

THE

# NATURAL HISTORY REVIEW:

A

Quarterly Journal of Biological Science,

EDITED BY

G. BUSK, F.R.S., Sec. L.S.      W. B. CARPENTER, M.D., F.R.S., F.L.S.

F. CURREY, F.R.S., F.L.S.      J. REAY GREENE, A.B.

T. H. HUXLEY, F.R.S., F.L.S.      J. LUBBOCK, F.R.S., F.L.S.

R. M'DONNELL, M.D., M.R.I.A.      D. OLIVER, F.R.S., F.L.S.

P. L. SCLATER, F.R.S., Sec. Z.S., F.L.S.      WYVILLE THOMSON, LL.D., F.R.S.E.

E. P. WRIGHT, A.M., M.D., F.L.S.

---

1863.

---



WILLIAMS AND NORGATE,

14, HENRIETTA STREET, COVENT GARDEN, LONDON; AND  
20, SOUTH FREDERICK STREET, EDINBURGH.

1863.

number very exactly. Now, Cuvier and Valenciennes, it is true, may have registered 4200 species as described in their joint work, as being in the French collection. But it is now well known, that many of Cuvier and Valenciennes' species are fictitious, the same fish having been in many instances described under half a dozen or more different names. We believe, therefore, that there is no reason to doubt of the superiority of the British to the French collection in this class of animals; though, if Professor Agassiz's estimate of species at Cambridge be correct, both of them must yield the palm to their transatlantic rival.

Professor Agassiz is likewise satisfied, from the rapid examination he has himself made, of the Echinoderms and Corals in the British Museum and Jardin des Plantes, that the Cambridge collections of these classes are "inferior to none, even if they are any where equalled."

---

## Original Articles.

---

### LVI. — ON THE MOLAR SERIES OF RHINOCEROS TICHORHINUS.

By W. Boyd Dawkins, B.A. Oxon., F.G.S.

CONTENTS:

|   |  |
|---|--|
| § 1. INTRODUCTION.  | § 6. CHARACTERISTICS OF PERMANENT LOWER MOLARS: — 1—Pm 2.                  |
| § 2. SYSTEM OF MEASUREMENTS.  | 2—Pm 3. 3—Pm 4. 4—M 1.   |
| § 3. COMMON CHARACTERISTICS OF PERMANENT AND DECIDUOUS MOLAR DENTITION.                               | 5—M 2. 6—M 3.  |
| § 4. DENTAL FORMULA.  | § 7. CHARACTERISTICS OF UPPER MILK MOLARS: — 1—Dm 1. 2—Dm 2.               |
| § 5. CHARACTERISTICS OF PERMANENT UPPER MOLAR SERIES: — 1.—Pm 2. 2—Pm 3. 3—Pm 4. 4—M 1. 5—M 2. 6—M 3. | 3—Dm 3. 4—Dm 4.  |
|   | § 8. CHARACTERISTICS OF LOWER MILK MOLARS: — 1—Dm 1. 2—Dm 2. 3—Dm 3 and 4. |

*Figures of the Upper and Lower Milk Series, and of Pm 2.*

---

§ 1. INTRODUCTION.—My object in the present communication is to reduce to some sort of order the classification of the Molar Series of *Rhinoceros tichorhinus*, and to define, as far as possible, each tooth from its homologues in other species. This I am able to do with considerable accuracy, by the application of a system of terms and measurements, that I have found invaluable, not only in the present instance but also in determining the more difficult Artiodactylian teeth, and by the characteristics which obtain in the large numbers that have passed through my hands. The generalizations are based upon a careful examination of seven jaws and upwards of 200 teeth, from Wookey Hole, of those in

the British Museum, and the Museums of the Royal College of Surgeons, of the Geological Survey, of Taunton, and especially of Oxford. In mapping out the teeth, I have adopted Brandt's\* nomenclature as far as possible, and all the more readily, as it coincides with a system of terms that I had used for some time before his monograph came into my hands.

§ 2. SYSTEM OF MEASUREMENTS.—The value of a system of measurements in accurately showing the relation of the parts measured to the whole tooth will be seen in its application in the following pages. As the crown varies in the relative size of its parts according to the state of wear, all the measurements are taken *along the base*, instead of the summit of the tooth. The four used below are numbered for the sake of reference, and will be referred to by the numbers at the beginning of each. All are taken in inches and tenths.

1. Antero-posterior measurement, taken along the *outside* of crown.
2. Antero-transverse measurement, taken across the anterior lobe of the tooth, from the middle of the anterior collis† to the middle of the anterior area, or at the neck of the anterior pair of fangs.
3. Postero-transverse measurement, taken across the posterior lobe of tooth, or at the neck of the posterior pair of fangs.
4. Circumference of base of crown.

§ 3. CHARACTERISTICS OF PERMANENT AND DECIDUOUS MOLAR DENTITION.—The Molar series of the upper and lower jaw are far more closely allied to each other than at first sight appears. Composed of the same elements, modified for a special purpose in each tooth, they possess a large number of common characteristics. The crowns are traversed by two depressions of variable depth, with their entrances either open, or more or less closed. Of these, the anterior, always opening upon the inner side, is the Anterior Valley [ A of fig. 1—7]‡; the posterior opening on the inner side of the lower, and the inner and posterior angle of the upper molars, is the Posterior Valley [ B of figures].§ In front of the Anterior Valley is the Anterior Collis|| [ D ], while between the two valleys, the Median Collis|| [ E ] forms the posterior wall of the one, the anterior of the other. The Posterior Collis\*\* [ F ], forms the

\* Brandt, 'De Rhinocerotis Antiquitatis seu Tichorini seu Pallasii structurā,' etc. Trans. de St. Pétersburg, Vol. vii. pt. 2. (4to. 1849.)

† *Vide* § 3.

‡ 'Vallis Anterior,' Brandt. 'Vallon Oblique' in the Upper Molars.—Cuvier.

§ 'Vallis Posterior,' Brandt. In the Upper Molars 'Echrancheure au bord Postérieur,' Cuvier. 'Fossette Postérieure,' Blainville.

|| 'Collis Anterior,' Brandt. In the Upper Molars 'Colline Seconde,' Cuvier.

¶ 'Collis Medius,' Brandt. In the Upper Molars, 'La Troisième Colline,' Cuvier. Christal.

\*\* 'Collis Posterior,' Brandt. In the Upper Molars, 'Bord Postérieur de la Dent,' Cuvier. Blainville.

posterior border of the tooth, and holds the same relation to the posterior that the Median Collis does to the Anterior Valley. In the upper molars this typical arrangement is concealed by the great development of the Anterior Valley and the Median Collis, at the expense of the Posterior Valley and Collis, which are thrust, as it were, backwards, and excluded from a share in the inner surface of the tooth. The entrance of the Posterior Valley is also so close to the summit of the crown, that it is soon worn away, leaving the valley as an island of enamel, surrounded by dentine. A series of teeth in my possession shows the stages by which the typical form is obscured. In it the posterior island of enamel of the Premolars gradually increases in size from before backwards, through the large partially-open valley of  $m\ 2$  into the indisputable posterior valley of  $m\ 3$ . Without this evidence, I should have hesitated in adopting Brandt's views of the homologies on the evidence he gives.

The external surface bears costæ (K), or ribs, more or less vertical, divided from each other by sulci, or grooves. The deepest and most persistent of these is the Median or *Master Groove* (I), dividing the surface vertically into two areas ( M. N. ), the anterior and the posterior. The former of these always bears two costæ, which, in the lower molars, are sometimes nearly obsolete.

The enamel bears rough vertical rugæ, more or less developed, and never parallel. Besides these is a set of fine vertical and parallel striæ, which in the older teeth are almost obliterated by the more strongly-marked series. Also, and especially in the Premolars, is a third set of markings, linear, horizontal, and very superficial, only to be seen in the young teeth, and forming, with the two vertical sets, a faint reticulated pattern. In the milk molars, the first of these three series of markings is very fine, the second barely visible, and the third absent from all that I have examined.

§ 4. DENTAL FORMULA.—With reference to the number of the Permanent molar series dentition, the great authorities are by no means agreed. On the one hand, Cuvier, on the faith of a letter from Adrien Camper,\* and after him Blainville,† maintain that *R. tichorhinus* has a full complement of Premolars; while, on the other, Pallas‡ and Fischer§ doubt it: and Brandt,|| after carefully weighing the evidence, concludes that the first Premolar is always absent from the adult. It must be remarked that neither Cuvier nor Blainville ever saw the first premolar, the existence of which they assume. Professor Owen, indeed, figures and describes¶ a tooth as being that in question, mistaking the deciduous for the permanent dentition in the two jaws from Thame and Lawford in the Oxford Museum. But,

\* Ossemens Fossiles, Vol. ii. Pt. I. p. 61, 1822. † Osteograph. Rhinoceros, p. 107.

‡ Novi. Comment. Petropol. Tom. xvii.

§ Fischer, Oryctographie de Moscou, p. 114.

|| Brandt. op. cit. p. 325.

¶ Brit. Foss. Mam. (1846), pp. 337—342, 363-4, Figs. 128, 137.

N. H. R.—1863.

besides the points of difference to be noticed in treating of the Milk series [§ 8, 1], the fact that in both the jaws the fourth tooth is in place, while the alveolus behind it shows that the fifth, or m 1, was still in the gum, is a conclusive proof that the teeth they contain do not belong to the permanent dentition. For in the recent, as the fossil *Rhinoceros m 1* is always in place a considerable time before *Pm 4*, and is always more worn.\* Neither in the skulls at St. Petersburg, ranging from young to old adults, nor in the jaws in the Oxford and British Museums, of all ages, is there the slightest vestige of *Pm 1*, but its place is represented by a rough crest, (*cristula aspera* of Brandt.) Nor in the four lower jaws, containing deciduous dentition, which I have sawn up, have I detected an alveolus or other trace of its germ. On the contrary, the fangs of the first milk molar, are so close together, and in stoutness and length so entirely different from the rest of the milk set, that there is very good presumptive evidence that in the lower jaw *Pm 1* is not calcified even in the youngest *Rhinoceros*. The dental formula therefore, as far as our present knowledge goes, will be  $Dm \frac{4}{4}$ ,

Pm 3 . m 3

Pm 3 . m 3

§ 5. CHARACTERISTICS OF PERMANENT UPPER MOLAR SERIES.— The teeth of the Upper Molar series most difficult to be determined on account of the variable form of the costæ, valleys and collæ consequent on different stages of wear, increase in size from the first Premolar (*Pm 2*) up to m 2 where a maximum of development is reached. The entrance of the anterior valley (A) also descends from before backwards, viewed in relation to the size of the tooth until in m 3 it is situated but 0·1 to 0·2 inches from the base of the crown. Generally in the Premolars it is blocked up by a small cusp and often in the true molars. On the grinding surface of the crown, a process of enamel thrown inwards and slightly backwards from the exterior lamina † [L of fig 1—4] meeting a corresponding process thrown forwards and slightly outwards from the middle of the median collis intercepts the posterior portion of the anterior valley. The former (G) of these is the *Anterior*, the latter (H) the Posterior 'Combing Plate.' Sometimes they are fused together at their junction, completely insulating the portion (C) of the valley they cut off, sometimes they merely touch, or leave a small interstice communicating with the main portion of the anterior valley. In the bicorn rhinoceros of ‡ Sumatra the anterior combing plate is always absent, as also in those teeth which Cuvier and Professor Owen figure as *R.*

\* In a skull of *R. Sumatrana* (2936 of the Hunterian Catalogue) m 1 is beginning to be worn, while the whole of the milk molars are still in place. It belonged to an animal considerably older than the Thame, or Lawford *Rhinoceros*.

† 'Collis externus,' Brandt. 'Colline Premiere qui suit exactement le bord,' Cuv.

‡ Vide 2935. Mus. Coll. Surg.

*leptorhinus*, and in the three upper molars of *R. hemitæchus* (Falc.) from Kirkdale, in the Oxford Museum. In an example on the other hand of *R. bicornis*‡ it is rudimentary in the true molars, and well developed in the Premolar series. Thus with reference to the 'combing plates,' the latter species stands half-way between *R. tichorhinus* and *R. sumatrana*.

The entrance of the anterior is at a lower level than that of the posterior valley, and the former penetrates more deeply than the latter into the substance of the tooth. The anterior A and median B collis advance *obliquely* forwards and outwards instead of *at right angles* to the median line. The posterior collis generally bears a cusp on its *summit*. The anterior (M) area is much smaller than the posterior (N), with the exception of *m* 3. An oblique ridge running upwards and outwards from the inner side of the base traverses the anterior surface diagonally, forming an oblique guard. This, however, is not so well developed, as in the *R. leptorhinus* of Cuvier and Professor Owen, or in the bicorn African or Sumatran species.

The median groove cuts the base in the true, never in the premolars; of the 4 fangs the inner pair are connate, *in the premolar series ungrooved on the inner side, in the true molars* always grooved widely and deeply.

Among the aberrant teeth one, *m* 2, is remarkable for having the entrance of the anterior valley completely blocked up to the summit of the crown, which is but little worn; one, *m* 1, also possesses two cusps, the one below the other, at the entrance of the anterior valley, the whole crown being at the same time considerably incurved. A cingulum, or 'bourrelet,' is present on the exterior of one last molar.

1. Pm 2. Of Pm 2 I have not met with any example. It is however figured and described by Brandt.\* It is characterized by its small size, and the stout ridge on its anterior aspect.

2. Pm 3. The inner base of Pm 3 regularly rounded, is unmarked by a vertical furrow. The second costa (K 2) is higher, broader and more prominent than the anterior, from which it is divided by a deep groove. The median groove (I) does not traverse the base of the exterior surface.

#### Measurements.

|         | (1)    | (2)    | (3)    | (4)    |              |
|---------|--------|--------|--------|--------|--------------|
| Maximum | 1.16   | . 1.5  | . 1.5  | : .    | Wookey Hole. |
| Average | . 1.04 | . 1.44 | . 1.47 | : 4.61 |              |
| Minimum | 1.1    | . 1.38 | . 1.38 | . .    | Wookey Hole. |

3. Pm 4. In the unworn or slightly worn crowns of Premolar 4, the exterior bears 5 costæ, the second higher than the first, from which it is divided by a deep groove, the third narrow, sharply defined, and higher than the second apically, gradually dying down

\* Vide 2941. Mus. Coll. Surg.

† Op. cit. p. 303.

and coalescing with the fourth at the distance of 1.1 to 1.4 in. from the base. The 5th or posterior costa, separated from the fourth by an elongated V-shaped groove disappears at a distance of from 0.9 to 1.2 in. from the base of the crown.

The anterior is much larger than the middle collis. Of the two valleys the anterior has its entrance from 0.7 to 1.1 from base, the posterior, widest posteriorly and roughly triangular in the unworn crowns from 0.6 to 0.8 inches.

*Measurements :*

|         | (1)  | (2) | (3)  | (4)  |              |
|---------|------|-----|------|------|--------------|
| Maximum | 1.5  | 1.9 | 1.8  | 6.5  | Wirksworth.  |
| Average | 1.32 | 1.8 | 1.69 | 5.66 |              |
| Minimum | 1.25 | 1.6 | 1.55 | 5.2  | Wookey Hole. |

4. M 1. Of the 4 costæ on the exterior of M 1, in the unworn or slightly worn tooth the anterior is the most prominent, in those that are less worn, the anterior and the third. A groove deeper than the median divides the anterior from the second, while a broad shallow depression divides the 4th, or posterior costa, from the third. The upper portion of the latter is slightly flattened. The bases of the median and anterior collis are equal or subequal in inward extension, and consequently there is less difference between the antero- and postero- transverse measurements than in m 2. The entrance of the anterior valley is situated from 0.4 to 0.8 inches from the base of the crown. In one molar abnormal, in other respects it is 0.93.

*Measurements :*

|          | (1)  | (2)  | (3)  | (4)  |              |
|----------|------|------|------|------|--------------|
| Maximum  | 1.6  | 2.38 | 2.0  | 7.2  | Wirksworth.  |
| + cement |      |      |      |      |              |
| Average  | 1.54 | 2.08 | 1.9  | 6.49 |              |
| Minimum  | 1.36 | 1.95 | 1.85 | 6.0  | Wookey Hole. |

5. M 2. Of the 4 costæ on the exterior of m 2 the third is the highest, the second, abruptly mapped off from the first by a deep furrow, dies down into the median groove, while the 4th is divided from the third by a broad shallow depression, dying away below. The anterior collis is by far larger than the median, and its base has a far greater inward extension than that of the latter. In both these respects it contrasts with m 1. The height of the entrance of the anterior valley from the base varies from 0.6 to 0.9, of the posterior from 0.7 to 1.1 inches.

*Measurements :*

|         | (1)  | (2)  | (3)  | (4)  |              |
|---------|------|------|------|------|--------------|
| Maximum | 1.75 | 2.5  | 2.1  | 7.7  | Wirksworth.  |
| Average | 1.77 | 2.36 | 1.98 | 7.07 |              |
| Minimum | 1.7  | 2.0  | 1.9  | 6.7  | Wookey Hole. |

6. M 8. The last molar, the most inconstant in form of all the teeth, in section sometimes trapezoid, sometimes triangular, is very frequently confounded with the other molars. In No. 856, of the Hunterian Catalogue of Fossil Mammals, it passes for 'the antepenultimate, or fifth molar'; in Nos. 859 and 865 for 'the penultimate, or sixth molar of the upper jaw.'

The exterior surface is marked by three broad ill-defined costæ, and is supported by two roots, the posterior of which is connate with the posterior of the inner surface. The posterior surface forms instead of a right a very obtuse angle with the exterior, from which it is divided by the third costa supported by the posterior and outer fang. The median groove is broad, deep and vertical.

The anterior far exceeds the median collis in every dimension. The anterior valley, with entrance from 0·1 to 0·4 inches from base of crown, is deep, narrow and nearly parallel to the median line. Posteriorly the two 'combing plates' meet and insulate a portion of it, which Brandt considers the homologue of the posterior valley. But its external position, its opening into the anterior valley in the unworn tooth, and its being mapped off from it by the combing plates, show that it is the representative of the intercepted part of the anterior valley, that he terms *Fossula externa*. The median collis is very small and variable in form, sometimes being a rounded pillar, at others a plate with a trenchant free edge. In one specimen in my possession it is fully developed, and equal in size and inward extension to the anterior collis.

In the great majority of the specimens that I have examined, the posterior valley and collis are represented respectively by a faint groove on the posterior aspect and a small cusp \* at its base. A series from Wookey Hole, shows the gradual increase of both in size, until the groove deepens into an undoubted valley, walled in posteriorly by a stout pillar 0·9 inch high, and in every respect the homologue of the posterior collis in the other molars. Deslongchamps† has arrived independently at the same conclusion with respect to the groove, which he terms, "Vallon postérieur mais rudimentaire."

*Measurements:*

|         | (1)  | (2)  | (3) | (4)  |
|---------|------|------|-----|------|
| Maximum | 1·85 | 2·2  | 1·6 | 7·0  |
| Average | 1·77 | 1·99 | 1·4 | 6·44 |
| Minimum | 1·64 | 1·88 | 1·4 | 6·4  |

§ 6. PERMANENT LOWER MOLAR SERIES.—In the permanent lower molars the exterior aspect of the crown is divided by the median

\* In a specimen in the British Museum from Harrowden this is absent.

† 'Mémoire sur nombreux Ossements de Mammifères Fossiles trouvés aux environs de Caen,' p. 57, pl. viii. fig. 4.

groove \* (I) more or less deep and inclined forwards into two equal or subequal areas, of which the anterior is the higher. The posterior (N) is more or less rounded off, without costæ. As in the upper molar series the premolars may be differentiated from the true molars by the median groove traversing the base in the latter, and never in the former. The inner aspect is divided by the two V-shaped open valleys, of which the anterior (A) is smaller and shallower than the posterior (B), into three collæ. Of these the anterior (D) is the smaller, the median (E) the larger. In the premolar series the latter is generally more tumid than the rest. The two 'lobes' of the tooth, are composed, the anterior of the median and anterior collæ, the posterior, of the posterior collis (F). The summit of the unworn anterior lobe is broadly and deeply, that of the posterior more faintly notched. The anterior aspect is flattened except in Pm 2, and traversed by a small ridge or guard, springing from the first costa and reaching inwards. It is found generally at a distance of two-thirds of the whole length of crown from the base, and is very strongly developed in the true molars. The posterior aspect rounded except in M 3, is also traversed by a small upward tending guard, generally arched, but sometimes straight. Springing from the outer side it dies away without impinging upon the inner surface of the third collis.

The fangs are four, divaricate connate, the outer with its fellow of the inner side. The tips of those of m 1 and 2 are slightly twisted, the anterior pair dextrally, the posterior sinistrally. Among the anomalies is the presence of a cusp at the entrance of the Posterior valley in M 1, 2, 3, at the posterior side of the same valley in M 1, and at the anterior side in Pm 3. The 'Crochet' on the anterior border of the Posterior valley which M. Christol† mentions may be cited also as an accidental variety. A cingulum also is found on the inner and outer surfaces of M 1 and 2.

1. Pm 2. In Pm 2 (fig. 7), the first of the Premolar series, the median groove (I) is very shallow and oblique, and, if prolonged, would cut the middle of the exterior and posterior fang. The anterior (M) is twice as large as the triangular posterior area (N), and is traversed by a faint diagonal depression, which separates the two almost obsolete costæ. The exterior base is tumid. The anterior valley (A) is shallow, open, and V-shaped, the posterior (B), very narrow and deep, is constricted by the great posterior extension of the median collis, which here reaches its relative maximum of development. The anterior collis is small, and the ascending ridge which sweeps round the anterior valley presents a trenchant edge.

|   | Inch. |
|---|-------|
| Maximum height of anterior area . . . . . | 1.3   |
| " " posterior area . . . . .              | 1.06  |

\* Fig. 5, 6, show the plan upon which the permanent lower molars are formed.

† Ann. des Sciences, Vol. iv. 1835.

*Measurements:*

|         | (1)  | (2)  | (3)  | (4) |              |
|---------|------|------|------|-----|--------------|
| Maximum | 0.85 | 0.75 | 0.65 | 2.6 | Magdeburgh.  |
| Average | 0.78 | 0.65 | 0.66 |     |              |
| Minimum | 0.75 | 0.6  | 0.63 | 2.5 | Wookey Hole. |

2. Pm 3. The median groove of the Pm 3 is far more vertical, and more strongly marked than in Pm 2, and is terminated inferiorly at an average distance of 0.58 inches from the tumid base of crown. The two costæ on the anterior area are faintly defined. The valleys are deep, and well marked.

|                   |                | Inch. |
|-------------------|----------------|-------|
| Maximum height of | anterior area  | 1.7   |
| " "               | posterior area | 1.45  |

*Measurements:*

|         | (1)  | (2)  | (3)  | (4)  |              |
|---------|------|------|------|------|--------------|
| Maximum | 1.06 | 0.9  | 0.9  | 3.8  | Caswell Bay. |
| Average | 0.96 | 0.83 | 0.86 | 3.46 |              |
| Minimum | 0.88 | 0.76 | 0.85 | 3.4  | Wookey Hole. |

3. Pm 4. In Premolar 4 the anterior area is flattened, and traversed by a diagonal groove, more or less deep, separating the first from the second costa, the latter of which, more prominent than the former, is isosceles-triangular, with a tumid base. The median groove, deeper than in Pm 3, is terminated inferiorly, at an average distance of 0.45 inches from the base of crown.

|                   |                | Inches. |
|-------------------|----------------|---------|
| Maximum height of | anterior area  | 2.22    |
| " "               | posterior area | 1.85    |

*Measurements:*

|         | (1)  | (2)  | (3)  | (4) |              |
|---------|------|------|------|-----|--------------|
| Maximum | 1.4  | 1.03 | 1.08 | 4.6 | Ilford.      |
| Average | 1.23 | 1.08 | 1.0  | 4.1 |              |
| Minimum | 1.15 | 1.15 | 1.08 | 4   | Wookey Hole. |

4. M 1. In M 1, as in the two following molars, the posterior collis is, relatively to the other two, much larger than in the Premolar series, and the median groove traverses the base of the crown.

|                   |                | Inches. |
|-------------------|----------------|---------|
| Maximum height of | anterior area  | 2.2     |
| " "               | posterior area | 1.9     |

*Measurements:*

|         | (1)  | (2)  | (3)  | (4)  |         |
|---------|------|------|------|------|---------|
| Maximum | 1.55 | 1.1  | 1.1  | 5.1  | Ilford. |
| Average | 1.39 | 1.17 | 1.12 | 4.64 |         |
| Minimum | 1.25 | 1.15 | 1.15 | 4.5  |         |

5. M2. With the exception of the increased depth of the median groove and the larger size, I am unable to detect special characteristics in M2.

*Measurements:*

|           | (1)  | (2)  | (3)    | (4)  |                |
|-----------|------|------|--------|------|----------------|
| Maximum . | 1.75 | 1.15 | . 1.17 | 5.3  | . Ilford.      |
| Average . | 1.57 | 1.20 | . 1.12 | 5.01 |                |
| Minimum . | 1.4  | 1.1  | . 9.5  | 4.7  | . Wookey Hole. |

6. M3. The median groove in the last molar reaches its maximum depth; the posterior area is either rounded off to join the posterior wall of the posterior collis, or, more usually, is slightly flattened, especially in the unworn tooth. The posterior collis is wider at the base than in the other molars, and of greater posterior extension. It is equal, or sub-equal to the median.

*Measurements:*

|           | (1)  | (2)  | (3)    | (4)  |                |
|-----------|------|------|--------|------|----------------|
| Maximum . | 2.1  | 1.2  | . 1.1  | 5.45 | . Wirksworth.  |
| Average . | 1.69 | 1.16 | . 1.09 | 5.27 |                |
| Minimum . | 1.48 | 1.2  | . 1.0  | 4.85 | . Wookey Hole. |

§ 7. THE UPPER MILK MOLARS.—The Upper Milk Molars\* of *R. tichorhinus*, four in number, and, with the exception of Dm 1, in plan resembling the true molars [§ 5. § 6.4, 5, 6.] differ from them in their far smaller size, in their valleys being relatively much larger, their collis much smaller, and in the second costa always being the higher. The median groove traverses the base of all.

1. Dm 1. The first Milk Molar† [fig. 1.], of which I have seen only one example, presents four well marked costæ (K) on its external surface, the first divided from the second by a broad V-shaped depression, that from the third by the broad median groove (I), while a narrower and more shallow groove divides the third from the fourth.

The anterior valley (A) is divided into three portions by the fused combing plates [G, H]. The first of these is a deep open cavity, the second the space intercepted by the combing plates, and lastly, at a higher level the inner and smaller cavity.

The anterior collis (D) is split up as it were into two cusp-like portions of which the posterior is the higher, by the fused combing plates that enter into the internal surface of the tooth. The median collis (E) is very large, and the posterior valley (B) is far larger than the anterior (A). The anterior portion of the crown

\* The verticality of the collis, and the non-development of the anterior combing plate in fig. 125 of The British Fossil Mammals, prove that the tooth figured is not that of *R. Tichorhinus*. It probably belongs to *R. hemitoechus* (Falc.)

† Dr. Schmerling, Recherches sur les Ossements Fossiles découvertes dans les cavernes de la Province de Liège, Vol. ii. pl. xxiii. fig. 3, gives a figure.

presents an ascending trenchant edge. The posterior surface is rounded and flattened. Of the four fangs the anterior and posterior pair are respectively fused together, as in the lower molars.

*Measurement:*

|             | (1) | (2) | (3) | (4) |
|-------------|-----|-----|-----|-----|
| Wookey Hole | 0·8 | 0·5 | 0·8 | 2·7 |

2. Dm 2. [fig. 2] The second Milk Molar bears four and sometimes 5 costæ (K). The groove between the first and second is by far the deeper. The anterior collis (D), small and slightly curved, is sometimes divided from the exterior lamina (L) by a depression. Anterior to the point of juncture is a broad trenchant plate in the unworn and partially worn tooth overlapping the posterior and outer edge of Dm 1. The median collis (E) is divided from the posterior (F) by a depression in the unworn tooth. The entrance of the anterior valley is wide, and partially blocked up by a cusp; and in all that I have examined there are small vertical folds on the posterior wall. The combing plates are fused together insulating the accessory valley (C), the walls of which are sometimes minutely folded.

*Measurements:* \*

|             | (1) | (2) | (3)  | (4) |
|-------------|-----|-----|------|-----|
| Wookey Hole | 1·2 | 1·2 | 1·1  | 3·9 |
| "           | 1·2 | 1·2 | 1·15 | 4·0 |

3. Dm 3. † (fig. 3) Of the four costæ of the third Milk Molar the second (K 2), round and tapering, is mapped off from the first by a deep V-shaped groove. It extends to the summit of the anterior as the faint and low third does to that of the posterior area. The median groove (I), inclined a little forwards, is well marked, and posterior to it is a faint elevation in the upper half of the tooth. The posterior wall of the anterior valley (A) is folded; its entrance is wide and sometimes blocked up by a cusp. The accessory valley (C) is completely insulated by the fused combing plates. The guard strong, but irregular at the inner side of the anterior aspect, and broken into cusps, is continued on the plate that overlaps the preceding tooth, as in Dm 2.

*Measurements:*

|         | (1)  | (2)  | (3)  | (4) |              |
|---------|------|------|------|-----|--------------|
| Maximum | 1·4  | 1·5  | 1·4  | 5·0 | Wookey Hole. |
| Average | 1·3  | 1·48 | 1·38 | 4·8 |              |
| Minimum | 1·32 | 1·42 | 1·26 | 4·7 | Wookey Hole. |

4. Dm 4. (fig. 4) Of the four costæ (K) of the last Milk Molar, ‡

\* I am unable to give average measurements, as, with the two above exceptions, all I have examined are germs with the base of crown more or less broken.

† Comp. fig. 7, pl. xxiii. of Dr. Schmerling. Op. cit.

‡ Comp. pl. xxiii. fig. 10, of Dr. Schmerling. Op. cit.

the second is strongly marked, the third broad and ill-defined, and traversed in its upper half by a faint depression. The groove posterior to it is broad and shallow. The anterior valley (A) advances with scarcely any curvature straight to the anterior and outer angle of tooth. The combing (G H) plates are fused together except in one instance. The anterior collis (D) is much larger than the middle (E), and is deeply marked by the inner termination of the guard.

*Measurements:*

Maximum . . 1.6 . . 1.8 . . 1.75 . . 6.0 . . Kents Hole.

Average . . 1.51 . . 1.62 . . 1.57 . . 5.8

Minimum . . 1.4 . . . . . 1.58 . . . . . Wookey Hole.

§ 8. LOWER MILK MOLARS.—The two lower jaws from Thame and Lawford, in the Bucklandian Museum, already alluded to [§ 4.] and described by Professor Owen,\* as containing the Premolar dentition, differ from the rami of the adult in the following points. The first tooth is situated far nearer the symphysis, all the teeth are much smaller in vertical height, the fangs are much less solid and more divaricant, with the exception of Dm 1, than in the permanent series. They in common with others that I have examined, by all these characteristics are shown to be young jaws containing the milk dentition, a portion of which (—Dm 3, and 4.) —I found *in situ* above Pm 3, 4, in the jaw of an adolescent animal from Wookey Hole. The arguments† therefore based upon the hypothesis that these jaws contain the permanent dentition, and especially Pm 1, fall to the ground. The teeth in outline only, and general arrangement of valleys and collis [§ 6] resemble the permanent series. A glance, however, at the measurements of each, shows the vast difference between them.

The fangs are 4, those of Dm 1 excepted, divaricant, excavated underneath, and connate as in the permanent lower molars.

1. Dm 1. Fig. 5, 6, a and the median groove (I) faintly impressed on Dm 1 and extending from the apex of the crown to the posterior angle of the base cuts off an anterior area (M) twice as great as the posterior. The former of these is also divided by a faint diagonal depression into two costæ, (K) of which the second is tumid, and more prominent than the first. Of the two valleys, the anterior (A) is but faintly impressed, the posterior (B) is deep, and constricted apically by the large posterior extension of the median collis (E) as in Pm 2. The anterior portion of the crown presents a trenchant ascending slightly curved edge, the anterior collis (D) being very small and insignificant. The two connate fangs are either implanted in one alveolus, or in two with but a thin partition between them. Of unusual length and far more

\* Brit. Foss. Mam. pp. 337—342. Figs. 128, 137.

† Op. cit. pp. 363, 364.

stout than the rest of the fangs, the consequent depth and size of the alveolus has given rise to the supposition, that it must have belonged to a premolar one. In one specimen, in my possession, it is visible even after the appearance of Pm 2 above the jaw.

A beautiful figure of this tooth is given in the British Foss. Mam. fig. 187, together with a description, page 339. The vertical height of an unworn crown from Wookey Hole is 0.6 inches.

*Measurements :*

|                          | (1)         | (2)         | (3)          | (4) |
|--------------------------|-------------|-------------|--------------|-----|
| Wookey Hole . . . . .    | 0.6         | 0.4         | 0.46         | 2.0 |
| Wookey Hole . . . . .    | 0.5         | 0.38        | 0.45         |     |
| <u>Lawford</u> . . . . . | <u>0.58</u> | <u>0.36</u> | <u>0.545</u> |     |

2. Dm 2. (Fig. 5, 6,  $\beta$ ) In Dm 2, the median groove is strongly impressed, the depression dividing the first from the second costa is shallow and wide. The second costa (K 2) is by far the most prominent. The anterior valley (A) is well marked, open, and subdivided into three portions by two small processes of enamel, of which the middle is the larger. The deep posterior valley (B) is constricted by the posterior extension of the median collis (E). This bears a faint cusp posteriorly about  $\frac{1}{3}$  of the length of tooth from the base of crown.

*Measurements :*

|                       | (1)  | (2)  | (3)  | (4) |
|-----------------------|------|------|------|-----|
| Lawford . . . . .     | 0.85 | 0.5  | 0.6  |     |
| Wookey Hole . . . . . | 0.95 | 0.53 | 0.65 | 2.8 |
| Wookey Hole . . . . . | 0.85 | 0.53 | 0.6  |     |

3. Dm 3-4. The following characteristics, which obtain in a large number of teeth, show that they are either the third or the fourth milk molars. I can detect no difference between them. The median groove (I) is well developed, and insulates the anterior from the posterior lobe, as in the true molars. The anterior area (M), the higher of the two, is flattened, and divided into two costæ by a vertical depression, more or less deep. The anterior valley (A) is at a higher level, and smaller than the posterior. The anterior collis (D) is larger than the posterior, and is flattened.

The tooth  $\gamma$  in Figs. 5 and 6 is the third of the milk series.

*Measurements :*

| Dm 3                       | (1)  | (2)  | (3)  |
|----------------------------|------|------|------|
| Jaw, Wookey Hole . . . . . | 1.85 | 0.75 | 0.76 |
| „ Lawford . . . . .        | 1.38 | 0.78 | 0.75 |
| „ Thame . . . . .          | 1.3  | 0.83 | 0.88 |
| Dm 4                       |      |      |      |
| Jaw, Lawford . . . . .     | 1.3  | 0.8  | 0.88 |
| „ Thame . . . . .          | 1.36 | 0.98 | 0.25 |

#### EXPLANATION OF FIGURES.

A, Anterior. B, Posterior. C, Accessory Valleys.  
 D, E, F, Anterior, Median, Posterior Colles.  
 G, Anterior, H, Posterior "combing plates."  
 I, Median Groove.  
 K, Costæ.  
 L, Exterior Lamina.  
 M, Anterior, N, Posterior Area.

LVII.—ON ANIMAL DEXTRINE, OR AMYLOID SUBSTANCE, ITS HISTORY AND PHYSIOLOGICAL PROPERTIES. By Robert MacDonnell, M.D.

It is now some years since materials resembling in some respects starch or dextrine of vegetable origin, have been recognized in the animal organism. The term Amyloid substance, so simply indicating this resemblance to starch, has been applied to these materials; and we now know that under this common name are embraced at least two compounds, which appear to be essentially distinct from each other. These I have elsewhere proposed to indicate as the Amyloid substance of Bernard, (or of the first species); and the Amyloid substance of Virchow, (or of the second species). The former is that of which I treat in the following pages; the latter, discovered by Virchow, in 1854, and now familiarly known to pathologists, although possessing many of the structural, chemical and optical properties of starch as it occurs in plants, cannot in the present state of our knowledge be considered as the animal dextrine.

The discovery of the Amyloid substance of Bernard was announced by the distinguished Professor, whose name it bears, at the meeting of the Academie des Sciences, held on March 23rd, 1857. Professor Bernard, in obedience to his theoretic views as to its use, named it "Glycogenic Substance." Hensen, somewhat prior to Bernard, and quite independently of him, had isolated this substance, the discovery of which, without doubt, constitutes one of the most important facts of animal physiology. Since its discovery its physiological properties and relations to various organs and tissues have been carefully investigated by various physiologists, and by none more successfully than by M. Charles Rouget.

Fig. 5

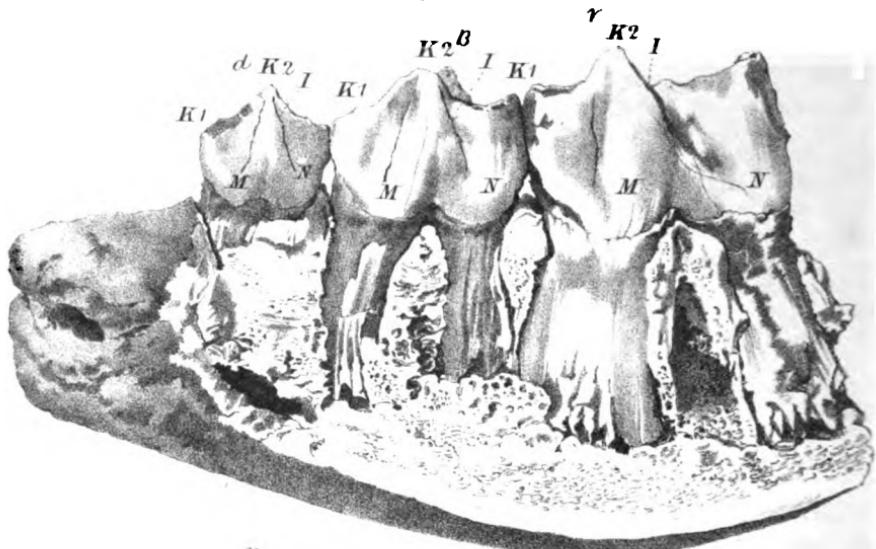


Fig. 6

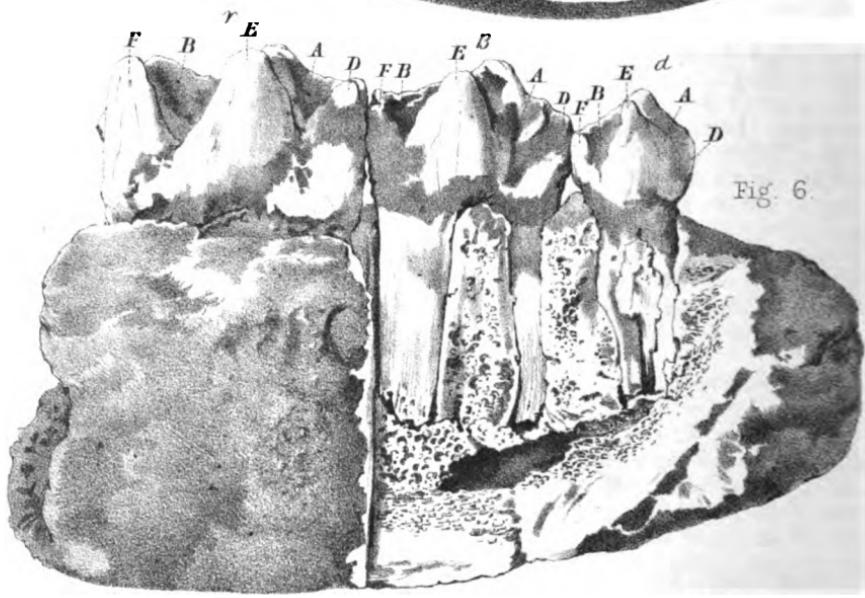


Fig 1.



Fig 1.



Fig 1

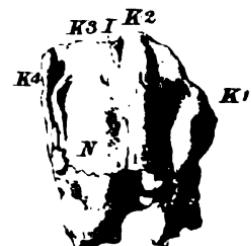


Fig. 4

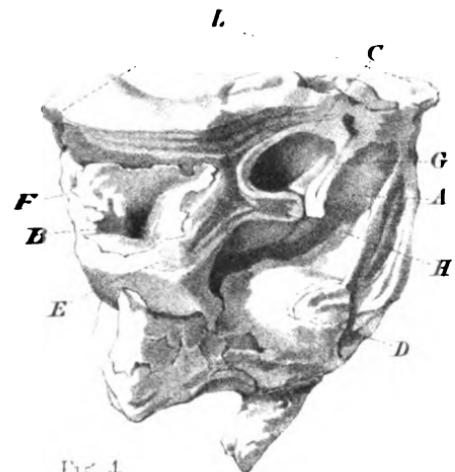


Fig. 3.

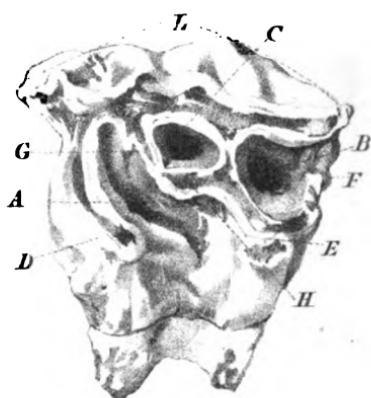


Fig. 4

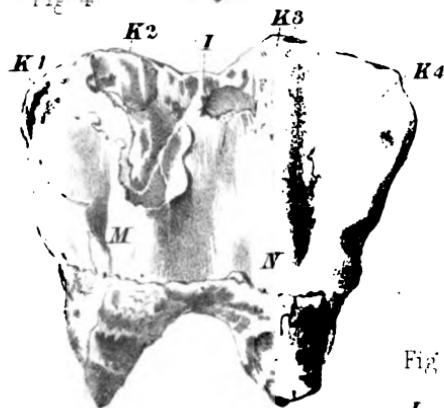


Fig. 3

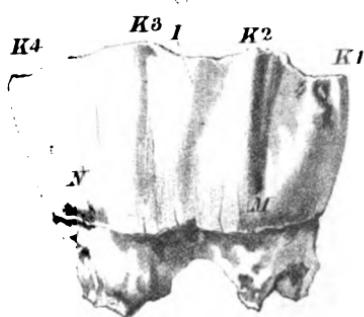


Fig. 2

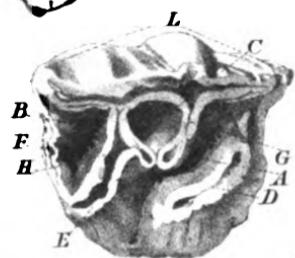


Fig. 2

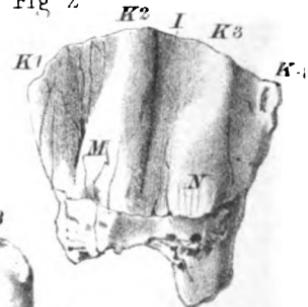


Fig. 7



Fig. 7.

