WEEKLY EVENING MEETING,

Friday, May 2.

THE DUKE OF NORTHUMBERLAND, K.G. F.R.S. President, in the Chair.

PROFESSOR OWEN, F.R.S.

On the Ruminant Quadrupeds and the Aboriginal Cattle of Britain.

THE speaker introduced the subject of the Ruminant order of quadrupeds, and the source of our domesticated species, by some general remarks upon the classification of the class *Mammalia*, and on the characters of the great natural group defined by Ray and Linnæus as the *Ungulata*, or hoofed mammalia.

These are divisible into two natural and parallel orders, having respectively the *Anoplotherium* and *Palæotherium* as their types; which genera, as far as geological researches have yet extended, were the first, or amongst the earliest, representatives of the *Ungulata* on this planet.

The brilliant researches by Baron Cuvier, the founder of palæontological science and the reconstructor of those primeval hoofed animals, from fragmentary fossil remains in the gypsum quarries at Montmartre, were alluded to.

Diagrams of the entire skeletons of the anoplotherium and palæotherium were referred to, in illustration of their dental and osteological peculiarities.

The *Anoplotherium*, with the typical dentition of

$$\textit{incisors}\ \frac{3-3}{3-3},\ \textit{canines}\ \frac{1-1}{1-1},\ \textit{premolars}\ \frac{4-4}{4-4},\ \textit{molars}\ \frac{3-3}{3-3} = 44,$$

had all its teeth of the same length, and in a continuous unbroken series: this character is peculiar to man in the existing creation. The *Palæotherium*, with the same dental formula as the *Anoplotherium*, had the canines longer than the other teeth, and developed into sharp-pointed weapons; necessitating a break in the dental series to receive their summits in closing the mouth.

The anoplotherium had 19 vertebræ between the neck and

sacrum, viz., 13 dorsal, and 6 lumbar. The palæotherium had 16 dorsal, and 7 lumbar vertebræ.

The anoplotherium had a femur with 2 trochanters, and the fore-part of the ankle-bone, called "astragalus," divided in 2 equal facets. Its hoofs formed a symmetrical pair on each foot. Cuvier has very justly inferred that its stomach must have been complex, and probably, in some respects, like that of the camel or peccari. The palæotherium had a femur with 3 trochanters, an astragalus with its fore-part unequally divided, and hoofs, 3 in number, on each foot. It most probably had a simple stomach, like the tapir and rhinoceros, which, amongst existing animals, most nearly resemble that extinct primitive hoofed quadruped, with toes in uneven number.

Every species of ungulate mammal with an uneven number of hoofs or toes, that has been introduced into this planet since the eocene tertiary period, whether it have 1 hoof on each foot, as in the horse, 3 as in the rhinoceros, or 5 as in the elephant, resembles the palæotherium in having more than 19 dorso-lumbar vertebræ, which vertebræ also differ in number in different genera; 22, *e.g.* in the rhinoceros, 23 in the mastodon, 27 in the hyrax. The typical pachyderms, with an odd number of hoofs, have also three trochanters on the femur, the fore-part of the astragalus unequally divided, and the pattern of the grinding surface of the molar teeth unsymmetrical, and usually crossed by oblique enamel ridges. All the existing odd-toed or perissodactyle mammals have a simple stomach, and a vast and complex cæcum; the horned species have either a single horn, or two odd horns, one behind the other on the middle line of the head, as, *e.g.*, in the one-horned and two-horned rhinoceroses.

Every species of ungulate animal with hoofs in even number, whether 2 on each foot, as in the giraffe and camel, or 4 on each foot, as in the hippopotamus, resembles the anoplotherium in having 19 dorso-lumbar vertebræ, neither more nor less; in having 2 trochanters on the femur, in having the fore-part of the astragalus equally divided, and in having the pattern of the grinding surface of the molar teeth more or less symmetrical. The horned species have the horns in 1 pair, or 2 pairs. All have the stomach more or less complex, and the cæcum small and simple. In the hog the gastric complexity is least displayed; but in the peccari the stomach has 3 compartments; and in the hippopotamus it is still more complex. But the most complex and peculiar form of stomach is that which enables the animal to "chew the cud," or submit the aliment to a second mastication, characteristic of the large group of even-hoofed *Ungulata*, called "*Ruminantia*."

These timid quadrupeds have many natural enemies; and if they had been compelled to submit each mouthful of grass to the full extent of mastication which its digestion requires, before it was swallowed, the grazing ruminant would have been exposed a

long time in the open prairie or savannah, before it had filled its stomach. Its chances of escaping a carnivorous enemy would have been in a like degree diminished. But by the peculiar structure of the ruminating stomach, the grass can be swallowed as quickly as it is cropped, and be stowed away in a large accessory receptacle, called the "rumen," or first cavity of the stomach; and this bag being filled, the ruminant can retreat to the covert, and lie down in a safe hiding-place to remasticate its food at leisure.

The modifications of the dentition, æsophagus, and stomach, by which the digestion in the ruminantia is carried out, were described and illustrated by diagrams.

The speaker next treated of the various kinds of horns and antlers; the manner of growth, shedding, renewal, and annual modifications of the deciduous horns, the peculiarities of the persistent horns, the mechanism of the cloven foot; and the provision for maintaining the hoofs in a healthy condition, were pointed out.

The following were the chief varieties of the ruminating stomach. In the small musk-deer (*Tragulus*), there are three cavities, with a small intercommunication canal between the second and last cavity; the "psalterium," or third cavity, in the normal ruminating stomach, being absent. This cavity is likewise absent in the camel-tribe, which have the cells of the second cavity greatly enlarged, and have also accessory groups of similar cells developed from the rumen, or first cavity. These cells can contain several gallons of water. The relation of this modification, and of the hump or humps on the back, to the peculiar geographical position of the camel-tribe, was pointed out.

The modifications of the ruminating stomach, the discovery of rudimental teeth in the embryo *Ruminantia*, which teeth (upper incisors and canines) have been supposed to characterize the pachyderms; the occurrence of another alleged pachydermal character, viz. the divided metacarpus and metatarsus in the fœtus or young of all ruminants, and its persistence in the existing *Moschus aquaticus*, and in a fossil species of antelope; the absence of cotyledons in the chorion of the camel-tribe, with the retention of some incisors as well as canines in the upper jaw of that tribe; the ascertained amount of visceral and osteological conformity of the supposed circumscribed order *Ruminantia*, with the other artiodactyle (even-toed) ungulata; above all, the number of lost links in that interesting chain which have now been restored from the ruins of former habitable surfaces of the earth—all these and other similar facts have concurred in establishing different views of the nature and value of the ruminant order from those entertained by Cuvier, and the majority of systematic naturalists up to 1840. Thus instead of viewing the *Anoplotherium* as a pachyderm, the speaker, having regard to the small size of its upper incisors and canines, to the retention of the individuality of its two chief metacarpal and metatarsal bones, and to the non-development of horns at any

period of life, would regard it rather as resembling an overgrown embryo-ruminant—of a ruminant in which growth had proceeded with arrest of development. The ordinal characters of the anoplotherium are those of the *Artiodactyla*. On the other hand, instead of viewing the horse as being next of kin to the camel, or as making the transition from the pachyderms to the ruminants, the speaker had been led by considerations of its third trochanter, its astragulus, its simple stomach, and enormous sacculated cæcum, the palæotherian type of the grinding surface of the molars, and the excessive number of the dorso-lumbar vertebræ, to the conviction of the essential affinities of the *Equidæ* with other perissodactyles (odd-toed hoofed beasts).

The primitive types of both odd-toed and even-toed ungulates occur in the eocene tertiary deposits: the earliest forms of the ruminant modification of the *Artiodactyla* appear in the miocene strata. The fossil remains of the aboriginal cattle of Britain have been found in the newer pliocene strata, in drift gravels, in brick-earth deposits, and in bone-caves. Two of these ancient cattle *(Bovidæ)* were of gigantic size, with immense horns; one was a true bison *(Bison priscus)*, the other a true ox *(Bos primigenius)*; contemporary with these was a smaller species of short-horned ox *(Bos longifrons)*, and a buffalo, apparently identical in species with the Arctic musk-buffalo *(Bubalus*, or *Ovibos, moschatus)*.

The small ox *(Bos longifrons)* is that which the aboriginal natives of Britain would be most likely to succeed in taming. They possessed domesticated cattle *(pecora)* when Cæsar invaded Britain. The cattle of the mountain fastnesses to which the Celtic population retreated before the Romans, viz. the Welsh "runt" and Highland "kyloe," most resemble in size and cranial characters the pleistocene *Bos longifrons*. Prof. Owen, therefore, regards the *Bos longifrons*, and not the gigantic *Bos primigenius*, as the source of part of our domestic cattle.

From the analogy of colonists of the present day he proceeded to argue that the Romans would import their own tamed cattle to their colonial settlements in Britain. The domesticated cattle of the Romans, Greeks, and Egyptians bore the nearest affinity to the Brahminy variety of cattle in India. As the domestic cattle imported by the Spaniards into South America have, in many localities, reverted to a wild state, so the speaker believed that the half-wild races of white cattle in Chillingham Park, and a few other preserves in Britain, were descended from introduced domesticated cattle. The size of the dew-lap, and an occasional rudiment of the hump in these white cattle, as well as the approximation to the light grey colour characteristic of the Brahminy race, seemed to point to their primitive oriental source. But the speaker could not regard the pure white colour as natural to a primitive wild stock of oxen. It is now maintained by careful destruction of all piebald calves that are produced by the so-preserved half-wild breeds.

If the blood of any of the aboriginal cattle, contemporary with the mammoth and hairy rhinoceros, still flowed in the veins of any of our domesticated races, he thought it would be that of the *Bos longifrons* transmitted through the short-horned or hornless varieties of the oxen of the mountains of Wales and Scotland.

In conclusion the speaker referred to the subjoined table of the classification of recent and extinct hoofed quadrupeds, as indicative of the progressive extinction of those forms of *Ungulata* least likely to be of use to man, and of the substitution of the ruminant forms, which, from the perfect digestion of their food, elaborate from it the most sapid and nutritious kinds of flesh.

UNGULATA.

Typica.

Artiodactyla*	Perissodactyla†
Anoplotherium	Palæotherium
Chalicotherium	Paloplotherium
Dichobune	Lophiodon
Cainotherium	Coryphodon
Poebrotherium	*Tapirus*‡
Xiphodon	Macrauchenia
Moschus‡	Hippotherium
Antilope	*Equus*
Ovis	Elasmotherium
Bos	*Hyrax*
Cervus	*Rhinoceros*
Camelopardalis	Acerotherium.
Camelus	
Auchenia	
Merycotherium	
Merycopotamus	
Hippopotamus	
Dichodon	
Hyracotherium	
Hyopotamus	
Anthracotherium	
Hippohyus	
Choeropotamus	
Dicotyles	
Phacochoerus	
Sus.	

* Ἄρτιος, *par*; δάκτυλος, *digitus*.

† Περισσοδάκτυλος, *qui digitos habet impares numero*.

‡ Only those genera printed in *italics* now exist.

Aberrantia.

TOXODONTIA
Toxodon
Nesodon.

PROBOSCIDIA
Elephas
Mastodon
Dinotherium.

SIRENIA
Manatus
Halicore
Rytina
Halitherium
Prorastomus.

[R. O.]

GENERAL MONTHLY MEETING,

Monday, May 5.

WILLIAM POLE, Esq. M.A. F.R.S. Treasurer and Vice-President, in the Chair.

C. W. Dilke, Esq.
C. Wentworth Dilke, Esq. and
George Hudswell Westerman, Esq.

were duly *elected* Members of the Royal Institution.

The following Professors were unanimously re-elected :—

WILLIAM THOMAS BRANDE, Esq. D.C.L. F.R.S. L. & E., as Honorary Professor of Chemistry in the Royal Institution.

JOHN TYNDALL, Esq. Ph.D. F.R.S. as Professor of Natural Philosophy in the Royal Institution.

A special vote of thanks was given to the LORD STANLEY, M.P. M.R.I. for his present of a Magneto-Electric Machine, by Watkins and Hill.

The following PRESENTS were announced, and the thanks of the Members returned for the same :—

FROM—

HER MAJESTY'S GOVERNMENT (*by Sir R. I. Murchison*)—Memoirs of the Geological Survey of the United Kingdom : British Organic Remains, Decades V. & VIII. 4to. 1855–6.

Administration of the Mines in Russia—Compte Rendu Annuel, pour 1854. Par A. T. Kupffer. 4to. 1855.

Arnold, Thomas James, Esq. Life Sub. R.I.—The Law Amendment Journal, for April 1856.

Astronomical Society, Royal—Monthly Notices. Vol. XVI. No. 6. 8vo. 1856.

Author—The Great Arctic Mystery. 8vo. 1856.

Bache, Dr. A. D. (the Superintendant)—Annual Report of the United States Coast Survey, 1853. 4to.