forms what is known as Meckel’s cartilage; but in the maxillary process the stage of chondrification is suppressed in man and other mammals, and the palato-quadrate cartilaginous bar which is so evident in embryo fishes and amphibians is not formed. It will thus be seen that both the maxillary and mandibular bars are derivatives of the first visceral arch. In the maxillary process a membrane bone is formed which blends with the sphenoid to form the internal pterygoid plate, while in front (ventrad) of this the upper jaw (maxilla) is developed in membrane by several centres. Of these, according to the usual description, (1) forms the body of the bone on the outer side of the infraorbital canal; (2) forms the body of the bone on the inner side of that canal; (3) forms the nasal process and the socket for the canine tooth; (4) makes the posterior three- quarters of the palatine process; while (5) and (6) form the pre­maxilla, each of the latter contributing a socket for one of the two incisor teeth. When these premaxillary sutures fail to unite, the de­formity known as “ cleft palate ” is produced and this may occur either between the lateral incisor and the canine or between the central and lateral incisor teeth. The recent researches of Professor E. Fawcett point to the conclusion that these centres are not really as numerous as is generally thought. He regards (1) and (2) as a single centre which grows up round the infraorbital canal, while the premaxilla he finds need not necessarily have two centres. The maxillary antrum is first developed as an outgrowth from the cartilaginous olfactory capsule into the membranous maxilla, though the cartilage soon disappears. The palate bone is developed by one centre which is formed in what will be the vertical plate of that bone in the membrane, behind the centre or centres for the body of the maxilla and at a little later date (see E. Fawcett, *Journ. Anat. and Phys.* vol. 40, p. 400).

The *mandibular* or *Meckel's cartilage* is continued up into the tympanum where it joins the proximal end of the cartilage of the second or hyoid arch, and it is from this junction (hyomandibular plate) that, according to H. Gadow, *Anat. Anzeiger,* Bd. 19, p. 396, the malleus and incus bones of the middle ear are developed (see Ear). Between the slender process of the malleus and the region of the inferior dental foramen, the cartilage later on disappears and its fibrous sheath forms the *long internal lateral* or *sphenomandibular ligament* (see fig. 33, L.I.L).

Hitherto each half of the lower jaw has been considered to be com­posed of several distinct skeletal elements, homologous with the elements found in the jaws of lower vertebrates. This view is still held by Professor K. von Bardeleben, who contends that there are present in the lower jaws of man and mammals six separate elements, the os mentale, coronoid, condyloid, angular, marginal and dentary. The researches of B. Henneberg, Professor E. Fawcett and of Dr A. Lowe, however, are so complete and correspond so closely that one cannot help believing that the human lower jaw, at all events, is ossified from one centre only on each side, which appears in membrane near the symphysis and extends into a small part of Meckel’s cartilage near the incisor tooth germs. From this centre, which represents the dentary of lower vertebrates, the whole adult bony jaw is formed and the greater part of Meckel’s cartilage disappears by a process of resorption. But, although this bone is mainly membranous, patches of cartilage appear in the coronoid and condylar processes as well as near the symphysis and perhaps at the angle. These, however, do not ossify by separate centres, but are invaded by the main dentary ossification already described. It seems evident, therefore, that in man the process of ossification is slurred over although some of the original elements of the lower vertebrates are repeated as temporary cartilaginous masses, *e.g.* coronary, condylar and angular. (See E. Fawcett, “ Thesis for the Degree of Doctor of Medicine,” University Library, Edinburgh, 1906; also A. Lowe, “ Development of Lower Jaw in Man,” *Proc. Anat. Soc.* of the University of Aberdeen, 1905, p. 59. In the latter paper the literature is reviewed.)

At birth the two halves of the mandible are separate as they are throughout life in many mammals *(e.g.* rodents), but in man they join together about the end of the first year.

It has been stated that within the tympanum the dorsal or proximal ends of the first and second visceral arches unite to form the hyo­mandibular plate from which, following H. Gadow, the *malleus* and *incus* are derived. The *stapes* is also probably formed from the proximal end of the second or hyoid arch (see fig. 33, St), and just ventral to this the cartilage of the arch fuses with that of the periotic capsule, where it is later on ossified as the *tympanohyal* element of the temporal bone (fig. 33, T.H). From this point the cartilage becomes free from the skull and runs round the pharynx until it meets its fellow of the opposite side in the mid-ventral line. That part of the cartilage which is nearest the skull remains as the *stylohyal* element (fig. 33, S.H) and this later on ossifies to form the *styloid process* which fuses with the tympanohyal between twenty and twenty-five. For some distance beyond the stylohyal element the cartilage de­generates into fibrous tissue forming the *stylohyoid ligament;* this represents the *epihyal* element, and occasionally instead of degenerating it ossifies to form an abnormal bone (fig. 33, E.H). Near the middle line the cartilage persists as the *ceratohyal* element or *lesser cornu of the hyoid bone* (fig. 33, C.H), while the most ventral part, where it fuses with its fellow of the opposite side as well as with the ventral part of the third arch, is the *basihyal* or *body of the hyoid bone* (fig. 33, B.H).

The dorsal part of the cartilage of the third arch is wanting, but its lateral part forms the *thyrohyal* or *great cornu of the hyoid bone* (fig. 33, Th.H), while its ventral part fuses with its fellow of the opposite side as well as with the ventral part of the second arch to form the body of the hyoid bone. The fourth and fifth arches only develop cartilage in their ventro-lateral parts and fuse to form the thyroid cartilage of the larynx (fig.\*33, Th.C) (see Respiratory System).

For further details see J. P. McMurrich, *Development of the Human Body* (1906); A. Keith, *Human Embryology and Morphology* (1905); H. Gadow, “ Modifications of the first and second Visceral Arches,” *Phil. Trans.* vol. 179 (1888), and "The Evolution of the Auditory Ossicles,” *Anat. Anzeiger,* Bd. xix. (1901).

*Comparative Anatomy.—*In the Amphioxus the pharynx is stiffened by chitinous bars which lie between the gill slits, but it is unlikely that

these are really homologous with the visceral skeleton of higher forms, though, in serving the same purpose, they are certainly analogous.

Among the Cyclostomata (hags and lampreys) there is an arrange­ment known as the “ branchial basket,” which has a more super­ficial position than the visceral arches of fish and probably corre­sponds to the extra-branchials of those vertebrates. The oral and hyoid arches are very rudimentary and probably have degenerated in consequence of the suctorial mode of nourishment. In the Elasmo- branchii (sharks and rays) the visceral skeleton is entirely cartilagin­ous. In the more primitive types such as the comb-toothed shark (Notidanus) the oral and hyoid arches are quite distinct. The oral arch consists of the upper jaw, or *palato-quadrate cartilage,* and the lower jaw, or *Meckel's cartilage;* these articulate with one another posteriorly and also with the skull. Behind these and distinct from them is the hyoid arch. Such a type of *Suspensorium* or jaw articula­tion is called *autostylic.* In the rays, on the other hand, the oral arch is connected with the skull by the proximal segment of the hyoid arch, which, since it connects both the hyoid and mandibular (oral) arches with the skull, is called the hyomandibular cartilage. This type of Suspensorium is termed *hyostylic.*

Below the hyomandibular cartilage the hyoid arch has two other