

48. On the Facial Vibrissæ of Mammalia. By R. I. POOCOК,
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(Text-figures 1-13.)

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INTRODUCTION.

The facts recorded in this and the following paper are some of the results of several years' work, done as time and opportunity permitted, in the Society's Prosectorium.

The features chosen for investigation were external cutaneous structures, which are often cut away or spoilt by shrinkage in dried skins, and which consequently can only be studied satisfactorily upon fresh or spirit-preserved material.

Work done in this way, however, upon specimens which in many cases cannot be preserved for want of storage space, has the great disadvantage of not being comparative in the proper sense of the word. Related animals die at intervals, often of long duration, and the specimens themselves cannot be set side by side and carefully compared from exactly the same point of view. The features presented by the organs under investigation can only be checked by notes or sketches taken from previous specimens, and where discrepancies, or apparent discrepancies, are detected, there is no possibility of referring to the example previously examined to ascertain the meaning or nature of the variation.

As a concrete illustration of the limitations imposed by piecemeal work of this description may be cited the rhinaria of mammals which, when viewed from the front, vary in shape according to the position in which the head is held, and it is not possible to be sure that the standpoint of the investigator is precisely the same in two or more consecutive cases. Hence the importance of verifying results originally obtained by the examination of additional specimens, a proceeding often impossible when the specimens belong to species that are seldom imported alive. Even in the case of common species opportunities of verification are frequently few and far between, and waiting for such chances entails long delay in the publication of results. Making allowance, however, for the circumstance that the

observations are based in a great measure upon single individuals, I believe the facts recorded to be of considerable systematic value and sufficiently interesting and important to stimulate extended inquiry along similar lines with profitable results.

The general arrangement of the facial vibrissæ in Mammalia may be well-known to some mammalogists; but it does not appear that these tactile hairs have ever been carefully studied throughout the Orders from the comparative point of view, nor can I find that systematists have made material, much less consistent, use of them in the discrimination of families, genera, and species. One would expect to find these vibrissæ described, if anywhere, in the British Museum Catalogues, where particular stress is laid upon external characters; but except for a casual reference to them in special cases, as in *Chironectes minimus* by Mr. Thomas in the Catalogue of Marsupials, authors of these catalogues have practically ignored them. Nevertheless, I believe they will prove to be of value to the systematic worker. But their main interest is perhaps bionomical.

The following account is not intended to be more than an introduction to the study of this subject. It is based mainly upon specimens that have died in the Zoological Gardens, and very little attempt has been made to carry investigation beyond the limits of ordinary menagerie species. These, however, comprise representatives of most of the orders and suborders of terrestrial mammals: and the types examined are sufficient to establish certain general principles as to the constancy or inconstancy of the occurrence of the tufts of tactile facial vibrissæ within the limits of major groups; but far more extensive investigations than it has been possible for me to undertake will be required to settle the range of their variation within groups of family or generic rank.

According to their position on the head the vibrissæ may be referred to the following categories:—

1. *Buccal*, comprising (*a*) those on the muzzle and upper lip, or *mystacial*, the chief of which are usually arranged in definite longitudinal lines, and (*b*) those on the chin and lower lip, the *submental*, of which there are generally two distinct rows in addition to some smaller ones less regularly arranged. Of these the mystacials are, as a rule, much the more important.

In the sketches illustrating this paper no attempt has been made to show exactly the numbers and position of these vibrissæ. The mystacials have purposely been represented in most cases as fewer and shorter than they are in reality, so as not to interfere with the genals and interramals.

2. *Interramal*, consisting of an unpaired tuft of bristles, often symmetrically arranged, projecting from the interramal area always behind the mandibular symphysis (chin).

3. *Genal*, consisting of one or two tufts, or isolated bristles on the triangular area of the cheek circumscribed by imaginary lines passing from the posterior canthus of the eye, the posterior angle of the mouth and the base of the ear.
4. *Superciliary*: the tuft over the eye, generally over its anterior portion but sometimes further back.
5. *Subocular*: those beneath the eye, present mainly in large herbivora.

The superciliaries and suboculars must not be confounded with the eye-lashes which, when present, form fringes on the upper and lower eyelids.

In many instances my observations are based upon single specimens. Where additional examples have been available, a certain amount of variation in the number and length of the vibrissæ has sometimes been observed. This is perhaps individual and perhaps seasonal as well. No doubt the vibrissæ are moulted and new ones half up are naturally shorter than those of full length, and if one or two are shed simultaneously out of a small tuft of, say four, the tuft will lack for the time being its full complement. But I believe the position of the tufts will be found to be constant at all events within specific, if not within generic limits.

My observations also tend to show that the vibrissæ are often better developed in the matter of length in younger than in older individuals. Possibly, in the latter, the power to reproduce them ultimately fails, and the older bristles get gradually worn down or chipped off at the end.

Order MONOTREMATA.

Echidna hystrix.—Vibrissæ aborted, as in all highly specialised Antenters.

Ornithorhynchus.—No vibrissæ detectable on dried skins in the British Museum.

Order MARSUPIALIA.

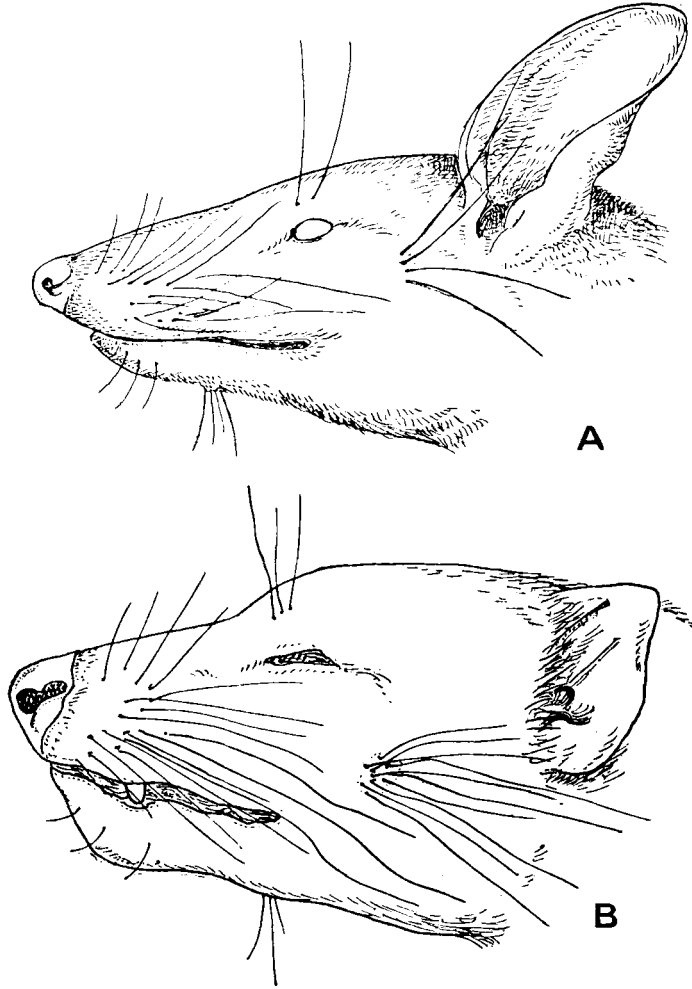
POLYPROTODONTIA.

Thylacinus cynocephalus (text-fig. 2), *Sarcophilus harrisi* (text-fig. 1, B), *Dasyurus viverrinus*, *Didelphys azarae* (text-fig. 1, A), *Philander laniger*, and *Marmosa elegans*.—The full complement of vibrissæ retained mostly in a high state of development. Genal tuft single and large, and situated nearly midway between the base of the ear and the corner of the mouth and well below the level of the eye, set a little lower in *Dasyurus* than in the others. Inter-ramal tuft beneath the corner of the mouth, except in *Didelphys azarae*, where it is placed nearer the chin. In *Thylacinus* (text-fig. 2) the vibrissæ are much shorter, finer and fewer than in the other types examined.

DIPROTODONTIA.

Full complement of vibrissæ generally retained, but the bristles usually shorter and less numerous than in the Polyprotodontia, the genals especially reduced and the interramals sometimes absent, notably in the Macropodidæ.

Text-figure 1.

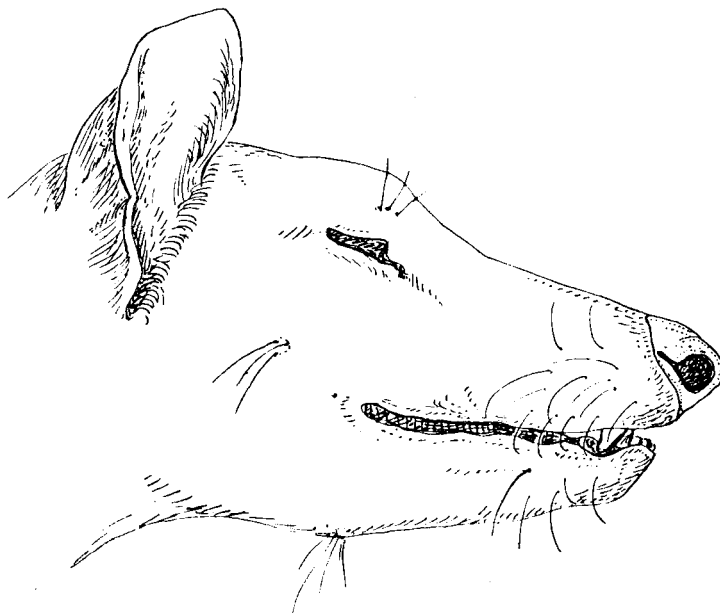


Vibrissæ of Polyprotodont Marsupials.

A. *Didelphys azarae*, the Azara Opossum.B. *Sarcophilus harrisi*, the Tasmanian Devil.

Trichosurus vulpecula fuliginosus (text-fig. 3, A).—All the vibrissæ retained and well developed. Genals four or five in number, forming a single cluster about halfway between the base of the ear and the corner of the mouth, and only slightly above the posterior angle of the latter, as in *Dasyurus*. Interramals farther back than in the Polyprotodontia, behind the mouth and beneath the eye.

Text-figure 2.



Vibrissæ of Polyprotodont Marsupial.

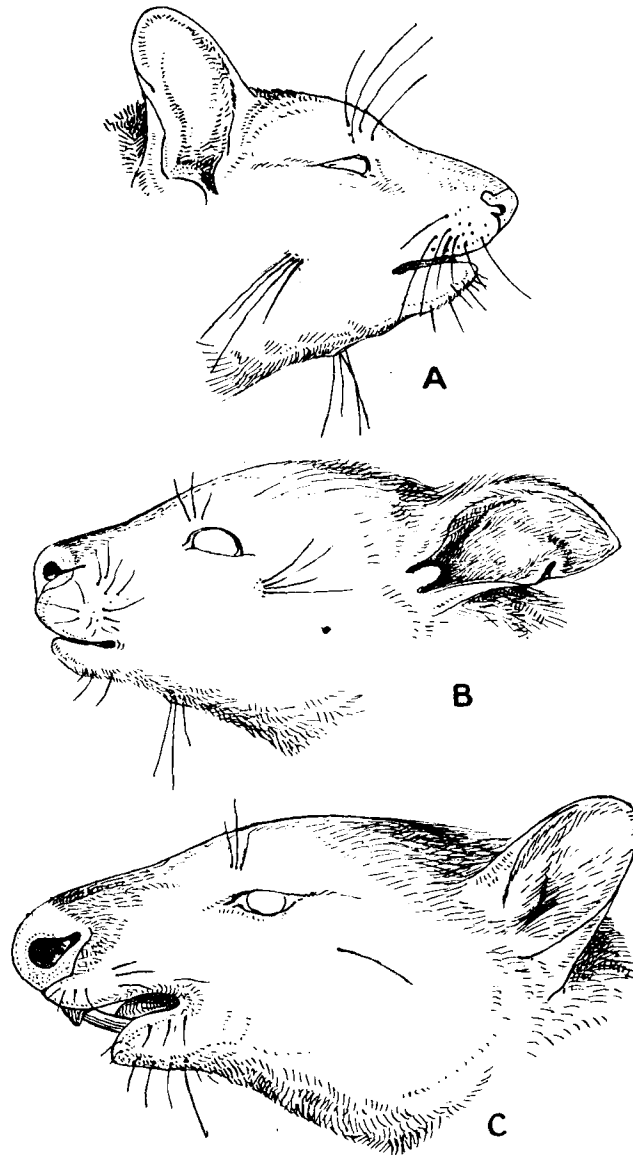
Thylacinus cynocephalus, the Tasmanian Wolf (old female).

Pseudochirus peregrinus.—Differs from *Trichosurus* in the lesser development of the interrामals and in having the genal tufts set higher up the cheek above the line of the mouth (one specimen).

Epiprymnus rufescens (text-fig. 3, B).—All the vibrissæ retained but shorter, especially the buccals, than in the Phalangerine genera mentioned, and the genals set high up in a horizontal line with the base of the ear and only a little below the posterior cantus of the eye.

Macropus billardieri.—Only one genal bristle in the same position as in *Epiprymnus*, and two short and fine interrामals.

Text-figure 3.



Vibrissae of Diprotodont Marsupials.

- A. *Trichosurus vulpecula fuliginosus*, the Sooty Phalanger.
 B. *Epyprymnus rufescens*, the Rufous Kangaroo Rat.
 C. *Dendrolagus ursinus*, the Ursine Tree-Kangaroo.

Macropus bennetti.—One interramal bristle; genals forming a strong tuft near the middle of the cheek some distance below and behind the posterior canthus of the eye.

Petrogale penicillata.—A pair of genals high up, in almost the same position as in *Æpyprymnus*. Interramals absent.

Dendrolagus ursinus (old) (text-fig. 3, C).—Vibrissæ all very much reduced in number and length. A single genal bristle in nearly the same position as in *Æpyprymnus*; interramals absent*.

Order EDENTATA (incl. PHOLIDOTA).

Euphractus villosus (text-fig. 4, C).—Buccal vibrissæ well developed especially the mystacials, which are longish and scattered. Genal vibrissæ represented by a large scattered tuft set on an eminence just below the eye. Superciliary vibrissæ absent. Interramal tuft well developed, on a small swelling just behind the line of the posterior angle of the mouth.

Tamandua tetradactyla.—Vibrissæ scarcely distinguishable, as appears to be the case in all the specialised Anteaters (? *Orycteropus*).

Bradypus tridactylus.—Only a few insignificant buccal vibrissæ retained.

Considering the relationship between the Sloths and Anteaters, coupled with their totally different manner of life, the deterioration of the vibrissæ in the two families is worth bearing in mind.

Manis tricuspis (text-fig. 4, D).—Vibrissæ aborted.

Order INSECTIVORA.

Centetes ecaudatus (text-fig. 4, B).—Mystacial vibrissæ numerous, divergent, and moderately long, arising some little distance behind the extremity of the elongated snout. A pair of longish superciliary vibrissæ set high above the eye. Three to four genal vibrissæ arranged in a vertical line midway between the eye and the ear, the uppermost between the level of the posterior canthus of the eye. Submental vibrissæ consisting mainly of four pairs extending along the sides of the chin, not upon its extremity. A single pair of interramals nearly in a line with the anterior canthus of the eye and the corner of the mouth.

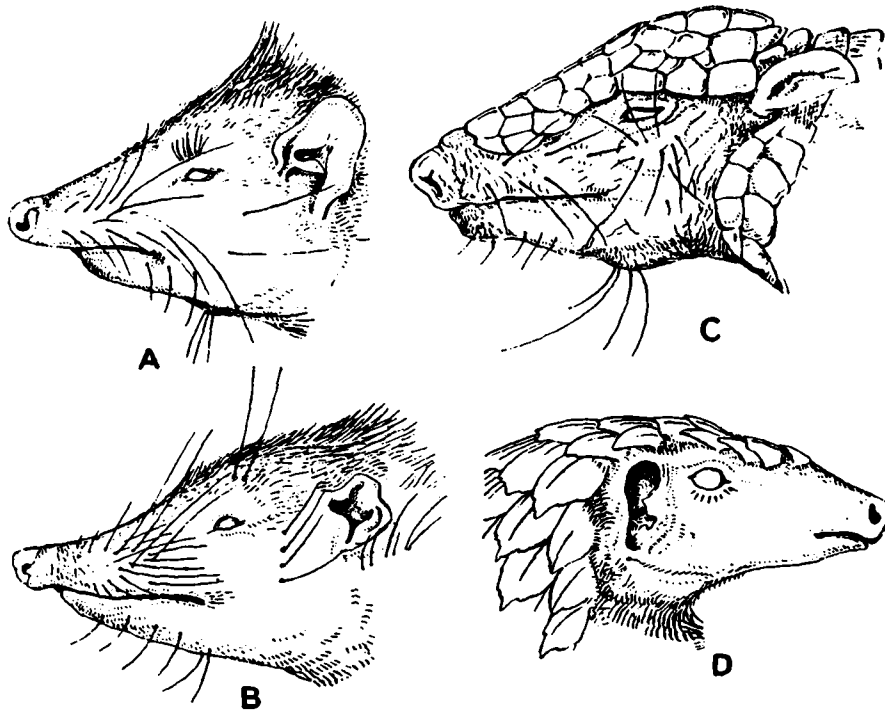
Potamogale velox (dried skin in Brit. Mus.).—Differs mainly from *Centetes* in that the mystacials are more numerous and much stiffer and longer, with some shorter ones on each side of the extremity of the blunted muzzle; the superciliaries are represented by one long vibrissa on each side rising close above the eye, and the interramals by a single pair rising far back on the throat on a line nearly midway between the eye and the ear.

Erinaceus europæus (text-fig. 4, A).—Differs from *Centetes*

* Sharply contrasted in this respect with *Dorcopsis luctuosus* which, according to Garrod (P. Z. S. 1875, p. 51, pl. viii.), has four very large interramal hair follicles recalling those of the Traguline Ruminants.

in several particulars. The superciliary vibrissæ short and represented by a tuft a little above the anterior canthus of the eye. Genal vibrissæ mixed with the coarse hair of the cheek and not easy to detect, reduced to two, the lower behind the corner of the mouth, the upper near the centre of the cheek some way below the eye. The submental only a little below the mouth and set farther back. The interramals, three in number, arising from a slight cutaneous eminence some distance behind the gape and in a line with the posterior canthus of the eye.

Text-figure 4.



Vibrissæ of Insectivora and Edentata, including Pholidota.

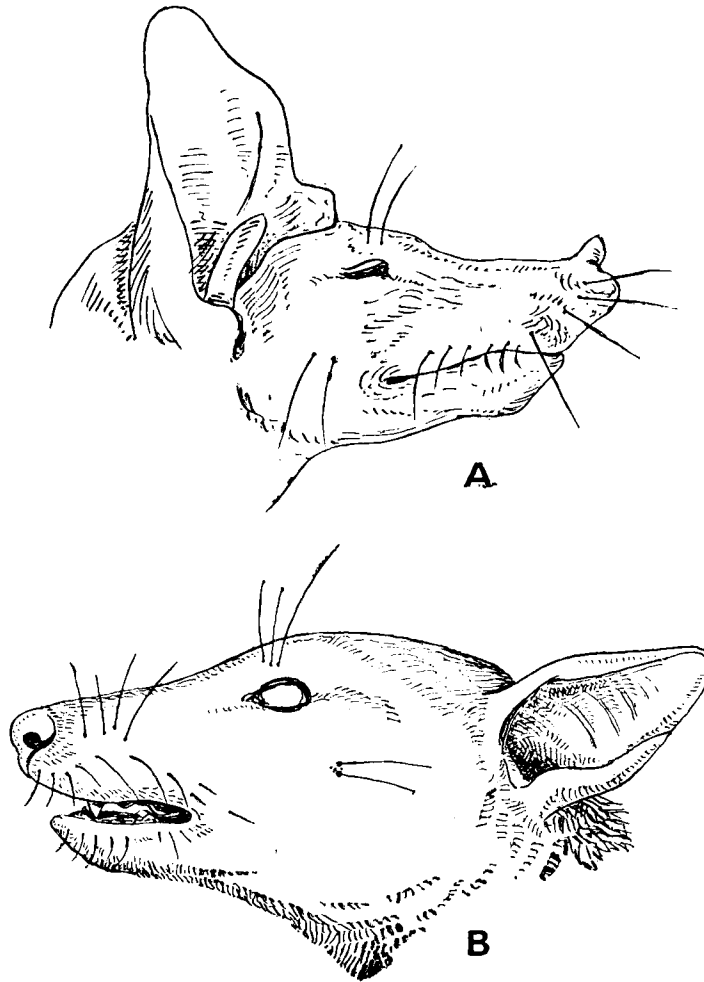
- A. *Erinaceus europæus*, the Common Hedgehog.
- B. *Centetes caulatus*, the Tenrec.
- C. *Euphractus villosus*, the Hairy Armadillo.
- D. *Manis tricuspis*, showing the absence of vibrissæ characteristic of most specialised Anteaters.

Sorex araneus.—Numerous mystacial and submental vibrissæ well behind the extremity of the snout. The superciliary, genal, and interramal vibrissæ apparently aborted.

Order CHIROPTERA.

Pteropus medius (text-fig. 5, B).—Mystacials and submentals comparatively short and delicate. A few superciliaries; a pair of genals near the middle of the cheek some distance below the posterior canthus of the eye. These are buried in the fur and

Text-figure 5.



Vibrissæ of Chiroptera.

- A. *Rhinopoma microphyllum*, one of the Microchiroptera.
 B. *Pteropus medius*, one of the Megachiroptera.

are difficult to distinguish amongst the coarser hairs intermixed with the fur of the cheek. Interramals absent.

Rhinopoma microphyllum (text-fig. 5, A).—A few long scattered mystacial bristles on the anterior portion of the snout and some shorter ones along the edge of the lip above the gape of the mouth. Two superciliaries and two genals nearly midway between the angle of the mouth and the base of the ear. Interramals absent.

Order PRIMATES.

LEMUROIDEA.

All the tufts of vibrissæ sometimes present, but the interramal usually and the genal occasionally absent.

Lemur varius (text-fig. 6, C).—Buccal, superciliary, interramal, and genal vibrissæ moderately developed, the genal set low down on the cheek well behind the corner of the mouth.

L. catta, *L. mongos*, and *L. fulvus* resemble *L. varius*, but the interramal tuft is absent in all specimens examined.

Daubentonia (Chiromys) madagascariensis (text-fig. 6, E).—Vibrissæ as in *Lemur varius*, the interramal tuft represented by a single seta in the example examined.

Galago crassicaudata (from Mombasa and Zanzibar) (text-fig. 6, A).—Vibrissæ shorter, finer, and less numerous than in *Lemur* and *Daubentonia*; the interramal tuft absent and the genal tuft set high up on the cheek behind, and only a little lower than, the posterior canthus of the eye.

Perodicticus potto.—Vibrissæ to all intents and purposes the same as in *Galago*, but the genals indistinguishable in the specimen examined.

ANTHROPOIDEA.

Apart from the interramal tuft, which is always apparently absent, the normal vibrissæ are occasionally present, but the genals are usually absent as well as the interramals, and in the higher forms at least the buccals and superciliaries, if retained, seem to lose their tactile function.

Leontocebus leoninus (text-fig. 6, B) and *Callithrix jacchus*.—Buccal and superciliary vibrissæ short and thin. Genal tuft represented by one or two slender setæ set low down on the cheek as in *Lemur* and *Daubentonia*, not high up as in *Galago crassicaudata*.

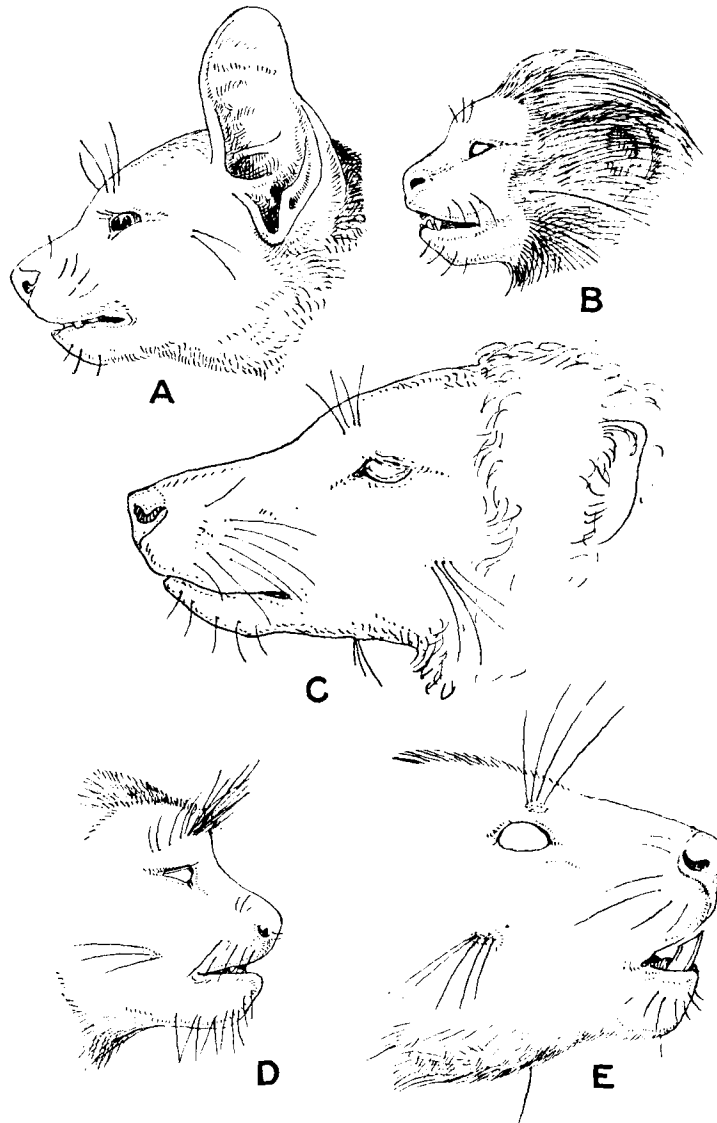
Nyctipithecus trivirgatus (text-fig. 6, D).—Vibrissæ as in *Leontocebus* and *Callithrix*, but coarser and more numerous.

Lagothrix lagotricha.—Only the buccal and superciliary vibrissæ.

Cercopithecus and other Old-World Monkeys.—Vibrissæ as in *Lagothrix*.

The deterioration of the vibrissæ passing upwards from the lowly organised lemurs to the more highly organised monkeys and apes is probably correlated with the gradual perfection of the hands, carrying with it increased sensitiveness of touch.

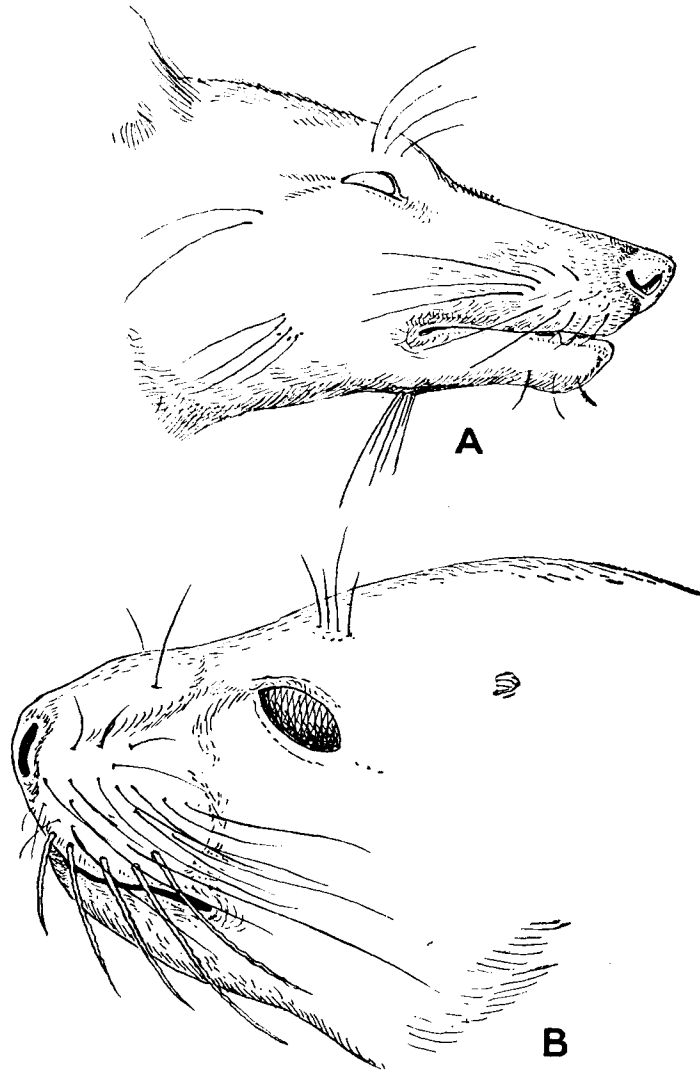
Text-figure 6.



Vibrissæ of primitive Primates.

- A. *Galago crassicaudata*.
- B. *Leontocebus leoninus*, Lion Marmoset.
- C. *Lemur varius*, the Ruffed Lemur.
- D. *Nyctipithecus trivirgatus*, one of the Cobidae.
- E. *Daubentonia madagascariensis*, the Aye-Aye.

Text-figure 7.



Vibrissæ of Carnivora.

- A. *Canis mesomelas*, to show the full complement of vibrissæ typically retained in Fissiped Carnivora, the genal tufts being two in number.
- B. *Cystophora cristata* (young), showing the tufts of vibrissæ characteristic of Pinniped Carnivora, the genal and interramal being absent.

Order CARNIVORA.

FISSIPEDIA.

Apart from the Ursidae, where all the vibrissæ are reduced to functionless or nearly functionless vestiges, the normal number of tufts is retained, except in the Felidae, where the interramal is always absent. The genal tuft is always double (text-fig. 7, A)*.

In subsequent papers I propose to describe more in detail some of the variations in the development and arrangement of the tufts in this suborder.

PINNIPEDIA.

Only the mystacial and superciliary tufts of vibrissæ retained and represented by stiff bristles; the mystacials especially copious: the superciliaries also sometimes abundant and long, sometimes few and very short—possibly a variation due to age.

Species examined: *Halictarctus gryppus*, *Phoca vitulina*, *Cystophora cristata* (young), *Mirounga leonina* (young), *Otaria californiana*, and *Arctocephalus pusillus*. In specimens of both the species of Otariidae the superciliaries are short and few; in the Phocidae they are well developed. The Elephant Seal (*Mirounga*) is peculiar in having a pair of the mystacials rising from a crease of skin on the summit of the muzzle, between the eyes and snout; but it is interesting to note that in its northern ally, *Cystophora cristata*, there is a similar pair of bristles rising vertically from the top of the muzzle, but set farther apart and not lodged in a crease of the skin (text-fig. 7, B).

Order RODENTIA.

The normal tufts generally represented and well developed, the mystacials especially long.

Suborder MYOMORPHA.

Epinomys norregicus (text-fig. 8, B.) and *Mus musculus*.—Inter-ramal tuft present and represented by about three bristles on the throat, some distance behind the chin. Genal tuft double, represented by a couple of bristles nearly in a line with the corner of the mouth and a little distance behind it, and of one long bristle about halfway between the ear and the eye and a little below the level of the latter. At least two moderately long superciliaries; mystacials copious and long.

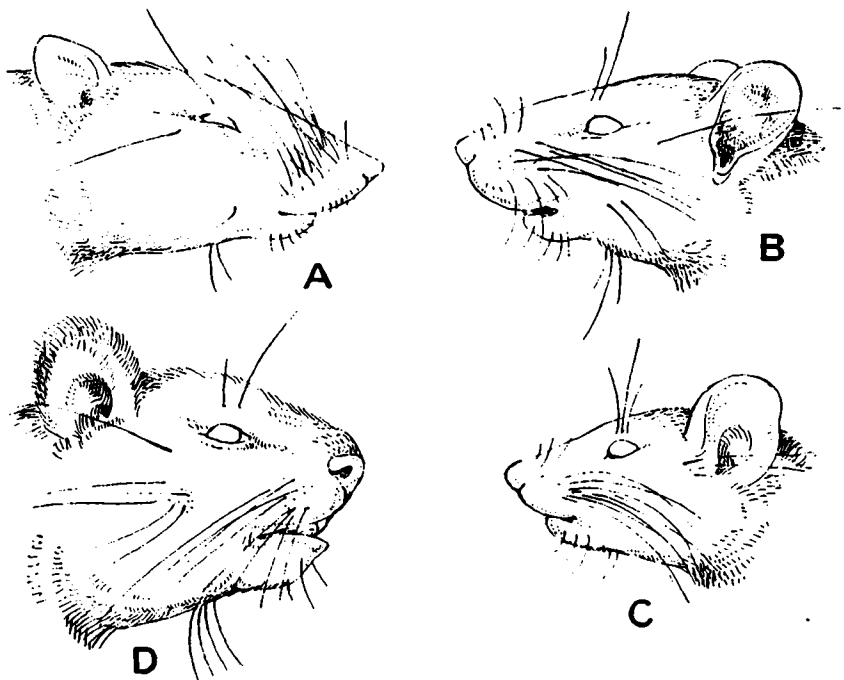
Uromys braijonii (Papua) (text-fig. 8, A).—As in *Epinomys* and *Mus*, but the specimen examined had only one very long superciliary bristle and one short genal bristle behind the corner of the mouth.

* In a Badger (*Melas melos*) the upper genal and the interramal were absent. [Note added July 28, 1914.]

Cricetomys gambianus.—Vibrissæ as in the preceding genera, but the superciliaries and genals shorter, the lower genal tuft set much farther back, if anything slightly behind rather than well in front of the line of the superior genal.

Reithrodon typicus.—Genal tuft single, consisting of two bristles near the middle of the cheek; interramal tuft small, immediately behind the chin.

Text-figure 8.



Vibrissæ of Sciuriformous and Myomorphous Rodents.

- A. *Uromys braijpii*, a Rat from New Guinea.
- B. *Epimys norvegicus*, the common Brown Rat.
- C. *Glis glis*, the Squirrel-tailed Dormouse.
- D. *Ratafa indica*, the large Indian Squirrel.

Glis glis (text-fig. 8, C).—Vibrissæ as in *Epimys* and *Mus*, but interramal tuft smaller and set a little further forwards, the genal tuft single and represented by a couple of vibrissæ high up in front of the ear.

Muscardinus avellanarius.—As in *Glis glis*, but the interramal tuft not detectable in the specimens examined.

Taeniolus orientalis.—Interaminal tuft absent; genal represented by a single bristle high up just beneath and below the corner of

the eye; three superciliaries; mystacials very numerous, varying in length, two of the posterior exceedingly long.

Jaculus jaculus? (a darker form from the Sudan).—Resembling the preceding, but the genal vibrissæ absent, and only one exceedingly long mystacial.

Suborder SCIUROMORPHA.

Ratufa indica (text-fig. 8, D).—Mystacials, interramals, and genals very well developed, the genals represented by a large tuft near the middle of the cheek above the line of the mouth and behind a vertical line passing from the posterior canthus of the eye; above the main tuft an isolated bristle.

Sciurus vulgaris and *prevosti*.—As in *Ratufa indica*, but without the isolated superior genal bristle.

Pteromys sp.—As in *Ratufa*, but interramal tuft absent.

Eutamias quadrivittatus.—Vibrissæ less well developed than in the preceding squirrels, the interramals absent, and the genals represented by a pair of fine bristles far back in a line with the mouth, as in *Epimys*.

Suborder HYSTRICOMORPHA.

Atherura africana (text-fig. 9, B).—Mystacials mostly of immense length, three or four superciliaries, one being exceedingly long; genals represented by a pair of very long bristles set high up in front of the ears and a little below the level of the eye; interramal tuft well developed.

Species of *Hystrix*, judging from living animals, resemble *Atherura*.

Coendou prehensilis and *Erethizon dorsatum* (text-fig. 10, A).—Vibrissæ all shorter and less numerous than in the Ground Porcupines; the interramals absent and the genals represented by a single bristle in front of the ear, occupying the same position in *Erethizon* as in *Atherura*, but lower down with regard to the eye in *Coendou*.

Octodon degus.—Mystacials long; superciliaries moderately long; genal represented by a tuft of about three high up, a little behind the corner of the eye; interramals absent.

Chinchilla lanigera.—Practically as in *Octodon*.

Lagostomus trichodactylus.—As in *Chinchilla* and *Octodon*, but the vibrissæ longer, coarser, and more abundant.

Dolichotis salinicola.—As in *Lagostomus*, but bristles finer.

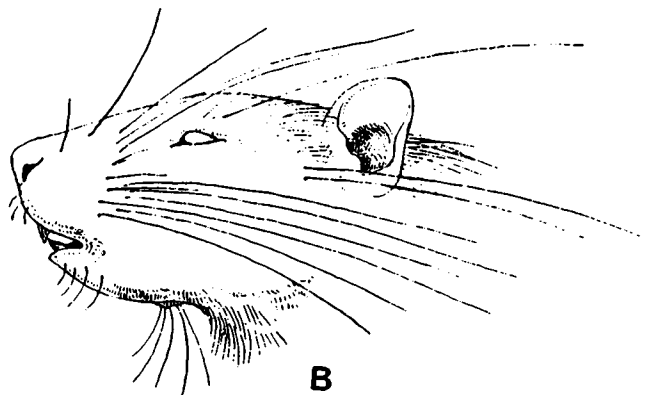
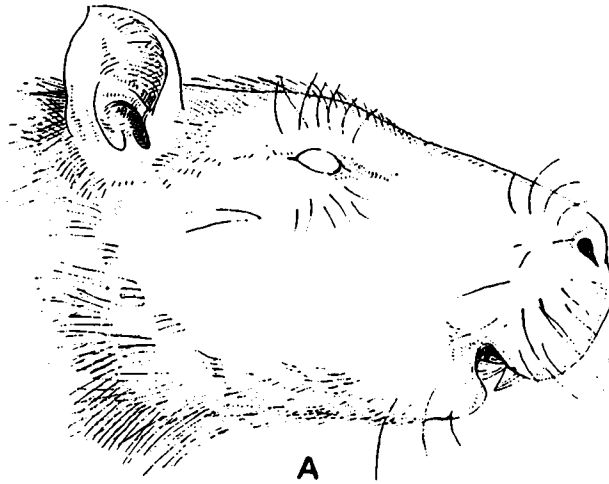
Dasyprocta columbiana.—Bristles disposed as in the preceding genera, but shorter than in *Dolichotis* and *Lagostomus*, and the interramal tuft present and well developed.

Cælogenys paca.—As in *Dasyprocta*.

Cavia rufescens ♂ (text-fig. 10, B, C).—Mystacial, superciliary, and genal tufts as in other Hystricomorphs, but the interramal tuft peculiar, consisting of two pairs of long, widely separated bristles set in a curved line along the posterior border of a broad,

nearly smooth glandular area similar to that of the Malaysian Mouse-deer (*Tragulus*).

Text-figure 9.



Vibrissæ of Hystricomorphous Rodents.

A. *Hydrochaerus hydrochaerus*, the Capybara or Carpincho.

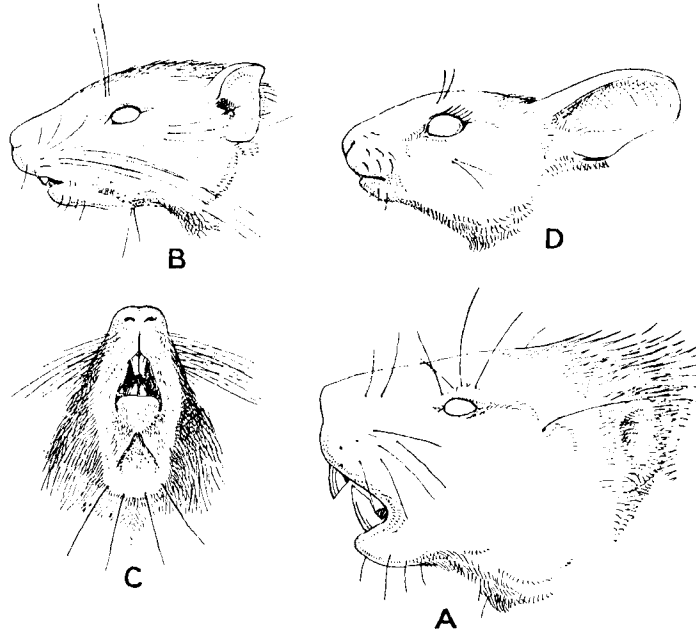
B. *Atherura africana*, the African Brush-tailed Porcupine.

Hydrochaerus hydrochaerus (text fig. 9, A). - Buccal, superciliary, and subocular vibrissæ short; interramal tuft absent; genal consisting of a pair of bristles slightly behind the corner of the eye, and considerably lower than a line passing from the eye to the base of the ear.

Two points may be noted in connection with the vibrissæ of the Hystricomorphs examined; first the constant position of the

genal tuft high up above the base of the ear and behind and only a little below the eye*, and second the presence of the interramal tuft in *Atherura*, *Hystrix*, *Dasyprocta*, *Calogeomys*, and *Cavia*, and its absence in the other genera with such widely different habits as *Coendou*, *Dolichotis*, and *Hydrochaeris*.

Text-figure 10.



Vibrissæ of Hystricomorphous and Lagomorphous Rodents.

- A. *Erethizon dorsatum*, an arboreal Porcupine.
 B. *Cavia rufescens*, side view of head.
 C. The same from below, showing the interramal vibrissæ arranged as in Traguline Ruminants.
 D. *Sylvilagus superciliaris*, a small Rabbit from Colombia.

Suborder LAGOMORPHA.

Sylvilagus superciliaris (young) (text-fig. 10, D).—All the vibrissæ short. Interramals absent; genals represented by a pair of bristles well below the eye and in front of a vertical line from its posterior canthus.

Oryzologus cuniculus.—Vibrissæ disposed as in the foregoing, but longer.

* Except in *Hydrochaeris*; but in this genus the high setting of the ears in conformity with aquatic life emphasises in appearance the actual low position of this tuft on the cheek.

Order HYRACOIDEA.

Procavia capensis (text-fig. 11, A).—Mystacial, superciliary, genal, and interramal tufts copious and long. Interramal unusually large, consisting of about half a dozen long vibrissæ set just behind the chin. Genal composed of from two to four vibrissæ set just behind a vertical line from the posterior canthus of the eye and well behind and a little higher than the corner of the mouth. Submental hairs fine, few and short. Short eyelashes on upper lid of eye, but no subocular vibrissæ.

Dendrohyrax dorsalis.—Vibrissæ retained as in the preceding species, but the anterior mystacials longer and coarser, the interramals and genals fewer—one of the latter and two of the former in the specimen examined.

Order PROBOSCIDEA.

None of the tufts definitely recognizable as such, but the mystacial and submental possibly represented by the hairs on the trunk and lower jaw and, probably in my opinion, the genal tuft by the glandular sac between the eye and the ear, which in young Elephants is filled with hairs the apices of which protrude from the orifice. Lashes on upper lid of eye well developed, often exceedingly long.

In the Sirenians, which are remotely related to the Proboscidean stock, the vibrissæ, apart from the buccals which are short, also appear to be absent, judging from Murie's and Garrod's figures of the Manatee*. This may indicate their divergence from the Proboscidean stem after the atrophy of the vibrissæ in those animals. At all events, the Sirenians differ markedly in the absence of the vibrissæ from other freshwater mammals (exc. *Ornithorhynchus*), most of which have the vibrissæ extraordinarily well developed both in quantity and thickness. It must be remembered, however, that the latter feed upon aquatic animals, whereas the Manatee feeds on water-weeds; and in this connection it may be noted that the Capybara has short, slender vibrissæ.

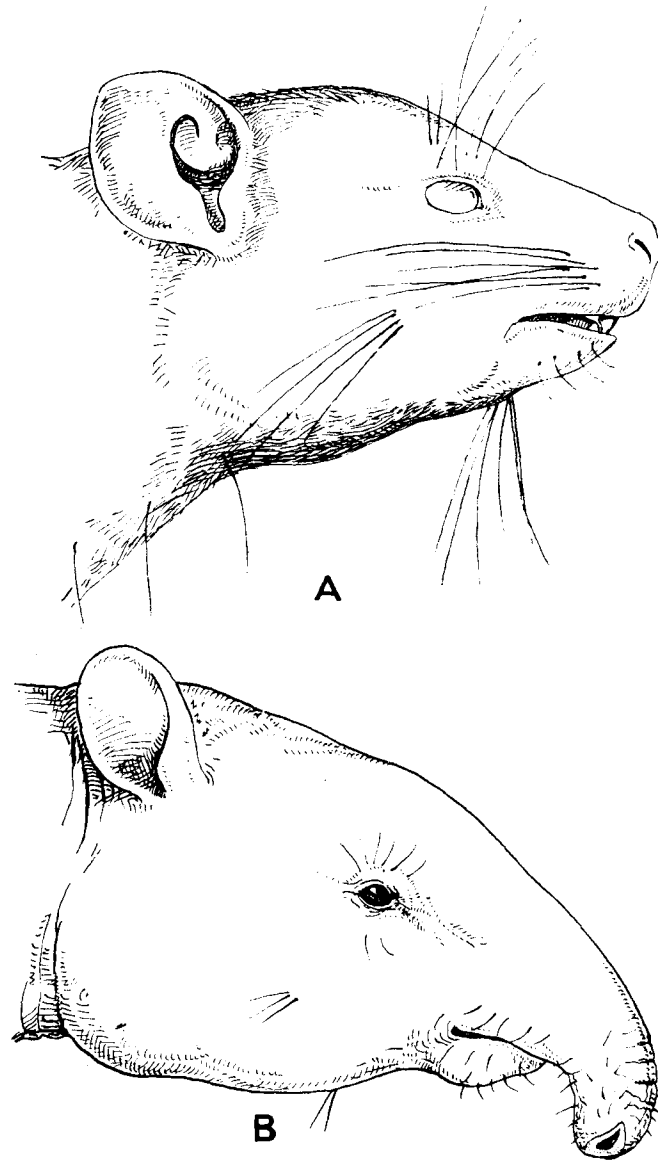
Order PERISSODACTYLA.

Tapiridae (text-fig. 11, B).—Buccal, superciliary, genal, and interramal tufts present, but neither copious nor coarse; the single genal tuft set low beneath the eye near the middle of the cheek. Subocular vibrissæ also present. Eye-lashes on upper lid of eye (observed on living animal).

Equidae.—Buccal vibrissæ numerous, moderately long and fine. Superciliaries and suboculars also present, but genal and interramal tufts absent. Eye-lashes on upper lid of eye.

* Trans. Zool. Soc. vols. viii. & x.

Text-figure 11.



Vibrissæ of Hyracoidea and Perissodactyla.

A. *Procavia capensis*, a primitive member of the Proboscidean stock.

B. *Tapirus indicus*, a primitive Perissodactyl.

Rhinocerotidae.—All vibrissæ absent. Eye-lashes on upper lid of eye.

Although the vibrissæ in the Tapirs are too short to be of very much service, their retention marks off this family as the most primitive of existing Perissodactyles, the Rhinoceros, by the same standard, being the most specialised. Another primitive facial character of the Tapirs, in my opinion, is the presence of a well-defined rhinarium of moist glandular skin.

Order ARTIODACTYLA.

NON-RUMINANTIA.

Tayassu (Dicotyles) tajaçu (text-fig. 12, A).—The full complement of vibrissæ retained. Mystacials moderately long, not spreading on to the area of the snout that projects beyond the lower lip. Submentals represented by a definite row on the posterior half of the lower lip close to the mouth. Superciliaries and suboculars well developed. Genal tuft divided, represented by one or two long bristles in a line with the mouth and some distance behind it, and by one or two a little higher up and set farther back. Interramals forming a large tuft of about half a dozen longish bristles just behind a vertical line passing from the corner of the mouth.

Hippopotamus amphibius and *Chæropotamus*.—Vibrissæ aborted, except the buccals, which are short and scattered (on living animal).

RUMINANTIA.

Tribe TRAGULINA.

Tragulus kanchil (text-fig. 13, B).—Full complement of vibrissæ retained as in the Peccary (*Tayassu tajaçu*), but much less well developed except the interramals, which form a tuft of five or six set at the posterior extremity of the interramal glandular area. Submentals forming for the most part two definite rows on the chin. Genal tuft divided, represented by one bristle in a line with the corner of the mouth, but some distance behind it, and by two or three considerably higher up and only a little behind and slightly below the level of the suboculars. Superciliaries forming a moderately well-developed tuft of three or four.

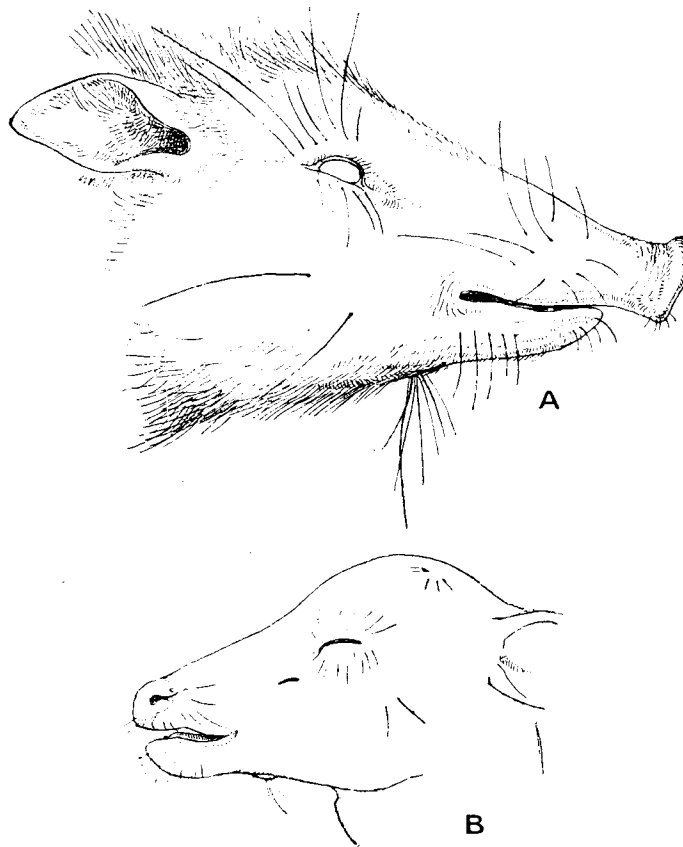
Tribe PECORA.

The buccal, superciliary, and subocular vibrissæ always retained apparently as in the equine Perissodactyla, but the genals and interramals much less constant though sometimes retained.

Mazama temá? (Guatemala).—Interramals represented by a small tuft of about three fine bristles just behind the chin; genals by a pair of fine and short bristles set far back on the cheek in a line with the mouth.

Axis axis (fœtus) (text-fig. 12, B).—Skin naked, but the full complement of facial vibrissæ present. Interramal tuft small, about midway between the chin and the throat. Genal tuft represented by two short bristles set a little higher than in the Guatemalan *Mazama*, just behind a vertical line passing from the posterior canthus of the eye.

Text-figure 12.



Vibrissæ of Artiodactyla.

A. *Tayassu tajaçu*, a primitive non-ruminant Artiodactyl.

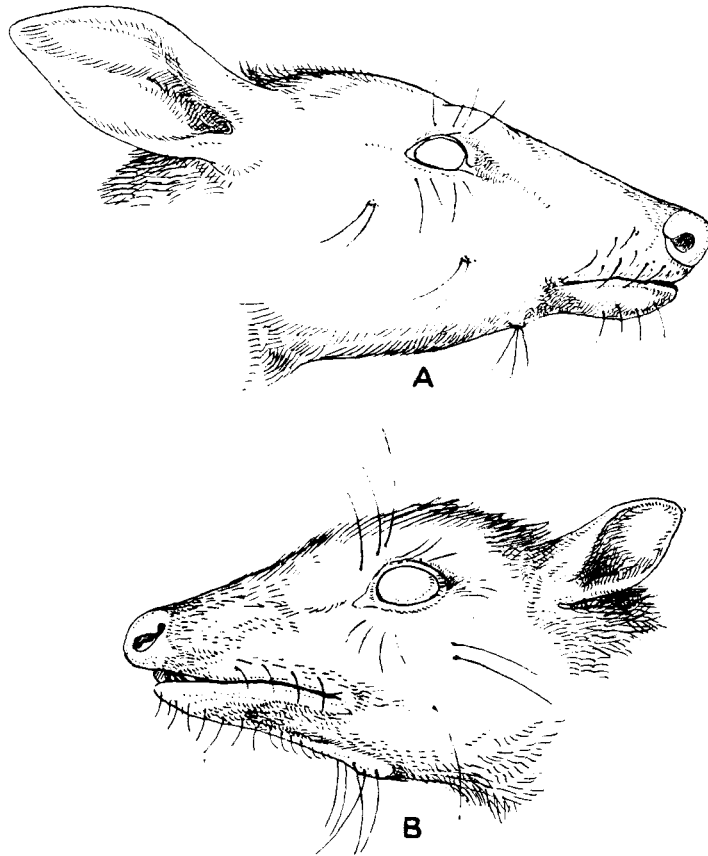
B. *Axis axis*, a hairless fœtus showing the early development of the vibrissæ.

Cervus eldi (old female).—Interramal tuft absent. Genals represented by two long bristles, one in a line with the mouth,

and beneath the anterior canthus of the eye, the other a little higher up and more posteriorly.

Cervus elaphus.—Interramals represented by one or two long bristles a little behind the chin. A pair of genals about midway

Text-figure 13.



Vibrissæ of Artiodactyla.

A. *Cephalophus coronatus*, a small Pecorine Artiodactyl.

B. *Tragulus kanchil*, a primitive ruminant Artiodactyl.

between the line of the mouth and of the eye and a little behind a vertical line touching the posterior canthus of the eye, in almost the same position as those of *Axis axis*.

Dama dama.—The normal vibrissæ present and long, but the

two genal and interramal tufts apparently represented by a single bristle each (on living animal).

Cephalophus coronatus (text-fig. 13, A).—Full complement of vibrissæ retained. Interramal tuft small and situated a little behind the chin. Genal tuft double, two bristles a little distance behind the corner of the mouth and beneath the anterior canthus of the eye, and two bristles higher up almost beneath the posterior canthus of the eye, but some distance below it.

Boselaphus tragocamelus.—Genal and interramal bristles retained, but few in number; the genals arising from the white "tragelaphine" cheek-spots.

Nanotragus pygmaeus.—A small interramal tuft just behind the chin. Genals absent.

Nototragus melanotis.—Interramals and genals absent.

Ammotragus lervia, *Antelope cervicapra* and other small caprine and gazelline species.—Interramals and genals absent.

Bos frontalis.—Genals absent; interramals represented by a single long bristle (one specimen).

Tribe TYLOPODA.

Judging from living animals the genal and interramal tufts are absent in *Camelus bactrianus* and *dromedarius* and in *Lama vicugna* and *huanacos*.

CONCLUSION.

The foregoing enumeration shows that in all the principal orders of terrestrial mammals some, at all events, of the species possess facial vibrissæ arranged upon a definite plan. Moreover, in a great many cases, within the limits of a single order, the species which are defective in the matter of vibrissæ are the higher derivative types, whereas those in which all or most of them are present are more generalised types. This may be seen by comparing: in the Marsupials, *Trichosurus* with *Dendrolagus*, the former being a primitive, and the latter a highly specialised Diprotodont; in the Edentates, *Dasyppus* with *Tamandua* and *Bradypus*; in the Insectivores, *Centetes* with *Sorex*; in the Rodentia *Atherura* with *Erethizon*; in the Primates, the Lemurs with the Monkeys; in the Carnivores, the Procyonidæ or Canidæ with the Ursidæ, and the Viverridæ with the Felidæ; in the Proboscidean stock the Hyracoidea with the Sirenia and the Elephant; in the Artiodactyla, the Peccary (*Tayassu*) with the Hippopotamus, the Tragulina with the Pecora; in the Perissodactyla, the Tapirs with the Horses and Rhinoceroses.

Facts such as these justify the conclusion that vibrissæ arranged on the plan above described are a primitive mammalian character*. This at all events appears to me to be the most plausible explanation of the facts, and the same line of reasoning may be applied to the carpal vibrissæ described by Mr. Beddard.

* I think the suboculars should perhaps be eliminated from this category.

It is well known that the hairs of Mammals frequently grow in tufts, especially where they are associated with scales; and this is probably a very primitive character. No doubt the facial vibrissæ are primitive tufts enlarged for tactile purposes. I suspect they date back to a very early post-Cynodont stage of mammalian evolution, and that their absence in the existing Monotremes is a derivative feature associated with the profound modifications of the jaws in the surviving members of that order.

That development and deficiency of the vibrissæ are intimately connected with mode of life is probable. But on this head much has yet to be learnt, and before any satisfactory conclusions can be established, far more observations than have as yet been made will have to be recorded. Attention, however, may be drawn to one or two features:—(1) The deficiency or complete absence of the vibrissæ in all the Anteaters, like *Echidna*, *Tamandua*, and *Manis*, quite unrelated genera. (2) Their high development in the matter of thickness and length in piscivorous or insectivorous aquatic or semi-aquatic genera like *Chironectes*, *Potamogale*, *Lutra*, and *Cynogale*, and their comparative feebleness or deficiency in aquatic herbivora, like the Sirenians, *Hippopotamus* and *Hydrochaeris**. (3) Their gradual failure in the Primates passing from the lower to the higher types—a failure probably, I think, correlated with gradual perfection in the use and sensitiveness of the hand. (4) Their high development in active arboreal species like Squirrels, and their reduction in size and quantity in slow climbers like Sloths (*Bradypus*), Pottos (*Perodicticus*), and the Tree-Kangaroo (*Dendrolagus ursinus*). (5) Their general prevalence in the smaller burrowing, bush-frequenting or forest species amongst Rodents, Carnivores and others, and their decadence in larger forms like the Ungulates.

* The Polar Bear is exceptional amongst predatory aquatic carnivores for the poor development of the vibrissæ. It must be remembered, however, that it is probably derived from some bear akin to the typical *Ursus* group, in which the vibrissæ were already defective, and that it feeds mainly upon seals caught at their blowholes or lying on the ice-floes.