NOTES ON THE DISSECTION OF AN AGNATHIC FŒTUS.

By LEWIS GRAHAM, M.S. (Lond.), F.R.C.S. (Eng.), *Demonstrator of Anatomy, University of Birmingham, Honorary Surgeon and Registrar, Birmingham and Midland Hospital for Women.*

THE following dissection was carried out on a female fœtus of 42 centimetres length from vertex to heel. The age, computed from its length and the general appearance, was about thirty-four weeks' intra-uterine

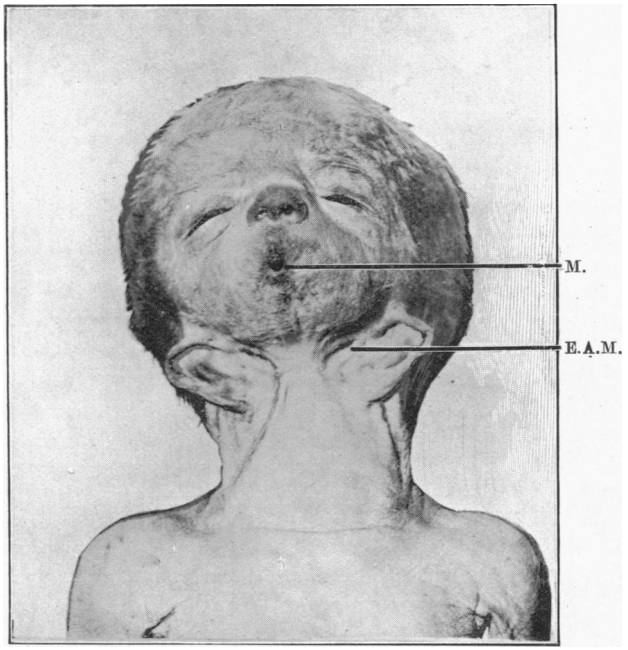

FIG. 1.—A full-face photograph of the fœtus.
M., mouth; E.A.M., external acoustic meatus.

life. Before dissection the most striking abnormal features were: a mouth reduced to a tiny slit, the apparent absence of lower jaw and chin and the situation of the ears in the neck. The rest of the body showed no departure from the normal, and the limbs, umbilical cord, trunk, and genitalia were

similar to those found in a fœtus of the same term of development. Inspection of the head showed the usual form of vertex, eyes, nose, and upper jaw. Immediately below the upper jaw there was an absence of the usual contour, which was due to the chin and lower jaw being undeveloped. The cutaneous structures passed directly backwards from the anterior end of the upper jaw to join the front part of the neck at a right angle. At this anterior end of the upper jaw there was a small vertical cleft (just

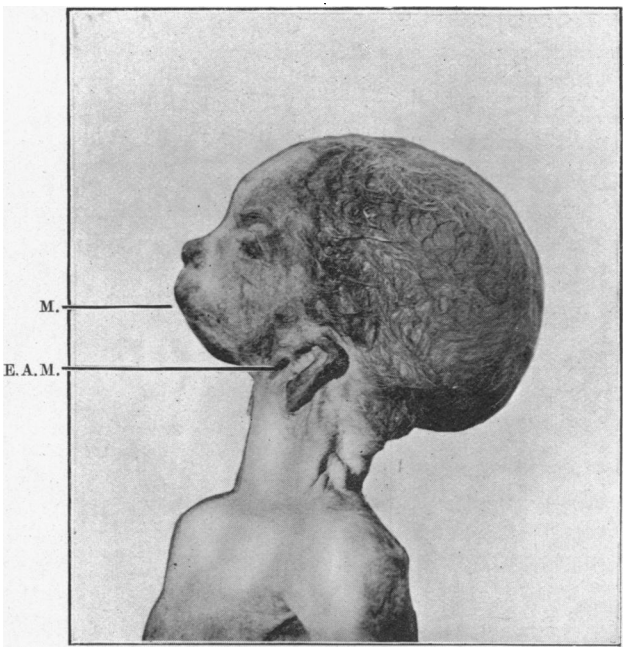

FIG. 2.—A profile photograph of the fœtus.
M., mouth; E.A.M., external acoustic meatus.

admitting a probe) which represented the mouth. No lower jaw was palpable, but the under surface of the hard palate was easily recognised. In the region of the tuberosities of the upper jaw were placed the auricles. They were well formed, but had no immediate relationship to the external acoustic meatus. The latter was placed nearer the middle line of the neck, and a probe passed about 7 millimetres along this passage.

A superficial dissection was first made of the left side of the head and neck. This displayed the following features:—

There was a well-marked mass of suet-like fat (probably the sucking-pad) lying below the zygomatic bone and maxilla. Deep to this was a

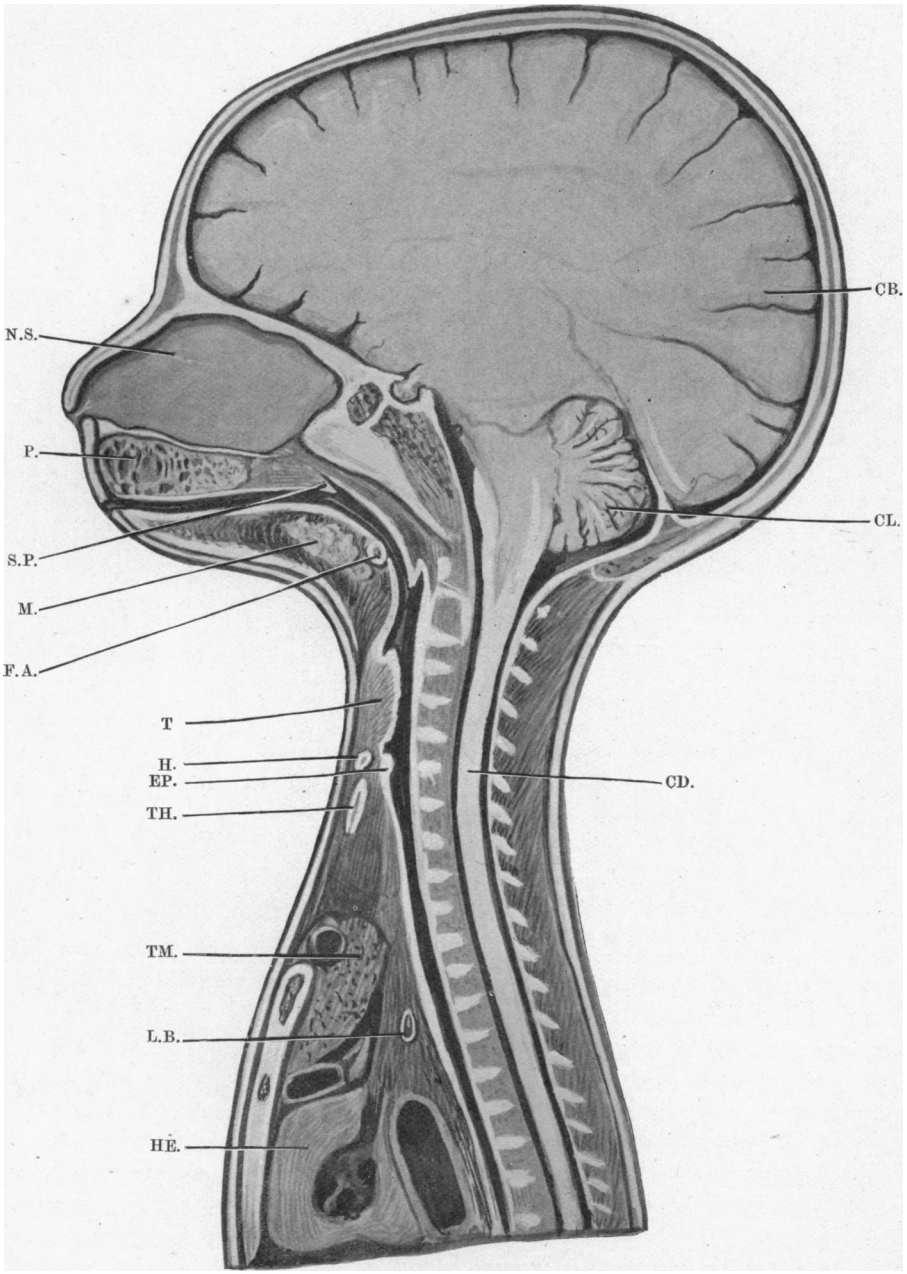

FIG. 3.—A sagittal section slightly to the left of the middle line.

N.S., nasal septum: P., hard palate; S.P., soft palate; M., muscular mass; F.A., first arch ossified to form rudimentary lower jaw; T., tongue; H., hyoid bone; EP., epiglottis; TH., thyroid cartilage; TM., thymus; L.B., left bronchus; HE., heart; CB., cerebrum; CL., cerebellum; CD., spinal cord. Nat. size.

quadrate muscular mass, arising from the zygomatic bone and extending hammock-wise across the neck to the opposite side. Its posterior border supported the rudimentary lower jaw, which was subsequently found at the position of the junction of the horizontal and vertical planes of the neck. This muscular mass was supplied by the fifth cranial nerve.

The sterno-mastoid was well developed, and the carotid and internal jugular vessels lay under it. The latter passed up behind the ear, as did the external maxillary artery and vein. The stylo-hyoid muscle crossed the carotid superficially, well behind the auricle, downwards to its insertion

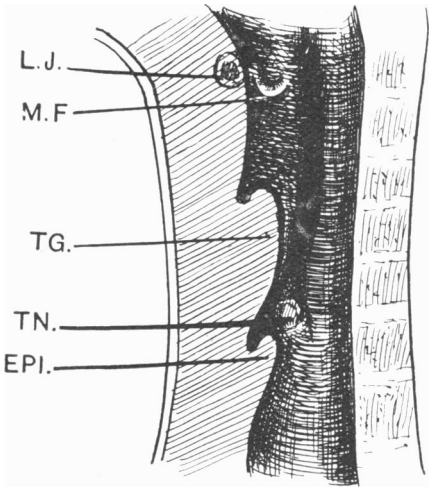

FIG. 4.—Enlargement of pharynx as seen in fig. 3.

L.J., lower jaw; M.F., mucous fold raised by handle of malleus; TG., tongue; TN., tonsil; EPI., epiglottis.

into the hyoid cartilage. This muscle was pierced in the usual fashion by the intermediate tendon of the digastric. Deep to it was the stylo-hyoid ligament passing downwards from a definite styloid cartilage. The latter was attached to the mastoid region of the temporal bone.

The fœtus was next divided in the sagittal plane of the body slightly to the left of the middle line.

The brain and spinal cord appeared normal, as did also the bones of the skull and vertebral column. The nasal septum was of the usual size and shape, and was attached by its lower border to the hard palate. The latter was wedge-shaped, thicker in front than behind, and in the former situation of considerable thickness (6 millimetres). Below it lay an oral passage leading from the anterior slit in front to the pharynx behind. This

chamber communicated above with the nasal cavities (which were normal), and below with the trachea and œsophagus.

Forming the floor of this oral passage was the undifferentiated mass of muscle, the sucking-pad of fat and skin already referred to. At the hinder end of these tissues was situated the small bar of bone representing the lower jaw.

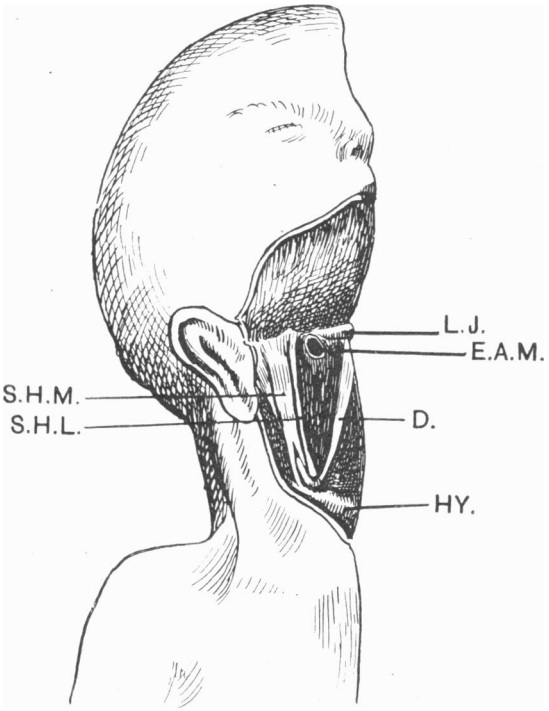

FIG. 5.—Superficial dissection of neck.

L.J., lower jaw; E.A.M., external acoustic meatus; D., anterior belly of digastric; HY., hyoid bone; S.H.M., stylo-hyoid muscle; S.H.L., stylo-hyoid ligament.

The tongue was placed below this, and lay vertically in the neck with its tip 1 centimetre below the lower jaw. On either side of it were the tonsillar recesses. At the side of the pharynx there appeared a longitudinal ridge running down from the basis cranii to the arcus glosso-palatinus of the tonsillar fossa. The depression behind it displayed no recess. In front, there was a semicircular elevation of the mucous membrane at the level of the jaw rudiment surrounding a slight dimple. The dimple corresponded to the medial end of the external acoustic meatus. The surrounding elevation was formed by the somewhat curved handle of the

malleus, which projected into the lateral wall of the pharynx This dimple appeared to be the sole representative of the first pharyngeal pouch, and the bottom of it to be the membrana tympani. It is certain that at the bottom of it there was only this thin partition between the external acoustic meatus and the pharynx.

A dissection was now made in the region of the auricle, its meatus, and the lower jaw.

After removing the sucking-pad and muscle, the external acoustic meatus was laid open. At its lateral end it was surrounded by the thin circle of bone (tympanic ring) shown in fig. 6, E. At its deep end was the

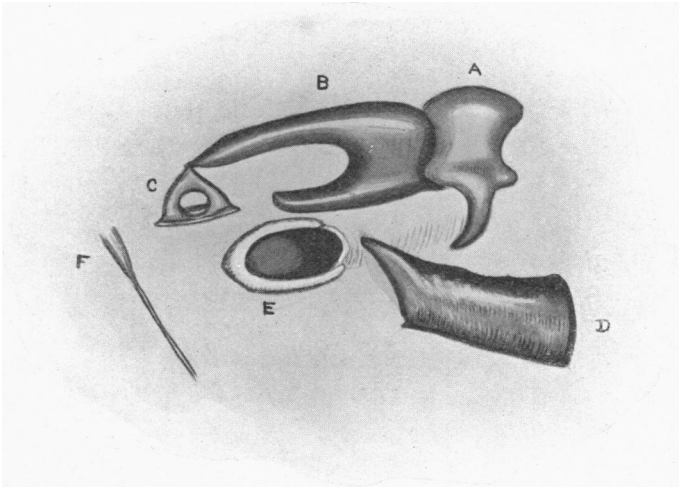

FIG. 6.—The ossicles of right side drawn *in situ*.
A, malleus; B, incus; C, stapes; D, lower jaw; E, tympanic ring surrounding external acoustic meatus; F, styloid process and stylo-hyoid ligament.

partition, noted above, which separated it from the pharynx. The membrane forming the partition was surrounded by the curved handle of the malleus, as shown in fig. 6, A.

The lower jaw rudiment lay for the most part very slightly above the level of the external acoustic meatus, but near the membrana tympani it is at the same level (*vide* fig. 5). When removed, no connexion between it and the skull suggestive of other derivatives of Meckel's cartilage was made out. It simply lay at the back of, and above, the undifferentiated muscular mass before mentioned.

After removing the lower jaw, a chain of ossicles was found. They lay deep to the external acoustic meatus and slightly above it. They extended from the side wall of the pharynx lateralwards to the under

surface of the temporal bone. Part of this had to be removed for their complete extraction. Their exact shape and relative positions are shown in fig. 6, A, B, and C.

An examination of these ossicles reveals the following interesting features. They are all somewhat deformed. Their sizes vary relatively and absolutely from those of normal bones. These differences in size can easily be seen on reference to figs. 7 and 8, in which they have been drawn to scale for comparison with the normal. The malleus is about half the length of that of the normal adult; the incus is larger than that of the adult; the stapes is about the same size as that of the adult. The tympanic ring is deformed, being much more oval than the normal tympanic ring.

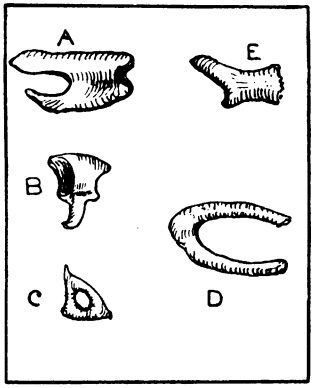

FIG. 7.—Ossicles, tympanic ring, and lower jaw in Agnathia. × 2.

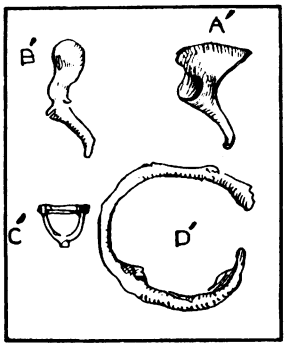

FIG. 8.—Normal ossicles of adult and tympanic ring at birth. × 2.

A and A′, incus; B and B′, malleus; C and C′, stapes; D, tympanic ring in Agnathia; D′, tympanic ring at birth; E, lower jaw in Agnathia.

It is also smaller than the average tympanic ring at birth. In making these comparisons it is borne in mind that the ossicles at birth are but slightly smaller than those of the adult.

The structures derived from the other pharyngeal pouches and arches (such as the tonsil, thymus, thyroid gland, hyoid bone, and larynx) showed no departure from the normal condition found in a fœtus of similar age.

The main interest, beyond the facts ascertained by dissection, centres round an inquiry as to what is primary and what is secondary with regard to these malformations. Has the failure of development of the jaw followed on absence of the first pharyngeal pouch; or has the pharyngeal pouch failed to develop on account of the rudimentary character of the lower jaw; or are they both manifestations of a common agency? It is impossible to give a certain answer; but taking into consideration the facts known

regarding the early stages of the development of the pharynx, it is known that the first pharyngeal pouch develops before any sign of jaw appears in connexion with Meckel's cartilage. In proof of this, in the model of the 2·5 millimetre embryo magnified a hundred times, and reconstructed by the Born method, now in this University, the first pharyngeal pouches have the following dimensions:—Vertical depth, on the right side 18 millimetres, and on the left side 15 millimetres. Lateral depth, on the right side 11 millimetres, and on the left side 12 millimetres. Yet in this embryo the only structure seen in the first pair of arches is the artery of the arch embedded in the mesenchyme. It would thus appear that the lack of development of the lower jaw is due either to failure of the first pharyngeal pouch, or to the same cause which led to the non-development of the cavities derived from this pouch (tuba auditiva, tympanic cavity, and antrum tympanicum).

Our knowledge of the causes producing monsters has been greatly increased in recent years by the work of Hertwig, Loeb, Stockard, and others. The masterly summary of these researches in Keibel and Mall's *Embryology*, by Professor Mall on the Pathology of the Human Ovum, is well known.

What was a mystery only a few years ago is a mystery no longer when one considers the wonderful experiments of the above workers in producing artificially the common forms of monsters such as spina bifida, cyclopia, etc.

Professor Mall's suggestion, though not yet capable of absolute proof, seems reasonable: that "it is no longer necessary for us to seek for mechanical obstructions which can compress the umbilical cord, such as amniotic bands, for it is now clear that the impairment of nutrition which naturally follows faulty implantation, or the various poisons which may be in a diseased uterus, can do the whole mischief. That monsters group themselves, both in nature and when made experimentally, rather shows that certain tissues are influenced at crucial periods in their development, and not that given substances have specific influences on the embryo as a whole."

BIBLIOGRAPHY.

(1) Birnbaum and Blacker, *Malformations of the Fœtus*, 1912.

(2) T. W. P Lawrence, *Proc. Anat. Soc., Journal of Anatomy and Physiology*, vol. xxvii., Nov. 1892.

(3) Förster, *Missbildungen des Menschen*, Taf. xiii.

(4) Schwalbe, *Die Morphologie der Missbildungen des Menschen und der Tiere.*

(5) Keibel and Mall, *Manual of Human Embryology*, 1912.