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**Proceedings of the Zoological Society of London.**

London :Academic Press, [etc.],1833-1965.

<http://www.biodiversitylibrary.org/bibliography/44963>

**1883:** <http://www.biodiversitylibrary.org/item/96834>

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April 17, 1883.

Prof. Flower, LL.D., F.R.S., President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of March 1883 :—

The registered additions to the Society's Menagerie during the month of March were 129 in number. Of these 35 were acquired by presentation, 49 by purchase, 11 were born in the Gardens, and 34 were received on deposit. The total number of departures during the same period, by death and removals, was 120.

The following are of special interest :—

1. Three Sirens (*Siren lacertina*) from South Carolina, presented by G. E. Manigault, Esq., C.M.Z.S., March 21st.

2. An American Teetee Monkey, of the genus *Callithrix*, which it is difficult to determine satisfactorily in its living state, but which is certainly new to the Society's Collection, purchased March 31st.

The Monkey, which was obtained of Mr. Hagenbeck of Hamburg, is about 15 inches in length of body, and has a long slender tail of about the same length. Its fur is of a nearly uniform dirty white ; face blackish ; hands and feet black ; tail pale reddish.

There is no specimen like it in the British Museum ; nor can I find any description applicable to it.

3. A Madagascar Lemur, of the genus *Hapalemur* (probably *H. griseus*), purchased March 31st, also new to the Society's Collection.

The following papers were read :—

1. On the Arrangement of the Orders and Families of existing Mammalia. By WILLIAM HENRY FLOWER, LL.D., F.R.S., P.Z.S., &c.

[Received April 17, 1883.]

In the present condition of the world, Mammals have become so broken up into distinct groups by the extinction of intermediate forms, that a systematic classification is perfectly practicable. Most of the associations of species, which we call "orders," and even the "suborders" and "families," are natural groups. In isolating, defining, and naming them, we are really dealing with facts of nature, of a totally different order from the artificial and fanciful divisions formed in the infancy of zoological science. It is therefore worth while to keep their characters and limits constantly in our view, and to test their validity by every advance of knowledge.

When, however, we pass to the extinct world, all is changed. In many cases the boundaries of our groups become enlarged until they touch those of others. New forms are discovered which cannot be placed within any of the existing divisions. As the horizon of our vision is thus expanded, the principles upon which a scheme of classification is constructed must be altogether changed. Our



present divisions and terminology are no longer sufficient for the purpose; and some other method will have to be invented to show the complex relationships existing between different animal forms when viewed as a whole. The present time, preeminently distinguished by the rapidly changing and advancing knowledge of extinct forms, is scarcely one in which this can be done with any satisfactory result. All attempts to form a classification embracing even the already known extinct species must be only of a very provisional and temporary nature. There are, moreover, special difficulties in undertaking this subject, to any one working on this side of the Atlantic.

It has often been remarked that the centre of gravity of the civilization, arts, literature, and commerce of the world appears to be shifting westward. This is certainly the case with palæontological discovery. Our knowledge of the ancient condition of animal life on the earth is being revolutionized by explorations in the so-called "New World." With regard to Mammals it is a curious fact, that although research has been prosecuted in suitable localities in many parts of Europe and Asia with considerable assiduity since the beginning of the century, scarcely a single form has been found which does not come within the limits of our actual ordinal groups, or which would necessitate any important modification in a classification based upon existing species. But in the New World, beginning with the earliest known South-American extinct forms—the *Toxodons*, *Nesodons*, *Mesotheriums*, &c., and passing to the still more wonderful discoveries of the last ten years in the Western Territories of the United States, we find ourselves in completely new realms of life. We are all at once confronted with numerous highly specialized forms, representing apparently new ordinal groups, and still more numerous generalized forms filling up the intervals, and breaking down the distinctions between nearly all the best-established orders of higher placental Mammals. With these I do not propose to deal in the present communication. The very abundance of the material that has lately come to hand is in itself an obstacle to drawing any satisfactory generalizations from it, as it has not left leisure to the few who have an opportunity of working at it to give such full and detailed descriptions as are necessary for the guidance of those who have not the advantage of examining the actual specimens.

In systematic descriptions in books, in lists, and catalogues, and in arranging collections, the objects dealt with must be placed in a single linear series. But by no means whatever can such a series be made to coincide with natural affinities. The artificial character of such an arrangement, the constant violation of all true relationships, are the more painfully evident the greater the knowledge of the real structure and affinities. But the necessity is obvious; and all that can be done is to make such an arrangement as little as possible discordant with facts. In preparing the article "Mammalia" for the ninth edition of the 'Encyclopædia Britannica,' such a scheme had to be framed; and the chief merit which I claim for it is, that it departs as little as possible from the prevailing, or what may be called traditional, sequences of arrangement. In the article,



which has just appeared in the XVth volume of the 'Encyclopædia,' the groups will be found more fully defined than it is necessary to do here; but it was suggested to me by our Secretary, that it would be desirable to place before the Fellows of the Society, in a more convenient form, an abstract of the arrangement adopted, preceded by a few explanatory notes upon the mutual relations of some of the principal groups.

One of the most certain and fundamental points in the classification of the Mammalia is, that all the animals now composing the class can be grouped primarily into three natural divisions, which, presenting very marked differential characters, and having no existing, or yet certainly demonstrated extinct, intermediate or transitional forms, may be considered as subclasses of equal value, taxonomically speaking, though very different in the numbers and importance of the animals at present composing them. These three groups are often called by the names originally proposed for them by Blainville—(1) *Ornithodelphia*, (2) *Didelphia*, (3) *Monodelphia*—the first being equivalent to the order *Monotremata*, the second to the *Marsupialia*, and the third including all the remaining members of the class. Although actual palæontological proof is wanting, there is much reason to believe that each of these, as now existing, are survivors of distinct branches to which the earliest forms of Mammals have successively given rise, and for which hypothetical branches Professor Huxley has proposed the names of *Prototheria*, *Metatheria*, and *Eutheria*<sup>1</sup>, names which, being far less open to objection than those of Blainville, are here used as equivalents of the latter.

The only known PROTOTHERIA, though agreeing in many important characters, evidently represent two very diverging stocks, perhaps as far removed as are the members of some of the accepted orders of the *Eutheria*. It would, however, be encumbering zoological science with new names to give them any other than the ordinarily known family designations of *Ornithorhynchidæ* and *Echidnidæ*.

Similarly with regard to the METATHERIA, although the great diversity in external form, in anatomical characters, and in mode of life of the various animals of this section might lead to their division into groups equivalent to the orders of the *Eutheria*, I do not think it advisable to depart from the usual custom of treating them all as forming one order, called *Marsupialia*, the limits of which are equivalent to those of the subclass, and the primary divisions of which are called "families." The limits of these six families are extremely well marked and easily defined; and as they form a regular gradation between two extreme types, they can be satisfactorily arranged in a serial order.

The remaining Mammals are included in the EUTHERIA, PLACENTALIA or MONODELPHIA. Their affinities with one another are so complex that it is impossible to arrange them serially with any regard to natural affinities. Indeed each order is now so isolated that it is almost impossible to say what its affinities are; and none of the hitherto proposed associations of the orders into larger groups

<sup>1</sup> P. Z. S. 1880, p. 649.



stand the test of critical investigation. All serial arrangements of the orders are therefore perfectly arbitrary; and although it would be of very great convenience for reference in books and museums if some general sequence, such as that here proposed, were generally adopted, such a result can scarcely be expected, as equally good reasons might be given for almost any other combination of the various elements of which the series is composed. In fact I have already seen reason to depart in some respects from that used in the 'Encyclopædia.'

The *Edentata*, *Sirenia*, and *Cetacea* stand apart from all the rest in the fact that their dentition does not conform to the general heterodont, diphyodont type to which that of all other Eutheria can be reduced, and which is such a close bond of union between them. In all three orders, however, some indications may be traced of relationship, however distant, with the general type.

I must refer to a paper communicated to the Society last year for my views as to the grouping of the animals composing the *Edentata*, which differ from those of most, if not all, zoologists who have previously made them their study<sup>1</sup>. I there gave reasons for believing that the Sloths and Anteaters were nearly related, and that the Armadillos, though much modified, belonged to the same stock, but that the Pangolins and the *Orycteropus* each represented very isolated forms. The division of the order into four suborders here proposed is an attempt to represent these views, though not altogether satisfactory, as the present divergence between the first two families is scarcely sufficiently indicated by their association in one suborder.

There is no difficulty about the limits of the order *Sirenia*, composed of aquatic, vegetable-eating animals, with complete absence of hind limbs, and low cerebral organization, represented in our present state of knowledge by but two existing genera, *Halicore* and *Manatus*, and a few extinct forms, which, though approaching a more generalized mammalian type, show no special characters allying them to any of the other orders. The few facts as yet collected relating to the former history of the *Sirenia* leave us as much in the dark as to the origin and affinities of this peculiar group of animals as we were when we only knew the living members. They lend no countenance to their association with the *Cetacea*; and, on the other hand, their supposed affinity with the *Ungulata* receives no very material support from them.

Another equally well-marked and equally isolated, though far more numerous and diversified order, is that of the *Cetacea*, placed simply for convenience next to the *Sirenia*; for except in their fish-like adaptation to aquatic life they have little in common with them. The old association of these orders in one group can only be maintained either in ignorance of their structure or in an avowedly artificial system. Among the existing members of the order, there are two very distinct types, the toothed Whales or *Odontoceti*, and the Baleen Whales or *Mystacoceti*, which present as many marked distinguishing structural characters as are found between many other divisions of the *Mammalia* which are

<sup>1</sup> P. Z. S. 1882, p. 358.



reckoned as orders. As the extinct *Zeuglodon*, as far as its characters are known, does not fall into either of these groups, but is in some respects an annectant form, I have placed it provisionally, at least, in a third group by itself, named *Archæoceti*. There is nothing known at present to connect the Cetacea with any other order of Mammals; but it is quite as likely that they are offsets of a primitive Ungulate as of a Carnivorous type<sup>1</sup>.

The remaining Eutherian Mammals are clearly united by the characters of their teeth, being all heterodont and diphyodont, with their dental system traceable to a common formula.

Although older views of the relationship of Ungulate Mammals expressed by the terms *Pachydermata*, *Ruminantia*, and so forth, still linger in some corners of zoological literature, no single point in zoological classification can be considered so firmly established as the distinction between the Perissodactyle and Artiodactyle Ungulates, both perfectly natural and distinctly circumscribed groups. The breaking-up of the latter into four equivalent sections, the *Pecora*, *Tylopoda*, *Tragulina*, and *Suina*, is equally in accordance with all known facts. Less certain, however, is the association of the *Proboscidea* and the *Hyracoidea* with the true Ungulates. By many they are each, although containing so very few existing species, made into distinct orders; and much is to be said in favour of this view. The discovery, however, of a vast number of extinct species of Ungulates which cannot be brought under the definition of either Perissodactyle or Artiodactyle, and yet are evidently allied to both, and which to a certain extent bridge over the interval between them and the isolated groups just mentioned, make it necessary either to introduce a number of new and ill-defined ordinal divisions, or to widen the scope of the original order so as to embrace them all, considering the Elephants and the Hyraces as representing suborders equivalent to the great Perissodactyle and Artiodactyle groups. It is the latter alternative that I have adopted.

In the association of the three orders *Insectivora*, *Cheiroptera*, and *Rodentia*, and in their subdivisions, I have followed Mr. Dobson's article in the 'Encyclopædia.' They appear to resemble each other in presenting a lower type of placentation to that of the other Eutherians, shown in the important part played by the umbilical vesicle, which becomes adherent to a considerable part of the inner surface of the chorion and conveys bloodvessels to it; but the few observations hitherto made upon this subject require to be confirmed and extended before it will be safe to attach much weight to them. This and other cranial and cerebral characters indicate that they occupy an inferior grade of development in the Mammalian series; but there are difficulties in interposing them in any other position than that assigned to them here, which must not be supposed to imply any superiority over the groups placed below them, but rather that they occupy a central position, connected, as palæon-

<sup>1</sup> On the question of the origin and affinities of the Cetacea, see a lecture delivered at the Royal Institution of Great Britain, May 25th, 1883, and published in 'Nature,' June 28th and July 5th, 1883.



tology seems to show, with the Carnivora on the one hand and the Ungulata on the other. In the 'Encyclopædia' they were placed at the bottom of the diphyodonts, between the Cetacea and the Ungulates; but this had the disadvantage of widely separating these probably allied groups, and of removing the Insectivora entirely from the Carnivora, with which they form a somewhat natural sequence.

The *Chiroptera* have always been placed near the *Insectivora*; but they are really a highly specialized group, as much isolated from all other Mammals by the modification of their anterior limbs in adaptation to aerial locomotion, as the Cetacea and the Sirenia, by the absence of hind limbs, are specially adapted to aquatic life. The *Rodentia*, though generally presenting a low grade of development, are also a specialized group. The position here assigned to them would accord with apparent relationships with the Ungulates, through the Elephant on the one hand, and the extinct *Mesotherium* on the other.

In the present state of the fauna of the earth, the *Carnivora* form a very distinct order, though naturally subdivided into two groups, the members of the one being more typical, while the other (the *Pinnipedia*) are aberrant, having the whole of their organization specially modified for living habitually in the water.

Lastly, the *Primates*, which in any natural system must be placed at the head of the series, are divisible into two very distinct groups—one containing the various forms of Lemurs (*Lemuroidea*), and the other containing the Monkeys and Man (*Anthropoidea*). Whether the *Lemuroidea* should form part of the Primates (according to the traditional view), or a distinct order altogether removed from it, is as yet an undetermined question, for both sides of which there is much to be said. There can, however, be no doubt that the *Anthropoidea* form a perfectly natural group, presenting a series of tolerably regular gradations from the Marmosets (*Hapale*) to Man. Certain breaks in the series, however, enable us to divide it into five distinct families:—*Hapalidæ* or Marmosets; *Cebidæ* or American Monkeys, with three premolar teeth on each side of each jaw; *Cercopithecidæ*, containing the majority of Old-world Monkeys; *Simiidæ*, consisting of the genera *Hylobates*, *Simia*, *Gorilla*, and *Troglodytes*, the true Man-like Apes; and, lastly, *Hominidæ*, containing the genus *Homo* alone.

## ORDERS, SUBORDERS, AND FAMILIES OF EXISTING MAMMALS.

Subclass PROTOTHERIA or *Ornithodelphia*.

### Order MONOTREMATA.

Ornithorhynchidæ.  
Echidnidæ.



Subclass **METATHERIA** or *Didelphia*.

Order **MARSUPIALIA**.

Didelphidæ.  
Dasyuridæ.  
Peramelidæ.  
Macropodidæ.  
Phalangistidæ.  
Phascolomyidæ.

Subclass **EUTHERIA** or *Monodelphia*.

Order **EDENTATA**.

Suborder **PILOSA**.

Bradypodidæ.  
Myrmecophagidæ.

Suborder **LORICATA**.

Dasypodidæ.

Suborder **SQUAMATA**.

Manidæ.

Suborder **TUBULIDENTATA**.

Orycteropodidæ.

Order **SIRENIA**.

Manatidæ.  
Halicornidæ.

Order **CETACEA**.

Suborder **MYSTACOCETI**.

Balænidæ.

Suborder **ODONTOCETI**.

Physeteridæ.  
Platanistidæ.  
Delphinidæ.

Order **UNGULATA**.

Suborder **ARTIODACTYLA**.

**SUINA**.

Hippopotamidæ.  
Phacochoeridæ.  
Suidæ.  
Dicotylidæ.

**TRAGULINA**.

Tragulidæ.

**TYLOPODA**.

Camelidæ.



**PECORA.**

Cervidæ.  
Giraffidæ.  
Antilocapridæ.  
Bovidæ.

Suborder **PERISSODACTYLA.**

Equidæ.  
Tapiridæ.  
Rhinocerotidæ.

Suborder **HYRACOIDEA.**

Hyracidæ.

Suborder **PROBOSCIDEA.**

Elephantidæ.

Order **RODENTIA.**Suborder **SIMPLICIDENTATA.**

Anomaluridæ.  
Sciuridæ.  
Haplodontidæ.  
Castoridæ.  
Myoxidæ.  
Lophiomyidæ.  
Muridæ.  
Spalacidæ.  
Geomyidæ.  
Dipodidæ.  
Octodontidæ.  
Hystriidæ.  
Chinchillidæ.  
Dinomyidæ.  
Caviidæ.

Suborder **DUPLICIDENTATA.**

Lagomyidæ.  
Leporidæ.

Order **CHIROPTERA.**Suborder **MEGACHIROPTERA.**

Pteropodidæ.

Suborder **MICROCHIROPTERA.**

Vespertilionidæ.  
Nycteridæ.  
Rhinolophidæ.  
Emballonuridæ.  
Phyllostomidæ.



Order **INSECTIVORA.**Suborder **DERMOPTERA.**

Galeopithecidae.

Suborder **INSECTIVORA VERA.**

Tupaïidae.

Macroscelidae.

Erinaceidae.

Soricidae.

Talpidæ.

Potamogalidae.

Solenodontidae.

Centetidae.

Chrysochloridae.

Order **CARNIVORA.**Suborder **PINNIPEDIA.**

Phocidae.

Trichechidae.

Otariidae.

Suborder **CARNIVORA VERA** or *Fissipedia.***ARCTOIDEA.**

Ursidae.

Ailuridae.

Procyonidae.

Mustelidae.

**CYNOIDEA.**

Canidae.

**ÆLUROIDEA.**

Hyænidæ.

Protelidæ.

Viverridæ.

Felidæ.

Order **PRIMATES.**Suborder **LEMUROIDEA.**

Chiromyidae.

Tarsiidae.

Lemuridae.

Suborder **ANTHROPOIDEA.**

Hapalidae.

Cebidae.

Cercopithecidae.

Simiidae.

Hominidae.