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Introduction and History

The study of glands has become of increasing interest during recent years and much work has been done on various animals; in rats, this work has been on the effects of feeding on the composition of the glands, and on weights and measurements of the glands in relation to body weight.

There are numerous glands called "salivary glands" opening into the oral cavity, which secrete a liquid called saliva. There are three pairs of large glands which are usually considered the salivary glands proper; the parotids, mandibulars (submaxillary), and sublinguals.

Albino rats (*Mus norvegicus albinus*) are used in this laboratory for the study of mammalian tissue in histology. Some difficulty has been encountered in identifying the glands of the salivary region, because on superficial examination, only two pairs of glands are evident. The large submaxillary glands are easily located because of their definite outline and tough texture, and the parotid is easily identified because it is irregularly shaped and loosely organized. Although the extra-orbital portion of the lacrimal gland lies where the parotid might be expected, its duct crosses the temporal muscle to empty into the outer corner of the eye.

Hunt (1) states that there are two salivary glands present in the rat, the submaxillary and the parotid, implying that the sublingual is not present.

The motive of this study was to ascertain whether a sublingual gland is present and to locate it, if possible.

The only reference found to the histology of these glands in rodents is in Maximow (2): "In the various mammals the glands of the oral cavity show great variations. Even in closely related species the same gland may have a totally different cellular composition." He further says that the submaxillary gland in rodents contains no mucin, but is all albuminous and that the sublingual gland or the "retrolingual" is pure mucous. He does not describe the location of the "retrolingual" except that it is close to the submaxillary.

A small gland was found embedded in the cephalic portion of the submaxillary gland. It lies within the same membrane and its duct enters or courses with the submaxillary duct. The gland is of lighter color although its texture is essentially the same as the submaxillary.

An attempt is made in this article to show that this gland is the sublingual gland.

Perhaps the reason this gland has not been identified before in the rat, is that it lies embedded in the submaxillary, whereas in most animals it lies in the same region but as a distinctly separate gland.

Material and Method

For this investigation normal rats from the Wistar stock have been used.

The first rat to be examined was dissected to expose the region of the salivary glands and fixed in formalin; these glands were located anatomically and a diagram made from this specimen. The glands were removed and numbered for histological examination. Subsequent specimens were examined fresh or hardened in 5% formalin for gross investigations.

After the first series of slides from the formalin material, others were made from fresh material dissected out and immediately fixed in Bouin's solution. The tissue was imbedded in paraffin and sections cut from 6 to 10 microns thick. They were stained with Delafield's haematoxylin and counter stained with eosin (in 95% alc.). The amount of stain was varied from quite light to medium dark. The light stain in which there was just enough haematoxylin to stain the nuclear parts and very little eosin was the best and these slides were used for the photomicrographs.

A set of slides has been made from three different rats, and several rats have been used to check the gross anatomy.

Description—Gross

The submaxillary glands are to be found as described in Hunt (1). They are a large pair of elongated glands on the ventral surface of the neck, with their median faces in contact, in the sagittal plane of the animal, throughout most of their length. The two submaxillary ducts (Wharton's) leave the anterior ends of the two glands and empty into the ventral buccal cavity.

On examination it is to be noted that the cephalic, lateral region of the submaxillary gland is of lighter color and can easily be separated from the main gland. (See Figure 1.) The submaxillary gland is lobed and can readily be split apart but not into complete units. The two glands are enclosed in one membrane, but the connective tissue between them is quite heavy and readily splits apart. The duct from this smaller, lighter gland may enter the submaxillary duct (Wharton's) almost immediately after leaving the gland, or it may course parallel nearly to the point of entrance into the buccal

cavity before this duct enters the submaxillary duct. The position of the gland and its duct would indicate that the gland is the sublingual gland and duct, "ductus sublingualis major".

The parotid glands were found as described by Hunt (1). They are loosely organized, elongated glands, "extending from the base of the external ear along the side of the neck to the ventral surface of it". (See Figure 1). The duct is formed from the tributaries from different parts of the gland, crosses the surface of the masseter muscle, then turns inward to the mouth cavity. There are two sections of the gland, one cephalad of the submaxillary gland and one dorsal to the external jugular vein on a level with the submaxillary gland.

Microscopic

Transverse sections cut through the two glands, the submaxillary and the "retrolingual", show them to be of distinctly different histological structures. (See Figures 2 and 3). The submaxillary gland is a mixed gland showing a large per cent of albuminous cells similar to human submaxillary. Apparently the statement of Maximow (2) that the submaxillary gland of rodents is pure albuminous does not hold for the albino rat.

Howell (3) says that the submaxillary gland secretes a more viscid substance than saliva containing mucin, "which acts as a lubricant during deglutination of coarse, dry fodder". The wood rat, *Teonoma*, uses large amounts of such food and has broader, better defined submaxillaries than have *Neotoma* and *Homodontomys* who eat starchy foods. The rats of our stock have been fed table scraps, fresh fruits, vegetables, meats, and cooked vegetables, with whole wheat bread and dry oat meal. This might explain the presence of large well developed submaxillary glands containing mucous cells.

The gland described earlier in the article, lying on the submaxillary is entirely mucous. The cells of this gland are larger than the mucous cells found in the submaxillary gland, as is usual of the cells of pure mucous glands. (See Figure 3).

Maximow's statement that the sublingual gland or "retrolingual" gland is pure mucous in rodents is borne out.

The parotid gland is a pure albuminous gland similar to the human parotid. Howell (3) says that the parotids secrete a liquid "that is comparatively non-viscid, without mucin, and rich in ptyalin, which latter is especially active in digestion of starchy foods". The parotid glands of our albino rats are not very well developed. This is as might be expected in rats with well developed submaxillaries.

Conclusion

The submaxillary glands are a large pair of glands on the ventral surface of neck, lying with their median faces in contact, throughout most of their length. They are mixed glands having a large per cent of albuminous cells like the human submaxillary glands. According to Maximow these glands are pure albuminous in some rodents, but this investigation shows them to be mixed glands in albino rats. Howell indicates that the submaxillary glands of the wood rat also contain mucin.

The gland lying embedded in the cephalic part of the submaxillary is described as the sublingual or "retrolingual" gland. Its duct enters Wharton's duct or runs parallel with it to enter the ventral buccal cavity. It is a pure mucous gland as Maximow says the sublingual gland of rodents has been found to be.

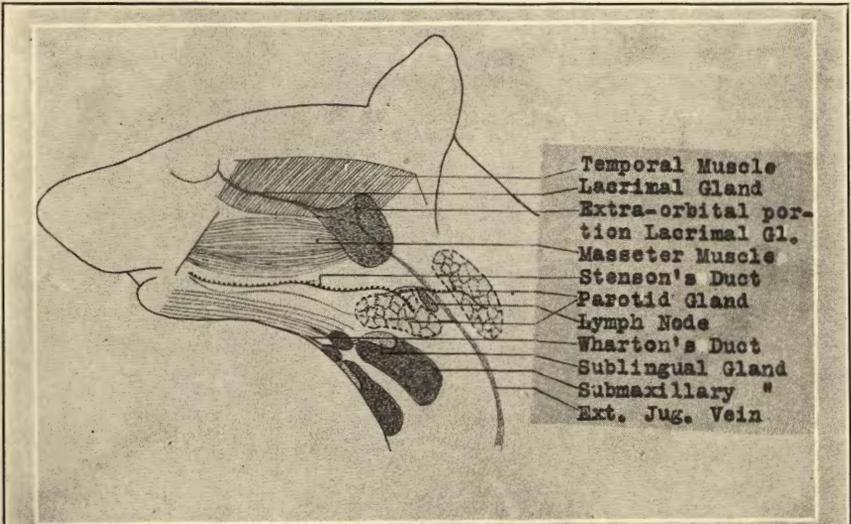
The parotid gland is a loosely organized gland of several sections. The ducts meet and traverse the masseter muscle and empty into the buccal cavity. It is a pure albuminous gland like the human parotid.

Literature Cited

1. Hunt, Harrison R., 1925. *A Laboratory Manual of the Anatomy of the Rat*, pp. 48-49. The Macmillan Co.
2. Maximow, Alexander A., 1930. *Text-Book of Histology*, pp. 493. W. B. Saunders Company.
3. Howell, A. Brazier, 1926. *Anatomy of the Wood Rat*, pp. 92-93. Williams and Wilkins Co.

Description of Plate

- Fig. 1. Diagram of the Gross Anatomy of the Lateral View of the Head and Neck with Glands in Place.
- Fig. 2. Photomicrograph of a Cross Section of the Submaxillary and Sublingual Glands, enlarged 13.5 diameters.
- Fig. 3. Same as Fig. 2, enlarged 134 diameters.



1



2



3