with water, but subsequently it dried up. Although sulphurous vapours escaped from its bed, which led to its being named La Soufrière, we read that it was more or less covered with vegetation.

On May 2, in addition to vapours, Pelée erupted ashes to cover Le Prêcheur. At 11.30 that night there were terrifying detonations, and "cinders" covered the country as far as Fort de France. These detonations, but varying in intensity, were continuous. With these sounds were mixed those of thunder, which followed the flashes of lightning in the dust cloud, the general rumbling in the crater, and the roar of many torrents. Thirty streams round Mont Pelée rose at once, and yet not a drop of rain had fallen on the coast. On May 5 the Rivière Blanche became a threatening and muddy torrent. Suddenly a column of vapour was seen to rise from the valley that expands below the crater of Mont Pelée, following which a "boiling water-spout" burst in the mountain, and this, laden with rocks and earth, buried the Guérin Sugar Works and rushed seawards, to founder two yachts, one of which was 150 metres off the shore, and to sink eight lighters.

Near the site of the factory this mud is at least 6 metres in depth. It appeared to Prof. Landes, who contributed to the last issue of *Les Colonies*, that the contents of the Étang Sec had broken their barrier and avalanche-like had rolled 700 metres downwards to the sea. The origin of this disaster, like that which on May 8 destroyed St. Pierre, is therefore to be found on the flanks of Pelée rather than at its crater.

Those who on April 27 visited the Étang Sec describe the same as a bowl 300 metres in diameter at the bottom and 800 metres at the top. The surface of the lake within this bowl was covered with black cinders, whilst the trees round the crater were covered with a "metallic black coating."

On the eastern side of the basin there was a cone 10 metres high and about 15 metres in diameter at its summit. From this new crater "smoke" rose in great puffs, water spouted from the borders of the basin and poured downwards to the lake, and there was a sound of boiling. The temperature of the water in the lake was that of the body, but where it entered it was probably very much higher. It deposited a fine slate-coloured powder, and contained sulphurous gas which blackened silver. Here and there green leaves could be seen in the lake, which the guides affirmed were on the upper branches of trees probably 20 metres in height.

The vicar-general says that about 4 a.m. on May 7 he saw on the flanks of Pelée two red craters, and these were visible for half an hour. On May 8, about 4 a.m., there was a violent thunderstorm, and torrents of rain fell in Fort de France.

At about 8 o'clock there was a hail of stones and hot cinders, and the sea retreated three times a distance of several hundred metres. Whilst this fiery tornado was obliterating St. Pierre, two atmospheric currents—one from the south-east and the other from the north—showered rain upon its flanks.

On May 1 *Les Colonies* told its readers that on April 29, between 3 and 5 p.m., there had been several shocks of earthquakes, but nothing is said about volcanic eruptions.

On May 2 it advertises an excursion to Mont Pelée, but it is not until after the eruption which took place the same night that any serious reference is made to the volcano. Next day (Saturday, May 3) *Les Colonies* is filled with details relating to a cinder rain that never ceases, the closing of houses, the difficulty of obtaining vegetables, the obliteration of roads, the muddy rivers, the dead birds and dying animals, and the flight on the steamers of the Compagnie Girard.

Great fear seems to have existed lest an earthquake should occur. The issues of May 6 and 7 continue the gruesome story. In his last issue the editor inserts a note that Thursday, May 8, being the Feast of the Ascension, his offices would be closed, and the next number of *Les Colonies* would appear on Friday. But for St. Pierre Friday never came.

A second paper in the *Century Magazine* gives the narratives of two eye-witnesses of the eruption in St. Vincent. The first of these is from Captain Calder, chief of the police in that island. From his account it appears that La Soufrière showed signs of eruption on May 5. On May 6, at 8.30 p.m., Captain Calder left Kingstown by boat for Chateau Belair, and about midnight he saw the whole top of the mountain burst into "flame." This was followed by a heavy explosion.

At 2.30 a.m. (May 7) there were similar explosions, with but little "flame." About 10 a.m. there was a terrific explosion, and in the "smoke" cloud there was a little pale flame. At 1.30 p.m. this cloud had reached a height of at least two miles. Next he describes the flight of the population holding boards above their heads to prevent injury from falling stones, following which are detailed accounts of the varying phases of the volcanic activity and the destruction which it wrought.

The second personal narrative is from Mr. T. McGregor McDonald. From this it appears that at Chateau Belair the first notice of an eruption was at 2.40 p.m. on May 6. At first the Soufrière erupted columns of white vapour without explosions. At 7.30 p.m. the vapour was accompanied with flame, and explosions took place at intervals of about two hours.

On May 7, at 6 a.m., black "stuff" was erupted. About 7.45 columns of vapour rose to a height of 30,000 feet in one minute. From 11.10, when there were thunder and lightning, Mr. McDonald made entries in his note-book of what was occurring almost every five minutes. This he did until 2 p.m., when beneath a rain of stones he escaped to Walliabou, where the diary was recommenced and continued up to 9.30 p.m. on May 14.

J. MILNE.

A TEXT-BOOK OF MAMMALS.[1]

FEW branches of zoological science have made greater advances during the last ten or a dozen years than has the study of mammals. Investigations with the microscope and the section-cutter have revolutionised our ideas as to the homology and succession of the dentition of the marsupials, while our conception of the relationship of that group to the monotremes on the one hand, and to the typical placentals on the other, has been totally altered by the discovery of a vestigial placenta in the bandicoots, and also by the apparent evidence of a connection with the creodonts afforded by certain extinct types from the South American Tertiaries. Then, again, the systematic part of the subject has been enriched by the discovery of a number of totally new and unexpected living generic types, such as Notoryctes and Cænolestes among the marsupials, Zenkerella and Idiurus among the scaly-tailed African squirrels, and Ocapia among the ungulates. Our conceptions of species and local races have undergone an equally profound change in the group under consideration, and the number of such new forms —some good and some bad—which have been added to our lists during the last few years is little short of astonishing. Moreover, trinomialism has been introduced into the science, and is largely adopted by a considerable number of eminent writers; and nomenclature itself has undergone a change which, while in many respects regrettable, could scarcely have been avoided, at least to a certain degree, if zoology is to maintain any

[1] "The Cambridge Natura History." Vol. x. Mammalia. By F. F. Beddard. Pp. xii+605. Illustrated. (London: Macmillan and Co., Ltd., 1902.) Price 17s. net.

semblance of consistency. Neither have the palæontologists been idle during the period referred to, the wonderful extinct mammalian fauna of Patagonia—inclusive of the ground-sloth, whose skin was recently found in a cave at Ultima Esperanza—having been to a large extent described during the last decade, while many interesting forms of extinct mammalian life have been made known from other parts of the world. If to the above be added the change of view with regard to the limits of zoological regions and the extent to which lands now widely sundered have been connected in past epochs of the world's history, there is little cause for wonder if the majority, or all, of the standard text-books dealing with mammals are more or less completely out of date.

Accordingly, it may be taken for granted that a trustworthy and up-to-date technical text-book on the study of mammals is a desideratum at the present time, and that the author has thus an unusually favourable opportunity before him. But this is not all that may be said in his favour, apart from the contents of the work itself. Mr. Beddard, from his official position at the Zoological Society's Gardens in the Regent's Park, has special, and probably unrivalled, opportunities of making himself acquainted with the anatomy of the soft parts of mammals —a subject too often neglected, or treated in insufficient detail in works of this nature. In addition to devoting a large amount of attention to the external glands of mammals, as well as to their internal anatomy in general, Mr. Beddard has made a special study of the mammalian brain, the results of which are incorporated in the volume before us. On this, if on no other, account his work must have an exceptionally high value for the students of mammals, as containing an enormous amount of information on this branch of the subject which can be obtained elsewhere only by laboriously searching through a long series of original memoirs.

A special feature of the volume is the large amount of space devoted to the consideration of extinct forms of mammalian life; and this is the more to the author's credit since, we believe, he is not himself a student of the palæontological aspect of the subject. He has, however, doubtless realised that the extinct forms afford the only key to the true relationship of their modern descendants; and he is to be congratulated that his work stands apart from all text-books on the same subject published in this country on account of the large amount of detailed information concerning extinct types. For one who is not himself a palæontologist, the author appears to have succeeded remarkably well in the treatment of this portion of the subject. He has, however, unfortunately quite failed to realise the nature of the dental succession in elephants and mastodons. Otherwise we should not have met with the statement on p. 220 that *Elephas planifrons* is the only member of its kind in which milk-molars are developed, and that in mastodons these teeth are more common; or the further and contradictory statement on p. 230 that these teeth occasionally persist throughout life. He should, of course, have known that milk-molars are always present, and that in one elephant and several mastodons they are succeeded by pre-molars.

As regards zoological regions, it is satisfactory to find that Mr. Beddard has adopted the view that the land surface of the globe is divisible, from this point of view, into three primary divisions, or realms, at least one of which is capable of being split up into regions. The division of the northern part of Arctogæa into a palæarctic and a nearctic region is, however, retained; and it is somewhat regrettable to find that the author is unable to convince himself of the necessity of a Sonoran region. Even greater matter for regret is his refusal to allow the rank of a region to Madagascar. Still, of course, the author has a perfect right to his own opinion, and cannot be condemned for following the same. In the introductory chapters a noticeable feature is the large amount of space allotted to the consideration of the structure and development of the milk-glands of mammals, in the course of which the author takes occasion to refer to the remarkable circumstance that the egg-pouch of the monotremes does not appear to be homologous with the nursing-pouch of the marsupials. Hair-glands are likewise discussed at some length, some countenance being given by the author to Dr. Weber's theory that the ancestral mammals were scaly creatures.

Teeth, as might have been expected, receive a large share of attention in the same section of the work, their cusps being named on the American system based on "trituberculism." Speaking generally, the author's treatment of the difficult subject of dentition is decidedly good; we believe, however, that on p. 48 he has written fifty-four in place of forty-four as the normal maximum number of mammalian teeth, while he has omitted to mention that the replaced tooth in marsupials, which he identifies with the last premolar, has been regarded by at least one recent writer as corresponding with the third of that series. Allusion is made to the mammalian resemblances of the dentition of the African Anomodontia (a group-name which, by the way, the author, on p. 48, credits to Huxley instead of Owen), but the question whether the one type is directly derived from the other is not discussed.

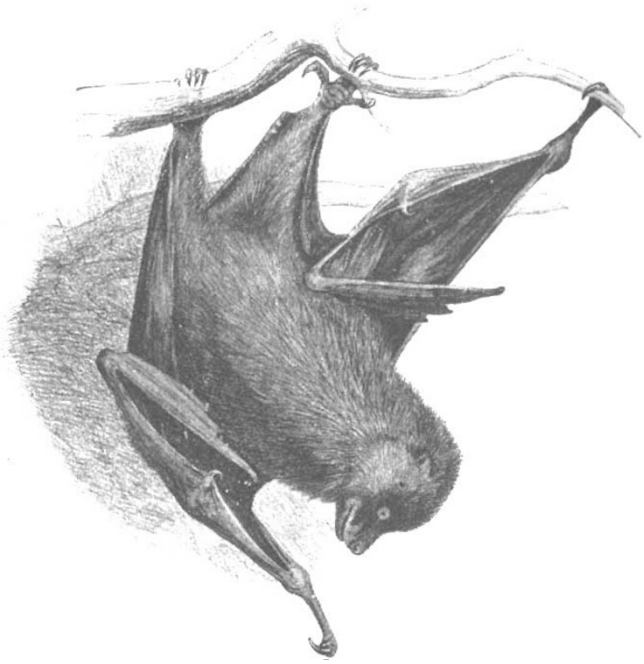

FIG. 1.—A Flying Fox (*Pteropus poliocephalus*). From Beddard's "Mammalia."

Passing from the introductory to the systematic portion of the work, we find Mr. Beddard differing from the majority of his predecessors in dividing the Mammalia into two, in place of three, primary groups—namely, the Prototheria, now represented only by the monotremes, and the Eutheria, including both marsupials and the true placentals. In view of the discovery of a vestigial placentation in marsupials, to which allusion has been already made, as well as from other considerations, we are inclined to think that the author is fully justified in the innovation, and hope to see the new departure followed by other writers. The absence of a corpus callosum in the brain of monotremes is regarded by the

author as important, in spite of the reduced size, or even absence, of that structure in marsupials.

The author's classification of the latter calls for no special comment, although attention may be directed to certain remarks on p. 128 as to the origin of the two chief groups, in which the view of the northern origin of the entire order is adopted without hesitation. As to whether diprotodonts came into existence as early as the Jurassic or the Cretaceous, Mr. Beddard maintains a cautious reserve, although we think he might have expressed a definite opinion on this point without undue risk. It is, perhaps, a pity, in the light of modern discoveries, that Owen's footless figure of the skeleton of Diprotodon is reproduced; and it rather puzzles us to reconcile the statement on p. 146, as to the close affinity of this creature to the kangaroos, with the assertion on the opposite page that its hind-foot could not be more unlike that of a kangaroo than it actually is.

But Mr. Beddard seems to take a delight in puzzling his readers by statements that to the average mind appear absolutely contradictory. For instance, on p. 160, after stating that the extinct Patagonian Prothylacinus and Amphiproviverra "are not merely polyprotodonts, but definitely dasyures," in the very next paragraph it is suggested that they are not marsupials at all.

The Edentate order is taken to include the pangolins and aard-varks as well as the typical American forms, although it is stated that the aard-varks do not show marked signs of affinity with the pangolins. A strong point in favour of the author's system is that the pangolins are stated to possess a muscle found elsewhere only in the American edentates. Fossil forms are treated at some length, but it would have been better had the author reproduced one of the figures of Glyptodon published by the La Plata Museum instead of the cut of an imperfect example from one of Owen's works. The inclusion of the North American Eocene ganodonts among the edentates is, we believe, a feature which appears for the first time in an English text-book.

The chapter on ungulates commences with a well-written description of the foot-structure of the different groups, followed by an interesting discussion on horns and antlers. Mr. Beddard was fortunately able to introduce a brief account of the okapi, although he was, of course, unacquainted with the fact that the adults are horned. This being so, it is somewhat curious to find no mention of Dr. Andrews's description of ancestral Proboscidea from Egypt, which was published about the same time as the announcement of the discovery of the okapi. We have already had occasion to allude to the author's unfortunate error in regard to the nature of the dentition of fossil elephants, and we are obliged to say that the whole chapter on ungulates, especially as regards recent forms, is far from being as satisfactory as it ought to be. In pointing out certain deficiencies and errors in this and other parts of the work, it may be well to state that it would be scarcely worth while to allude to these, were we not impressed with the high value and importance of the work as a whole, which makes it the more to be regretted that such blemishes should occur.

As regards the Equidæ and Tapiridæ, we have little or no fault to find, but when treating of the rhinoceroses, the author should have been aware that the white species has been recorded from Central Africa, while the affinity to this species of the extinct so-called *Rhinoceros tichorhinus* should have been indicated. More severe criticism is called for with regard to the chapters on the deer and hollow-horned ruminants, which are everywhere "scrappy" and in many cases absolutely misleading. To include among the typical deer such a widely different animal as Père David's deer is at the present day little short of absurd. But, unfortunately, the author appears quite unable to recognise the essential difference between the "brow-tined" and the "forked" types of antlers, otherwise we should not have, on p. 301, the absurd statement that the antlers of the extinct *Cervus* (properly *Anaglochis*) *sedgwicki* are "like those of a red deer exaggerated." It would be just as true to say that a leopard is coloured exactly like a tiger! The account of the species rightly included in the genus Cervus is, moreover, altogether inadequate, the reader not even being informed that the species incorrectly called *C. luehdorfi* is one of several Asiatic representatives of the wapiti. The treatment of the antelopes, although brief, is fairly satisfactory, but in describing the wild oxen the author states that the gaur and the gayal have a white rump-patch, whereas that feature is distinctive of the banting alone; and he aids in perpetuating the error that the British white park-cattle are the nearest relatives of the extinct wild ox of Europe.

The sheep and goats are very unsatisfactorily treated, both as regards description and illustration, some of the figures being those of immature animals, while the distribution and nomenclature are in several instances incorrect. As an example, it will suffice to mention that (on p. 324) one and the same sheep is stated, under the name of *Ovis nahura*, to be Tibetan, and, as *O. burrhel*, Indian. Again, in the description of the goats, after stating that the horns are never spirally curved, Mr. Beddard writes that the markhor (the horns of which are spirally twisted) is confined to certain parts of Afghanistan!

Little need be said with regard to the treatment of the other mammalian orders, which follows to a great extent the usual lines, and is generally satisfactory. Details connected with the characters or distribution of species are, however, in several instances not altogether correct. For instance (p. 418), it is altogether misleading to write of the South American *Canis jubatus* as the red wolf of America; while Enhydriodon (p. 440)—of which, by the way, the name is misspelt—has nothing to do with the sea-otter. Again, the statement on p. 569, that the monkeys of the genus Rhinopithecus have "also a long, but more definitely upturned nose," seems to suggest that in certain instances the author has no practical acquaintance with the animals of which he is writing. Probably the recent transference of the Tibetan Æluropus from the bears to the raccoons was not published soon enough to allow of the animal finding a place among the latter in Mr. Beddard's volume.

To turn to another consideration, even careless readers will scarcely fail to notice that while the figure of the polecat (on p. 436) is lettered *Mustela putorius*, the animal is alluded to in the text as *Putorius foetidus*. Whether this is due to carelessness, or whether it is an instance of a remarkable hesitation displayed by the author as to which name to adopt for certain genera, it is not for us to say. Such hesitation is, however, very noticeable throughout the book, the author frequently using one name, although stating that an alternative title is the proper one. It is, indeed, very difficult to decide what has been his guide in this matter. Sometimes he follows modern ruling, as in the substitution of Microtus for Arvicola, while in other cases he retains discredited names, such as Cariacus for the American deer. In regard to the wide sense in which generic terms are for the most part used, we are in full accord with Mr. Beddard.

As the result of a somewhat lengthened perusal of his work, we are glad to be able to say that the author has succeeded in producing a volume which cannot fail to be of very high value to all students of the Mammalia, especially from the standpoints of morphology and palæontology. It has failings (many of which might have been remedied by the exercise of a little more care on the part of the author and his editors), but these occupy a very subordinate position in comparison to its merits; and, with this reservation, the work may be said to maintain the high standard of excellence of the series of which it forms a part. R. L.