Innervation, Especially Sensory Innervation, of Soft Palate in Hedgehog.

Natsuo OHTOMO 大友夏男.

(Received June 18, 1954.)

Rather many histological studies on the innervation of the palate have been reported, e.g., by CECCHERELLI (1908), KADANOFF (1927), SAKAI (1944) and FUNABASHI (1947) on human palate and by ELIN (1871), LEDIG (1872), RETZIUS (1892), ÁBRAHÁM (1937), HAMADA (1940) and OGASAWARA and others (1954) on mamalian palates. However, most of these studies were limited to the hard palate, only SAKAI (1944) and FUNABASHI (1947) having studied the human adult and embryonic soft palates, respectively, with anything like thoroughness. Thus, seeing that there is no study at all in the past on mamalian soft palate worth mentioning, I undertook a research on the soft palate in hedgehog, utilizing SETO's silver impregnation. The observations I gained in this research I studied in collation with the results obtained by SAKAI (1944) and FUNABASHI (1947) mentioned above, as follows.

The formation of nerve plexus in the soft palate in hedgehog is quite similar to that in human counterpart, submucosal plexus with coarse meshes being formed in the submucosa provided with purely mucous glands and fine-meshed proprial plexus derived from the former plexus in the tunica propria of the mucous membrane. These plexuses are composed of unmedullated vegetative fibres and medullated sensory fibres, and no nerve cells are contained therein, as different from such plexuses in the tongue and the pharynx, as reported recently.

Many studies at this laboratory has established the theory that the development of sensory fibres is proportional to that of the papillae. Thus, the development of the papillae in the soft palate of a hedgehog is of importance in studying the sensory innervation of this part. The epithelium is generally high in this part, the posterior part thereof being especially high. Of the papillae formed into this epithelium, beside the special papillae described below, formed in the fore part of the soft palate near the median line and on both sides of it, the very elongated papillae formed in the rear part is worthy of special attention. The papillae in other parts of the soft palate are also rather long and slender.
The special papillae mentioned above are provided with taste-buds, similar in construction to the so-called gemmal papillae found by SAKAI (1947) along the median line in the foremost part of human soft palate. Similarly papillae have been recently found by OHGAKI (1953) on the under-surface of human tongues. These papillae have small secondary papillae, are covered with a very thin epithelium which is surfaced with a corneate plate as that on the lingual fungiform papillae and contain taste-buds. However, they are not circumvallated as the lingual papillae, the thin epithelium over them directly going over into the very thick epithelium surrounding them. In the papillar trunks of these papillae are found a small number of lymphocyte aggregations.

The sensory innervation of these gemmal papillae is very similar to that of the lingual fungiform papillae of this animal as I have previously reported upon, though the complexity of the terminal formation is proportional to the size of the papillae. Basal plexus consisting of vegetative fibres and medullated sensory fibres is formed at the basis of the papillar trunk (Fig. 1). This is, however, different from such...
plexus found in the circumvallate and the foliate papillae in that it contains no REMAK's hemiganglion cells. The nerve fibres from this basal plexus run up into the papillary trunk, the vegetative fibres forming the terminal reticulum and the sensory fibres ending freely in the subepithelial layer, especially in the secondary papillae. The sensory fibres are in the larger papillae sometimes very stout. These fibres end in unbranched, simple and sometimes rather complex branched terminations (Figs. 1 and 2), but none in such more complex glomerular terminations as seen in human soft palate (SAKAI). Intraepithelial fibres are also found in the epithelium covering these special gemmal papillae, as in the fungiform and the foliate papillae of this animal, always ending unbranched close to the corneate plate either sharply or in nodules (Fig. 3). In the hedgehog soft palate, such intraepithelial fibres were limited to these gemmal papillae in existence.

The sensory terminal formations for the taste-buds in the special gemmal papillae in hedgehog were often rather complexly ramified, though in general simpler than those in human counterpart.

Fig. 3. Ditto. A few unbranched intraepithelial fibres are also seen. Same staining. ×320, reduced to 1/2.

Sometimes intragemmal, and more rarely, extragemmal, fibres were also observable here in the gemmal papillae (Figs. 1 and 4).

Some sensory fibres were found entering the papillae other than the above special

Fig. 4. Sensory innervation of a taste-bud in a gemmal papilla. Hedgehog soft palate. Here are seen intra- and extragemmal fibres also very clearly. Same staining. ×320, reduced to 2/3.
N. OHTOMO:

Fig. 5. Unbranched and simple branched sensory terminations formed in a slender papilla existing in the lateral part of a hedgehog soft palate. Same staining. ×320, reduced to 1/2.

Fig. 6. A somewhat complex branched sensory termination seen in a larger papilla near the median part of a hedgehog soft palate. Same staining. ×400, reduced to 2/3.

Fig. 7. A small glomerular termination found in a small papilla of a hedgehog soft palate. Same staining. ×400, reduced to 1/2.

gemmal papillae, but their terminations were in most cases limited to unbranched and simple branched endings (Figs. 5 and 6), such corpuscular terminations as found in human soft palate being found only very rarely. In rare cases also, branched terminations of some complexity (Fig. 6) and glomerular terminations were observed. That the gland ducts can be also provided with intraepithelial fibres has been proved by SETO (1939) in human urethral and proctodaeal glands, by SADA (1943) in human oesophageal glands and by HORIZU (1943) in the mucous glands in the tuba auditiva. SAKAI (1944) has proved them in the ducts of the mucous glands in human soft palate, but in hedgehogs, I could find
only sensory fibres running in contact with such ducts but no one penetrating their epithelium. In the ciliated epithelium lining the nasal part of the soft palate, however, I found some sharply ending unbranched intraepithelial fibres, as shown in Fig. 8, similar to those in human soft palate.

In summary, it may be seen that the development of the sensory fibres supplying the soft palate and their terminations in hedgehog is far below that of human adult and is roughly on the same footing as in human embryo. This fact is probably a proof that the development of sensory nerve fibres is the highest in man.
References.