

## THE COMPARATIVE MORPHOLOGY OF THE M. CANINUS

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THE M. caninus was thought by Ruge to be a derivative of the M. orbicularis oris and an adaptation peculiar to primates; he gave to the muscle complex the name M. canino-orbicularis. In the order primates this seemed an apt term for an apparently self-evident truth—the muscles were inseparable.

Theoretically there are objections to both these assumptions, objections weighty enough to require their investigation. As a result, it will appear doubtful whether the M. caninus can be considered either as a muscle peculiar to the primates or as a derivative of the M. orbicularis oris. Adaptations of muscles occur often, and these, at times, are difficult to homologize, e.g. the P.p. orbitalis and jugalis M. maxillo-naso-labialis: new muscles with special functions also occur which may seem, in the present state of our knowledge, impossible to homologize. But these latter are, usually, small muscles which are confined to one particular animal, or one small group of animals. The fact that the M. caninus is found throughout the primates suggests that it is an adaptation of some muscle matrix present in the subprimates rather than a new specialization. Its origin from the canine fossa precludes the M. orbicularis oris as its matrix; the latter is essentially a superficial muscle, whereas the origin of the M. caninus lies deep to morphologically old and long-established nerves and muscles; it has, in fact, the most deeply situated muscle attachment in this area.

In looking for a matrix for the M. caninus, therefore, it must not have a less deeply situated origin than the other muscles of this area. Further, the origin must be a very large one, extending, possibly, from the bony narial margin to the root of the zygoma. This would be necessary to account for the different types of M. caninus found in primates. In the lemurs and Cercopithecidae the muscle takes origin from the canine jugum where it reaches almost to the bony narial margin; and in the anthropoids from the canine fossa, extending towards the root of the zygoma.

Such a muscle is found quite commonly, though not universally, in the subprimates, viz. the P. profunda M. maxillo-naso-labialis (M. bucco-naso-labialis of Schreiber and Meinertz). Boas and Paulli (1908) describe this muscle in the rabbit as part of the M. buccinator.

*P. profunda M. maxillo-naso-labialis.* In a previous article (Lightoller, 1934) it was suggested that the muscles taking origin from bone in the orbito-nasal region had, in all probability, a common matrix, and might conveniently

be grouped together under the name *M. maxillo-naso-labialis*; further, it was shown that this muscle complex consisted of four portions: three of these are superficial, *P.p. orbitalis*, *jugalis* and *alveolaris*, to the deeply situated fourth, *P. profunda*.<sup>1</sup> It has been suggested that the more superficial are homologous with the *capita angulare* and *infra-orbitale* and, possibly, the *Mm. labii superioris profundus*<sup>2</sup> and *nasalis*. It is now suggested that the *P. profunda* is homologous with the *Mm. caninus* and *incisivus superior*.

The *P. profunda* has been described in many rodents, under the name *M. bucco-naso-labialis*, by Schreiber and Meinertz. In the present series of dissections it has been found in the three rodents dissected, in many marsupials, in three types of the *Pteropidae* family and in a *Cynopterus sphinx*.

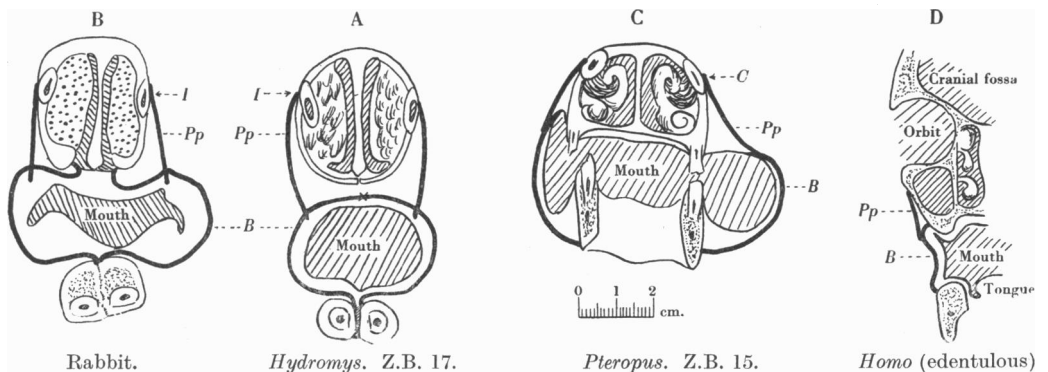


Fig. 1. Diotopographic tracings of the rostral surface of oblique sections through the nasal area in four mammals. A. *Hydromys chrysogaster*. The *P. profunda* takes origin from the incisor jugum and is inserted into the submucosa of the cheek. The caudo-rostral fibres of the *M. buccinator* are omitted; the dorso-ventral fibres form an almost complete sphincter. B. *Lepus cuniculus*. The arrangement is very similar to the above, but the *M. buccinator* is attached to bone dorsally as well as ventrally. C. *Pteropus scapulatus*. The *P. profunda*, in this section, takes origin from the canine jugum and ends superficial to, or interlaced with, the fibres of the *M. buccinator*. D. *Homo sapiens*. This section was viewed obliquely. The *P. profunda* (*M. caninus*) ends similarly to *Pteropus*; it takes origin from the canine fossa. Note that, in all sections, the *P. profunda* supports the vestibule of the cheek.

In many mammals the muscle, apparently, is not present, e.g. dog and cat (Huber), horse and cow (Sisson & Grossman).

**Rodents.** In both *Hydromys* and *Notomys* the *P. profunda* takes origin from the large semicircular incisor jugum. In the former it extends from the rostral end of the jugum to the pre-orbital fibres of the *M. masseter* (Fig. 2); in the latter it does not extend so far caudally. In both the general direction of the fibres is ventral; but, as the sheet is fan-shaped, the ends have rostral and caudal inclinations. The caudal fibres end by interlacing with those of the *M. buccinator*; but a large number of the rostral fibres lie rostral to this

<sup>1</sup> This lies deep not only to the other muscles in this region but also to the *N. infra-orbitalis*.

<sup>2</sup> This has been described and figured in *Homo* (Lightoller, 1928).

muscle, and end in the submucosa of the upper lip (Fig. 2). In both these rodents the dorso-ventral fibres of the *M. buccinator* are attached ventrally to the dorso-medial edge of the asymphyseal mandible; dorsally they are not attached to the maxilla, but end, ventral to the palate, in a median raphe (Fig. 1 A).

*Lepus cuniculus*. The muscle here is similar to that just described, but complicated by the interlacement, dorsally, of the fibres of the *M. nasolabialis* (naso-labialis superior of Meinertz). The dorso-ventral fibres of the *M. buccinator* gain attachment to the maxilla (Fig. 1 B).

*Marsupials*. In marsupials the muscle is very variable. In *Dendrolagus lumholtzii* the muscle is not dissimilar to that described for rodents, but all the fibres interlace with the *M. buccinator*, none are attached to the mucosa of the lip.

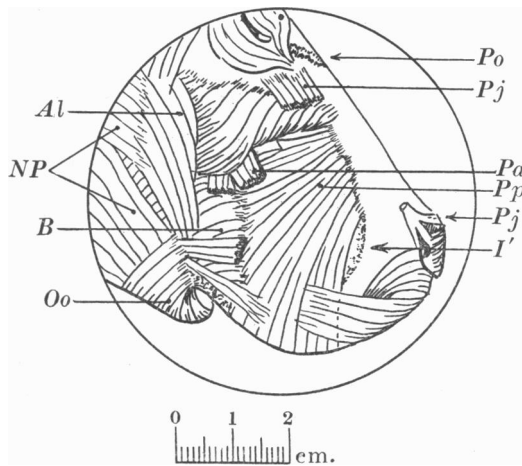


Fig. 2. A dioptogram of the snout of *Hydromys chrysogaster*. The *P. profunda* takes origin from the semicircular incisor jugum; its caudal fibres interlace with the *M. buccinator*, its rostral fibres end in the submucosa of the upper lip. (Z.B. 17.)

In *Antechinus swainsonii* and *Perameles nasuta* the muscle is band-like and runs parallel to the alveolar margin. It takes origin from this margin, and its rostro-caudally directed fibres end at the angle of the mouth by interlacing with those of the *M. buccinator*. The orbicularis oris fibres are feebly developed in the upper lip.

In the koala only the rostral, in *Hypsiprymnodon* only the caudal, fibres are represented; in both, however, the fibres interlace with those of the *Mm. buccinator* and orbicularis oris.

In *Myrmecobius*, *Dasyurus maculatus* and *Trichosurus vulpecula* the muscle takes origin from the alveolar margin; thence it passes, in a dorso-ventral direction, between the mucosa and the *M. orbicularis oris*; some fibres end in the former and others interlace with the latter.

In *Sarcophilus harrisi* is seen a stage which is intermediate between that of *Dendrolagus* and *Dasyurus*. Here the muscle consists of two layers; the deep takes origin from the alveolar margin, the more superficial from the bone deep to the tendons of the P. jugalis. Both sets of fibres fuse towards their insertion, which is similar to that of *Dasyurus*.

In *Thalacomys lagotis* the muscle is highly specialized.

*Chiroptera*. Three varieties of the fruit-eating bat, *Pteropus*, were dissected and the P. profunda is similar in size and form in each. It takes origin, anterior to the canine jugum, from the premaxilla close to the bony narial margin; also from a slightly curved line which extends from here as far caudally as the M. palpebralis medialis.<sup>1</sup> The most caudal fibres may lie dorsal or ventral to

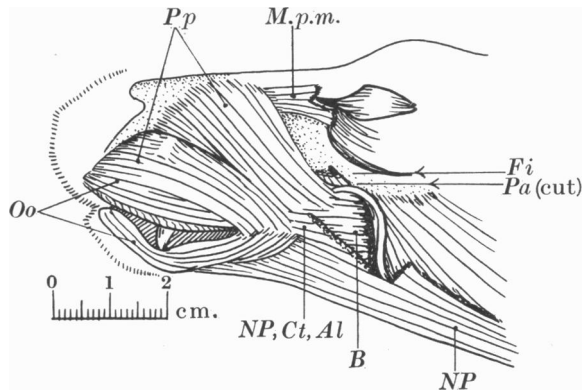


Fig. 3. A dioptogram of the snout of *Pteropus scapulatus*. The P. profunda is large. Its origin extends from an area rostral to the canine jugum to an area dorsal, sometimes ventral, to the M. palpebralis medialis. It passes superficial to the Mm. orbicularis oris and buccinator and interlaces with both these muscles. (Z.B. 15.)

this; in either case they approach the root of the zygoma (Fig. 3). The P. profunda sheet tends to divide into rostral and caudal portions (Fig. 3). From this wide area of origin the fibres pass ventro-caudally to end by interlacing with, or to lie superficial to, the Mm. orbicularis oris and buccinator (Figs. 1 C and 3). In *Pteropus* the M. buccinator does not consist of dorso-ventral and caudo-rostral sheets; its fibres run obliquely and are attached, directly or indirectly, to the lateral surfaces of the maxilla and mandible (Fig. 1 C).

In *Cynopterus sphinx tithaechailus* only the caudal fibres are present, but these end by interlacing with those of the Mm. orbicularis oris and buccinator.

*Primates*. In primates there is not found any large P. profunda such as has been described above; the rostral and caudal portions are represented by two separate deeply situated muscles, viz. the Mm. incisivus superior and caninus.

<sup>1</sup> This term has been used because the attachment of the M. orbicularis oculi to the maxilla is muscular and not ligamentous.

The caudal portion is effectively represented by the *M. caninus*; the rostral portion, however, is far more variable in its mode of origin.

To cover by a single name these variations, a wider view must be taken of the area from which the *M. incisivus superior* may take origin. It may be defined as a muscle which takes origin from the neighbourhood of the ventral or lateral margins of the bony anterior nares, becomes closely associated or fuses with the *M. orbicularis oris*, and ends, when able to be separately traced, in the modiolar region.<sup>1</sup>

As might be expected, in some animals there will be fibres from the ventral as well as fibres from the lateral margin of the bony nares, each of which may join the *M. orbicularis oris* independently; in other cases it may be difficult to decide whether the muscle should be called a *M. caninus* or a *M. incisivus*.

The lemurs (*Z 06* and *Z 07*) (Lightoller, 1934) possess only a *M. incisivus superior*. A few weak fibres take origin ventral to the bony nares, but a large sheet of fibres takes origin lateral to the fossa.

In the Cercopithecidae (Lightoller, 1928) a similar condition is found, but both groups of muscle fibres are well developed. In neither of these groups is a *M. caninus* present.<sup>2</sup>

In the gorilla (Ruge, 1887), orang (Lightoller, 1928) and *Homo* are present a *M. incisivus superior* taking origin from the incisive fossa and a *M. caninus* from the canine fossa. Both are deeply situated and represent the rostral and caudal portions of the *P. profunda*. No fibres take origin from the lateral margin of the bony nares.

In primates, therefore, the *P. profunda* of lower mammals is represented in two ways: the whole of the rostral fibres may remain with a complete absence of the caudal ones; or, the infra-narial rostral fibres and the whole of the caudal fibres may be present.

*Function.* The complete enumeration of the functions of the *P. profunda* in any or all of the above-mentioned orders could only be ascertained by a prolonged and careful study of the animals in question. But a simple function seems common to all—even to *Homo*, viz. to support the vestibule of the cheek and upper lip (Fig. 1). In Man, of course, it has been adapted for the production of sound, especially speech.

#### SUMMARY

A brief account has been given of the *P. profunda M. maxillo-naso-labialis* in certain selected mammals and in Man. It has been shown that the muscle is frequently, though not invariably, present in the Mammalia; but insufficient material is at present available to determine either the frequency of its

<sup>1</sup> The fibres taking origin lateral to the bony nares are neither true caninus nor true incisivus, but from the condition found in *Pteropus* it seems better to class them with this than to give them a new name.

<sup>2</sup> Those fibres which take origin from the lateral margin of the bony nares have, hitherto, been classed as *M. caninus*.

occurrence or of its presence or absence in any particular order. The muscle has been shown to support the vestibule of the cheek and upper lip, and the *Mm. incisivus superior* and *caninus* of Man have been homologized with it.

In conclusion I wish to thank Prof. Burkitt for his assistance and for his helpful criticism, and the Department of Anatomy, University of Sydney, for the material and facilities wherewith to conduct this investigation.

#### ABBREVIATIONS

Figures accompanied by a scale are dioptograms. *Al*=*M. auriculo-labialis*; *B*=*M. buccinator*; *C*=canine tooth; *Ct*=*M. cervicalis transversus*; *Fi*=foramen infra-orbitale; *I*=incisor tooth; *I'*=incisor jugum; *M.p.m.*=*M. palpebralis medialis*; *NP*=*noto-platysma*; *Oo*=*M. orbicularis oris*; *Pa*=*P. alveolaris*; *Pj*=*P. jugalis*; *Po*=*P. orbitalis*; *Pp*=*P. profunda*.

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