also affects the basic architecture. The arches give rise to skeletal structures from predominantly cartilaginous precursors; the pouches and clefts either are effaced or persist as ducts or canals. Some give rise to important glandular structures. The branchial system is formed at the 5 mm embryo stage, in week 4, with its 4 arches, 4 pharyngeal clefts, and 5 pharyngeal pouches The mandibular arch (arch I) is centered on Meckel's cartilage. The malleus and incus, ossicles of the middle ear, develop from its posterior portion. The mandible and muscles of mastication form from tissues (mesenchyme and invading neural crest cells) surrounding Meckel's cartilage It is supplied by aortic arch I (facial artery) and the mandibular division of the trigeminal nerve (V3) The hyoid arch (arch II) is centered on Reichert's cartilage. It gives rise to the stapes of the middle ear, the styloid process of the temporal bone, the stylohyoid ligament, the lesser horns and upper part of the body of the hyoid bone, the platysma muscle, and the muscles of facial expression It is supplied by aortic arch II (external carotid artery) and the facial nerve (VII) The thyrohyoid arch (arch III) produces the body and greater horns of the hyoid bone and the stylopharyngeus muscle It is supplied by aortic arch III (internal carotid artery) and the glossopharyngeal nerve (IX) The (unnamed) arch IV is much less clearly differentiate It gives rise to the cartilages of the larynx and the cricothyroid muscle It is supplied by aortic arch IV and the external branch of the superior laryngeal nerve of the vagus nerve (X) Pharyngeal arches V and VI (unnamed) are never seen in humans. Their corresponding aortic arches, however, do occur. The muscle mass of arch V forms some of the intrinsic muscles of the larynx, which are supplied by the recurrent or inferior laryngeal branch of the vagus nerve (X) The cartilages of arches IV and V become the framework of the larynx The thyroid cartilage originates from both arches IV and V The cricoid, arytenoids, the rings of the trachea, and the bronchi are formed from arch VI Arch VI is distinctly differentiated, whereas V is transitory AT 8 mm, ARCH II develops more rapidly than the others and overlaps the other arches caudally. This process is further accentuated by the flexion of the head at this stage of development AT ABOUT 13 mm (about 34 days), ARCH II has entirely overlapped arches III and IV. It also has closed the second, third, and fourth pharyngeal clefts to form the cervical sinus. Only the first pharyngeal cleft persists, and by day 42, it is seen as the external auditory meatus, the only exterior evidence of the pharyngeal system Embryonic precursor structures in vertebrates Pharyngeal archSchematic of developing human fetus with first, second and third arches labelledDetailsCarnegie stage10IdentifiersLatinarcus pharyngeiMeSHD001934TEarch. by E5.4.2.0.0.0.2 E5.4.2.0.0.0.2 Anatomical terminology[edit on Wikidata] Floor of the pharynx of human embryo at about 26 days oldScheme of the pharyngeal archesScheme of the pharyngeal archesI-IV: pharyngeal archesI-4: pharyngeal pouches (inside) and/or pharyngeal grooves (outside): Tuberculum laterale: Tuberculum impar: Foramen cecum: Ductus thyreoglossus: Sinus cervicalis The pharyngeal arches, also known as visceral arches, are structures seen in the embryonic development of vertebrates that are recognisable precursors for many structures. In fish, the arches are known as the branchial arches, or gill arches. In the human embryo, the arches are first seen during the fourth week of development. They appear as a series of outpouchings of mesoderm on both sides of the developing pharynx. The vasculature of the pharyngeal arches is known as the aortic arches. In fish, the branchial arches support the gills. Structure in vertebrates, the pharyngeal arches are derived from all three germ layers (the primary layers of cells that form during embryogenesis).[1] Neural crest cells enter these arches where they contribute to features of the skull and facial skeleton such as bone and cartilage.[1] However, the existence of pharyngeal structures before neural crest cells evolved is indicated by the existence of neural crest-independent mechanisms of pharyngeal arch development.[2] The first, most anterior pharyngeal arch gives rise to the oral jaw. The second arch becomes the hyoid and jaw support.[11] In fish, the other posterior arches contribute to the branchial skeleton, which support the gills; in tetrapods the anterior arches develop into components of the ear, tonsils, and thymus.[3] The genetic and developmental basis of pharyngeal arch development is well characterized. It has been shown that Hox genes and other developmental genes such as DLX are important for patterning the anterior/posterior and dorsal/ventral axes of the branchial arches.[4] Some fish species have a second set of jaws in their throat, known as pharyngeal jaws, which develop using the same genetic pathways involved in oral jaw formation.[5] During human and all vertebrate development, a series of pharyngeal arch pairs form in the developing embryo. These 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. The arches are numbered from 1 to 6, with 1 being the arch closest to the head of the embryo, and arch 5 existing only transiently.[6] These grow and join in the ventral midline. The first arch, as the first to form, separates the mouth pit or stomodeum from the pericardium. By differential growth the neck elongates and new arches form, so the pharynx has six arches ultimately. Each pharyngeal arch has a cartilaginous stick, a muscle component that differentiates from the cartilaginous tissue, an artery, and a cranial nerve. Each of these is surrounded by mesenchyme. Arches do not develop simultaneously but instead possess a "staggered" development. Pharyngeal pouches form on the endodermal side between the arches, and pharyngeal grooves (or clefts) form from the lateral ectodermal surface of the neck region to separate the arches.[7] In fish the pouches line up with the clefts, and these thin segments become gills. In mammals the endoderm and ectoderm not only remain intact but also continue to be separated by a mesoderm layer. The development of the pharyngeal arches provides a useful landmark with which to establish the precise stage of embryonic development. Their formation and development corresponds to Carnegie stages 10 to 16 in mammals, and Hamburger–Hamilton stages 14 to 28 in the chicken. Although there are six pharyngeal arches, in humans the fifth arch exists only transiently during embryogenesis.[8] First arch The first pharyngeal arch also mandibular arch (corresponding to the first branchial arch or gill arch of fish), is the first of six pharyngeal arches that develops during the fourth week of development.[9] It is located between the stomodeum and the first pharyngeal groove. Processes This arch divides into a maxillary process and a mandibular process, giving rise to structures including the bones of the lower two-thirds of the face and the jaw. The maxillary process becomes the maxilla (or upper jaw), and palate while the mandibular process becomes the mandible or lower jaw. This arch also gives rise to the muscles of mastication. Meckel's cartilage Meckel's cartilage forms in the mesoderm of the mandibular process and eventually regresses to form the incus and malleus of the middle ear, the anterior ligament of the malleus and the sphenomandibular ligament. The mandible or lower jaw forms by perichondral ossification using Meckel's cartilage as a 'template', but the maxillary does not arise from direct ossification of Meckel's cartilage. Derivatives The skeletal elements and muscles are derived from mesoderm of the pharyngeal arches. Skeletal malleus and incus of the middle ear,maxilla and mandible spine of sphenoid bone sphenomandibular ligament, palatine bone squamous part of temporal bone anterior ligament of malleus Muscles muscles of mastication (chewing) masseter medial and lateral pterygoid muscles temporalis mylohyoid muscle digastric muscle, anterior belly tensor veli palatini muscle tensor tympani muscle Other Mucous membrane and glands of the anterior two thirds of the tongue are derived from octoderm and endoderm of the arch. Nerve supply The mandibular and maxillary branches of the trigeminal nerve (CN V) innervate the structures derived from the corresponding processes of the first arch. In some lower animals, each arch is supplied by two cranial nerves. The nerve of the arch itself runs along the cranial side of the arch and is called post-trematic nerve of the arch. Each arch also receives a branch from the nerve of the succeeding arch called the pre-trematic nerve which runs along the caudal border of the arch. In human embryo, a double innervation is seen only in the first pharyngeal arch. The mandibular nerve is the post-trematic nerve of the first arch and chorda tympani (branch of facial nerve) is the pre-trematic nerve. This double innervation is reflected in the nerve supply of anterior two-thirds of tongue which is derived from the first arch.[10] Blood supply The artery of the first arch is the first aortic arch, [11] which partially persists as the maxillary artery. Second arch The second pharyngeal arch or hyoid arch, is the second of fifth pharyngeal arches that develops in fetal life during the fourth week of development[9] and assists in forming the side and front of the neck. Reichert's cartilage Cartilage in the second pharyngeal arch is referred to as Reichert's cartilage and contributes to many structures in the fully developed adult.[12] In contrast to the Meckel's cartilage of the first pharyngeal arch it does not constitute a continuous element, and instead is composed of two distinct cartilaginous segments joined by a faint layer of mesenchyme.[13] Dorsal ends of Reichert's cartilage ossify during development to form the stapes of the middle ear before being incorporated into the middle ear cavity, while the ventral portion ossifies to form the lesser cornu and upper part of the body of the hyoid bone. Caudal to what will eventually become the stapes, Reichert's cartilage also forms the styloid process of the temporal bone. The cartilage between the hyoid bone and styloid process will not remain as development continues, but its perichondrium will eventually form the stylohyoid ligament. Derivatives Skeletal From the cartilage of the second arch arises Stapes, Temporal styloid process, Stylohyoid ligament, and Lesser cornu of the hyoid bone. Muscles Facial muscles Occipitofrontalis muscle Platysma Stylohyoid muscle Posterior belly of digastric muscle Stapedius muscle Auricular muscles Nerve supply Facial nerve (CN VII) Blood supply The artery of the second arch is the second aortic arch.[11] which gives origin to the stapediaal artery in some mammals but atrophies in humans. Muscles derived from the pharyngeal arches Pharyngeal muscles or Brancial muscles are striated muscles of the head and neck. Unlike skeletal muscles that developmentally come from somites, pharyngeal muscles are developmentally formed from the pharyngeal arches. Most of the skeletal musculature supplied by the cranial nerves (special visceral efferent) is pharyngeal. Exceptions include, but are not limited to, the extraocular muscles and some of the muscles of the tongue. These exceptions receive general somatic efferent innervation. First arch All of the pharyngeal muscles that come from the first pharyngeal arch are innervated by the mandibular divisions of the trigeminal nerve.[14] These muscles include all the muscles of mastication, the anterior belly of the digastric, the mylohyoid, tensor tympani, and tensor veli palatini. Second arch All of the pharyngeal muscles of the second pharyngeal arch are innervated by the facial nerve. These muscles include the muscles of facial expression, the posterior belly of the digastric, the stylohyoid muscle, the auricular muscle[14] and the stapediuss muscle of the middle ear. Third arch There is only one muscle of third pharyngeal arch, the stylopharyngeus. The stylopharyngeus and other structures from the third pharyngeal arch are all innervated by the glossopharyngeal nerve. Fourth and sixth arches 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.[14] These muscles include all the muscles of the palate (exception of the tensor veli palatini which is innervated by the trigeminal nerve), all the muscles of the pharynx (except stylopharyngeus which is innervated by the glossopharyngeal nerve), and all the muscles of the mouth pit or stomodeum from the pericardium. By differential growth the neck elongates and new arches form, so the pharynx has six arches ultimately. Each pharyngeal arch has a cartilaginous stick, a muscle component that differentiates from the cartilaginous tissue, an artery, and a cranial nerve. Each of these is surrounded by mesenchyme. Arches do not develop simultaneously but instead possess a "staggered" development. Pharyngeal pouches form on the endodermal side between the arches, and pharyngeal grooves (or clefts) form from the lateral ectodermal surface of the neck region to separate the arches.[7] In fish the pouches line up with the clefts, and these thin segments are produced from the nerve of arch 6, and the laryngeal cartilages from arches 4 and 6. The superior laryngeal branch of the vagus nerve arises from arch 4. Its arteries, which project between the nerves of the fourth and sixth arches, become the left-side arch of the aorta and the right subclavian artery. On the right side, the artery of Arch 6 is obliterated while, on the left side, the artery persists as the ductus arteriosus; circulatory changes immediately following birth cause the vessel to close down, leaving a remnant, the ligamentum arteriosum. During growth, these arteries descend into their ultimate positions in the chest, creating the elongated recurrent paths.[6] Pharyngeal arch Muscular contributions[15] Skeletal contributions Nerve Artery 1st (also called "mandibular arch") Muscles of mastication, anterior belly of the digastric, mylohyoid, tensor tympani, tensor veli palatini Premaxilla, maxilla, mandible (only as a model for mandible not actual formation of mandible), zygomatic bone, part of the temporal bone,[16] the incus, and the malleus of the middle ear, also Meckel's cartilage and the sphenomandibular ligament. Trigeminal nerve (part of V2[17] and V3) Maxillary artery, external carotid artery, Vidian artery 2nd (also called the "hyoid arch") Muscles of facial expression, buccinator, platysma, stapedius, stylohyoid, posterior belly of the digastric, auricular[14] Stapes, temporal styloid process, hyoid bone (lesser horns and upper part of body), stylohyoid ligament,[14] Reichert's cartilage Facial nerve (VII) Ascending pharyngeal artery, Inferior tympanic artery, primitive hyoid artery, Stapedial artery 3rd Stylopharyngeus Hyoid bone (greater horns and lower part of body), thymus Glossopharyngeal nerve (IX) common carotid, internal carotid 4th Cricothyroid muscle, all intrinsic muscles of soft palate (including levator veli palatini) except tensor veli palatini) except tensor veli palatini) Thyroid cartilage, epiglottic cartilage[18] Vagus nerve (X), superior laryngeal nerve[19] Right 4th aortic arch: subclavian artery Left 4th aortic arch: aortic arch 6th All intrinsic muscles of larynx except the cricothyroid muscle Cricoid cartilage, arytenoid cartilages, corniculate cartilage, cuneiform cartilages[18] Vagus nerve (X), recurrent laryngeal nerve[19] Right 6th aortic arch: pulmonary artery Left 6th aortic arch: pulmonary artery and ductus arteriosus See also This article uses anatomical terminology. 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