

## CHAPTER IX.

### LINEAR SERIES—*continued.*

#### TEETH.

FROM the consideration of numerical Variation in mammæ we may proceed to an examination of like phenomena in the case of the teeth of vertebrates. The modes of Variation in these organs are, as might be expected, in many ways similar, but several circumstances combine to make the Variations of teeth more complicated than those of mammæ.

Teeth arise developmentally by special differentiation at points along the jaws, much as the mammæ arise by differentiation at points along the mammary lines; and as in the case of mammæ, so in the case of teeth, we are concerned first with changes in the number of points at which such differentiation takes place, and next with the general changes or accommodations which occur in the series in association with numerical changes. As in mammæ, so also in teeth, numerical Variation may occur sometimes by the division of a single member of the series into two, and sometimes by a reconstitution of at least a considerable part of the series.

Between the case of mammæ and that of teeth, there is however an important point of distinction. The series of mammæ is practically an undifferentiated series. There is between mammæ standing in one mammary line no obvious qualitative differentiation. Though not all identical in structure, the differences between them are of size and of quantity, not of form or quality. If such qualitative difference is present it must be trifling. In considering Variation in mammæ we have thus to deal only with changes in number, and with the geometrical and perhaps mechanical question of the relative positions of the mammæ. The teeth of most Vertebrates, however, are differentiated to form a series of organs of differing forms and functions, and the study of Variation in teeth may thus be complicated by the occurrence of qualitative changes in addition to simply numerical ones. In teeth, in fact, there are not only Meristic variations, but Substantive variations

also; and thus, as in the case of vertebræ, for instance, in any given example of a numerical change qualitative changes must be looked for too.

As a preliminary to the consideration of evidence relating to the Variation of teeth it may be useful to call attention to certain peculiarities of teeth considered as a Meristic Series. In the Introduction, Section V, it was pointed out that in order to get any conception of the Evolution of parts repeated in an animal, the fact of this Repetition must be recognized, and it must be always remembered that we are seeking for the mode in which not one part but a series of similar parts has been produced. The simplest case to which this principle applies is that of organs paired about the middle line, and in the steps by which such parts have taken on a given form it is clear that similar variations must have occurred on the two sides. In the absence of evidence it might be supposed either that such variations had occurred little by little on the two sides independently, or on the other hand, that Variation had come in symmetrically and simultaneously on the two sides. Upon the answer given to this question the success of all attempts to form a just estimate of the magnitude of the integral steps of Variation depends. In many examples already given it has now been shewn that though in the case of paired organs Variation may be asymmetrical, yet it is not rarely symmetrical, and in part the question has thus been answered.

In the evidence that remains many more cases of such symmetrical variations will be described, and it may be taken as established that when the organs stand in bilateral symmetry, that is to say, as images on either side of a middle line, their Variation may be similar and symmetrical.

The teeth present this problem of the Variation of parts standing as images, in an unusual and peculiar way. For in the case of teeth we have to consider not only the steps by which the right and left sides of each jaw have maintained their similarity and symmetry, but in addition the further question as to the relation of the teeth in the upper jaw to those in the lower jaw. There are many animals in which there is very great difference between the upper and lower rows of teeth, and it must of course be remembered that perhaps in no animal are the teeth in the upper jaw an exact copy of those in the lower, but nevertheless there is often a substantial similarity between them, and in such cases we have to consider the bond or kinship between the upper and lower teeth whereby they have become similar or remained so. For it may be stated at once that there is some evidence that the teeth in the upper and lower jaws may vary similarly and simultaneously, though such cases are decidedly rare, especially in numerical Variation, and are much less common than symmetrical Variation on the two sides of the same jaw.

In speaking of the relation of the series of the upper jaw to that of the lower jaw as one of images, it must be remembered that the expression is only very loosely applicable. In particular it should be noticed that though in so far as the lower teeth are a copy of the upper ones the resemblance is one of images, yet the teeth which resemble each other do not usually stand opposite to each other in the bite, but members of the upper series alternate with those of the lower. The incisors, as a rule, however, and the back teeth of a certain number of forms do bite opposite each other, and in them the relation of images is fairly close.

The importance of the recognition of the relation of images as subsisting between the teeth of the upper and lower jaws will be seen when this case is compared with that of the two sides of the body. For ordinary bilateral symmetry is, as has already been suggested, an expression of the original equality and similarity of the two halves into which the ovum was divided by the first cleavage-plane, or by one of the cleavages shortly succeeding upon this. The fact that the two halves of the body are images of each other is thus both an evidence and a consequence of the fact that the forces dividing the ovum into two similar halves are equal and opposite to each other. The bilateral symmetry of Variation is thus only a special case of this principle.

In view of the fact that the teeth in the upper and lower jaws may vary simultaneously and similarly, just as the two halves of the body may do, it seems likely that the division of the tissues to form the mouth-slit must be a process in this respect comparable with a cleavage along the future middle line of the body. It is difficult, however, to realize the actual occurrence of such a process of division in the case of the slit forming the original stomodæum, and this difficulty is increased by the recent observations of SEDGWICK<sup>1</sup> to the effect that in the Elasmobranchs examined by him the mouth-slit first appears as a *longitudinal* row of pores. If this is so the relation of images must exist in the case of the mouth, not only in respect of the two sides of the slit, but also in respect of the anterior and posterior extensions of the slit. But whatever may be the processes by which the tissues bounding the mouth of a vertebrate come apart from each other, the result is clearly in many cases to produce an anterior series of organs in the upper jaw, related to a posterior series of organs in the lower jaw, much in the same way that the right side of a jaw is related to the left of the same jaw. This relation may appear as has been stated, not only in the normal resemblances between the upper and lower teeth, but also in the fact that similar and simultaneous Variation is possible to them.

In another respect the Repetition of teeth may differ from that of other Linear Series already considered. In many animals, the

<sup>1</sup> SEDGWICK, A., *Quart. Jour. Micr. Sci.*, 1892, p. 570.

Pike, the Alligator, or the Toothed Whales, for example, the teeth stand in a regular and usually continuous series, differing from each other chiefly in size, ranging from small teeth in front, through large teeth, and often down to small teeth again at the back of the jaw. Such a 'homodont' series as a rule passes through only one maximum. Most mammals, however, are 'heterodont,' that is to say, the teeth can be distinguished into at least two groups, the incisors and canines on the one hand, and the premolars and molars on the other; and in a large number of animals having this arrangement the anterior members of the series of premolars and molars are small, increasing regularly in size from before backwards, reaching a maximum usually in some tooth anterior to the last. Though instances will be given of Variation, and especially of reduplication, occurring in most of the teeth, even in those which stand well in the middle of the series of back-teeth, such as the upper carnassials of the Cat, or the fourth premolars of the Seal, yet on the whole Variation in heterodont forms is more common at the anterior and posterior ends of the series of back-teeth. In view of this fact it is of some importance to recognize that the small members at the beginning of the premolar series are as regards their relatively small size, in the condition of terminal members of series, and exhibit the variability of terminal members almost as much as the last molars.

With these remarks by way of preface, evidence as to the numerical Variation of teeth in certain groups will be given in full. This account will for the most part be confined to a brief description of the conditions presented by the specimens. In the next chapter the principles which may be perceived to underlie these facts and the general conclusions to which they appear to lead will be separately discussed.

The evidence here given relates to certain selected groups<sup>1</sup> of Mammals, and chiefly to the Primates (excepting Lemuroidea), Carnivora (Canidæ, Felidæ, Viverridæ, Mustelidæ and Pinnipedidæ), and Marsupialia (Phalangeridæ, Dasyuridæ, Didelphyidæ, part of Macro-podidæ, &c.).

The facts to be given relate chiefly to increase in number of teeth. In the case of terminal members of series, such as the most anterior premolar or the last molar, some reliable facts as to cases of absence were found, but for the most part the evidence as to the absence of teeth is ambiguous and each case requires separate treatment.

The evidence is in this chapter arranged according to the

<sup>1</sup> Evidence as to the dental variations of Man is not here introduced. Considerable collections of such facts have been made by MAGROR (*Anom. du syst. dent.*), BUSCH (*Dent. Monats. f. Zahnk.* 1886, iv.), and others, and illustrative specimens are to be found in most museums. I do not know that among these human variations are included phenomena different in kind from those seen in other groups, except perhaps certain cases of teeth united together, a condition rarely if ever recorded in other animals.

zoological position of the groups concerned. In several cases variations of similar nature were seen in different groups; cases of this kind will be brought into association in the next chapter.

As regards nomenclature I have in the main followed the common English system, numbering both the premolars and molars from in front backwards. In one respect I have departed from the practice now much followed. It has seemed on the whole better that the premolar which in any given jaw stands first, should be called  $p^1$ , even though in certain cases there may be reasons for doubting whether it is the true homologue of the  $p^1$  of other cases<sup>1</sup>. Theoretical views of this kind can only at best be used as a substitute for the obvious nomenclature in a few restricted cases, such as that of the Cat, in which by the application of the methods of reasoning ordinarily adopted in Comparative Anatomy the first upper premolar would be looked on as the equivalent of  $p^2$  in the Dog. There are, however, few who would feel confident in extending this reasoning to many other cases, that of Man, for instance, and I believe it is on the whole simpler to number the teeth according to their visible and actual relations. As I have already attempted to shew in another place<sup>2</sup>, in the light of the facts of Variation, it is to be doubted whether in their variations teeth do follow those strict rules of individual homology by which naturalists have sought to relate the arrangements in different types with each other.

The material examined has consisted chiefly of specimens in the British Museum and the Museums of the College of Surgeons, Leyden, Oxford and Cambridge, the Paris Museum of Natural History, and some smaller collections. I have to thank the authorities of these several museums for the great kindness I have received from them; and in particular I must express my indebtedness to Mr Oldfield Thomas, of the British Museum, for the constant help and advice which he has given me, both as regards the subject of teeth generally and especially in examining the specimens in the British Museum<sup>3</sup>.

## PRIMATES.

SIMIIDÆ. The Anthropoid Apes (Orang, Chimpanzee, and Gorilla).

\*165. The teeth of the three large Anthropoids are perhaps more variable, both in number and position, than those of any other

<sup>1</sup> In cases where confusion might arise any change from common nomenclature is notified in the text.

<sup>2</sup> *Proc. Zool. Soc.*, 1892, p. 102.

<sup>3</sup> In the following descriptions B.M. stands for British Museum; C.S.M. for Museum of the Royal College of Surgeons; C.M., O.M., U.C.M., Leyd. M., P.M., for the Cambridge, Oxford, University College London, Leyden and Paris Museums respectively.

group of mammals of which I have been able to examine a considerable number. In different collections 142 normal adult skulls were seen and 12 cases of extra teeth. Of these one was a case of extra incisor (Gorilla, No. 186), one of anomalous teeth (Gorilla, No. 187), and the remainder molars. Thus far therefore there are nearly 8 per cent. cases of extra teeth. This figure is remarkable in comparison with the rarity of such cases in *Hyllobates* (51 skulls seen, all normal), and the like rarity in other Old World monkeys (423 normals and 2 cases of extra teeth).

***Simia satyrus*** (Orang-utan).

Normal adult skulls seen, 52.

*Supernumerary molars.*

- \*166. Adult male having additional posterior molar ( $m^4$ ) behind and in series with the normal teeth, on *both* sides in upper jaws and on left side in lower jaw. In each case the  $m^4$  is rather smaller than  $m^3$ , but all are well formed, having each four cusps and the normal complement of fangs, viz., one in front and one behind in the lower jaw, and two on outer and one on inner side in upper jaw. On right side of lower jaw there is no trace of additional molar, though there is almost as much room for it as on the left side. C. M., 1160, *D*, described by HUMPHRY, G. M., *Jour. Anat. Phys.*, 1874, p. 140, *Plate*.
167. Female (Borneo) having six cheek-teeth in each upper jaw and in right lower jaw [doubtless a case like the foregoing] mentioned by PETERS, W., *Sitzungsb. naturf. Fr. Berlin*, 1872, p. 76.
168. Specimen with large alveolus on each side for  $m^4$ . L. M., 24.
169. Specimen (Borneo) having  $\overline{m^4}$  in right lower jaw, behind and in series with the normal teeth. The tooth is of rather small size, but is regular in position and form. B. M., 3, *m*.
170. Specimen having a right  $\overline{m^4}$  more than half the size of  $\overline{m^3}$ . U. C. M., *E*, 253.
171. Specimen having supernumerary molar on each side in lower jaw. MAYER, *Arch. f. Naturg.*, 1849, l. xv. p. 356.
172. Similar case. FITZINGER, *Sitzungsb. math.—nat. Cl. Ak. Wien*, 1853, i. p. 436.  
Similar case. BRÜHL, *Zur Kenntniss des Orangkopfes*, Wien, 1856.  
[? refers to the case described by FITZINGER.]
- Molar absent.*
173. Specimen "remarkable for absence of the upper right third molar and for absence of nasal bones, which are greatly reduced in some other specimens." C. S. M., 44. See *Catalogue Mus. Coll. Surg.* 1884. The other teeth are all normal and fully formed.

*Variations in position of teeth.* Though not directly pertaining to the subject here considered, the following examples of consider-

able departure from the normal arrangement may be perhaps usefully introduced in illustration of the peculiar variability of the dentition of the group.

- \*174. A skull from Borneo in the Oxford University Museum (numbered 2043 *a*) has the following extraordinary arrangement. All the teeth are normal and in place except the second premolar of each side in the upper jaw. On both sides there is a large diastema between  $p^1$  and  $m^1$ . The diastema on the left side is of about the same size as the normal second premolar, but that on the right side is considerably too small for a normal tooth. The singularity of this specimen lies in the fact that the missing tooth of the right side is present in the skull, but instead of being in its proper place it stands up from the roof of the mouth within the arcade immediately *in front of the right canine and almost exactly on the level of the second incisor*, being *in the premaxilla*, at some distance in front of the maxillary suture.

That this tooth is actually the second premolar which has by some means been shifted into this position there can be no doubt whatever. It has the exact form of the normal second premolar, and is of full size. It stands nearly vertically but is a little inclined towards the outside. The canine is by the growth of this tooth slightly separated from the second incisor, and the first premolar is consequently pushed also somewhat further back. Hence it happens that the diastema for the second premolar on the right side is not of full size. This should be understood, as it might otherwise be imagined that the contraction was due to a complementary increase in the size of the other teeth, of which there is no evidence.

On the *left* side of the palate there was a very slight elevation at a point homologous and symmetrical with that at which the second premolar of the right side was placed. As it seemed possible that the missing tooth of the left side might be concealed beneath this elevation, a small piece of bone was here cut away, with the result that a tooth of about the same size and formation as  $p^2$  was found imbedded in the bone. In this case therefore the second premolar of the right side and of the left side have travelled away from their proper positions and taken up new and symmetrical positions in the palate, anterior to the canines. The facts of this case go to shew that the germ of a tooth contains within itself all the elements necessary to its development into its own true form, provided of course that nutrition is unrestricted. This might no doubt be reasonably expected; but since the forms of organs and of teeth in particular are by some attributed to the mechanical effects of growth under mutual pressure, it may be well to call special attention to this case, which goes far to disprove such a view.

175. Specimen having the teeth of the two sides in the lower jaw in extraordinarily asymmetrical disposition. The bone of the jaw does

not seem to have been broken, but there appears to have been disease of the articulations of the mandibles. B. M., 86, 12, 20, 10.

176. Specimen in which "position of the left upper canine is abnormal. It is displaced backwards and lies to the outer side of the first premolar, which it has pushed towards the middle line." C. S. M., 41 (see *Catalogue*).
177. Case in which upper right canine occupies a position within and on a level with the first premolar, which is pushed outwards. C. S. M., 40, A.

**Troglodytes niger, calvus, &c. (Chimpanzee).**

Normal adult skulls seen, 35.

*Supernumerary molars.*

- \*178. Specimen having on right side in upper jaw a very small square tooth behind  $m^3$ , in the arcade (Fig. 35); and in the left upper

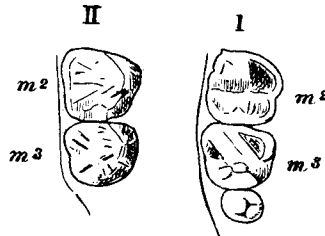


FIG. 35. Posterior right upper molars of Chimpanzee.

I. The case No. 178 (*Coll. Surg. Mus.*, No. 1).

II. A normal Chimpanzee of approximately the same size.

jaw an empty alveolus in the similar place, shewing clearly that a similar tooth has been present: lower jaw normal. C. S. M., 1.

179. Specimen in which teeth all gone, but alveoli exist behind those of the normal teeth on both sides in upper jaw, and there is little doubt that there was here a fourth molar on each side. C. S. M., 9.
180. Specimen in which teeth all gone, but alveoli shew clearly that there was a fourth upper molar on right side; evidence on left side inconclusive: lower jaw gone. C. S. M., 12.
181. Specimen of *T. calvus* having an extra  $\bar{m}^4$  in lower jaw on right side. This tooth is about one quarter of the size of  $\bar{m}^3$ , resembling that in case No. 178. This specimen is in the private collection of Prof. MILNE EDWARDS, who was so kind as to shew it to me.

**Gorilla savagei (Gorilla).**

Normal adult skulls seen, 55.



*Supernumerary molars.*

- \*182. Specimen having  $m^4$  behind and in series with the others on both sides in lower jaw and on right side in upper jaw. On left side both teeth are square and somewhat worn, but the right  $\bar{m}^4$  is a curious conical tooth. Gallery of P. M., A, 505, described by GERVAIS, P., *Journ. de Zool.*, III. p. 164. Pl.
183. Two cases of four molars in each upper jaw. MAGITOT, *Anom. du syst. dent.*, p. 100, Pl. v. fig. 8. [Of these one is in collection of Dr Auzoux; the other is No. 121 in P. M., but as I did not see it when examining the collection it is not reckoned in the statistics given above.]
- Similar case, HENSEL, *Morph. Jahrb.*, v. p. 543.
184. Specimen having supernumerary molar which had not quite pierced bone [no statement as to position]. WYMAN, JEFFRIES, *Proc. Boston N. H. S.*, v. p. 160.
185. Specimen having extra molar in crypt on each side in upper jaw behind  $\bar{m}^3$ . L. M., 3.

*Supernumerary incisor.*

- \*186. Fully adult male from Congo having an extra incisor in lower jaw. There are thus five incisors in lower jaw (Fig. 36), of which

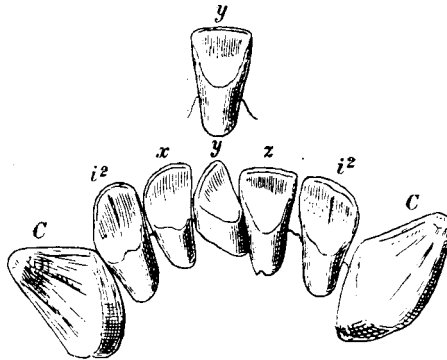


FIG. 36. Lower incisors and canines of Gorilla No. 186.  $x$ ,  $y$  and  $z$  are three central incisors. The upper figure shews the tooth  $y$  as seen from the side. (Specimen in *Coll. Surg. Mus.*, 21, A.)

one, presumably the supernumerary, stands almost exactly in the middle line. This tooth is turned half round, so that the plane of its chisel stands obliquely. The teeth are all well formed and none belong to the milk-dentition, for the milk-teeth are much smaller and of different form. I did not succeed in satisfying myself that the central tooth is certainly the supernumerary. The second incisors are in place on each side and are quite distinct, and the right first incisor is similarly normal.

But whether the oblique tooth, or the tooth between it and the right  $i^1$ , should be rather considered supernumerary cannot be declared with certainty. Probably this is one of the cases, of which more will be said hereafter, in which *both* teeth replace the normally single  $i^1$ . C. S. M. 21, A.

187. *Anomalous extra teeth.* A lower jaw in the Museum of the Odontological Society "having two supernumerary teeth embedded in the bone beneath the coronoid process and sigmoid notch. Originally only a small nodule of enamel was visible on the inner surface of the right ascending ramus, just external to the upper extremity of the inferior dental canal. On cutting away the bone this nodule was found to be a portion of a supernumerary tooth having a conical crown and a single tapering root. Lying above it, another supernumerary tooth was discovered, of which there had previously been no sign whatever. This was likewise exposed by removing the superjacent bone, and found to be a larger tooth with a conical crown and three long narrow roots. The teeth were lying parallel to each other, with their crowns pointing upwards and backwards, so that they could hardly under any circumstances have been erupted in the alveolar arch." *Trans. Odont. Soc.*, 1887, xix. p. 266, fig.

Specimen having fragment of a tooth imbedded in bone between left lower canine and  $p^1$ ; perhaps a fragment of a milk-tooth P.M., A, 506.

[Two specimens in the stores of the P.M. shew great irregularities in the arrangement of the teeth; but in both cases so many teeth had been lost during life that a satisfactory description of the abnormalities cannot now be given.]

### **Hylobates** (Gibbons).

Normal specimens seen, 51. No abnormal case known to me.

### OLD WORLD MONKEYS other than Anthropoid Apes.

188. Of the genera *Semnopithecus*, *Colobus*, *Nasalis*, *Cercopithecus*, *Cercocebus*, *Macacus* and *Cynocephalus*; 419 normal specimens examined. Only two had definite supernumerary teeth, but in one other case it was possible that extra molars had been present.

### *Supernumerary molars.*

189. **Cynocephalus porcarius**, having large extra molar behind and in series in each upper jaw. The two teeth are of the same pattern precisely. In lower jaw there is on each side a large space behind  $m^3$ , but there is no tooth in it. O. M., 2011, b.
190. **Macacus rhesus**, old male, having a fourth molar in place in right *lower* jaw. The tooth does not stand up fully from the bone. On the same side in the *upper* jaw there is also a fourth molar, but was entirely enclosed in bone and was only found by cutting away the side of the maxilla by way of exploration. B. M., 30, c.
191. **Macacus radiatus**, having small and fairly definite depression behind  $m^3$  in each jaw. These depressions seem to be perhaps the alveoli of teeth but it cannot be positively stated that extra molars have been present. C.S.M., 145.
192. *Abnormal arrangement.* Only one case of considerable irregularity of arrangement seen, viz., **Cercopithecus lalandii** (C. S. M. 113), case in which lower canines are recurved and pass *behind* the upper ones. See *Cat. Mus. Coll. Surg.*

## NEW WORLD MONKEYS.

- \*193. In the species of Cebidæ and especially in *Ateles* supernumerary teeth are rather common, eight cases being found in 284 skulls, or nearly 3 per cent. (in addition to cases recorded by others). Of American monkeys belonging to other genera 92 skulls were seen, all being normal. Some cases of absence of the third molar were seen in *Ateles*, which are interesting in connexion with the fact that there are normally only two molars in Hapalidæ.

CEBIDÆ: normal formula  $i \frac{2}{2}, c \frac{1}{1}, p \frac{3}{3}, m \frac{3}{3}$ .

**Chrysothrix**, normal adults, 5.

**Cebus**, normal adults belonging to about ten species, 66.

*Supernumerary molars.*

194. **Cebus robustus**: supernumerary molar in each upper jaw giving  $p \frac{3}{3}, m \frac{4}{3}$ ; DE BLAINVILLE, Laurent's *Annal. d'Anat. et Phys.*, 1837, I. p. 300, Pl. VIII. fig. 6.
195. **C. variegatus**: small tubercular molar in right lower jaw behind  $\overline{m^3}$ . The extra tooth is cylindrical and peg-like, having about  $\frac{1}{4}$ th the diameter  $\overline{m^3}$ . *Leyd. Mus.* 8, Cat. 11.

**Ateles**: normal adult skulls, belonging to several species, 60.

*Supernumerary molars.*

- \*196. **A. pentadactylus**: extra molar in series behind  $m^3$  in both upper and lower jaws on right side, in each case a small round tooth. P. M., A, 1505. This specimen described by DE BLAINVILLE Laurent's *Ann. d'Anat. et Phys.*, 1837, I. p. 300, Pl. VIII. fig. 5; mentioned also by GEOFFROY ST HILAIRE, *Anom. d'Organ.*, I. p. 660.
197. **A. vellerosus**: extra molar on left side in lower jaw behind  $\overline{m^3}$ , as a fully-formed and well-shaped tooth, but not so large as  $\overline{m^3}$ . B. M., 89. 12. 7. 1.
198. **Ateles sp.**: extra molar on left side in lower jaw. MAGITOT, *Anom. du syst. dent.*, p. 101, No. 6.

*Supernumerary premolars.*

- \*199. **Brachyteles hemidactylus** [a genus doubtfully distinct from *Ateles*]: specimen from S. America having l. upper series and all lower series normal. In place of right upper  $p^1$  are two teeth (Fig. 37). These two teeth are similar to each other and for want of space they bulge a little out of the arcade. Each is in size and shape very like normal  $p^1$ , having a sharp cusp and a flat internal part to the crown. Both teeth are slightly rotated in opposite directions, so that the cusp of the anterior is antero-

lateral instead of lateral, while the cusp of the posterior is postero-

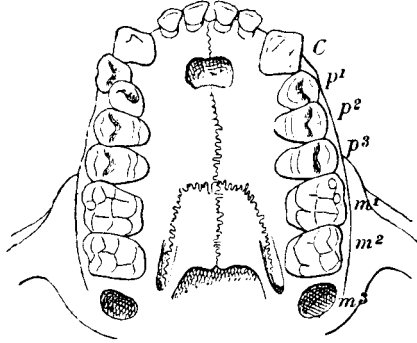


FIG. 37. Surface view of upper jaw of *Brachyteles hemidactylus*, described in No. 199. From skull in *Brit. Mus.*, 42, a.

lateral. These two teeth stand thus in somewhat complementary positions. *B. M.*, 42, a.

\*200. **Ateles marginatus**: wild specimen from river Cupai, has

$$p \begin{array}{c} 4-4 \\ 3-3 \end{array}, \quad m \begin{array}{c} 3-3 \\ 3-3 \end{array},$$

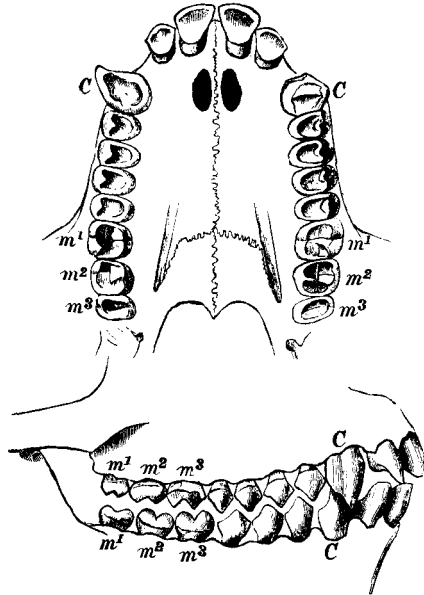


FIG. 38. Surface view of upper teeth of *Ateles marginatus*, specimen described in No. 200, and side view of both jaws together. The specimen is in *Brit. Mus.*, 1214, b.

that is to say, an extra premolar on each side in the upper jaw, the lower jaw being normal. The four upper premolars are perfectly formed, large teeth, in regular series on both sides. As a consequence the lower canines bite on and *partly behind* the upper canines. There was nothing to suggest that any one of these teeth was supernumerary, rather than another (Fig. 38). B. M., 1214, *b*.

*Supernumerary incisor.*

201. **Ateles ater**: specimen from Peruvian Amazon: in right upper jaw there is a large alveolus for  $i^2$ , which is gone, while a *third* incisor stands between this and the canine. This third incisor bites on lower canine, and lower  $p^1$  of the same side bites *in front* of the upper canine. B. M., 1108, *d*.
202. **Ateles paniscus**: extra incisor in upper jaw. RUDOLPHI, *Anat.-phys. Abh.*, 1802, p. 145.

*Absence of molars* (cp. No. 209). Inasmuch as  $p \frac{3}{3}$ ,  $m \frac{2}{2}$  is the normal formula for the Hapalidæ, the following cases of absence of  $m^3$  in *Ateles* are interesting. There was in no case any doubt that the skulls were fully adult, and there was no suggestion that the absent tooth had been lost.

- \*203. **Ateles marginatus**: specimen from the Zoological Society's menagerie, bones rough and unhealthy-looking, but skull well formed and certainly not very young, has no  $m^3$  in either jaw, giving the formula  $p \frac{3-3}{3-3}$ ,  $m \frac{2-2}{2-2}$ , as in Hapalidæ. There is no space in the jaw behind  $m^2$ , and in the upper jaw the bone ends there almost abruptly.
204. **A. melanochir**: Caraccas specimen, having no posterior  $m^3$  on either side in upper jaw. The lower series normal, but the jaws are somewhat asymmetrical, so that the lower posterior right  $m^3$  is behind the level of its fellow of the other side. B. M., 48. 10. 26. 3.
205. **A. variegatus**: wild specimen, having lower  $\bar{m}^3$  absent on both sides. Left  $i^2$  is also absent, but has been almost certainly present. C. M., 1098, *B*.

**Mycetes**: of various species, adult normals, 81.

*Supernumerary molar.*

206. **M. niger**: supernumerary molar in the right upper jaw. The arrangement is peculiar. So far as  $m^2$  the teeth are normal. Behind and in series with  $m^2$  there is a large tooth, a good deal larger than the normal  $m^3$ , and having rather the form of  $m^2$  than of  $m^3$ . Its form is, however, not precisely that of  $m^2$ , for the middle or fifth cusp is rather *anterior* to the centre of the tooth,

instead of being posterior to it as usual. *Outside* this tooth is another, standing out of the arcade, having the size and almost the form of normal  $m^3$ . B. M., 749, c. (Fig. 39).

This case may be an example of one of two principles which will be in the next chapter pointed out as operating in the case

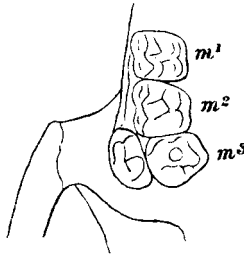


FIG. 39. *Mycetes niger*, No. 206; right upper molars. *Brit. Mus.*, 749, c.

of dental Variation. *Either*  $m^2$  may have divided into two, both standing in series, and the normal  $m^3$  may have been pushed out of the arcade in connexion with this reduplication; *or* the tooth standing outside may represent an addition to the normal series, and in that case the tooth standing as  $m^3$  in the series may be a representation of  $m^3$ , raised to the normally higher condition of  $m^2$  in correlation with the presence of an extra tooth in the series, in the way shewn to occur in other cases (see Chapter x., Section 7). Between these alternative possibilities I cannot decide.

*Supernumerary premolar.*

207. ***Mycetes niger***: between and internal to  $p^1$  and  $p^2$  on left side there is a premolar. This is probably a supernumerary one, but the jaw is so much diseased that the relations are not distinct. B. M., 749, d.
208. ***Callithrix***, normal adults, 22. (In B. M., 51, b on both sides  $m^3$  is separated by a narrow diastema from  $m^2$ . The appearances suggest that possibly a small rudimentary tooth may have stood between them, but this is quite uncertain).

***Nyctipithecus***: 11 normals.

209. ***Pithecia***: 11 normals.  
Specimen having no right  $m^3$ , and apparently this tooth was not about to be formed, for the dentition is otherwise complete. C. M., 1094, a. (Cp. No. 202.)

***Lagothrix***, 6, ***Chiropotes***, 1, ***Ouakaria***, 3 normals respectively.

**HAPALIDÆ**. In this group  $m^3$  is normally absent; and no specimen having this tooth or any other dental abnormality was seen. Of adult normal skulls 33 were seen, belonging to various species.

## CARNIVORA.

## CANIDÆ.

The evidence of the Variation of teeth in Canidæ is divided into three groups according as it concerns (1) incisors, (2) pre-molars, (3) molars. No case specially relating to the canines is known. In each of these groups the cases relating to (A) *wild* Canidæ are taken first, and those relating to (B) domestic Dogs afterwards.

Of wild specimens of the genus *Canis* (including the Fox) 289 skulls were seen, and amongst them were 11 cases of supernumerary teeth, about 3·5 per cent. (besides many recorded cases). Of 216 domestic Dogs (including Pariahs, Esquimaux, &c.) 16 had supernumerary teeth, or 7·4 per cent. (besides many recorded cases). I have not included skulls of edentulous breeds, in which the original condition of the teeth cannot be told with certainty.

Statistics of the occurrence of supernumerary teeth are given by HENSEL, *Morph. Jahrb.*, 1879. Among 345 domestic Dogs in his collection there are 28 cases of one or more extra molars, 12 cases of extra premolar, and 5 cases of extra incisor. [If therefore no two of these cases refer to the same skull, there were in all 45 cases of extra teeth in 345 skulls, or 13 per cent. It is not stated that the collection was not strictly promiscuous, but it may be anticipated that this figure is rather high.] An analysis of Hensel's cases will be given in the sections relating to the particular teeth.

The usual dentition of the genus *Canis* is  $i\frac{3}{3}$ ,  $c\frac{1}{1}$ ,  $p\frac{4}{4}$ ,  $m\frac{2}{2}$ . The Wild Dog of Sumatra, Java and India, *C. javanicus* and *C. primævus* (by some considered as one species) have  $m\frac{2}{2}$  and have been set apart as a genus under the name *Cuon* (HODGSON, *Calcutta Jour. N. H.*, 1842, ii. p. 205). The genus *Icticyon* differs in having normally  $m\frac{1}{2}$ . The genus *Otocyon* on the contrary has usually  $m\frac{3}{4}$ .

Of the variations to be described in *Canis* the most notable are (1) cases of  $i\frac{4-4}{4}$ ; (2) cases of extra premolar, common in upper, very rare in lower jaws; (3) cases of  $\overline{m^3}$  or  $\overline{m^4}$ , and one case of  $m\frac{3}{4}$  giving the formula characteristic of *Otocyon*. In several instances a considerable increase in the size of  $\overline{m^2}$  or  $\overline{m^3}$  is found associated with the presence of  $\overline{m^3}$  or  $\overline{m^4}$  respectively. An interesting group of cases of extra molars was found in *C. cancrivorus*, in which this abnormality seems to be common.

The frequent absence of  $p^1$  in the Esquimaux dogs is worth notice. Absence of  $\overline{m^3}$  is common in Dogs, but absence of  $\overline{m^2}$  is rare.

In *Otocyon* one case of  $m\frac{4}{4}$  is recorded, and in *Icticyon* one example has  $m\frac{2}{2}$  instead of  $m\frac{1}{2}$ .

I. *Variation in Incisors and Canines.*

## A. WILD CANIDÆ.

No case of *extra* incisor known to me.

Two cases of *absent* incisor, viz.

210. [**Canis**] **Vulpes pennsylvanica**, Brit. Columbia, having  $i \frac{3-3}{2-2}$ ; apparently  $i^1$  has not been present on either side. B. M., 1402, b.
211. **Canis vulpes**: only 5 incisors in lower jaw, with no trace of alveolus for the sixth. SCHÄFF, E., *Zool. Gart.*, 1887, XXVIII. p. 270.

## B. DOGS.

212. **Dog** (resembling Bloodhound): *four* incisors on each side in upper jaw. The externals,  $i^3$ , normal, but no evidence as to which of the other teeth supernumerary. *Leyden Mus.*
213. **Thibetan Mastiff**, Nepal: sockets for four teeth on each side in pmx. Teeth all gone. Alveoli of two sides nearly symmetrical. In absence of the teeth it cannot be positively stated that this is not a case of persistent milk-teeth, but this seemed unlikely. B. M., 166, g.
214. **Mastiff**: four teeth on each side in front of canines; from form of teeth probably case of persistent milk-canines. Lower jaw gone. O. M., 1749.
215. **Dog**: on right, sockets for three teeth in addition to  $i^3$  which is in place. *These three sockets all smaller than the normal ones*, and socket for upper right canine also slightly reduced in size. *Odont. Soc. Mus.*
216. **Dog**: small skull in my possession, has in place of right  $i^3$  *two alveoli, both at the same level*, divided by a thin bony septum, the one internal to the other: left  $i^3$  is in place and normal: lower jaw gone.
217. Among 345 Dogs' skulls four had extra upper incisor on *one* side, and one skull had perfectly formed fourth upper incisor on *both* sides. This tooth smaller than third incisor. HENSEL, *l. c.*, p. 534. Several cases of 7 or 8 incisors in upper jaw, teeth being usually asymmetrical. NEHRING, *Sitzb. nat. Fr. Berl.*, 1882, p. 67.
218. In *lower jaw* such cases much rarer. Supernum. lower incisor on *one* side, one case [? in 650 skulls], NEHRING, *ibid.*; also a Dog (*chien chinois-japonais*), 4 incisors in each lower jaw. MAGITOT, *An. syst. dent.*, p. 81.
- Case of divided incisor.*
219. **Bulldog**: right  $i^2$  with very wide crown; main cusp partially bifid, as if intermediate between single and double condition, *Morph. Lab. Cambridge.*

Similar case kindly sent to me by Prof. G. B. Howes.



220. *Absence of incisor* is very rare in Dog. One case of  $i \frac{3-3}{2-2}$  given by HENSEL, *l. c.* p. 534. (Hensel observes that this gives the formula for incisors of *Enhydris [Latax]*; he also calls attention to fig. of **Enhydris** with *three lower incisors* in OWEN, *Odontogr.*, Pl. 128, fig. 12, but as this is not mentioned as an anomaly in text, it is very doubtful.)
221. **Dog** having the upper canine imperfectly divided into two on each side as shewn in Fig. 39. The plane of division was at right

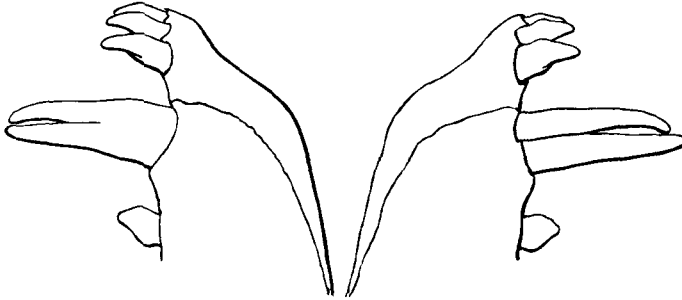


FIG. 39. Right and left profiles of Dog having the canines partially divided.

angles to the line of the alveolus so that the two parts of each canine stood in the plane of the series of teeth. The division was more complete on the right side than on the left. The lower canines were normal. This specimen was kindly sent to me by Mr J. Harrison.

## II. Variation in Premolars.

Several distinct variations were found in the premolars of Canidæ. A number of cases shew five upper premolars instead of four, and the question then arises whether the extra tooth is due to the division of a single tooth, or to reconstitution of the series<sup>1</sup>. The occurrence of a fifth premolar in the lower jaw is much rarer, only three or four cases (Wolf (2) and Greyhound (? 2)) being known to me. The following other forms of Variation occurred. In *C. mesomelas*, No. 228, an extra tooth stood internal to  $p^3$ , and was perhaps a duplicate of this tooth. One case of bifid  $p^1$  was seen, and two cases in which  $p^2$  had apparently divided to form two single-rooted teeth (*C. viverrinus*, No. 227 and a Sledge-dog, No. 237). A few examples of absence of  $p^1$  deserve notice. Lastly, though really an example of Substantive Variation, I have included a curious case of possibly Homœotic variation of  $p^3$  into the partial likeness of the carnassial (No. 245).

<sup>1</sup> On this point see Chapter x. Sections 3 and 5.

*Increase in number of Premolars.*

## A. WILD CANIDÆ.

222. **C. dingo**: specimen having two closely similar teeth between  $p^2$  and the canine in each upper jaw<sup>1</sup>. Both the teeth had the form and size of a premolar. This not a case of persistent milk-tooth, NEHRING, A., *Sitzb. naturf. Fr. Berlin*, 1882, p. 66.
223. **C. dingo**: on right side  $p^1$  is in place, and there is an alveolus for second tooth of about same size. On left side  $p^1$  is rather small. L. M.
- \*224. **C. lateralis**, Gaboon. On l. side  $p^1$  is single, but on rt. side there are two almost identical teeth between  $p^2$  and the canine: of these the most anterior is level with, but slightly smaller than, left  $p^1$ . (Fig. 40) B. M., 1689, a. (See MIVART, *P. Z. S.*, 1890, p. 377.)

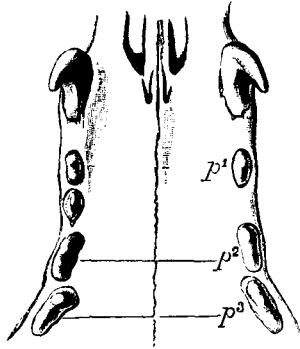


FIG. 40. *Canis lateralis*, No. 224. View of canines and front premolars of the upper jaw.  $p^1$  of the left side is in symmetry with two teeth on the right side.

225. **C. vulpes**: in 142 skulls, one case of two teeth between  $p^2$  and canine (sc. five premolars) in left upper jaw. HENSEL, *l. c.*, p. 548.  
In *C. vulpes* the root of  $p^1$  is not rarely partly divided into two by a groove of variable depth. The division is sometimes nearly complete, as in C. S. M., 651.
226. **C. mesomelas**: two teeth between  $p^2$  and canine in left lower jaw, anterior the larger. DÖNITZ, *Sitzb. naturf. Fr. Berl.*, 1869, p. 41.  
*Division of  $p^2$*
227. **C. viverrinus**: left  $p^2$  represented by two teeth, each having one root. Of these the anterior is tubercular, while the posterior is rather long from before backwards. Anterior premolars normal. L. M. (Compare **Sledge-dog**, No. 237.)  
*Reduplication of  $p^3$*
- \*228. **C. mesomelas**: inside right upper  $p^3$  is a supernumerary tooth which nearly resembles  $p^3$ , but is a little smaller; lower jaw normal. C. S. M., 643. (See Nos. 226 and 247.)
229. **C. lupus**: in addition to irregularities in position of teeth, there is a doubtful appearance as of an alveolus inside left  $p^2$  which is displaced outwards. C. S. M., 624.

<sup>1</sup> MIVART, *l. c.*, by mistake quotes this case as one of extra teeth above and below.

*Partially bifid premolar.*

230. **C. vulpes** : right  $p^1$  has *three* roots and a partially double crown with two cusps (Fig. 41). The whole crown is pyramidal, the labial face being parallel to the arcade and the three roots stand each at one angle of the base : left  $p^1$  normal; lower jaw missing. B. M., 175, o.

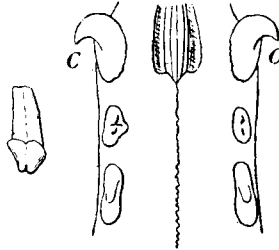


FIG. 41. Teeth of Fox (*C. vulpes*) described in No. 230. The separate view shews the right first premolar removed, seen from the labial side.

*Extra premolar in lower jaw.*

231. **C. lupus** : two teeth between  $p^2$  and canine in lower jaw on *right* side, one case: and the same on *left* side also, one case. These two occurred in 27 Wolf skulls seen by HENSEL, *Morph. Jahrb.*, 1879, v. p. 548.

#### B. DOMESTIC DOGS.

- \*232. **Dog** : between  $p^2$  and canine on *rt.* side there are two teeth, each shaped like a normal  $p^1$ , the anterior being somewhat the larger. This seen in two cases, figured in Fig. 42, II. and III.

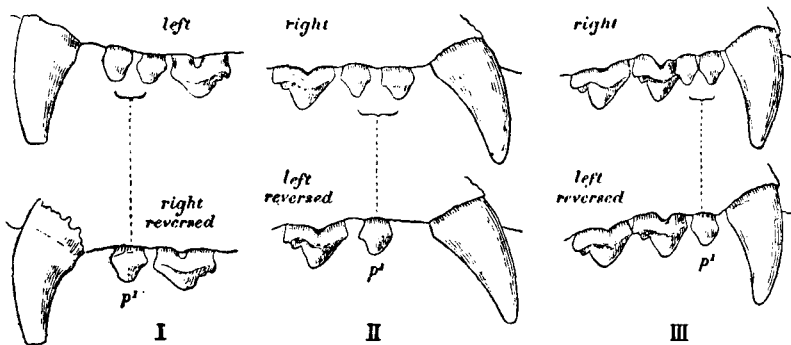


FIG. 42. Profiles of canines and anterior premolars in three dogs having two teeth on one side in symmetry with one tooth on the other.

I. C. S. M., 570. II. and III. Skulls in Cambridge Univ. Morph. Lab.

Lower jaws absent. The property of the Zool. Lab., Cambridge (cp. *C. lateralis*, No. 224).

233. **Spaniel** : similar case, left side, Fig. 42, I. C. S. M., 570.

234. **Dog**: large skull, having  $p \begin{smallmatrix} 5 \\ \hline 5 \end{smallmatrix} \begin{smallmatrix} \hline 5 \\ 5 \end{smallmatrix}$ , all the normal teeth being in place, of proper form and size, standing evenly without crowding. O. M., 1780.
235. **Dogs**. In 345 skulls were 11 cases of supernumerary premolar in the upper jaw, viz.
- on both sides, 1 case,
  - on right side, 7 cases,
  - on left side, 3 cases.

These were all cases described by HENSEL as instances of the presence of " $p^3$ " of his notation, *i.e.* a tooth between  $p^1$  and canine. HENSEL, *Morph. Jahrb.*, 1879, v. p. 546. Out of 650 skulls, including Hensel's 345, 18 had two anterior premolars as described, on both sides in upper jaw. NEHRING, *Sitzb. naturf. Fr. Berl.*, 1882, p. 66.

**English Spaniel**: outside and anterior to right  $p^1$  is a worn stump, probably of an extra tooth (?). B. M., 166, j.

236. **Deerhound**: two alveoli where  $\bar{p}^1$  should be; probably two distinct teeth stood here, but it is possible that the two alveoli were for distinct roots of a single tooth. C. M., 991, B.

#### *Division of $p^2$ .*

237. **Sledge-dog**, Greenland: all teeth normal except left upper  $p^2$ . This tooth normally of course has two roots. Here it is represented by two distinct teeth, each having one root. The anterior has a fairly sharp cusp, but the posterior has a rounded crown. The teeth are in perfectly good condition and do not look worn. They are separated from each other by a considerable diastema. It appears clear that instead of the normal  $p^2$ , two distinct teeth have been formed. O. M., 1787 (compare **C. viverrinus**, No. 227).

#### *Absence of Premolars.*

##### A. WILD CANIDÆ.

238. **C. corsac**:  $\bar{p}^1$  absent on both sides without trace. GIEBEL, *Bronn's Kl. u. Ord.*, Mamm. p. 196, Note.
239. **C. occidentalis**:  $\bar{p}^1$  absent on both sides. C. S. M., 629.
240. **C. vulpes**: in 142 skulls:

	$\bar{p}^1$ absent from both sides	1 case,
do. „ „	left „	1 „
do. „ „	right „	1 „
$\bar{p}^1$ „ „	both „	1 „
do. „ „	left „	2 „
do. „ „	right „	2 „

HENSEL, *Morph. Jahrb.*, 1879, p. 548. A doubtful case of absence of left  $\bar{p}^1$ . B. M., 175, c.

241. **C. (Nyctereutes) procyonoides** :  $\underline{p}^1$  absent on both sides without trace in B. M., 186, *e*; and absent on right side in B. M., 186, *d*. On the contrary B. M. 186 *a* and *b* and C. S. M., 672, are normal.

The following cases of absent premolars were doubtful : **C. dingo** : right  $\underline{p}^1$  and left  $\overline{p}^1$ . C. S. M. **C. antarcticus** :  $\underline{p}^1$  above and below on left side. C. S. M., 635.

### B. DOMESTIC DOGS.

242. From the nature of the case it is not often possible to say with confidence that  $\underline{p}^1$  has *not* been present in a given skull, but from the material examined this variation appears to be rather rare. In 216 skulls, excepting those of Esquimaux dogs, I only saw two clear cases in which the bones were smooth, without trace of alveolus, viz. "**Danish**" **Dog** :  $\overline{p}^1$  absent on both sides, O. M., 1786. **Terrier** :  $\underline{p}^1$  absent on both sides. C. S. M., 579. Many others doubtful.

According to HENSEL, however, absence of  $\underline{p}^1$  is common, and he states that in 345 skulls the following occurred :

$\underline{p}^1$ absent on both sides	5 cases,
do. " " one	4 "
$\overline{p}^1$ " " both	frequently,
do. " " one	9 cases,
$\overline{p}^1$ absent on both sides and $\underline{p}^1$ on one side,	1 case.

*Morph. Jalrb.*, 1879, p. 546. [This is of course a far higher frequency than was found by me, but perhaps discrepancy arises from difference in reckoning the evidence of absence.]

Two doubtful cases of absence of  $\underline{p}^2$  were seen in Dogs.

- \*243. **Esquimaux Dogs** : absence of  $\underline{p}^1$  quite common, the following skulls being all of the breed that I have seen.

Normals, with  $\underline{p}^1$ , only two specimens. Specimens with no  $\underline{p}^1$ , above or below, the canines in such cases standing close to  $\underline{p}^2$ , three cases, viz. B. M., 58. 5. 4. 96; B. M., 166, *a*; C. S. M., 542.  $\underline{p}^1$  absent on left side and  $\overline{p}^1$  on both sides, C. M., 1000, *c*.  $\overline{p}^1$  absent both sides and  $\overline{p}^1$  absent on left side, L. M.  $\underline{p}^1$  and  $\overline{p}^1$  both absent from right side; left normal, O. M., 1789.  $\overline{p}^1$  absent on left side, B. M., 166, *r*, 3.  $\overline{p}^1$  absent on right side, B. M., 166, *t*, 2.

The partial establishment of a character of this kind in a breed, which, if selected at all, has been selected for very different qualities, is rather interesting. It need scarcely be remarked that the partial loss of this tooth cannot in the Esquimaux dog have occurred in connexion with an enfeebled habit of life, as might perhaps be supposed by some in the case of the edentulous lap-dogs.

As will be shewn in the next section, absence of the front premolars is a common character in the dogs of the ancient Incas, but in them the posterior molars are also frequently absent. There is no special reason for supposing that the Esquimaux dogs came originally from America, but it may be worth recalling as a suggestion, that according to anthropologists the relations

of the Esquimaux are rather with American tribes than with Europeans. If this were established, it would be not unlikely that the Esquimaux dogs might be descended from dogs domesticated in America before the coming of Europeans, and so far belong rather with the Inca dogs than with ours<sup>1</sup>.

- \*244. **Inca Dogs.** The domestic dogs from the Inca interments, belonging to a period before the coming of the Spaniards, have been investigated by NEHRING. Of nine skulls not one had the full number of teeth and there was no case of supernumerary teeth. Sometimes the anterior premolar was absent, sometimes a posterior molar, and in some cases both. The formulæ were as follows:

$$p \frac{4-4}{4-3}, m \frac{2-2}{2-3} \text{ 1 case.}$$

$$p \frac{4-4}{3-3}, m \frac{2-2}{3-2} \text{ 1 case.}$$

$$p \frac{4-4}{3-3}, m \frac{2-2}{3-3} \text{ 3 cases.}$$

$$p \frac{4-4}{3-3}, m \frac{2-1}{2-2} \text{ 1 case.}$$

$$p \frac{4-3}{4-4}, m \frac{2-2}{2-2} \text{ 1 case.}$$

$$p \frac{3-3}{3-3}, m \frac{2-2}{3-3} \text{ 2 cases.}$$

The dogs were all of moderate size, and none shewed any defects in the form of teeth, which were all strong and sound. NEHRING, A., *Kosmos*, 1884, xv. p. 94.

*Variation (? Homœotic) in form of third Premolar.*

- \*245. **Dog:** large breed. In the upper jaw *on both sides* the third premolar, instead of having only two roots, has a third internal root, thus somewhat resembling the carnassial. The crown of the tooth very slightly changed. This is not a case of persistent milk-tooth, which though a three-rooted tooth, is very different. C. S. M., 558.

III. *Variation in Molars.*

Supernumerary molars are not rare in Canidæ. In all cases seen by me these teeth are single-rooted, round-crowned, rather tubercular teeth, placed behind  $\overline{m^2}$  or  $\overline{m^3}$  as the case may be. HENSEL<sup>1</sup> has observed that if  $\overline{m^4}$  occurs, then  $\overline{m^3}$  which is normally single-rooted, not infrequently has a double root, though the same variation may occur when there is no  $\overline{m^4}$  present. Conversely, when  $\overline{m^3}$  is absent, not a rare variation, then  $\overline{m^2}$  is often of a

<sup>1</sup> BARTLETT, arguing chiefly from habits, considers the Esquimaux dogs to be domesticated wolves, and says that they often breed with the wolf. *P. Z. S.*, 1890, p. 47.

<sup>2</sup> HENSEL, *Morph. Jahrb.*, 1879, v. p. 539.

size below the normal, having a single root and a crown slightly developed, like that of  $\overline{m^3}$ . This reduced condition of  $\overline{m^2}$  may also occur in cases in which  $\overline{m^3}$  is not absent. These observations of Hensel's, which are of great consequence to an appreciation of the nature of Repetition, I can fully attest, and similar cases of Variation in adjacent teeth associated with the presence of a supernumerary were seen in other animals also.

#### A. WILD CANIDÆ.

##### *Supernumerary Molars.*

246. **C. lupus:** 26 normals seen. Specimen from Courland having supernumerary  $\overline{m^3}$  on left. In this specimen  $\overline{m^2}$  is rather abnormally large on *both* sides, and the lower third molar, on the *left* side, viz. that on which the upper jaw has an extra tooth, is larger than right  $\overline{m^3}$ , but it is not larger than usual. C. M., 976, *M.*

HENSEL, *l. c.*, p. 548, saw 27 skulls, none having extra molar, but one specimen known to him had a right  $\overline{m^3}$ .

247. **C. mesomelas** ♀ (a Jackal): small, bitubercular left  $\overline{m^3}$ . DÖNITZ, *Sitzb. naturf. Fr. Berlin*, 1872, p. 54. (See Nos. 226 and 228.)

The S. American *Canidæ* (*Lycalopex* group) are remarkable for the frequency with which they possess extra molars, as the following cases (*C. azaræ*, *vetulus*, *magellanicus* and *cancrivorus*) testify. FLOWER and LYDEKKER<sup>1</sup> speak of the occasional presence of  $\overline{m^3}$  in *C. cancrivorus*, but the evidence taken together seems rather to shew that there is a general variability at the end of the molar series in both jaws in these species; for not only is  $\overline{m^3}$  found, but in some cases  $\overline{m^4}$  also, while in one instance there was an 'odontome,' or rather a complex of 4 small teeth attached to  $\overline{m^3}$ .

248. **C. vetulus**, Brazil: specimen having an extra molar in right lower jaw (Fig. 44, I.). The posterior part of  $\overline{m^3}$  is slightly pushed outwards and a very small extra tooth stands behind and partly internal to it. Right  $\overline{m^3}$  is slightly larger than left  $\overline{m^3}$  and differs from it also a little in pattern. The extra tooth has one large and about three smaller blunt cusps on its crown, and might be described as a small representation of the larger  $\overline{m^4}$  seen in other cases. B. M., 84. 2. 21. 1 (mentioned by MIVART<sup>2</sup>, *Monogr. Canidæ*).
- \*249. **Canis azaræ:** Brazilian specimen having a large supernumerary molar ( $\overline{m^3}$ ) in *each* upper jaw placed in series with the others. In this specimen the great enlargement of  $\overline{m^2}$  is very

<sup>1</sup> *Mammals, Living and Extinct*, 1891, p. 546.

<sup>2</sup> In the same place Mivart mentions a case of  $\overline{m^3}$  in "*C. cancrivorus*," but I have not seen it. Perhaps this reference is to van der Hoeven's case (No. 249) which was by Burmeister named *C. cancrivorus* (see HUXLEY, *P. Z. S.*, 1880, p. 268).

noticeable on both sides, and this tooth is present as a large tooth with apparently *three* roots. In the lower jaw there is no extra tooth, but the molars are considerably larger than those of a

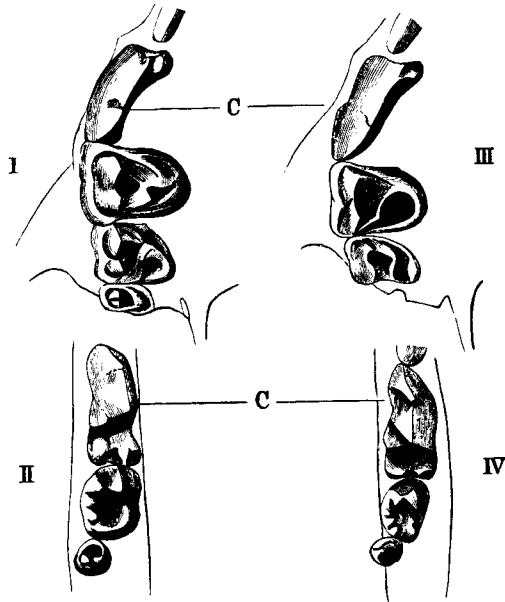


FIG. 43. *Canis azaræ*. I. and II. Right upper and lower jaws of the specimen described in No. 248, shewing the extra upper molar and the correlated enlargement of  $\bar{m}^2$  and  $\bar{m}^3$ . III. and IV. are taken from a normal specimen of slightly larger size. C, carnassial teeth.

This figure was kindly drawn for me by Mr J. J. Lister.

normal specimen (Fig. 43). In the figure, side by side with the teeth of the abnormal form, are shewn the teeth of a normal skull which was slightly larger than the abnormal one, for comparison. *Leyden Mus.*<sup>1</sup>

250. **C. magellanicus**: specimen having  $\bar{m}^3$  on both sides. B. M., 46. 11. 3. 9 (mentioned by HUXLEY, *l. c.*).
- \*251. **C. cancrivorus**. The only skulls of this species seen by me are those in B. M. Of these one skull with lower jaw, one skull without lower jaw, and one lower jaw without skull, have numerically the normal dentition of *Canis*, but of these, one has right  $\bar{m}^3$  much larger than corresponding left tooth. The following were abnormal: small tubercular  $\bar{m}^2$  on both sides, upper series normal, B. M., 1033, *b*, and also B. M., 1033, *c*, (Fig. 44, II.) mentioned by HUXLEY, *l. c.*
252. Specimen having upper series and left lower series normal. On inner side of right  $\bar{m}^3$  and as it were growing out from this tooth is a

<sup>1</sup> This is no doubt the skull described by van der HOEVEN, *Verh. k. Ak. Wet., Amst.*, iii. 1856, *Pl.* See HUXLEY, *P. Z. S.*, 1880, p. 268.



large 'odontome' composed of four small tubercular teeth. Each of these has a distinct crown and neck, but apparently the necks join with

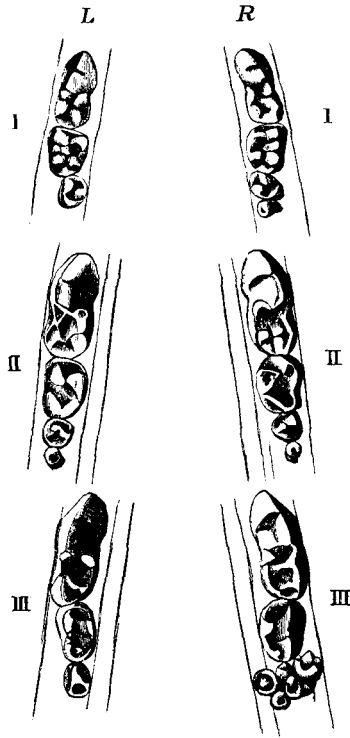


FIG. 44. Posterior lower molars of S. American Foxes. I. *C. vetulus* No. 249. II. *C. cancrivorus* No. 251. III. *C. cancrivorus* No. 252. In each case the right and left sides are shewn. R, right. L, left.

each other and with the neck of  $\overline{m}^3$ , which is displaced (Fig. 44, III.). B. M., 1033, *a.* (mentioned by HUXLEY, *P. Z. S.*, 1880, p. 268; figured by MIVART, *P. Z. S.*, 1890, p. 377).

In answer to an inquiry, Prof. NEHRING informs me that he has three skulls of *C. cancrivorus* Desm. (= *C. braziliensis* Lund.) from the province of S. Paolo, Brazil, which are normal, except that in one  $\overline{p}^2$  has never replaced  $\overline{a}^2$ , which is in place; and that another Venezuelan skull of this species is also normal. [Whether the B. M. specimens are really of the same species as these I do not know.]

- \*253. The rarity of supernumerary molars in *C. vulpes*, the common Fox, is remarkable in contrast with the foregoing evidence. In 142 cases (to which I can add 37), HENSEL, *Morph. Jahrb.*, 1879, found no single case.

#### Absence of Molars.

254.  $\overline{m}^2$  is very rarely absent in Canidæ, and among the wild forms no case seen in 289 skulls (except a doubtful case in *C. occidentalis*, right

side, C. S. M., 628).  $\bar{m}^3$  was observed to be absent in the following: **C. lagopus**, from Kamtschatka, absent on both sides in two cases received in same consignment with 4 normal skulls. *B. M.*, 88. 2. 20. 9 and 10; another case from Norway. *Leyd. Mus.* **C. zerda**: on left side. C. S. M., 671. **C. vulpes**: ditto, 2 cases. *B. M.*, 177, *a* and 175, *b*. **C. viverrinus**: on right side. *Leyd. Mus.* **C. procyonoides**: ditto. *Leyd. Mus.* HENSEL, *l. c.*, gives the following: **C. vulpes**: 142 skulls;  $\bar{m}^3$  absent on both sides, 5 cases; on left side, 3 cases. **C. lupus**:  $\bar{m}^3$  absent on left side, 2 cases; on right side, 1 case.

#### ICTICYON AND OTOCYON.

\* It is remarkable that in each of the two genera *Icticyon* and *Otocyon*, which are especially distinguished from *Canis* by the possession of unusual dental formulæ, numerical Variation in the teeth has been recorded, though the number of skulls of these forms in Museums is very small. The two forms, besides, differ from *Canis* in opposite ways, the one having a tooth less in each jaw while the other has in each jaw a tooth more, so that the presence of extra teeth in the two species is all the more important.

255. **Icticyon venaticus**: according to the authorities has  $p\frac{4}{4}, m\frac{1}{2}$ , viz. a molar less than the Dog in each jaw. The following skulls are all that I have seen. The carnassials did not vary appreciably in the three skulls. Each skull differs from the others, as follows.

$p\frac{4}{4}, m\frac{1}{2}$ , *B. M.*, 185, *a*.

$p\frac{4}{4}, m, \frac{1}{1}$ , *B. M.*, 185, *b*.

$p\frac{4}{4}, m\frac{2}{2}$ , C. S. M., 533. (See FLOWER, *P. Z. S.*, 1880, p. 71.)

256. **Otocyon megalotis** [= *lalandii* and *caffer*]: the usual formula is  $p\frac{4}{4}, m\frac{3}{4}$ , that is, one molar more than the Dog in each jaw. It occurs in 4 skulls at *B. M.* and in 2 at C. S. M. One specimen has in addition an extra molar of good size in each upper jaw, giving  $m\frac{4-4}{4-4}$ . In this case  $m^3$  is enlarged also on both sides. C. S. M., 675 (see *Cat. Mus. Coll. Surg.*, &c.). Three specimens having  $m\frac{3}{4}$  mentioned by DÖNITZ, *Sitzb. naturf. Fr. Berlin*, 1872, p. 54.

#### B. DOMESTIC DOGS.

##### Supernumerary Molars.

257. **Dogs.** In 345 skulls the following 28 cases occurred, chiefly in large breeds:

$\bar{m}^3$ on both sides and $\bar{m}^4$ on one side,	1 case.
$\bar{m}^3$ on both sides	2 cases.
$\bar{m}^3$ on one side	9 cases.
$\bar{m}^3$ and $\bar{m}^4$ on one side only	2 cases.
$\bar{m}^4$ on both sides	6 cases.
$\bar{m}^4$ on one side only	8 cases.

HENSEL, *Morph. Jahrb.*, 1879, v. p. 538.

In addition to these,

$\overline{m^3}$  and  $\overline{m^4}$  absent on both sides, 1 case.

This was the only case in 860 skulls of *Canis*, of which about 650 were Dogs. The formula in it is thus that of *Otocyon* or the fossil *Amphicyon*. NEHRING, *Sitzb. naturf. Fr. Berlin*, 1882, p. 66.

- In 216 skulls seen by me there were 8 cases of extra molars, viz. :—  
 258. **Sheep dog** : left  $\overline{m^3}$ . C. S. M., 587; **Bulldog** : left  $\overline{m^3}$ . B. M., 166 s; **Dog** from New Zealand, having left  $\overline{m^3}$ , left  $\overline{m^3}$  being larger than right  $\overline{m^3}$ . C. M., 1000; Bhotea **Mastiff** :  $\overline{m^4}$  on right B. M., 166, f.; **Pointer** : left  $\overline{m^4}$ . C. M., 1000, A; **Dog** : right  $\overline{m^4}$  *Camb, Morph. Lab.*; **Pariah** :  $\overline{m^4}$  has been present on both sides, also a small stump below  $p^1$  and  $p^2$ , possibly part of a milk-tooth. B. M., 166, d.  
 259. **Mastiff** : supernumerary  $\overline{m^4}$  on right. The right  $\overline{m^3}$  materially larger than left  $\overline{m^3}$  (Fig. 45). C. S. M., 555.

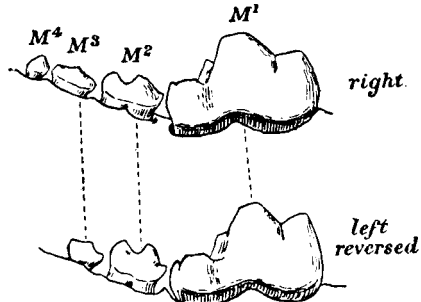


FIG. 45. Posterior molars of lower jaw of Mastiff No. 259, having an extra  $\overline{m^4}$  on the right side. Right  $\overline{m^3}$  is materially larger than left  $\overline{m^3}$ .

260. **Dog**, large size, supernumerary  $\overline{m^4}$  on right side. On both sides  $\overline{m^3}$  is two-rooted<sup>1</sup> and of large size. *Leyd. Mus.*, 258.  
 261. WINDLE and HUMPHREYS, *P. Z. S.*, 1890, p. 27, give an account of extra molars in the Dog, speaking of *upper jaws only*, and some of the foregoing are mentioned by them. As they do not specify the collection in which each is found the identity of the cases is not easy to tell. The following cases given by them are, I believe, all in addition to those already specified :—**Bulldog**, **Lurcher**, **Pointer** and **Terrier**,  $\overline{m^3}$  on both sides. **Bulldog**  $\overline{m^3}$  on left side; **Esquimaux**, **Pug**, **Spaniel**, **West Indian Dog**,  $\overline{m^3}$  on right side.  
**Coach-dog** :  $\overline{m^4}$  on both sides, MAGITOT, *Anom. Syst. dent.*, p. 103.

#### Absence of Molars.

262. **Dog** : in 345 skulls the following seen :  $\overline{m^2}$  and  $\overline{m^3}$  absent on both sides, 2 cases;  $\overline{m^2}$  and  $\overline{m^3}$  absent on both sides, 1 case;  $\overline{m^3}$  absent on both sides, 25 cases;  $\overline{m^3}$  absent on one side, 9 cases. HENSEL, *l. c.*  
 In 216 seen by me the following occurred :  $\overline{m^3}$  absent on both sides, 7 cases; C. M., 993 and 978; C. S. M. (*Store*), 65 and 67; two skulls marked "Skye Terrier,"

<sup>1</sup> It generally has a simple, conical root, but not rarely it has an imperfectly divided root, e.g. Newfoundland dog, O. M., 1778.

probably both of the same strain, C. M. 991, *F* and *G*; and Fox Terrier, C. M., 991, *R*;  $\bar{m}^3$  absent on left side, 2 cases. Irish Wolf-dog, B. M. 82. 11. 11. 1; Fox Terrier, C. S. M., 580, *A*;  $\bar{m}^3$  absent on right side, 1 case, Bloodhound, B. M., 166, *t*. besides a few doubtful cases.

**Inca dogs**: for evidence as to absence of molars, see No. 244.

### FELIDÆ.

The following evidence relates to the genera *Felis* and *Cynælurus*. The usual formula is  $i_3^3$ ,  $c_1^1$ ,  $p_3^3$ ,  $m_1^1$ . Of wild species, 278 adult skulls having no extra teeth were seen, and 8 cases of extra teeth (nearly 3 per cent.): of domestic Cats, 35 adults without, and 3 cases with extra teeth (so far, about 9 per cent.). As in Canidæ so in Felidæ, there is a remarkable group of cases of variation in the anterior premolars. In the normal a small anterior premolar stands in the upper jaw, and commonly it is one-rooted, sometimes two-rooted (cases given); but there is no small anterior premolar in the lower jaw.

Cases of variation consisting in the presence of two small premolars above are common<sup>1</sup>, just as there are often two small anterior premolars in the Dog. There are besides a few cases of the presence of a small anterior premolar in the lower jaw, but they are rather rare, and curiously enough there seems to be no case of the coincidence of these two variations in the same skull.

As already stated, in describing cases, the small anterior premolar in the upper jaw will be here spoken of as  $p^1$ , though no suggestion that it is the homologue of the Dog's  $p^1$  is meant.

In a few species  $p^1$  is most commonly absent (cases given). There are some curious cases of *duplicates* of large premolars (Cat) and one of *duplicate canine* (Tiger), also a few of supernumerary molar. Though so small, and biting on no tooth of the lower jaw,  $m^1$  is nearly always in place even in old skulls (HENSEL).

#### Variation in Incisors.

No quite satisfactory case of numerical variation in incisors of Felidæ known to me. The following should however be mentioned.

263. **F. lynx**: two extra teeth in premaxillæ. Right incisors normal; sockets for left incisors normal. Outside left  $i^2$  and close to canine is an extra tooth of good size, and in same place on right is a socket for a similar tooth. Since they are in premaxillæ these teeth are probably not persistent milk-canines. Lower canines bite in front of the extra teeth. B. M., 1156, *a*.

#### Incisors absent.

264. **F. pardalis**:  $i^1$  and  $\bar{i}^1$  absent on left side. As regards the lower jaw the tooth may have been present, and been lost, but left  $i^1$  has probably never been present. It is especially notable that left  $i^2$  is larger than right  $i^2$ , but there is no indication that  $i^1$  is compounded with it. B. M., 1068, *a*.

**F. chate** [*?=pardalis*]: doubtful if  $i^1$  has been present on either side. B. M., 55. 12. 26. 178.

265. **Cynælurus jubatus**: no trace of right  $i^2$ ; same skull has no  $p^1$ ; lower jaw normal. B. M., 135, *f*.

<sup>1</sup> For discussion of such cases see Chapter x. Section 5.

*Anterior Premolars (supernumerary).*

## UPPER JAW.

- \*266. **F. pardus**: right  $p^1$  single and normal; on l. side two such teeth, both standing at level anterior to right  $p^1$ . The anterior is of same size as right  $p^1$ ; the posterior is rather smaller. B. M., 87. 4. 25. 1.
267. **F. eyra**: two small anterior premolars in left upper jaw, BAIRD, *U. S. and Mex. Bound. Surv.*, Pt. 2, Pl. XIII. figs. 2, a and 2, c [anomaly not mentioned in text].
- \*268. **F. catus**, Athens. Two small anterior premolars in upper jaw both sides (Fig. 46, I.), small and standing close together. On rt. anterior the larger, on l. posterior the larger. B. M., 47. 7. 22. 2.

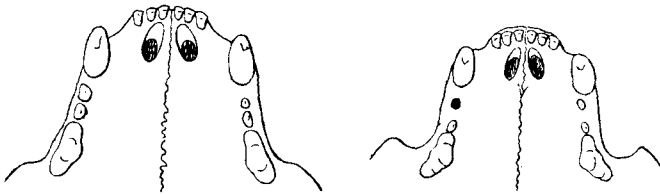


FIG. 46. Left-hand figure: upper jaw of *F. catus*, No. 268. Right-hand figure: upper jaw of *F. inconspicua*, No. 269.

- \*269. **F. inconspicua** (= *torquata*). Rajpootana. Two small anterior premolars in upper jaw both sides; both small, diastema between them. Posterior is nearly in contact with " $p^3$ ", while anterior is only a little behind canine (Fig. 46, II.). B. M., 85. 8. 1. 26. (Another specimen has  $p^1$  as large single-fanged tooth.)
270. **F. domestica** (out of 38 skulls): internal to and rather behind left  $p^1$  is an almost identical copy of it, though rather smaller. Not a milk-tooth. C. S. M., 414.
271. Out of 252 skulls two anterior premolars on both sides, 4 cases; on right, 2 cases; on left, 1 case [none specially described]. HENSEL, *Morph. Jahrb.*, 1879, v. p. 553.
272. **F. caligata**, Socotra: outside right  $p^1$ , a small extra tooth. In this specimen  $p^1$  on each side has two roots. B. M., 857, b.  
Doubtful cases of extra upper anterior premolar, *F. pardus*, C. S. M. 365; *F. leo*, C. S. M. 308.

## LOWER JAW.

273. **F. concolor**: a supernumerary anterior premolar on both sides present, *Berl. Anat. Mus.*, 3678. HENSEL, *ibid.* **F. catus** or **maniculata**: ditto. *Frankf. Mus.*, HENSEL, *ibid.* **F. catus**: ditto. on left side, closely resembling  $p^1$ . Two cases, B. M., 1143 and 1143, a.
274. **F. domestica**: (in 252 skulls) a supernumerary premolar on both sides, just in front of and nearly same size as the usual " $p^2$ ," one case; on left, as a very small tooth midway between canine and " $p^2$ ," one case; on right, rather larger than in foregoing and nearer to " $p^2$ ," one case. HENSEL, *ibid.*
275. **F. tetraodon**: alveolus for small anterior premolar in right lower jaw; but as this fossil form very rare, uncertain whether normally

present in the species, DE BLAINVILLE, *Ostéogr.*, Atlas, Pl. XVI. *Felis fossiles*.

*Variations in size of  $p^1$ .*

276. **F. pardus**:  $p^1$  sometimes two-rooted, as C. S. M., 360 (African); more often one-rooted, as C. S. M., 364, &c.: many gradations between these. In B. M., 115,  $q$  right  $p^1$  extraordinarily large, left normal. Minute alveolus external and posterior to each of these; on left side a small worn stump [? of milk-tooth] in this alveolus.
277. **F. domestica**:  $p^1$  two-rooted C. S. M. 409 and B. M., 127,  $q$ ; on right side two-rooted B. M. 127,  $s$ . **F. catus** C. S. M. 401 and **F. minuta** (Borneo) B. M., 122,  $f$ ,  $p^1$  partially two-rooted. **F. caligata**, see above, No. 272. **F. chaus**: left  $p^1$  very small, right  $p^1$  fair size. B. M. 131,  $e$ . **F. jaguarondi**, ditto, B. M.

*Absence of  $p^1$ .*

In the following cases it appeared that  $p^1$  had not been present.

278. **F. catus**, both sides, a cave-skull, HENSEL, *l. c.*; left side only, Caucasus, B. M. 1143,  $m$ ; **F. tigris**, HENSEL, **F. onca**, both sides, B. M., 117,  $c$ ; **F. manul**, ditto, B. M. 1863,  $a$ ; **F. nebulosa**, ditto, two cases [? normal for species] B. M.; **F. rubiginosa**, Malacca, ditto, B. M., 1856,  $a$ ; **F. chaus**: both sides in domesticated specimen from India, B. M.; and in B. M. 58. 5. 4. 69, similar specimen, this tooth is small on left, absent on right; **F. brachyurus**, absent both sides, B. M.; **F. chinensis**, right absent, B. M., 70. 2. 18. 25; **F. javanensis**, left absent, B. M. 1641,  $a$  (but in B. M. 1309,  $b$ ,  $p^1$  is particularly large). **F. domestica**: in 252 skulls  $p^1$  absent both sides 6 times, and one side, once (in 2 cases anterior deciduous tooth remained on both sides in upper jaws of adults) HENSEL, *l. c.* p. 552; in 38 skulls seen by me,  $p^1$  absent both sides, 2 cases; right side in one case (Manx, C. S. M., 428,  $A$ ).

In the following species the absence of  $p^1$  was so frequent as to call for special notice.

279. **Cynælurus jubatus**: of 8 skulls 3 (2 African) were like Cat, having  $p^1$  both sides;  $p^1$  absent both sides, 3 cases, B. M., 135,  $f$  and C. S. M.—; left  $p^1$  absent, right very small, C. S. M., 441; right  $p^1$  absent [?]. B. M., 135,  $c$ .
280. **F. caracal**: out of 8 skulls only 4 had any indication that  $p^1$  might have been present, and in these it was doubtful.
281. **Lynx**: of Lynxes of possibly different species, 17 skulls have no  $p^1$ , a skull marked "*Lynx borealis*," B. M., 1230,  $a$  has a small, worn stump as  $p^1$  on each side.
282. **F. pajeros** (= *pampana*), Chili: 2 skulls only known to HENSEL, *l. c.*, both without  $p^1$ . This tooth absent in B. M. 126 and 126,  $c$ ; but in one specimen seen, right  $p^1$  absent but left  $p^1$  of good size.

*Partial division (?) of lower premolar.*

Two cases relate to this subject. The first lower premolar of Felidæ is a two-rooted tooth of well-known form. In the first of the following cases it bore an extra talon and root; in the second there was a small extra root on the internal face. (Cp. **C. vulpes**, No. 230.)

283. **F. tigris**: anterior right lower premolar has a thin supernumerary root on internal side of the tooth at the level between the two normal roots. This tooth in form resembled a milk-carnassial to some extent, but it was certainly not one of the normal milk-teeth. C. S. M., 333.

- \*284. **F. fontanieri** (see No. 290): anterior premolar of right lower jaw has additional talon on internal and anterior surface (Fig. 47). This

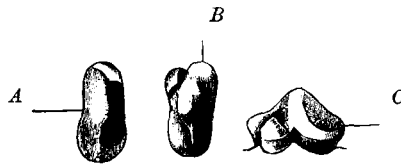


FIG. 47. *Felis fontanieri*, No. 284.

A. The normal anterior premolar of the left lower jaw. B. The corresponding tooth of the right side from above. C. The same from the lingual side.

portion has a separate root, and stands somewhat apart from rest of crown, looking like a partially separated tooth. B. M., 90. 7. 8. 1.

#### *Duplicate Teeth.*

285. **F. tigris**: on right side, two canines in the same socket, both of large size, the anterior being the smaller; neither is a milk-tooth. *Mus. Odont. Soc.*
286. **F. domestica**: having a large supernumerary tooth in each upper jaw. The extra tooth was in each case a small but accurate copy of the carnassial tooth (Fig. 48) of its own side. In each



FIG. 48. The teeth in upper jaw of Cat, No. 286.

case the extra tooth stood internally to the carnassial tooth, extending from the level of the middle of the carnassial tooth to the level of the middle of the molar. B. M., 83. 3. 10. I.

287. Specimen having a tooth in the upper jaw closely resembling the second premolar ("p<sup>3</sup>" *auctt.*) internal to and between it and the carnassial. The internal tooth is slightly smaller than the second premolar<sup>1</sup> (Fig. 49). C. S. M., 414.

<sup>1</sup> In this case, it is not possible to say strictly that either of the two teeth "is" the normal second premolar, rather than the other.

288. Specimen having a small tooth internal to the middle of the lower [?side] carnassial ( $\overline{m}^1$ ): the extra tooth was here divided into two cusps so that it was a copy of the carnassial. HENSEL, *l. c.*

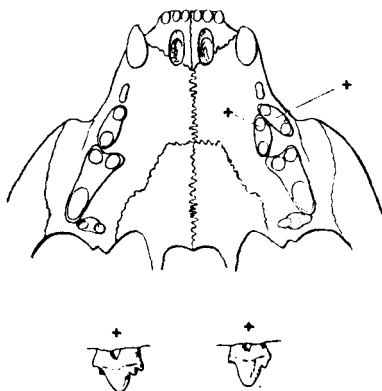


FIG. 49. Plan of teeth in upper jaw of Cat, No. 287. The two teeth marked with crosses are separately shewn, that on the right being the external.

289. Specimen having a tooth like the last, but not so distinctly divided into two cusps, internal to posterior end of lower carnassial [?side]. *ibid.*

#### *Supernumerary Molars.*

Cases like the last cannot be clearly separated from cases of true extra molars in series, such as the following.

It is remarkable that no case of supernumerary *upper* molar in series seems to be known in Felidæ. In the Tiger and other species the upper molar is sometimes single- and sometimes double-rooted.

- \*290. **F. fontanieri**: a species nearly allied to the Leopard (*F. pardus*), inhabiting the Kiu-Kiang, a geographically isolated region of N. China. Only two skulls are known, and each of them presents an abnormality in dentition (see No. 284). Skull having supernumerary tubercular tooth in series ( $\overline{m}^2$ ) behind the left lower molar ( $\overline{m}^1$ ). B. M., 1490, *a.*
291. **F. pardalis**:  $\overline{m}^2$  on left side. HENSEL, *Morph. Jahrb.*, 1879, v, p. 541. **F. tigrina**: tubercular  $\overline{m}^2$  on left side. SCHLEGEL, *P. Z. S.*, 1866, p. 419. **F. lynx**: ditto [? side]. MAGITOT, *Anom. syst. dent.*, p. 103. **F. domestica**: "supernumerary permanent molar in lower jaw" [no particulars]. WYMAN, J., *Proc. Boston N. H. S.*, v, p. 160. **F. pardus**: doubtful indication that a left  $\overline{m}^2$  has been present. C. M., 933, F.

#### *Absent Molar.*

**F. leo**:  $m^1$  absent on both sides, and there is no space for it behind the upper carnassials. B. M., 3043. The only case seen in all Felidæ examined. **F. domestica**:  $m^1$  absent [? both sides]. HENSEL, *l. c.*, p. 541.



## VIVERRIDÆ.

Of the Viverridæ, *Herpestes* and *Crossarchus* are the only genera represented in collections in quantity sufficient to repay study of their dental variations. In the teeth of these two genera, however, variation is considerable and appears in some interesting forms.

In *Herpestes* there is first some evidence of variability in the number of the incisors, including one case of extra incisor. Next the facts respecting the presence or absence of the anterior premolar are of some consequence, both as illustrating the general variability and modes of Variation of this tooth, and also because the normal presence or normal absence of the anterior premolar is one of the characteristics of different species, which shew a progression in this respect. There is one case which should probably be looked on as an example of duplicate anterior premolar.

There are besides two cases of duplicates of large premolars, but of true supernumerary molars in series only one case was seen. Another specimen shewed what is perhaps partial division of a molar. Of 130 skulls, five had supernumerary teeth, not including cases of unusual presence of anterior premolar.

*Incisors.*

- The following cases shewed departure from the normal  $i_3^3$ .
292. **Herpestes gracilis**: an extra incisor in lower jaw.  $\bar{i}^2$  and  $\bar{i}^3$  in place and clearly recognizable on both sides, but between the two second incisors are *three* small teeth, all of about the same size and shape. Neither of these is a milk-tooth, for the milk-teeth are distinctly different both in size and form. There was no evidence to shew which tooth was the supernumerary one. B. M., 826, a.
- \*293. **H. nipalensis** ♂: only *four* incisors in lower jaws. This is a remarkably clean and sound skull. The four incisors stand close together, filling up the whole space between the two lower canines. There is no reasonable doubt that only four lower incisors have been present. It is difficult to see that any of the four incisors exactly corresponds with any of the normal teeth; for while the two lateral teeth are of about the same size as normal  $\bar{i}^2$ , they have a different position, arising from the outer sides of the jaw, slightly in front of the roots of the canines, whereas normal  $\bar{i}^2$  arises *internal* to the other incisors. To what extent the alteration in position is correlated with the change in number cannot be affirmed. B. M. 146, m.
- \*294. **H. persicus**: only *four* incisors in lower jaw. Judging from general appearances it seemed that  $\bar{i}^1$  was missing from both sides. The teeth stand in a close series between the canines, which are nearer together than in normal specimens. The consequence of this to the arrangement of the bite is curious. The left lower canine bites in its normal place, between the upper canine and  $\bar{i}^3$ ; but the right lower canine bites *in front* of the upper  $\bar{i}^2$ , which is displaced backwards

towards the right upper canine. The whole anterior part of the lower jaw is thus twisted a little towards the left side.

Besides these two definite cases of absence of incisors, in the following instances there was a presumption that the absence was due to variation, but a definite statement cannot be made.

**H. smithii**: only four incisors in lower jaw. B. M., 1435, a. **H. gracilis**: doubtful case of absence of  $\bar{a}$  on both sides. B. M., 789, b. **H. nyula**: doubtful if right  $\bar{c}^2$  has been present. B. M.

#### *Anterior Premolars.*

In the great majority of both Asiatic and African species of *Herpestes* the anterior premolar ( $p^1$ ) is normally present in both jaws, and in these species 6 cases of absent  $\bar{p}^1$  were seen. When present it is a tooth of small but still considerable size. It appeared from the specimens that  $\bar{p}^1$  in the species *H. gracilis* (Africa generally), and both  $\bar{p}^1$  and  $\bar{p}^2$  in *H. galera* (E. Africa) are commonly absent. As in other cases of absence of teeth the question arises whether the absence is due to age or accident, or on the other hand to original deficiency. This question cannot be definitely answered, but some considerations touching it should be mentioned.

First, as has been said, the tooth when present is of moderate size: though small, it is quite large enough to be functional, and is in no sense rudimentary. In his synopsis of the genera, THOMAS<sup>1</sup> says of *Herpestes*, "Premolars  $\frac{4}{4}$  (if only 3 in either jaw, a diastema always present)." There is however no reason for supposing that the presence or absence of  $p^1$  is determined by chance. From the fact that a tooth is small, it by no means follows that it is often lost. To any one handling large numbers of skulls, instances of the contrary must be familiar. A case in the Otters well illustrates this point. In *Lutra vulgaris* upper  $p^1$  is a small tooth, and from its singular position internal to the canine, it might be supposed that the development of the canine might easily push it out; yet in 41 skulls of *Lutra vulgaris*, only 1 case of absence of  $p^1$  was seen. Of *L. cinerea* on the contrary six skulls are without  $p^1$ ; but as in two young skulls it is present on both sides, there is thus a strong presumption that in this species the tooth is lost with maturity. The frequent absence in the one species and the constant presence in the others points to a difference in organization between them. When  $p^1$  is missing in a skull, though we are not entitled to infer that it has not been present, still the fact of its presence in one case and of its absence in another is on the face of it an indication that between the two there is a difference or Variation, but whether the Variation lay in the number of teeth originally formed or in the mode in which they were affected by subsequent growth is uncertain. In the specimens to be described the absence of  $p^1$  in certain individuals or species is no less definite than its presence in the others, and that which is a variation in one species will be seen to be the rule in others.

\* As regards the presence of  $p^1$  the specimens thus make a progressive series. Most species having  $p^{\frac{4}{4}}$ , but  $p^{\frac{4}{3}}$  as a variation; *H. gracilis* (and *pulverulentus*) having  $p^{\frac{4}{3}}$  normally, but  $p^{\frac{4}{4}}$  as a variation and  $p^{\frac{3-4}{3-4}}$

<sup>1</sup> THOMAS, O., on the African Mongoose, *P. Z. S.*, 1882, p. 62.

also as a variation; and lastly *H. galera* having  $p_3^2$  normally but shewing a case of  $p \frac{3-4}{3-4}$  and another of  $p \frac{4-4}{4-3}$ . Lastly, all specimens of *Crossarchus* seen had  $p_3^2$ .

Of species commonly having  $p_4^1$ , 91 such skulls and the following cases of absence of  $p^1$  were seen:

- \*295. **H. ichneumon**, 9 normals:  $\bar{p}^1$  absent both sides. B. M.; on left, C. M., 965, *D.* **H. griseus**, 21 normals:  $\bar{p}^1$  absent on right, two cases. B. M., 145, *k* and *m.* **H. smithii**, 6 normals:  $\bar{p}^1$  absent both sides. B. M., 979, *b*; on left side, B. M. 84. 6. 3. 13.
296. **H. gracilis** on the contrary shewed  $p_4^1$  in 8 specimens,  $\bar{p}^1$  present both sides once, B. M., 789, *a*; left  $\bar{p}^1$  absent once. B. M., 789, *b.*
- H. pulverulentus**:  $p_4^1$  in 2 specimens.
297. **H. galera**:  $p_4^1$  in 7 skulls, one being quite young:  $p^1$  is present in all four places, in one young skull making  $p_4^1$ , B. M., 148, *d*;  $\bar{p}^1$  and  $\underline{p}^1$  both present and well developed on right side in old skull. On the left there is ample room for them. B. M., 79, *a*,  $\underline{p}^1$  present on both sides and alveolus for  $\bar{p}^1$  on right. B. M., 148, *l.*
- Crossarchus**: 13 skulls assigned to 4 species, all had  $p_4^1$ .

#### Case of two Anterior Premolars.

298. **H. microcephalus**: on right side two teeth like  $\underline{p}^1$ , crowded together, others normal. Leyd. M. Compare *Rhinogale melleri* (an African Mongoose) of which only known skull (in B. M.) has  $p \frac{5-5}{4-4}$ . The appearance here is that a tooth unlike and rather larger than  $\underline{p}^1$  stands in front of it on each side (see THOMAS, *l.c.*, pp. 62 and 84).

#### Supernumerary Large Premolars.

Taken together the two following cases are important as illustrating the difficulty of drawing any sharp distinction between cases of duplicates of particular teeth and cases of extra teeth in series. They should be read in connexion with the cases of *F. domestica* (No. 286), *Helictis orientalis* (No. 312), *Vison horsfieldii* (No. 311), *Ommatophoca rossii* (No. 320), *Phoca grœnlandica* (No. 324), &c.

- \*299. **Herpestes gracilis**: supernumerary tooth in right lower jaw (Fig. 50). On comparing the teeth of this specimen with those of

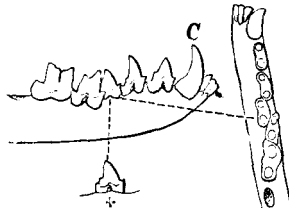


FIG. 50. Right lower jaw of *Herpestes gracilis*, No. 299. View from labial side; ground-plan of the jaw; separate view of the tooth +. C, the canine.

other *Herpestes* in which  $\bar{p}^1$  is present it is quite certain that no tooth in the abnormal jaw corresponds with  $\bar{p}^1$ . The foremost of its premolars on both sides clearly has the form of  $\underline{p}^2$ . The next teeth have the correct form of  $\underline{p}^3$ . In the left lower jaw the next tooth is  $\bar{p}^3$ ; but

on the right side immediately in succession to  $\bar{p}^3$  but slightly within the arcade is another tooth (marked + in the figure), which is very nearly a copy of  $\bar{p}^3$ , though a little smaller. On the *outside* of the jaw and behind this tooth is a normal  $\bar{p}^4$ . From its singular position outside the series, this tooth might easily be taken for a supernumerary one though its form clearly shews it to be a natural  $\bar{p}^3$  displaced, while two teeth having the form of  $\bar{p}^3$  stand in succession. B. M., 63. 7. 7. 18. (mentioned by THOMAS, *P. Z. S.*, 1882, p. 62).

300. **H. ichneumon** (Andalusia): in one of the upper jaws between and internal to  $\bar{p}^2$  and  $\bar{p}^3$  is a 3-rooted tooth (not a milk-tooth) which in size and shape is about intermediate between  $\bar{p}^2$  and  $\bar{p}^3$ . *Leyd. M.*

### Molars.

The only cases of noticeable variation in molars were both in the same species, *Crossarchus zebra*. Of this species six skulls were seen, four normal, and also the two following, the first being a case of extra molar on each side, the next a case of increase in size and complex variation in  $\bar{m}^2$ , on the left side suggesting a partial division of this tooth.

- \*301. **Crossarchus zebra**: small but well-formed additional molar in upper jaw on each side, making  $p^{\frac{3}{3}}$ ,  $m^{\frac{3}{3}}$ . (Fig. 51, III.) Teeth unfortunately all much worn, so that it is not possible to determine whether any of the molars differ from their normal forms in correlation with the existence of these extra teeth; but as far as size is concerned, there was no sign of such change,  $\bar{m}^1$  and  $\bar{m}^2$  being of the usual size. B. M., 73. 2. 24. 18 mentioned by THOMAS, *P. Z. S.*, 1882, pp. 61 and 89.

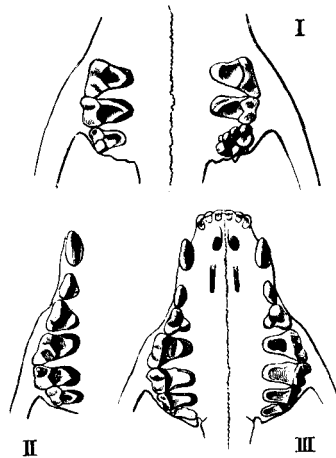


FIG. 51. *Crossarchus zebra*. I. Posterior upper molars of No. 302.  
 II. A normal specimen, right upper jaw.  
 III. Upper jaw of No. 301.

302. **C. zebra**: all teeth normal except second molars in the upper jaws on each side, which depart from the normal in the following manner. *Right*  $m^2$  has a small extra cusp (Fig. 51, I.) on its outer side, making four instead of three as usual (cp. figure of normal, Fig. 51, II.). The *left*  $m^2$  is very extraordinary. It is rather less than twice the size of its fellow of the other side (Fig. 51, I.). The crown is of an irregularly elliptical form, the long axis being oblique. The posterior and anterior faces are marked by a shallow groove, giving an appearance of imperfect division into two teeth. The total number of cusps is greater than twice that borne by the other, but from the irregularity of the surface it is not possible to speak more precisely. For fear of injury the tooth was not extracted, so that the number of roots cannot be specified. B. M., 82. 5. 26. 1.
303. **H. ichneumon** (Egypt), having no right  $\bar{m}^2$ . *Leyd. Mus.*

### MUSTELIDÆ<sup>1</sup>.

The evidence of dental Variation in this family is at present too small in amount to be of much value. It is chiefly interesting in so far as it relates to cases of the occurrence in one genus or sub-family, of a formula characteristic of another. Variations of this class, consisting in the presence of or absence of the anterior premolar or last molar, are in some of the forms very common. As will be suggested in the next chapter, some of these, for example, the variations in  $p^1$  in the Badger, have a certain importance as giving some measure of the magnitude which a tooth may have when the species is, as it were, oscillating between the possession and loss of the tooth in question.

Amongst Mustelidæ there were two cases of supernumerary large premolars, probably reduplicatory.

#### *Anterior Premolars.*

- Mustela** (Martens), normally  $p^1_4, m^1_5$ . Seen in adult skulls of various species (*M. pennanti, martes, foinea, zibellina, flavigula, americana*), 62: also the following:
304. **M. foinea** ♂:  $\bar{p}^1$  absent both sides. B. M., 1229, k. **M. zibellina**:  $p^1$  absent both sides from both jaws [perhaps lost], B. M., 58. 5. 8. 189. **M. flavigula**, Madras.  $p^1$  clearly absent from both jaws, B. M., 79. 11. 21. 621. **M. martes**? the same. C. S. M., 681. **M. melanopus**:  $p^1$  absent, probably lost, B. M., 42. 1. 19. 100.
- Putorius** (Weasels, Stoats, Ferrets and Polecats), normally  $p^1_3, m^1_4$ . Seen in adult skulls of various species (*P. vulgaris, erminea, brasiliensis = xanthogenys, fatidus = eversmanni = sarmaticus, lutreola, nudipes, &c.*), 105: also the following:
305. **P. erminea**: l.  $\bar{p}^1$  absent, B. M., 43. 5. 27. 11. On the other hand, **P. fatidus**, B. M., 192 s, has rt.  $\bar{p}^1$  as a two-rooted tooth, standing in a plane at right angles to the arcade.
- Gulo**:  $p^1_4, m^1_5$ . 5 specimens.

<sup>1</sup> Totals of normal skulls refer to *Brit. Mus.* and *Cambridge Mus.* only.

**Galictis** :  $p\frac{3}{3}, m\frac{1}{2}$ . Normal adults (*G. barbara* 8, *vittata* 4, *allamandi* 2), 14 specimens.

\*306. **G. barbara**, having minute extra anterior premolar (making 4) in each lower jaw. B. M., 839, f.

In 28 skulls HENSEL found the following variations in premolars, the molars being always  $m\frac{1}{2}$ .

$p \frac{3-3}{3-3}$ , viz. the normal, 12 cases

$p \frac{3-3}{2-2}$  ..... 6 ,,

$p \frac{3-3}{3-2}$  ..... 3 ,,

$p \frac{3-3}{2-3}$  ..... 2 ,,

also  $p \frac{2-3}{2-2}, p \frac{3-2}{3-3}, p \frac{4-4}{2-2}, p \frac{2-2}{2-3}, p \frac{3-4}{3-3}$  each in one case.

Taken together therefore there were 12 normals with  $p\frac{3}{3}$ , 16 cases of greater or less reduction, and 2 cases of increase. HENSEL, *Säugethiere Süd-Brasiliens*, p. 83.

307. **G. vittata** :  $p^1$  may be absent, especially from upper jaw. BURMEISTER, *Reise durch d. La Plataa-Staton*, Halle, 1861, II. p. 409 [this variation not seen by HENSEL].

**Pocilogale** :  $p\frac{2}{2}, m\frac{1}{2}$ . 3 specimens.

**Mephitis** :  $p\frac{2}{2}, m\frac{1}{2}$ . 9 specimens.

308. **Conepatus** :  $p\frac{2}{2}, m\frac{1}{2}$ . 12 specimens. *Conepatus* is the S. American representative of *Mephitis*, and normally differs from it in having one premolar less in upper jaw. This tooth is sometimes present as a minute tooth making  $p\frac{2}{2}$ . Sometimes on the contrary there is a premolar less in the lower jaw, giving  $p\frac{2}{2}$ . *Coves, Fur-bearing Animals of N. Amer.*, p. 192 and Note.

In addition to the 12 normals mentioned two cases of  $p\frac{2}{2}$  were seen, viz. **C. mapurito**, B. M., 88. 11. 25. 8, and **C. chilensis**, B. M. 829, a. In the former the anterior premolar is of good size, but in the latter it is very rudimentary. Another case mentioned by BAIRD, *Mamm. of N. Amer.*, p. 192.

**Mydaus** :  $p\frac{2}{2}, m\frac{1}{2}$ . 4 specimens.

\*309. **Meles** : commonly  $p\frac{2}{2}, m\frac{1}{2}$ . In **M. taxus**, the common Badger,  $p^1$  is frequently absent from one or more places. Of 36 skulls only 16 had  $p^1$  in all jaws, 7 have it in each lower jaw and 2 had no such tooth in either jaw. In remaining cases it was sometimes absent on right, sometimes on left, sometimes from above and sometimes from below. Some of these cases may be due to senile changes but this was certainly not so in all. Absence from lower jaw seems the most common. HENSEL, *Morph. Jahrb.*, 1879, v. p. 550.

Of genus *Meles* the following were seen by myself. + means presence, - absence of  $p^1$ .

<sup>1</sup> The numbers given by Hensel are the totals of  $p+m$ , but he states that the variation always concerned the small anterior premolars next the canines.

	Upper jaw		Lower jaw		Cases
	right	left	right	left	
<i>Meles taxus</i>	+	+	+	+	3
" "	-	-	+	+	16
" "	-	-	?	?	1
" "	-	-	-	-	1
" "	+	-	+	+	3
" "	+	+	-	+	1
					<hr/> 25 <hr/>
<i>M. anakim</i> )	-	-	-	-	2
Japan j					
<i>M. chinensis</i>	-	-	-	-	3

**Taxidea** :  $p_3^3, m_2^1$ . 7 specimens.

**Mellivora** :  $p_3^3, m_1^1$ . 7 specimens.

**Helictis** :  $p_4^1, m_2^1$ . 6 specimens.

**Ictonyx** (= Zorilla) :  $p_3^3, m_2^1$ . 14 specimens.

310. **Lutra.** The Otters for the most part have  $p_3^4, m_2^1$ . The anterior premolar of the upper jaw is a small tooth standing internal to the canine, but in the common Otter its presence is most constant. In the Oriental *L. cinerea*, and the Neo-tropical *L. felina* on the contrary this tooth appears to be more frequently absent than present. The following table gives the results of examination of a series of skulls.

+ signifies presence, - absence of  $p^1$ .

	right	left	Cases
<i>Lutra vulgaris</i> .....	+	+	40
" "	-	+	1
" <i>macrodus</i> .....	+	+	11
" "	-	-	2 (1 old; 1 young)
" <i>cinerea</i> .....	+	+	2 (young)
" "	-	-	6
" <i>sumatrana</i> .....	+	+	4
" <i>capensis</i> .....	+	+	1
" "	-	-	1
" <i>maculicollis</i> .....	+	+	1
" <i>felina</i> .....	+	+	3
" "	-	-	3
" "	+	-	2
" sp. (S. America)	+	+	14
" "	-	-	1
" "	+	-	1

In *L. cinerea* (= *leptonyx*) the absence of  $p^1$  is associated with a more forward position of  $p^2$ , of which the anterior border is then level with the posterior border of the canines<sup>1</sup>.

<sup>1</sup> See FLOWER and LYDEKKER, *Mammals, Living and Extinct*, p. 568, Fig. 261.

*Large Premolars.*

311. **Putorius** (labelled "*Vison Horsfieldii*"): at the place in which the right lower posterior premolar (" $p^1$ ") should stand there are two such teeth at the same level. They are almost identical, but the inner

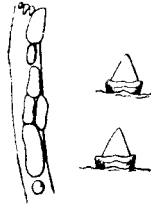


FIG. 52. *Putorius*, No. 311, right lower jaw, ground-plan of teeth and profile views of two teeth at the same level. Upper figure is the internal tooth.

- (upper in figure) is slightly the smaller (Fig. 52). B. M., 823, a.
312. **Helictis orientalis**, Java: having supernumerary two-rooted tooth internal to and between  $p^2$  and  $p^3$ . This extra tooth is almost a copy of  $p^2$  (Fig. 53). B. M., 824, a.

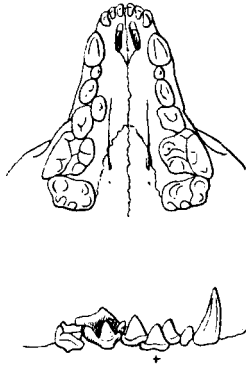


FIG. 53. *Helictis orientalis*, No. 312. Surface view of upper jaw and a representation of the right upper teeth as seen from inside.

*Molars.*

313. **Putorius**: HENSEL, *Morph. Jahrb.*, v. 1879, p. 540, states that he has several skulls of *Putorius putorius* with an extra upper molar on one side in a rudimentary condition. GIEBEL, Bronn's *Kl. u. Ord.*, p. 186, Taf. xv. figs. 1, 2 and 3, figures a specimen of "*Putorius typus*" having a fairly well developed extra upper molar on each side making  $m^2_{\frac{2}{2}}$  instead of  $m^2_{\frac{1}{2}}$ . Probably both these accounts refer to **P. foetidus**.
314. **Lutra platensis**: supernumerary molar on one side of upper jaw. Such a tooth normally present on both sides in *L. valetoni*, a fossil form. VON HEUGLIN, *Nov. Act. Leop. Car. Cæs.*, xxix. p. 20. **Lutra**



- sp., S. America, B. M., 85. 11. 23. 1, has small alveolus behind  $\bar{m}^2$  on each side.
315. **Mellivora** (= *Ratelus*): similar case. VON HEUGLIN, *ibid.*
316. **Meles taxus** has normally  $m\frac{2}{3}$ . Skull from Quarternary diluvium of Westeregeln has small alveolus behind right  $m^1$  and left  $\bar{m}^2$ . Another fossil skull has  $m\frac{2}{3}$ . NEHRING, *Arch. f. Anthrop.* x. p. 20. [? Small alveolus behind left  $\bar{m}^2$  in B. M., 211, *h.*]
317. **Lutra**: case of absence of  $\bar{m}^2$ ; **Mustela**:  $\bar{m}^2$  may be absent. HENSEL, *l. c.*

## PINNIPEDIA.

With reference to dental Variation in Otariidæ and Phocidæ there is a considerable quantity of evidence. In some of the species the frequency of abnormalities is remarkably great. Among the most interesting examples are two cases of reduction in the number of incisors, both occurring in *Phoca barbata*. These cases are especially important in connexion with the fact that the Seals are exceptional among Carnivores in having a number of incisors other than  $\frac{3}{2}$ , and that among the different sub-families of Seals there is diversity in this respect.

Taken together, the cases of Variation in the premolars and molars of Seals illustrate nearly all the principles observed in the numerical Variation of teeth. In both premolars and molars there are examples of the replacement of one tooth by two, and in some of these the resulting teeth stand in series while in others they do not. Besides these there are numerous instances of extra premolars and molars belonging to various categories.

As regards the frequency of extra teeth in Seals it may be mentioned that of Phocidæ 139 normals were seen, and 11 cases of supernumerary teeth; of Otariidæ 121 normals and 5 cases of supernumerary teeth.

From the simplicity of the normal dentition and from the diversity of the variations presented, the evidence as to the teeth of Seals may conveniently be studied by those who are interested in the phenomena of Variation without special knowledge of the subject of mammalian dentition.

*Incisors.*

It will be remembered that of Phocidæ the sub-family Phocinæ (like Otariidæ) has normally  $i\frac{3}{2}$ , while the Monachinæ have  $i\frac{2}{2}$  and the Cystophorinæ  $i\frac{1}{2}$ . Of Phocinæ of various genera and species 105 skulls having  $i\frac{3}{2}$  were seen, and in addition the two following.

- \*318. **Phoca barbata**. Greenland: skull having  $i\frac{2}{1}$  on both sides (Fig. 54). This skull is a particularly good one and is neither very old nor very young. The teeth stand regularly together and there is no lacuna between them. There is no reasonable doubt that an incisor is absent from each side of each jaw. The shape of the

premaxillæ is different from that seen in other specimens of *Phoca*, and, doubtless in correlation with the absence of the two upper

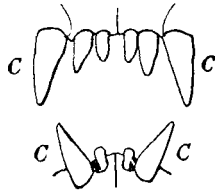


FIG. 54. Incisors and canines of *Phoca barbata*, No. 318.

incisors, the width of the premaxillæ is considerably less than in specimens having the normal dentition. B. M., 90. 8. 1. 6.

319. **P. barbata:** in left upper jaw are three normal incisors; but on the right side the incisors have been lost. The alveoli, however, shew plainly that only two incisors had been present. Of these the outer one in size agrees with  $i^3$ , being a large alveolus equal to that of  $i^3$  of the other side, but the second alveolus, occupying the place of  $i^1$  and  $i^2$ , is also a large alveolus, scarcely smaller than that for  $i^3$ . It appears therefore that in this specimen a single large tooth stood in place of  $i^1$  and  $i^2$ . A lower jaw placed with this skull was normal, but it was not certain that it belonged to the skull. O. M., 1724.

#### *Premolars and Molars.*

*Normal arrangement.* In Phocidæ there are normally five teeth behind the canines in each jaw, and according to the received accounts, of these teeth 4 are premolars and one is a molar, giving  $p^4, m^1$ . The Otariidæ on the other hand have generally  $p^4, m^2$ , but both the two upper molars stand at a level behind that of the lower molar, so that the posterior molar,  $m^2$  is placed so far back that it meets no tooth in the lower jaw. Some of the Otariidæ, however, as *O. californiana*, do not possess such a posterior tooth, and have only  $m^1$ . *O. stelleri* is peculiar in the fact that it also has only one upper molar, but this tooth is separated by a large diastema from  $p^4$ , and stands in the position characteristic  $m^2$  of the other Otariidæ. Hence it may be supposed that  $m^1$  is really absent while  $m^2$  is present.

Amongst the cases will be found some of the presence in Phocidæ, especially *Halichoerus*, of an extra molar placed in the usual position of  $m^2$  in the Otariidæ. But lest any one should think it manifest that this is an example of Reversion to the Otarian condition, attention is called to cases of such an extra molar in the Otariidæ also. Similarly there are instances of absent molar in those Otariidæ which have  $m^2$ , leaving  $m^1$ ; and of these cases one occurs in such a way as to leave the peculiar diastema between

$p^4$  and the molar, referred to above as characteristic of *O. stelleri* (see No. 342).

The cases are grouped in an arbitrary collocation, according as it seemed desirable that particular variations should be studied together. In the sections dealing with premolars, Phocidæ are not separated from Otariidæ.

*First Premolar.*

- \*320. **Ommatophoca rossii**, an Antarctic Seal. Of this form only two skulls are known, both in the British Museum. One of these (B. M., 324, *b.*) has the arrangement usually found in Phocidæ, namely, five teeth behind the canines in each jaw, giving the formula

$$i \frac{2-2}{2-2}, c \frac{1-1}{1-1}, p + m \frac{5-5}{5-5}$$

(on the analogy of other Seals  $p \frac{4}{4}, m \frac{1}{1}$ ). The other specimen is exceedingly remarkable (Fig. 55). In it the incisors and canines

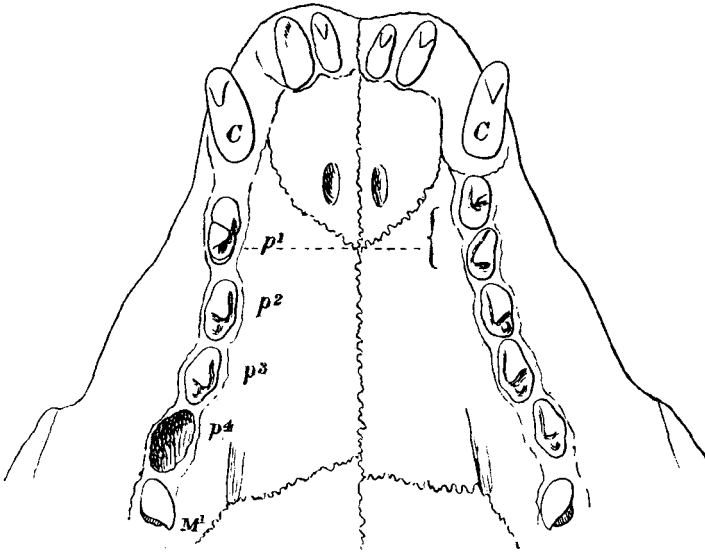


FIG. 55. *Ommatophoca rossii*, No. 320, teeth of the upper jaw.

are as in the first specimen, but the first tooth behind the canines on both sides in the lower jaw and on the right side in the upper jaw, has a very peculiar form, having a deep groove passing over the whole length of the tooth, on its outer and inner sides. These grooves extend from the tip of the root along both sides of the crown, and thus imperfectly divide each tooth into an anterior and

a posterior half. The cusp of each tooth is also divided by the grooves so as to form two small cusps. Each of these teeth is therefore an imperfectly double structure, and may be described as being just half-way between a single tooth and two teeth. These teeth are shewn in Fig. 56.

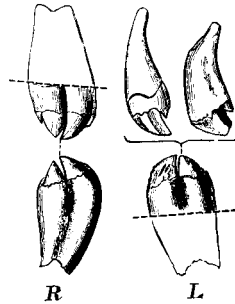


FIG. 56. *Ommatophoca rossii*, No. 320. The anterior premolars of upper and lower jaws from the side. (The left lower and right upper teeth were not extracted.)

On the left side in the upper jaw, as the *vis-à-vis* to one of these double teeth, there are actually two complete teeth, of very similar but not identical form, as shewn in Fig. 56. Each stands in a distinct alveolus, the two being separated by a bridge of bone. The dental formula of this skull, taken as it stands, is therefore  $p \begin{smallmatrix} 5-4 \\ 4-4 \end{smallmatrix}, m \begin{smallmatrix} 1-1 \\ 1-1 \end{smallmatrix}$ , for since the bigeminous teeth are not completely divided, they must be reckoned as single teeth.

321. **Cystophora cristata**: internal to and slightly in front of  $p^1$  on each side in the upper jaws is an extra tooth. These extra teeth are alike in form but are rather smaller than  $p^1$ . C. M., 895.
322. **Cystophora cristata** (label, *Phoca cristata*): internal to right upper  $p^1$  is an alveolus for a small one-rooted tooth. In the corresponding situation in the left lower jaw there is such an extra tooth in place. Leyd. M.
323. **Zalophus lobatus** (= *Otaria lobata*): left  $p^1$  smaller than right  $p^1$ , and between the canine and the left  $p^1$  there is a supernumerary tooth, smaller than left  $p^1$ . (The same skull has another extra tooth outside and between  $p^3$  and  $p^4$ , see below No. 333.) Leyd. M.

[**P. vitulina**: alveolus for left  $p^1$  much larger than that for rt.  $p^1$ ; the latter tooth is in place, but left  $p^1$  is missing. C. M., 902.]

#### Large Premolars.

324. **P. grœnlandica**: in the position in which left upper  $p^4$  should stand there are two whole and complete teeth, each as large as normal  $p^4$ . Fig. 57). The two stand perfectly in series, and owing to the wide

gaps normally existing between the teeth in this species there is no crowding. Between these two teeth there are slight differences of

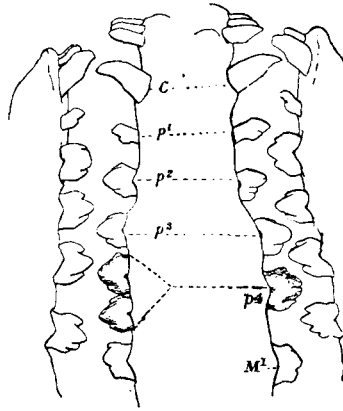


FIG. 57. *Phoca groenlandica*, No. 324. Left and right profiles. This figure was kindly drawn for me by Mr J. J. Lister.

form, and the posterior is rather the larger. On both sides  $\bar{m}^1$  is in place and at the same level. Both the two teeth in place of  $\bar{p}^4$  bite between  $\bar{p}^4$  and  $\bar{m}^1$  of the lower jaw. On the *right* side  $\bar{p}^3$  is normal and  $\bar{m}^2$  is also normal but  $\bar{p}^4$  is a very large and thick tooth, and its main cusp is cloven, giving it the appearance of imperfect division into two. In this case therefore  $\bar{p}^4$  on the one side may be supposed to have divided into two perfect and nearly similar teeth, while on the right side this division is begun but not completed. *Leyd. M.*

325. **Otaria ursina** ♂: supernumerary premolar in left upper jaw. This is a curious case. The right upper and both lower jaws are normal. On comparing the left upper series of 7 teeth with the right series which has 6 normal teeth, it is seen firstly that the two molars of each side are alike in form and stand at their proper levels (Fig. 58).

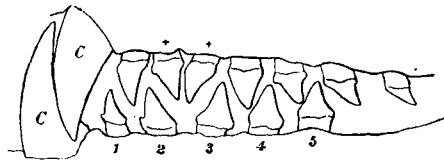


FIG. 58. *Otaria ursina*, No. 325, seen from left side. 1, 2, 3, 4, first to fourth lower premolars; 5, lower molar.

Next, the two posterior premolars of each side ( $\bar{p}^3$  and  $\bar{p}^4$ ) agree so nearly that there is no reasonable doubt that they are not concerned in the variation. Anterior to this there is difficulty, for whereas  $\bar{p}^1$  and  $\bar{p}^2$  are normal and in place on the right side, there are *three* teeth on the left side to balance them. These three teeth moreover are so nearly alike that it is impossible to say that either of them is

definitely the extra tooth. The first premolars of each side are almost exactly alike, and the second and third of the left side are each very like the second on the right side ( $p^2$ ), so that it might be said that  $p^2$  was represented by two teeth on the left side; and as seen in Fig. 58 the second and third on the left side bite between  $\bar{p}^2$  and  $\bar{p}^3$  of the lower jaw, as the normal  $\underline{p}^2$  would do. This is however accomplished by the backward displacement of  $\bar{p}^3$ . Probably therefore this should be looked on as a case of division of  $\underline{p}^2$ , but there is no proof that the *three* first premolars of the left side are not collectively equivalent to the first two of the right side. C. M., 911, f.

326. **P. grœnlandica**: the second upper right premolar is represented by two teeth, each of which has two roots; the two teeth stand at the same level in the arcade, the inner one being rather smaller. On the left side the second upper premolar is *incompletely* double, the crown being partially divided by an oblique constriction into an anterior and internal portion and a larger posterior and external part. The former has one root and the latter two. P. M., A, 2897.

327. **Otaria jubata**: left upper  $p^3$  a bigeminous tooth something like the anterior premolars of *Ommatophoca* (No. 320). In this animal all the premolars and molars are one-rooted and have simple conical crowns. The abnormal tooth is formed as it were of two such simple teeth imperfectly divided from each other through their whole length, the plane of division being transverse to the jaw. The teeth of the two sides are not alike and in particular the posterior lower  $\bar{m}^1$  is much smaller than the right. The skull has been much mended and the position of some of the teeth is not very certain, but the above-mentioned facts are correct. C. S. M., 975.

\*328. **Otaria cinerea**: supernumerary tooth in upper jaw on both sides. The extra tooth in each case stands within the arcade, internal to the

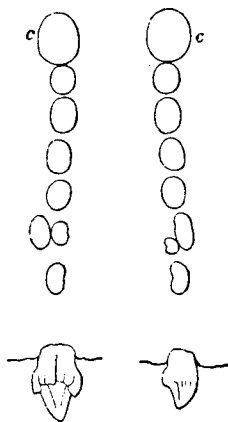


FIG. 59. *Otaria cinerea*, No. \*328. A diagram of the positions of the upper teeth, and profiles of the teeth standing internal to each  $m^1$ .

5th tooth behind the canine (sc.  $m^1$ ), which is pushed outwards by it. The extra tooth of the left side (Fig. 59) is a little larger and at a level rather anterior to that of the left extra tooth. C. M., 911\*\*.

- \*329. **P. vitulina**: having a supernumerary tooth in each jaw on the right side. This is a somewhat remarkable case. In both jaws the extra tooth does not stand in series with the others but is placed within the arcade (Fig. 59, ++). That of the upper jaw is a curved tooth with one large median cusp and a small cusp anterior to and posterior to it, having somewhat the form of  $\bar{p}^2$  of the lower jaw. This tooth stands within the arcade at a level between that of  $\bar{p}^2$  and  $\bar{p}^3$  which are pushed outward by it. The extra tooth of the lower jaw in shape closely resembles that of the upper jaw, but is slightly larger, having very much the size and shape of the lower right  $\bar{p}^2$ . In position this extra tooth does not stand between  $p^2$  and  $p^3$  like the upper supernumerary, but is placed within the arcade and  $\bar{p}^3$  and  $\bar{p}^4$  which are somewhat separated by it. C. M., 903. [Judged by the ordinary rules of dental homology, the two extra teeth are not homologous, for the upper one is between  $p^2$  and  $p^3$ , while the lower one is between  $\bar{p}^3$  and  $\bar{p}^4$ . But when the jaws are put together it appears that the two extra teeth are opposite to each other almost exactly, the large cusp of the lower one being in the bite scarcely at all posterior to the large cusp of the upper. The tooth of the lower jaw is thus almost exactly the image or reflexion of the tooth in the upper jaw.]

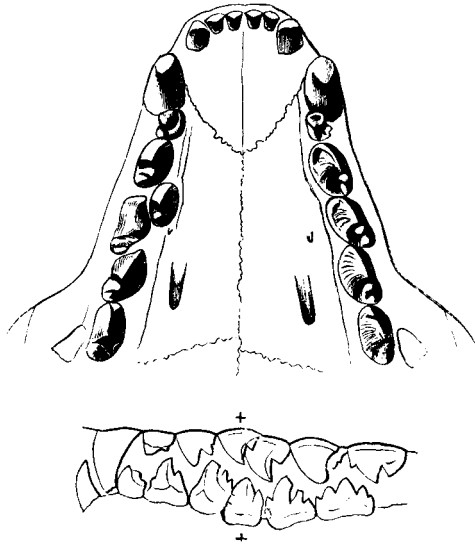


FIG. 60. *Phoca vitulina*, No. 329; view of upper teeth from the surface, and an imaginary profile of the upper and lower teeth of the right side seen from within.

330. **Otaria ursina**: this skull in bad condition. The *Catalogue* (1884) states that between  $\bar{p}^2$  and  $\bar{p}^3$  on both sides and between  $\bar{p}^4$  and  $\bar{m}^1$  on both sides there was a small supernumerary tooth, in all, four extra teeth in the upper jaw. The anterior supernumeraries are in place and one rather smaller than  $\bar{p}^2$ . The posterior supernumeraries are lost, but from the alveoli they must have been of fair size, though not so large

as  $p^4$ . In each case the extra tooth is placed a little within the arcade though the adjacent teeth are also spaced out for it. This skull has been a good deal mended. C. S. M., 990.

331. **Phoca groenlandica**: in right upper jaw  $p^4$  is smaller than the corresponding tooth of the left side, though it is two-rooted as usual. Between it and  $p^3$  there is a small, peg-like, supernumerary tooth. Both  $p^4$  and the extra tooth bite between  $\bar{p}^3$  and  $\bar{m}^1$  of the lower jaw. *Leyd. M.*
332. **P. groenlandica**: supernumerary tooth with two roots placed internally to and between left  $p^4$  and  $m^1$ . The last molars stand at the same level on the two sides. B. M., 328, *i.*
333. **Zalophus lobatus**: in right upper jaw a supernumerary tooth placed on the outside of the arcade on a level with the interspace between  $p^3$  and  $p^4$ . This tooth resembles  $p^4$  or  $m^1$ . On the left side  $p^1$  is smaller than on right side and a supernumerary tooth which is still smaller stands between  $p^1$  and the canine. *Leyd. M.* [given above, No. 323].
334. **P. vitulina**: in right lower jaw a supernumerary tooth inside the arcade, between  $\bar{p}^3$  and  $\bar{p}^4$ . In size and form it agrees very nearly with the first premolar of the right lower jaw: other teeth normal. C. M., 903, *F.*
335. **P. vitulina**: in front of  $\bar{p}^3$  on left side the teeth are all lost but there has been some irregularity, probably a supernumerary tooth level with  $\bar{p}^3$ : also behind right  $m^1$  there is a small tubercular nodule of bone which may perhaps cover a supernumerary molar. C. S. M., 1064.

#### Molars.

336. **P. vitulina**: on left side there is a small supernumerary molar placed behind  $m^1$ . This tooth stands in the line of the arcade (Fig. 61)

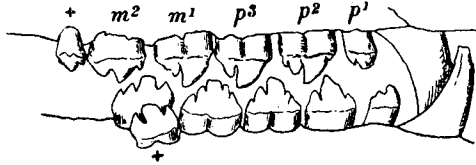


FIG. 61. *Phoca vitulina* No. 336, a profile of the left teeth in the bite as seen from within.

but is turned so that its greatest width is set transversely to the jaw. In the lower jaw of the same side there is a supernumerary tooth placed internally to  $m^1$ . This tooth has two roots and three cusps, and is therefore not a copy of  $\bar{m}^1$ , which has 4—5 cusps. C. S. M., 1067.

- \*337. **Halichærus grypus**: of 47 skulls seen, 12 have one or more supernumerary molars. One case of  $p^4$ ,  $m^2$ . NEHRING, *Sitzb. naturf. Fr. Berlin*, 1883, p. 110.

Of 34 skulls in Greifswald Museum there were 3 cases of  $m \frac{2-2}{1-1}$ , and five cases of  $m^2$  on one side only. *Ibid.*, 1882, p. 123.

Of 11 skulls seen by myself two individuals (C. M.) have an extra molar on left side. In these cases the extra teeth are placed at a considerable distance behind  $m^1$  as they are in *Otaria*. [In addition to these GRAY figures a skull with  $m^2$  but without allusion to this fact in the text. *Hand-list of Seals in B. M.*, 1874, Pl. VII.]



A skull having left  $m^1$  two-rooted, right  $m^1$  being much less so. C. S. M., 1059.

338. **P. grœnlandica**: minute supernumerary molar on each side in upper jaw making  $m^2_1$ . P. M., A. 2898.

339. **Zalophus californianus**, an Eared Seal not far removed from *Otaria*, but having  $p + m^{\frac{6}{5}}$  instead of  $\frac{6}{5}$ . The five back teeth are arranged as a rule in a continuous series, but sometimes there is a small space between the last molar and the penultimate [cp. *O. stelleri*], and occasionally they are all slightly and evenly spaced.

One case of  $p + m^{\frac{6}{5}}$  on both sides and two cases of  $p + m^{\frac{6}{5}}$  on one side only. In these the extra teeth were behind the (normally) last molar and smaller than it, being without the accessory cusps seen in that tooth. ALLEN, J. A., *N. Amer. Pinnipeds*, 1880, pp. 209, 224 and 226.

340. **Z. lobatus**: one specimen having  $p + m^{\frac{6}{5}}$  on right and  $\frac{5}{5}$  on left, *Leyd. M.* [in addition to 3 specimens with the normal  $\frac{5}{5}$ ].

341. **Callorhinus ursinus**: normally  $p + m^{\frac{6}{5}}$ ; one case having  $\frac{7-7}{5-5}$

and one case with  $\frac{7-6}{5-5}$ . ALLEN, *l. c.*, p. 224 (cp. No. 343).

*Reduction in numbers of molars.*

342. **Arctocephalus australis**, normally  $p + m^{\frac{6}{5}}$ : one case of  $\frac{6-5}{5-5}$ .

General statement made that in cases of absence of a tooth it is the antepenultimate molar which is missing [not described in a specific case]. ALLEN, *l. c.*, p. 224.

343. **Callorhinus ursinus**, normally  $\frac{6}{5}$ ; 2 cases of  $\frac{5}{5}$ . ALLEN, *l. c.* (cp. No. 341).

344. **Otaria jubata**, normally  $\frac{6}{5}$ : one specimen having  $\frac{6}{5}$  on both sides, *Leyd. M.*; one specimen having right  $\frac{5}{5}$  left  $\frac{6}{5}$ . *Leyd. M.*

**Cystophora cristata**: only one molar, viz. left  $m^1$  present; from the state of the bones it seemed possible that the others had not been formed, but this is quite uncertain. C. S. M., 1101. **Macrorhinus leoninus**: doubtful if the molars had been present. C. S. M. 1109.

## UNGULATA.

As to the occurrence of Variation in the dentition of Ungulates I have no statistics, but a certain number of miscellaneous cases have been collected from different sources. Most of the cases relate to domestic animals and are given on the authority of MOROT and GOUBAUX.

Perhaps the most interesting evidence is that regarding the change of form in the "canines" of the Sheep. These teeth of course have normally the shape of *incisors*, but in the cases described by Morot they had more or less of the character of canines. This evidence, though belonging properly to the Substantive class, is introduced here on account of its close relation to some general aspects of variation in teeth.

\* It is noticeable that there is so far no case of an incisor appearing in the upper jaw of Ruminants.

The evidence is divided into two groups, the first relating to incisors and canines, the second to premolars and molars.

*Incisors and Canines.*

345. **Elephas africanus** ♂: the left tusk imperfectly doubled. The root of this tooth was double<sup>1</sup>, one root being outer and the other inner. The half of the tusk arising from the outer root twisted round and over the other half so that at the other end it lay above and internal to it. The structure of the tusk was essentially double, but the two parts were more or less blended together in the middle third. The external ends were separate, but broken and somewhat deformed. FRIEDLÓWSKY, A., *Sitzungsab. d. K. Ak. Wien*, 1868, LIX. I. p. 333. *Plate.*
346. **Horse.** Supernumerary incisors common. MAGITOT, *Anom. Syst. dent.*, p. 104, *Plates.* Numerous specimens in Museum of Veterinary School at Alfort.
347. Specimen having 12 upper incisors and 12 lower incisors belonging to the permanent dentition. GOUBAUX, *Rec. méd. vét.*, 1854, Ser. 4, I. p. 71. Similar observation, LAFOSSE, *Cours Hippiatrique*, 1772, p. 32.
348. Extra teeth of more or less irregular form placed behind upper incisors very common: many specimens in museum at Alfort. Specimens having left  $i^2$  as a double structure, the two halves not being separated. (*Alfort Mus.*) MAGITOT, *l. c.*, Pl. XIX. fig. 25.

*Absence of incisor in Horse is rare. Goubaux, who has largely studied the subject, knew no case of absence of any tooth in Horse, l. c.*

349. Skeleton of Cart-mare in C. M. has only two incisors on the left side in the upper jaw. The teeth stand evenly and without break or trace of any other incisor having been present. There is no sufficient indication to shew which of the incisors is missing, but the two incisors present agree most nearly with  $i^2$  and  $i^3$ . This specimen was first pointed out to me by Mr S. F. Harmer. (See also case given by RUDOLPHI, *Anat.-phys. Abh.*, 1802, p. 145.)
- \*350. Mare of common breed, foaled March, 1876, having in the upper jaw no  $i^3$  in either milk or permanent dentition, and in the lower jaw no permanent  $i^3$ . In the upper jaw there were only 4 milk incisors, which were subsequently replaced by 4 permanent incisors. Animal seen by MOROT in Apr. 1880; it then had 4 permanent incisors in the upper jaw, but no  $i^3$ . In the lower jaw permanent  $i^1$  and  $i^2$  were in place, together with  $i^3$  of the milk series on each side. As Morot remarks it is still possible that the other incisors might appear. Dam normal; half-sister abnormal, given in next case. MOROT, *Bull. Soc. méd. vét.*, 1885, Ser. 7, II. p. 125.
- \*351. Mare out of same mother as last case, by another sire, foaled Apr. 1877, had only 4 milk-incisors in upper jaw. Seen by Morot at 3 years old, had then the teeth of lower jaw normal, viz. permanent  $i^1$ , and milk  $i^2$  and  $i^3$  all in place. In upper jaw were permanent  $i^1$  and milk  $i^2$  on each side. The right milk  $i^2$  on the external side had a light groove parallel to the long axis of the tooth, suggesting that it might be a double structure, but the groove was very slight and the crown was single. At five years old this animal had the normal 6 lower incisors, but in the upper jaw left  $i^3$  was absent. On the other hand a well-formed supernumerary tooth stood behind right  $i^3$ , right  $i^2$  being partly rotated. *Ibid.*, p. 127.

<sup>1</sup> See also a curious case of "nine tusks" imperfectly described by CHAPMAN, J., *Travels in Interior of S. Africa*, II. p. 98.

352. **Ass** : (♀ some 20 yrs. old) on right side in upper jaw were two canines, one in front of the other in the same alveolus. MOROT, *Rec. méd. vét.*, 1889, Ser. 6, VII. p. 480. Another somewhat similar case, *ibid.*
353. **Cow** : in place of right  $\bar{i}_3$ , two third incisors placed side by side. MOROT, *Bull. et mém. Soc. méd. vét.*, 1886, p. 321.  
**Goat**, 4—5 weeks old ; supernumerary lower incisor placed between the two median incisors which rose above it. This tooth stood transversely so that its edge lay exactly in the long axis of the head. MOROT, *l. c.*
354. **Sheep** : extra incisor on left side. (*Alfort Mus.*). GOUBAUX, *Rec. méd. vét.*, 1854, Ser. 4, I. [Several other cases.]

*Abnormal form of Canines in Sheep.*

- \*355. In the lower jaw of the Sheep there are on each side 4 incisiform teeth, arranged in close series without any diastema. Of these the outermost, known in veterinary works as "corner teeth," are considered by zoologists as representing canines.

The corner teeth or canines have been found in a considerable number of cases actually shaped like canines instead of like the incisors as usual. These teeth have been found presenting this modification in several degrees, but in order to gain a fair view of the matter it is necessary to read the evidence in its entirety.

The facts given were founded on 18 animals, 15 ewes and 3 males [whether rams or wethers not stated]. In these 18 cases there were 28 individual teeth of abnormal form. Of these 14 were conical with a point either sharp or rounded ; 7 were conical with a bifid point ; 5 were cuneiform ; 1 was cylindrical with a surface shaped like an ass' hoof ; 1 was pyramidal.

In 8 specimens the abnormality was unilateral and in 10 it was bilateral, but in the latter the corner teeth of the two sides were frequently of differing forms [details given]. MOROT, *Bull. Soc. méd. vét.*, 1887, p. 166.

**Fig.** No case of Variation in incisors met with.

[This is perhaps singular in connexion with the fact that the Peccaries (*Dicotyles*) have  $i \frac{2}{3}$ .]

- \*356. **Dicotyles torquatus** (normally  $i \frac{2}{3}$ ): two specimens having  $i \frac{3-2}{3-3}$ ; in one of them  $i^2$  of the side having the extra tooth is deformed. Another young skull of *Dicotyles* also had 3 incisors on left side. HENSEL, *Säugethiere Süd-Brasilien*, p. 94.

*Molars.*

357. **Horse** : supernumerary molars exceedingly rare ; case of such a tooth in left upper jaw, behind and in series with the others. GOUBAUX, *Rec. méd. vét.*, 1854, Ser. 4, I. p. 71, same case, figured by MAGROR, *l. c.*, Pl. v. fig. 9.

- \*358. **Ass**: thoroughbred Spanish she-ass, in the Museum of the Royal College of Surgeons, has a large supernumerary molar on each side in series in the upper jaw, and a similar tooth in the left lower jaw. The same skull has the first premolar also present on each side in the upper jaw, as is not unfrequently the case in Equidæ. All four canines are present as minute teeth. The dental formula for this skull is therefore

$$i \frac{3-3}{3-3} \quad c \frac{1-1}{1-1} \quad p \frac{4-4}{3-3} \quad m \frac{4-4}{4-3} = 45.$$

359. **Auchenia lama**: specimen having a supernumerary (fourth) molar in the lower jaw [? on both sides]. This tooth was fully formed and resembled the normal last molar. In the upper jaw was a small alveolus behind  $m^3$ , for another tooth which was not present in the specimen. RÜTIMEYER, L., *Vers. einer natürl. Geschichte des Rindes*, Zurich, i. p. 55, Note.
360. **Cervus axis** ♀: specimen having a supernumerary grinder placed on the inside of the normal series on the left side of the upper jaw. In the lower jaw of the same specimen the following supernumerary teeth: (1) a small, compressed accessory tooth on both sides placed internally to  $m^2$ ; and (2) behind the large three-fold sixth molar was a smaller two-fold tooth which had caused a displacement of the 6th molar. DÖNITZ, *Sitzungsb. d. naturf. Fr.*, Berlin, 1872, p. 54.
361. **Cervus rufus**: having supernumerary (4th) premolar on one side in lower jaw. HENSEL, *Morph. Jahrb.*, v. p. 555.
362. **Ox**: supernumerary upper molar on left side. MAGITOR, *l. c.*, p. 106.
- Sheep**: extra molar in left lower jaw, *ibid.*, p. 105, Pl. v. fig. 10. [?some error; the figure represents a normal jaw.]

### MARSUPIALIA.

The facts given in illustration of Variation in the dentition of Marsupials relate only to a part of the subject and to selected forms. Some of the cases to be given are however of exceptional importance. Evidence is offered in reference to the following subjects:

- (1) Incisors.
- (2) Premolars, and the "Intermediate" teeth (in the lower jaw), of Phalangeridæ.
- (3) Premolars and Molars of Dasyuridæ and Didelphyidæ.
- (4) Molars of certain Macropodidæ.

#### (1) Incisors.

The following cases of Variation in incisors are all that were met with in the Marsupials examined.

- \* DIDELPHYIDÆ: incisors normally  $\frac{5}{4}$ , thus differing from the Dasyuridæ ( $i \frac{4}{3}$ ) with which they have much in common<sup>1</sup>. Of various

<sup>1</sup> THOMAS states that the family Didelphyidæ "is, on the whole, very closely allied to the Dasyuridæ, from which, were it not for its isolated geographical position, it would be very doubtfully separable." *Cat. Marsup. Brit. Mus.*, 1888, p. 315.

species 90 adult skulls seen having this number of incisors and three cases of abnormal number of incisors. Of these the first two must not be reckoned in estimating the percentage of abnormalities in a promiscuous sample, for Mr Thomas, who kindly shewed me these specimens, informs me that they were preserved and brought to the Museum expressly as abnormalities. The existence of these variations is nevertheless particularly interesting in connexion with the exceptional number of incisors normal in *Didelphys*.

363. ***Didelphys marsupialis***: in right upper jaw *six* incisors; left upper jaw and the whole lower jaw missing. B. M., 92. 11. 3. 28.
364. Another specimen has on the right side  $\frac{5}{4}$  as usual, but on the left  $i \frac{5}{5}$ . It appears that  $\bar{i}^1$  and  $\bar{i}^2$  of the two sides correspond, but on the left side *three* very similar teeth stand in series behind  $\bar{i}^2$ . B. M., 92. 11. 3. 29.
365. ***D. turneri*** (= *crassicaudata*), Demerara. A single specimen of this species in collection. It has  $i \frac{4-4}{4-4}$ , but there is no evidence to shew which of the upper incisors were missing. B. M.

DASYURIDÆ: incisors normally  $\frac{4}{3}$ ; of genera other than *Myrmecobius*, 63 normal skulls seen.

***Dasyurus*** sp., having only two incisors in left lower jaw; right lower jaw normal, upper jaws missing [doubtful case]. B. M., 250.

\*

***Myrmecobius fasciatus***: with incisors normal 4 whole skulls,

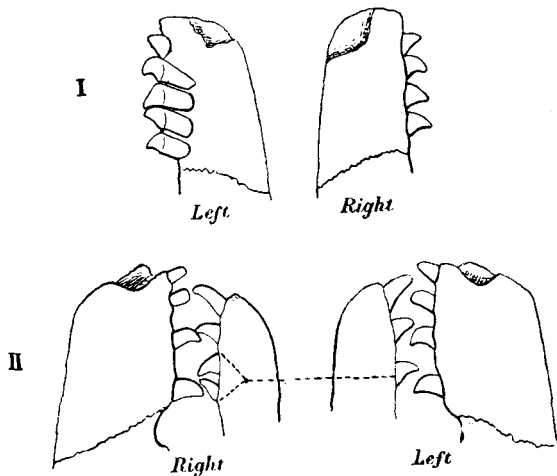


FIG. 62. *Myrmecobius fasciatus*.

I. Right and left profiles of upper jaw of No. 366.

II. Right and left profiles of the two jaws of No. 367. (Premaxillary teeth alone shewn.)

5 skulls without lower jaws, and 1 lower jaw without skull; abnormalities 2, as follows:

- \*366. A young skull having in the upper jaw on the left side (Fig. 62, I.) *two* teeth, both apparently in place of left  $i^3$ , making

$$i \frac{5-4}{3-3} \text{ B. M., 314, } g.$$

- \*367. A specimen having *four* incisors in the right lower jaw, the left being normal. Perhaps the two hindmost of the four represent the third lower incisor of the left side in the way suggested by the dotted lines in the figure (Fig. 62, II.). B. M., 314, *b*.

PHALANGERIDÆ: incisors (neglecting "intermediate" teeth of lower jaw) normally  $\frac{3}{1}$ ; this seen in 209 skulls of various genera and species.

368. **Phalanger orientalis**, Solomon Islands: left  $i^3$  as an imperfectly double tooth, having two sub-cylindrical crowns and only one root (Fig. 63). The two crowns



FIG. 63. *Phalanger orientalis*. No. 368.  
Upper incisors and canines. The separate figure shews the left  $i^3$  extracted.

stand in the same transverse plane, the one being internal to the other and rather smaller than it. Lower jaw missing. B. M., 1936, *c*. [Two other skulls from same locality normal.]

369. **P. maculatus**, Port Moresby: only *two* incisors on each side in the upper jaw. The centrals,  $i^1$ , of each side, are in place; externally to them there is on each side an alveolus for a tooth, which, judging from the size of the alveolus, was probably  $i^2$ . Immediately behind these alveoli the canines follow on each side. In this case it may be said that the missing teeth are  $i^3$  in all probability. Lower jaw normal. B. M., 79. 3. 5. 8.
370. Specimen having "in each upper jaw two incisors instead of three," [also has no left  $p^1$ , see No. 377]. *Leyd. Mus.*, 55. JENTINK, F. A., *Notes Leyd. Mus.*, 1885, VII. p. 90. Two specimens, *Leyd. Mus.*, 56 and 61 are without  $i^3$  of right upper jaw, *ibid.*, p. 91. Specimen in which "five of the upper incisors are wanting [only one "intermediate" tooth in left lower jaw, see No. 377]. *Leyd. Mus.*, 63, *ibid.*, p. 91.
371. **Pseudochirus forbesi**: of this species only a single skull known; it has no upper  $i^3$  [and no upper first premolar, see No. 379]. B. M., 1943. THOMAS, O., *Cat. Marsup. Brit. Mus.*, 1888, p. 183.

(2) *Premolars, and the "Intermediate" teeth (in the lower jaw) of PHALANGERIDÆ.*

The evidence here offered relates to the following genera:—*Phalanger*, *Trichosurus*, *Pseudochirus*, *Petauroides*, *Dactylopsila* and *Petaurus*. Before speaking of the variations seen, a few words are needed in explanation of the nomenclature adopted.

In these forms there is only one tooth having a milk-predecessor, and in all the genera here referred to this is a distinct and recognizable tooth, with a chisel-shaped crown. Following Thomas' system I shall call this tooth  $p^4$  throughout. This name is used as being well understood and convenient, but without any intention of subscribing to the principles of homology upon which the system of nomenclature is based.

In front of  $p^4$  there is great diversity.

In Thomas' paper<sup>1</sup> a careful and well-considered attempt was made to bring these anterior teeth into a formal scheme of homologies, and though the application of this method to the teeth of the lower jaw was avowedly tentative, yet at first sight the results in the case of the upper teeth were fairly satisfactory. Nevertheless it appears to me that in view of the facts of Variation about to be related, the system elaborated by Thomas breaks down; not because there is any other system which can claim to supersede it, but because the phenomena are not capable of this kind of treatment. To anyone who will carefully study the examples given in the following pages, especially those relating to the genus *Phalanger*, it will, I think, become evident that it is not possible to apply any scheme based on the conception that each tooth has an individual Homology which is consistently respected in Variation.

The evidence concerns first the premolars of the upper jaw, and secondly the lower "intermediate" teeth. Inasmuch as in several of the cases there was Variation in both these groups of teeth, the evidence relating to them cannot well be separated. As regards the upper teeth, all the cases of importance occurred in *Phalanger* and *Trichosurus*, and owing to the similarity between the dentitions of these two genera it is not difficult to employ terms which shall be distinctive, though the question of the homologies of the teeth go unanswered. In all the forms concerned there are three upper incisors, and the tooth immediately succeeding them will be called the canine, though its position and form differ greatly in the various genera; for while in *Phalanger* and *Trichosurus* it is a large caniniform tooth placed on the suture between premaxilla and maxilla, in *Pseudochirus*, for instance, it is proportionally smaller and stands in the maxilla at some distance behind the suture.

*Upper jaw.* As already stated, the large premolar having a milk-predecessor will be called  $p^4$ .

In *Trichosurus* between the canine and  $p^4$  there is usually one large tooth, in shape and size much like the canine: this tooth will be called  $p^1$  as Thomas proposed. Though when present it is large, it is not rarely absent altogether (*v. infra*). In *Phalanger* there is a similar  $p^1$ , though of somewhat smaller size; but besides  $p^1$  there is usually another premolar, a small tooth, placed between  $p^1$  and  $p^4$ . On Thomas' system this is  $p^3$  and for purposes of description the name will be used here. In the *left* upper jaw of the skull shewn in Fig. 65 C,  $p^1$ ,  $p^3$  and  $p^4$  are

<sup>1</sup> *Phil. Trans.*, 1887, clxxviii. and *Cat. Marsup. Brit. Mus.*

shewn in the ordinary state. Lastly, in *Pseudochirus* behind the canine there is a very small tooth, presumably  $p^1$ , and between it and  $p^4$  a tooth of good size, presumably  $p^3$ .

*Lower jaw.* In the front of the lower jaw there is on each side one long incisor. Between it and the tooth corresponding to  $p^4$  of the upper jaw there are several small or "intermediate" teeth, whose number varies greatly throughout the group. Thomas has made a provisional attempt to find homologies for these small teeth, but in view of the facts of their Variation it seems impossible to attribute individuality to them and they will therefore be here merely numbered from before backwards.

**Phalanger orientalis.** In this species evidence will be offered to prove the following facts:—

(1) That between  $p^4$  and  $p^1$  there may be *two* small teeth, one or both of which may perhaps represent  $p^3$  (Fig. 65).

(2) That between  $p^4$  and the small  $p^3$  there may be a large tooth (Fig. 64, C), like the  $p^3$  of *Pseudochirus*.

(3) That  $p^3$  may be absent.

(4) That in case of absence of  $p^3$ ,  $p^1$  may be near to  $p^4$  (Fig. 64, A).

(5) That between the canine and  $p^4$  there may be on one side the usual large  $p^1$ , but on the other *two* teeth, evenly spaced, each of about the proportions of  $p^1$  (Fig. 64, B).

(6) That in the lower jaw the number of intermediate teeth may vary from none to five, three being the most usual number.

\*372. Specimen having left side normal, one small premolar standing between  $p^1$  and  $p^4$ . In the right upper jaw  $p^1$  is normal and stands at the same level as left  $p^1$ ;  $p^4$  is also normal in size, form and position (Fig. 64 C). In front of  $p^1$  however there is a two-rooted tooth (marked  $y$  in the figure) having somewhat the same shape as  $p^4$ , but about  $\frac{2}{3}$  rds the size. This tooth has not the form of the milk-predecessor of  $p^4$ . A small peg-like tooth ( $x$  in the figure) matching the small premolar (" $p^3$ ") is also present, but is crowded out of the arcade and stands internal to the tooth  $y$ . The lower jaw has three intermediate teeth on each side. B. M., 1780, *f.* The form and position of the tooth  $y$  suggest a comparison with the arrangement in *Pseudochirus*, in which " $p^3$ " is in a very similar condition. In Fig. 64, D, a profile of *Pseudochirus* is shewn, the dotted lines indicating the comparison suggested. It will thus be seen that if the tooth  $y$  corresponds to  $p^3$  of *Pseudochirus*, the tooth  $x$  then has no correspondent.

\*373. Specimen (var. **breviceps**, Solomon Islands) having in right upper jaw  $p^1$  and  $p^4$  but no " $p^3$ ": in left upper jaw  $p^1$  stands at a level anterior to that of right  $p^1$ , and a small peg-shaped tooth, " $p^3$ ," is present close to and almost touching  $p^4$ . (Fig. 64, A) Lower jaw, right side, two intermediate teeth, of which the posterior stands internal to  $p^3$ ; right side three intermediate teeth. B. M., 1936, *f.*



\*374. Specimen (var. **breviceps** ♀, Duke of York I.) having in rt. upper jaw  $p^1$  and  $p^4$ , but no " $p^3$ ": in left upper jaw there are two teeth of the size and shape of  $p^1$  (Fig. 64, B), one of them

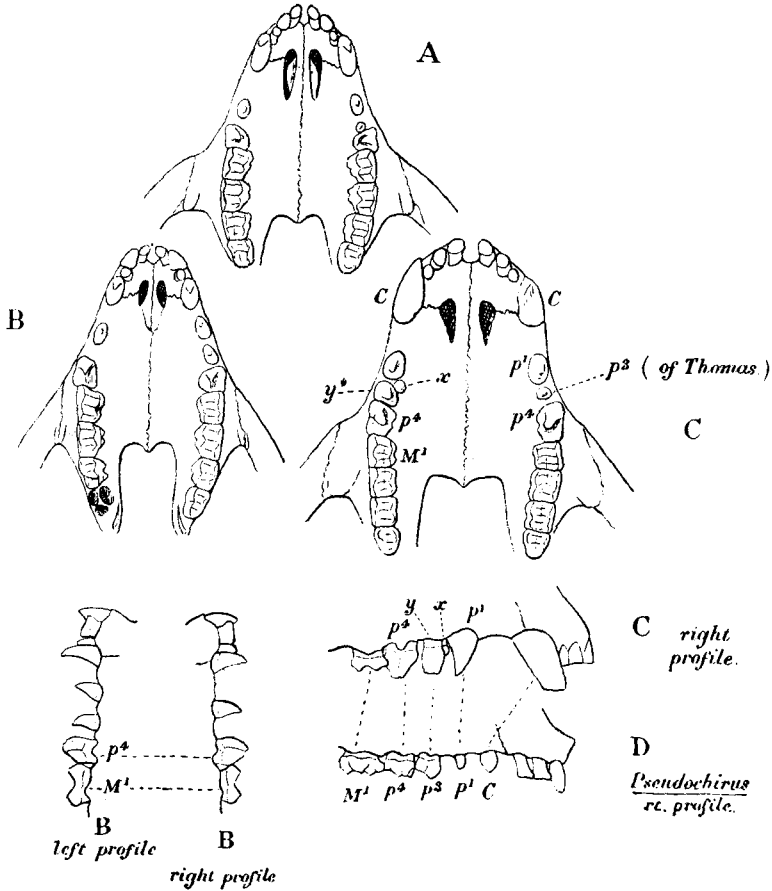


FIG. 64. Dentition of *Phalanger orientalis*.

A. *P. orientalis*, No. 373, having no right " $p^3$ ": left  $p^1$  in front of right  $p^1$ .  
 B. *P. orientalis*, No. 374: no right " $p^3$ "; on left, two teeth both like  $p^1$ , in symmetry approximately balancing right  $p^1$ . Below are the right and left profiles of the upper jaws of this skull.

C. *P. orientalis*, No. 372. The left side normal, lettered on THOMAS'S system. Right side described in text. Below is a profile of right side.

D. *Pseudochirus*, profile of normal upper teeth from right side enlarged to compare with C. Teeth lettered on THOMAS'S system.

being at a level anterior to right  $p^1$  and the other posterior to it (see figures). On neither side is there any tooth having the

size and form of " $p^3$ ." In lower jaw, right side 3 interm. teeth; left side *no* interm. tooth. B. M., 1936, *j*.

- \*375. Specimen having *two* small premolars on each side between  $p^1$  and  $p^4$ . The two teeth are very small and sharply pointed (Fig. 65). In

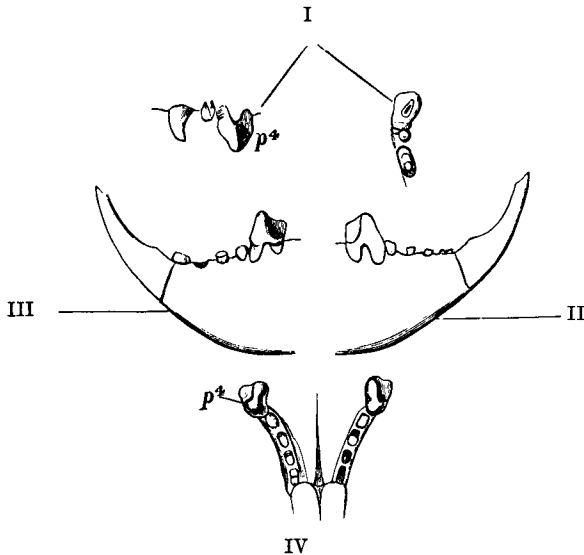


FIG. 65. Teeth of *Phalanger orientalis*. No. 375.  
I. Premolars of left upper jaw, surface and side views.  
II. and III. Right and left lower jaws as far as  $p^4$ .  
IV. The same in surface view.  
(From a drawing kindly sent by Dr JENTINK.)

the lower jaw there are on the right side five intermediate teeth between the incisor and  $p^4$ , and on the left side *four* such teeth (instead of three as usual). *Leyd. Mus.*, 104, JENTINK, F. A., *Notes Leyd. Mus.*, 1885, VII. p. 90.

*Statistics of the occurrence of small Premolars and lower  
"Intermediate" teeth in Phalanger orientalis and  
Phalanger maculatus.*

\*376. **Phalanger orientalis.**

Statistics as to the absence of the small " $p^3$ ," and as to the number of the "intermediate" teeth, may conveniently be given together in tabular form. The species has a wide distribution and is by THOMAS divided into a larger var. *typicus*, and a smaller eastern var. *breviceps*. In the latter the small  $p^3$  is usually absent. The Leyden specimens are not thus divided by JENTINK, and in order to include the statistics given by him (*l. c.*) the distinction into two races is not followed in the table.

When present, " $p^3$ " generally stands at an even distance from  $p^1$  and  $p^4$ , as in the left side of Fig. 64, C, and *not* as in the left side of Fig. 64, A. The

positions of the intermediate teeth are most various, sometimes they are evenly spaced out between  $p^1$  and  $p^4$ , but sometimes they are crowded together. The teeth in corresponding ordinal positions do not always stand at the same levels on the two sides.

Small upper premolar ("p <sup>3</sup> ")		No. of intermediate teeth in l. j.		CASES.			
right	left	right	left	Leyden (Jentink)	Other Museums	Total	
-	-	1	1		3	2	
-	-	3	0		1	1	
-	-	1	3		1	1	
-	-	2	3	1	1	2	
-	-	3	3	3	2	5	
+	-	3	3	2		2	
+	+	4	3	1		1	
+	+	1	2	1		1	
+	+	2	2	2	2	4	
+	+	2	3	1		1	
+	+	3	2	2		2	(One of these is No. 372)
+	+	3	3	44	6	50	
+	+	3	4	1		1	
+	+	4	3	1		1	(No. 375)
2	2	5	4	1		1	
						76	

\*377. **Phalanger maculatus**: in this species the small premolar ("p<sup>3</sup>") between upper  $p^1$  and  $p^4$  is generally absent, and in the lower jaw there are usually only two "intermediate" teeth. The following table shews the variations seen in 58 skulls and 7 lower jaws wanting skulls (including 43<sup>1</sup> Leyden skulls described by JENTINK, l. c.).

Small upper premolar		Intermediate teeth in l. j.		CASES.				
right	left	right	left	Leyden (Jentink)	Other Museums	Total		
-	-	1	1	2	1	3		+ 1 lr. jaw
-	-	1	2	2		2		
-	-	2	1	2		3	+ 2 lr. jaws	
-	-	2	2	27 <sup>1</sup>	8	35	+ 4 lr. jaws	
-	-	3	2		2	2		
-	-	3	3	2		2	<sup>1</sup> In one of these l. $p^1$ absent (see No. 370)	
+	-	2	3	1		1		
+	+	3	3		1	1		
+	+	2	1	1		1		
+	+	2	3	1		1		
+	+	3	2	2		2		
+	+	3	3	2	1	4		
+	+	4	3	1		1		
						58		

<sup>1</sup> Not including the case, *Leyd. Mus.*, 153 (Jentink, l. c., p. 91), in which the "small" upper premolar is stated to be absent as an abnormality. As  $p^3$  is usually absent in the species, probably this refers to  $p^1$ .

The above includes six skulls from Waigiu, the individual peculiarities of which are given below :

-	-	3	3	1		1	B. M., 61. 12. 11. 18.
-	+	3	3		1	1	
+	+	2	3	1		1	
+	+	3	2	1		1	B. M., 61. 12. 11. 17.
+	+	3	3		1	1	
+	+	4	3	1		1	

The great variability of these skulls from the island of Waigiu is very remarkable. The 4 Leyden specimens were described by JENTINK<sup>1</sup>. In one of these there was besides no left upper 2nd molar, which was entirely absent without trace, leaving a diastema between  $m^1$  and  $m^2$ . In connexion with the variations of the dentition of *P. maculatus* in Waigiu the following singular circumstance should be mentioned. In all other localities the male *P. maculatus* alone is spotted with white, the female being without spots, but in Waigiu the females are spotted like the males<sup>2</sup>. This curious fact was first noticed by JENTINK (*l. c.*, p. 111).

In the other species of *Phalanger* no case of special importance met with; but since in *P. ursinus*  $p^1$  is normally (4 skulls seen) two-rooted, it may be of interest to note that such a two-rooted condition of  $p^1$  was seen on both sides as a variation in *P. ornatus*, B. M., 1317, *b* (2 other specimens having single-rooted  $p^1$ ).

\*378. **Trichosurus vulpecula** (= *Phalangista vulpina*). The typical form of this species is Australian, while the large variety, **fuliginosa**, is peculiar to Tasmania. In the typical form no instance of absence of  $p^1$  seen in 17 specimens examined. All possessed this tooth on each side, and though varying a good deal in size, it was in every case well-formed and functional, never being in a condition which could be called rudimentary.

Of the Tasmanian variety *fuliginosa*, 18 specimens (8 in B. M., 10 in C. M.) were examined.

In 6  $p^1$  was present on both sides.

1 right side only.

1 left.

2  $p^1$  was absent altogether. C. M., 14 *k* and *l*.

Nevertheless in every case in which this tooth is present it is a large tooth of about the size of the canines. In one case  $p^1$  is two-rooted on each side, as (THOMAS, *Cat. Marsup.*, p. 186) in the Celebesian *Phalanger ursinus*. C. M., 14 *a*, Hobart Town, Tasmania.

Of the "intermediate" teeth in lower jaw one only is usually present, being

<sup>1</sup> The small premolar was accidentally described in the paper referred to as being between the canine and  $p^4$ , instead of between the anterior premolar and  $p^4$ . JENTINK, *in litt.*

<sup>2</sup> Compare the converse case of **Hepialus humuli** (the Ghost Moth), of which, in all other localities, the males are clear white and the females are light yellow-brown with spots; but in the Shetland Islands the males are like the females, though in varying degrees. See JENNER WEIR, *Entomologist*, 1880, p. 251, Pl.

close to the large incisor. In two cases (C. M., 15 *g* and *h*, prob. both Australian) there are two intermediate teeth, one near the incisor, the other near  $\bar{p}^2$ .

379. **Pseudochirus**. Of various species 29 skulls shew no numerical variation in upper series. The number of "intermediate" teeth in lower jaw is very variable, 2 on each side being the most frequent, but 1 and 3 being also common. **P. peregrinus**, Upper Hunter R., B. M., 41, 1182, has 2 intermediate teeth in left lower jaw, but on the right side one *partially double* intermediate tooth. (See also No. 371.)

- Petaurus**: 25 skulls shew no numerical variation in upper series. In this genus the number of small teeth in the lower jaw is remarkably constant. In addition to  $\bar{p}^2$  there were 3 small teeth on each side in all cases seen except two, viz.—**P. breviceps** var. **papuanus** (8 normals): right side normal; left lower jaw has 4 teeth besides  $\bar{p}^2$  (Fig. 66). B. M., 77. 7. 18. 19.

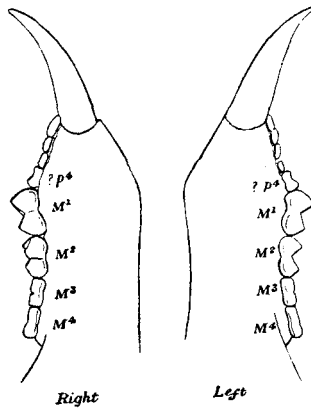


FIG. 66. *Petaurus breviceps*, No. 380. Lower jaws in profile: on right side three intermediate teeth, on left side four.

381. Another specimen has, in addition to  $\bar{p}^2$ , *four* small teeth in each lower jaw. There is a small diastema between the 3rd and 4th. B. M., 42. 5. 26. 1. [no skull].
382. **Dactylopsila trivirgata**: 3 specimens have upper series normal. In addition one has an extra tooth in left upper jaw between  $p^1$  and canine. This tooth somewhat resembles but is rather smaller than the canine, near and *slightly internal* to which it stands [*reduplicated canine*]. B. M., 1197, *d*.

(3) *Premolars and molars of Dasyuridæ and Didelphyidæ.*

**Thylacinus**, 19 normals; **Sarcophilus**, 9 normals, no abnormal known to me.

**Dasyurus**, 37 normals (4 species).

383. **D. geoffroyi**: specimen in which  $p^4$  in right lower jaw has its crown partially divided into two, the plane of division being at right angles to the jaw. C. M., 39, *a*.

384. **D. viverrinus**: right upper  $m^4$  slightly larger than the left, which is normal. C. M., 38, *g*.
- \*385. **D. maculatus**, Tasmania, having a supernumerary molar in left upper jaw, and on both sides in the lower jaw. The fourth molar in the upper jaws is increased in size in a remarkable manner (Fig. 67, B and C).

This case requires detailed description. In Fig. 67, A, a normal right upper jaw is shewn. It belongs to a specimen considerably larger than the abnormal one, but the latter, Mr Thomas tells me, is a good deal smaller than the normal size of the species. In the normal there are two small pre-molars ( $p^1$  and  $p^3$  of Thomas), and behind these, four molars. The molars increase in size from the first to the third, which is by far the largest. Behind the third is the fourth molar, which is much smaller than the others, having the peculiar flattened form shewn in the Figure 67, A.

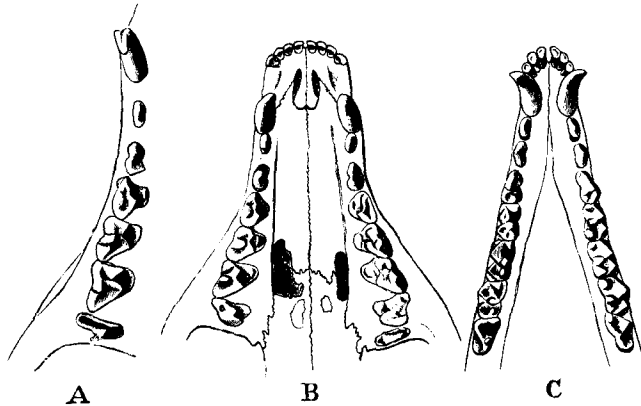


FIG. 67. A. Right upper jaw of normal *Dasyurus maculatus* (shewn as far as the canine) for comparison with the variety. (N.B. The latter is considerably smaller.)

B. Upper jaw of *D. maculatus*, No. 385.

C. Lower jaw of the same specimen.

On comparing the abnormal skull with a normal one it is seen that the two premolars and first three molars on each side are unchanged. Behind the third molar on the *right* side there is a single tooth; but this, instead of being a thin tooth like normal  $m^4$ , is considerably larger and the longitudinal measurement in the line of the jaw is not very much less than the transverse measurement. In the right upper jaw therefore the *number* of the teeth is unchanged.

On the *left* side, behind the third molar, there is a square tooth ( $m^4$ ) of good size, about equal in bulk to half  $m^3$ , while behind this again there is another tooth,  $m^5$ , which is a thin

and small tooth having nearly the form and size of normal  $\overline{m^4}$ . The lower series is alike on both sides, each having an extra molar behind  $\overline{m^4}$  (Fig. 67, C). The two extra teeth are well formed, being as long but not quite so thick as  $\overline{m^4}$ . B. M., 41, 12, 2, 3.

In *Cat. Marsup. Brit. Mus.*, 1888, p. 265, note, THOMAS refers to this skull, and describes it as an instance of an additional molar inserted between  $m^3$  and  $m^4$  on the left side above and on both sides below. This view is of course based on the resemblance that the extra  $\overline{m^5}$  of the left side bears to a normal  $\overline{m^4}$  and on the fact that the left  $m^4$  is like no tooth normally present. In the light however of what has been seen in other cases of supernumerary molars a simpler view is possible. For in cases in which a supernumerary molar is developed behind a molar which is normally a small tooth, the latter is frequently larger than its normal size. In the present case it appears that on the right side  $m^4$  has been thus raised from a small tooth to be a tooth of fair size, while on the left side the change has gone further, and not only is  $m^4$  promoted still more, but a supernumerary  $\overline{m^5}$  is developed as well. It is interesting to note that this  $\overline{m^5}$  is a small tooth, very like normal  $\overline{m^4}$ , and it thus may be said to be beginning at the stage which  $\overline{m^4}$  generally reaches. In the lower jaw  $\overline{m^5}$  is added without marked change in  $\overline{m^4}$ ; for  $\overline{m^4}$  is normally a large tooth and has, as it were, no arrears to be made up. Mr Thomas, to whom I am indebted for having first called my attention to this remarkable case, allows me to say that he is prepared to accept the view here suggested.

- Phascologale.** In the upper jaw normally 3 premolars, by Thomas reckoned as  $p^1$ ,  $p^3$  and  $p^4$ . Between the first and second (" $p^3$ ") there is sometimes, but not always, a small space, and in the following case a supernumerary tooth was present in this position.
386. **Phascologale dorsalis**, (Fig. 68) having an extra premolar between the first and second in the left upper jaw: rest normal. B. M., 1868, b. THOMAS, O., *Phil. Trans.*, 1887, p. 447, Pl. 27, figs. 7 and 8.
- In the lower jaw  $\overline{p^1}$  is often small and may be absent. As Thomas has observed, the size of  $p^4$  in the upper and lower jaws maintains a

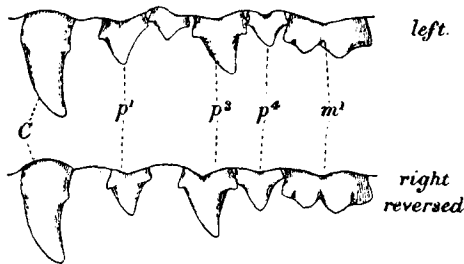


FIG. 68. *Phascologale dorsalis*, No. 386. Teeth of left upper jaw from canine to first molar; below, the teeth of the right side reversed (after THOMAS).

- fairly regular correspondence. Within the limits of one species  $\bar{p}^4$  may shew great variation; for instance, of **Phascologale flavipes** 7 specimens were seen; in 1  $\bar{p}^4$  was absent, in 2 it was small, in 2 moderate, and in 2 it was large.
388. **Didelphys**: 79 specimens normal. One specimen alone, **D. lanigera**, Colombia, B. M., 1733, *b*, was abnormal, having no  $m^4$  in either upper or lower jaws. **D. opossum** (one specimen, B. M.) had right  $\bar{m}^4$  larger than the left.

(4) *Molars of certain Macropodidæ.*

The following evidence relates to the genera *Bettongia*, *Potorous* and *Lagorchestes*. In these forms the molars are normally four in each jaw. As THOMAS observes (*Cat. Marsup. Brit. Mus.*, p. 105, *note*), in *Bettongia* cases of fifth molar occur, but on the other hand cases of non-eruption of  $m^4$  occur also. The variations seen in the three genera were as follows.

- Bettongia penicillata**: 8 specimens have  $m \frac{4-4}{4-4}$ ; in 7 of them  $m^4$  is small (in B. M., 279, *j*,  $\bar{m}^4$  is very minute; but in B. M., 278, *m*, the lower  $\bar{m}^4$  is large).
- \*389. 1 specimen ♀ has  $m^4$  in left lower jaw only, this tooth being small. B. M., 279, *a*.
- \*390. 1 specimen has  $m \frac{1.2.3.0.5-1.2.3.0.0}{1.2.3.4.5-1.2.3.4.5}$ . In both upper jaws there is a small empty crypt behind  $m^3$ , and on right side behind this again there is a minute tubercular tooth not represented on the other side. B. M., 279, *b*.
- B. cuniculus**: 2 specimens have  $m \frac{4-4}{4-4}$ .
391. 1 specimen has no left  $\bar{m}^4$ . B. M., 982, *c*.
- \*392. 1 specimen has  $m \frac{5-5}{5-5}$ ; in upper jaws  $m^5$  very small in crypts, but in lower jaws they are of good size. B. M. 51. 4. 24. 7.
- B. lesueri**: 13 specimens have  $m \frac{4-4}{4-4}$  (in one of them  $m^4$  very small. B. M., 277, *g*).
393. 1 specimen has  $m \frac{5-5}{4-4}$ ,  $m^5$  being minute and lying in crypts. B. M., 41, 1157.
394. **Potorous (Hypsiprymnus)**:  $m \frac{4-4}{4-4}$  in 5 specimens of *P. tri-dactylus* and in 2 of *P. platyops*. A single specimen of **P. gilberti** has no right upper  $m^4$ . B. M., 282, *b*.
395. **Lagorchestes**. In this genus  $m^4$  is present and is a large tooth, not materially smaller than  $m^3$ . Nevertheless it commonly falls short of the other teeth and remains partly within the jaw. This was the case in 10 skulls of *L. leporoides* and *L. conspicillatus*. In one skull of *L. leporoides*,  $m^4$  stood at the same height as the other teeth. I see no reason to suppose that all the other skulls were young, and it seems more likely that this imperfect eruption of  $m^4$  is characteristic.



## SELACHII.

Some features characteristic of Meristic Variation are well seen in the case of the teeth of Sharks and Rays. Of these fishes there are many having little differentiation between the separate rows of teeth. In these a distinct identity cannot be attributed to the several rows, and numerical Variation is quite common. But besides these there are a few forms whose teeth are differentiated sufficiently to permit a recognition of particular rows of teeth in different specimens, and to justify the application of the term "homologous" to such rows. Nevertheless with such differentiation Meristic Variation does not cease.

In the following examples it will be seen further that in such Variation there may be not merely a simple division of single teeth but rather a recasting of the whole series, or at least of that part of it which presents the Variation, for the lines of *division* in the type may correspond with the *centres* of teeth in the variety.

These cases also exemplify the fact that variations of some kinds are often only to be detected when in some degree imperfect; for if the divisions in No. 396 for instance had taken place similarly on both sides, it would have been difficult to recognize that this was a case of Variation.

\*396. **Rhinoptera jussieui** (= *javanica*): specimen in which the number and arrangement of the rows of teeth is different on the two sides, as shewn in Fig. 69, upper diagram. The disposition on the right side of the figure is normal, that on the left being unlike that of any known form. Specimen in B. M. described by SMITH WOODWARD, *Ann. and Mag. N.H.*, Ser. 6, vol. i. 1888, p. 281, fig. As Woodward points out, the rows of plates on the left side may be conceived as having arisen by division partly of the plates of the central row and partly from the lateral row, marked I. But if this be accepted as a representation of the relation of the normal to the abnormal, in the way indicated by the lettering, the plates of the row marked *0 b*, for instance, must be supposed each to belong half to one rank and half to a lower rank. The same applies to the plates in the row *I b*. By whatever cause therefore the points of development of the teeth are determined, it is clear that the centres from which each of the teeth in the rows *I b* and *0 b* was developed were not merely divided out from centres in the normal places but have undergone a rearrangement also. With change of number there is also change of pattern.

The tessellation on the abnormal side is so regular and definite that had it existed in the same form on both sides the specimen might readily have become the type of a new species.

There is indeed in the British Museum a unique pair of jaws in both of which (upper and lower) a very similar tessellation

occurs in a nearly symmetrical way. This specimen is described as *Rhinoptera polyodon*, but it is by no means unlikely that it

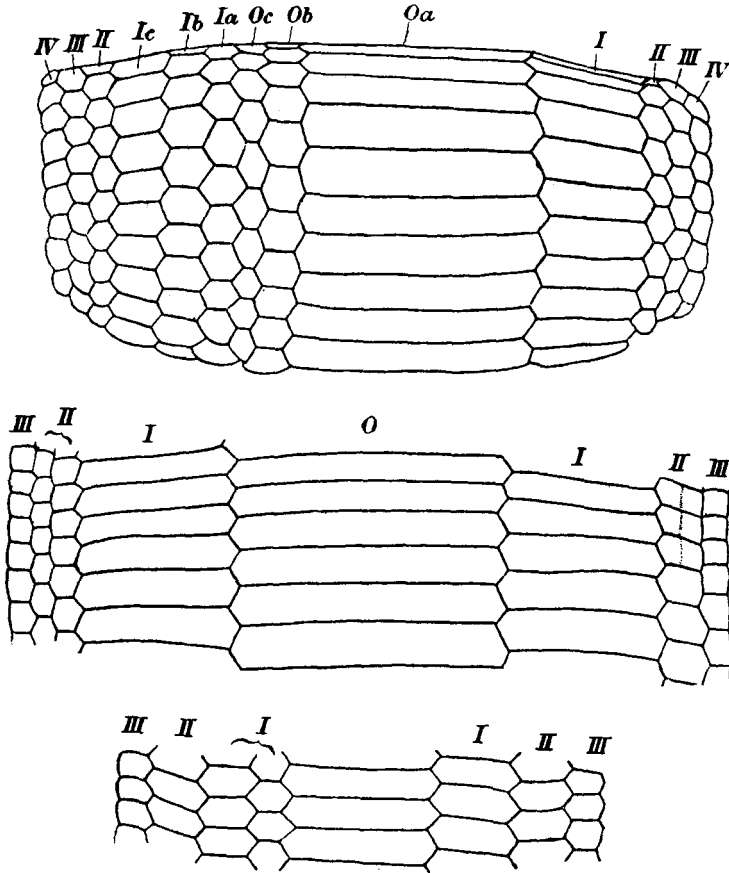


FIG. 69. Upper figure; *Rhinoptera jussieui*, No. 396, after SMITH WOODWARD, from whom the lettering is copied.

Middle figure, *Rhinoptera*, sp., No. 397.

Lower figure *Rhinoptera javanica*, No. 398, after OWEN.

is actually a Variation derived from the usual formula of *Rhinoptera*. It is figured by GÜNTHER, *Study of Fishes*, 1880, p. 346, Fig. 133.

- \*397. **Rhinoptera** sp. incert.: teeth as in middle diagram, Fig. 69. On the left side *three* rows of small lateral teeth, while on the right side two of these rows are represented by one row, which in one part of the series shews an indication of division. C. S. M. (*Hunterian Specimen*).

398. **Rhinoptera javanica**: the row of teeth marked I is one side single, but on the other side is represented by two rows. Fig. 69, lower diagram. OWEN, *Odontography*, Pl. 25, Fig. 2. C. S. M. (*Hunterian specimen*).
399. **Cestracion philippi**: an upper jaw having the teeth disposed as in the figure (Fig. 70). C. S. M.

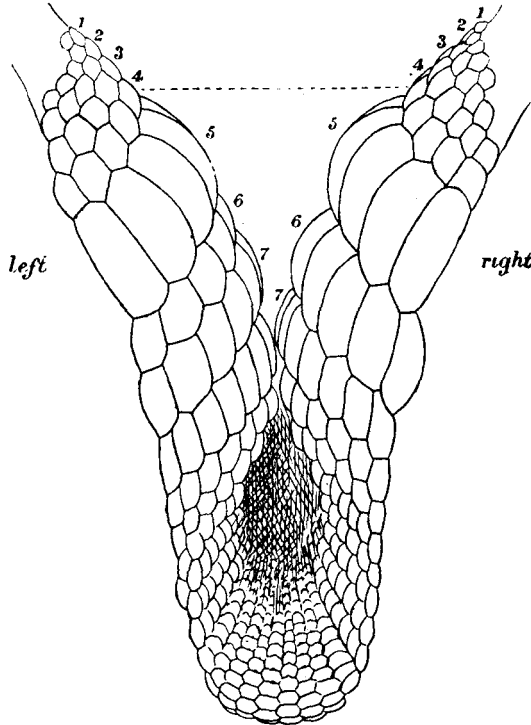


FIG. 70. Upper jaw of *Cestracion philippi*, No. 399.

On comparing the teeth of the two sides it will be seen first that the rows do not correspond individually, and secondly that they do not at all readily correspond collectively. Assuming that the rows marked 4 on each side are in correspondence (which is not by any means certain) several difficulties remain: for right 5th is larger than left 5th, but left 6th and 7th together are larger than right 6th; right 7th is about the same size as left 8th, but right 8th is larger than left 9th. The proportions in the figure were carefully copied from the specimen.

400. "**Cestracion** sp." [so labelled, but probably not this genus]: lower jaw as in Fig. 71. On the right side the second row of large plates is represented by two rows, properly fitting into each other, but on the left side the plates of the inner side are completely

divided, but the division is gradually lost towards the middle of the jaw and the external plates are without trace of division. C. S. M.

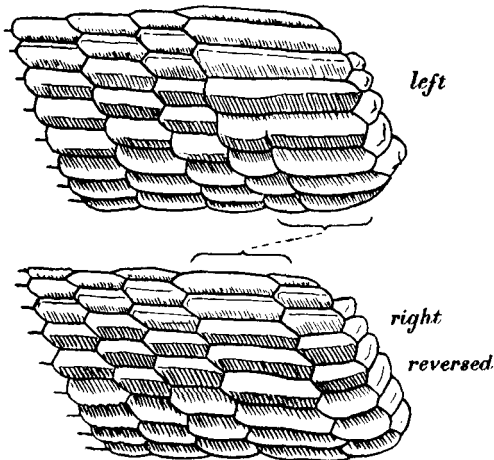


FIG. 71. The lower jaw of a Selachian, No. 400. The proximal ends shewn (enlarged). The right is reversed for comparison with the left.

#### RADULÆ OF A GASTEROPOD.

The following example of Meristic Variation in the teeth of a Molluscan odontophore may be taken in connexion with the subject of teeth, though the structures are of course wholly different in nature. For information on this subject I am indebted to the Rev. A. H. COOKE.

Generally speaking the number and shapes of the radular teeth are very characteristic of the different classificatory divisions. There are however certain forms in which a wide range of Variation is met with; of these the case of *Buccinum undatum* is the most conspicuous.

\*401. ***Buccinum undatum*.** In most specimens the number of denticles on the central plate is 5—7 and on the laterals 3—4.

In 27 specimens from Hammerfest and Vardö the teeth were as follows:—

Central plate.	Lateral plates.	Cases.
5	4	8
6	4	12
7	4	2
6—8	4	1
9	4	1
6	3 & 4	1
7	3 & 4	1
8	4 & 5	1

from FRIELE, *Jahrb. deut. mal. Ges.*, VI. 1879, p. 257.

\*402. The range of Variation may be still greater than this, the number of centrals being sometimes as low as 3. Fig. 72 shews the different conditions found. In it eight varieties are shewn,

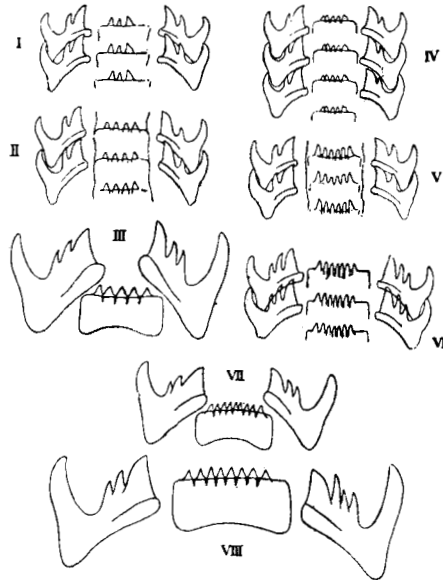


FIG. 72. Variations in odontophore of *Buccinum undatum*.

I. Three centrals (Labrador). II. Four centrals. III. Five centrals, approximately symmetrical bilaterally. IV. Five centrals, not symmetrical; the two external centrals on one side almost separate, correspond with a bifid denticle on the other side (Labrador). V. Six complete centrals (Labrador). VI. Seven centrals (Lynn). VII. Nine almost distinct centrals. VIII. Eight centrals; laterals asymmetrical (4 and 5).

I. II. IV.—VI. from photographs made and kindly lent by Mr A. H. COOKE. III. VII. VIII. after FRIELE.

I. II. IV.—VI. being taken from Mr Cooke's specimens, III. VII. and VIII. from Friele's figures.

As thus seen, in these variations considerable symmetry may be maintained. This symmetry and definiteness of the varieties in the cases with 3 and 4 centrals is especially noteworthy, inasmuch as these are abnormal forms and have presumably arisen discontinuously. As also seen in the figure, *e.g.* IV. and VI. this symmetry is not universal, and may be imperfect. The specimen shewn in VIII. is remarkable for the asymmetry of the lateral plates, which have 4 and 5 denticles respectively.

In connexion with the subject of symmetrical division interest attaches to cases like that shewn in Fig. 72, IV. in which on the

outside of the central plate a pair of almost wholly separate denticles on one side correspond with a large, imperfectly divided denticle of the other side. A very similar specimen is figured by FRIELE, *Norske Nordhavs-Exp.*, VIII. Pl. v. fig. 16.

The number found in one part of the radula is usually maintained throughout the whole series, but this is not always so. A case in which the number of centrals at the anterior end of the radula was 6, and at the posterior end 8, is given by FRIELE, *Norske Nordhavs-Exp.*, 1882, VIII. p. 27, Taf. v. fig. 17.